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Full Length Research Paper

Screening of elite material against major diseases of safflower under field conditions

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A field experiment with three replications was conducted at the All India Coordinated Research Project (AICRP) on oilseeds at Marathwada Agricultural University (MAU), Parbhani, Maharashtra on the screening of different elite material against major diseases. Significant differences in resistance to all the diseases were found in the elite material tested. Among the 46 elite lines, 21 and 33 elite lines registered highly resistant reaction against *Alternaria* leaf spot and to root rot, respectively while 15 lines registered resistant reaction to wilt. This study concludes that screening elite lines for resistance to diseases is an important step in developing varieties/hybrids with improved resistance to different diseases.

Key words: Safflower, diseases, resistance.

INTRODUCTION

Safflower (*Carthamus tinctorius* L.) occupies prominent place in the agricultural wealth and economy of India. It belongs to family *Compositae* and believes to be native of Afganistan. The word *Carthamus* is arabic word *quartum* (means the colour of dye obtained from florets). It is described as "*Kusumbha*" in ancient Sanskrit literature. Other Indian names, like *Kusum*, *Karrad* (Hindi), *Kusumpuli* (Bengali), *Kusumbo* (Gujrathi), *Kardi*, *Kurdi* (Marathi), *Sendurakam* (Tamil), *Kusuma* (Telgu), *Kusube*, *Kusume* (Kannada), *Kusumba* (Punjabi) seem to have been derived from "*Kusumbha*". Presently the most common name being "*Kusum*" or "*Kardi*". It is a rich source of proteins and edible oil and so many farmers plant it. It is known to suffer from many fungal, bacterial and viral diseases at different stages of crop growth (Bhale et al., 1998). Seed is the costliest input in safflower cultivation and is highly prone to losses in germination and vigour due to seed mycoflora. Safflower plant is also prone to infection by several seed-borne fungi (Ramesh and Avitha, 2005). Seeds also act as carrier in transmission of pathogens and thereby cause economic threat to safflower cultivation. Considering the economic losses in this present investigation attempts were therefore made to as certain this spectrum of fungal flora associated with the seeds of safflower elite materials.

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MATERIALS AND METHODS

The seeds of elite materials of safflower were received from Directorate of Oil Seeds Research, Hyderabad. These elite lines were screened in the field under artificial epiphytotic conditions for various diseases during monsoon season of 2012 at AICRP on oilseeds, Marathwada Agricultural University, Parbhani, Maharashtra. The screening of elite material against major diseases was done in three replications. Forty six elite materials were screened in the field under artificial epiphytotic conditions during *monsoon,* 2012. The test lines were sown in a randomised block design with the Gross plot size being single row of 3.0 m. Distance between rows was 30 cm and plant to plant distance was kept 15 cm as closer distance favours disease development. *Alternaria* susceptible genotype Manjira, Rhizoctonia and Fusarium susceptible genotype Nira were sown after every fifth row of test

Table 1. 0-9 disease scale for *Alternaria.*

Disease incidence (0-9) scale	Disease incidence (%)	Reaction
0	No symptoms	Immune
1	<1	Resistant
3	1-10	Moderately resistant
5	11-25	Tolerant
7	26-50	Susceptible
9	>50	Highly susceptible

Table 2. Disease rating scale (Mayee and Datar, 1986).

Disease incidence (0-9) scale	Disease incidence (%)	Reaction
0	No wilting	Immune
1	<1	Resistant
3	1-10	Moderately resistant
5	11-20	Tolerant
7	21-50	Susceptible
9	51 and above	Highly susceptible

material. Recommended agronomic practices and insect pest control measures were followed as per the package of practices of University of Agricultural Sciences, Dharwad, Karnataka (Anonymous, 2003). Further, the elite materials were categorized as highly resistant, resistant, moderately resistant, susceptible and highly susceptible based on 0 to 9 disease scale for *Alternaria*. (Table 1). Percent disease score was calculated as per the standard area diagram developed by Mayee and Datar (1986). For recording the disease intensity (*Fusarium* wilt and *Macrophomina* rot) under field condition, 0 to 9 disease rating scale developed by Mayee and Datar (1986) was used (Table 2). For this purpose five leaves located at the bottom, five in the middle and five at the top of the plant were chosen and scored as per scale given subsequently.

RESULTS AND DISCUSSION

Continuous efforts to locate resistant sources and their utilisation in resistance breeding programme are imperative to manage the diseases in the long run. Screening was therefore undertaken to evaluate a large number of elite line collections against major diseases during *monsoon* 2012. The lines were evaluated based on 0 to 9 disease rating scale. The reaction of the different lines is presented in Table 3. Significant variations in disease severity index (0 to 9 scale) for major diseases of safflower were observed in various lines. Of the 46 elite line collections evaluated, only 21 lines, *viz*., IVT-11-11, IVT-11-14, IVT-11-15, IVT-11-16, IVT-11-17, IVT-11-18, IVT-11-19, IAHT-I-11-01, IAHT-I-11-02, IAHT-I-11-03, IAHT-I-11-04, IAHT-I-11-05, IAHT-I-11-06, IAHT-I-11-07, IAHT-I-11-09, AVHT-II-11-01, AVHT-II-11-02, AVHT-II-11-04, AVHT-II-11-05, AVHT-II-11-01, HUS 305 (Resistant check) registered resistant reaction. These 21 lines were identified as resistant. Four lines were found to be susceptible to *Alternaria* leaf spot.

Results (Table 4) revealed that among the 46 elite lines evaluated only 14 lines, *viz*., IVT-11-02, IVT-11-03, IVT-11-04, IVT-11-11, IVT-11-14, IVT-11-15, IVT-11-16, IVT-11-19, IVT-11-20, IVT-11-21, IAHT-I-11-06, AVHT-II-11-02, AVHT-II-11-05, AVHT-II-11-01 and HUS 305 (resistant check) registered resistant reaction, Twenty nine lines were identified as moderately resistant, and two lines were found to be susceptible to wilt.

The results (Table 5) of this present study indicated that among the 46 elite lines evaluated only 33 lines, *viz*., IVT-11-01, IVT-11-05, IVT-11-07, IVT-11-08, IVT-11-11, IVT-11-12, IVT-11-13, IVT-11-15, IVT-11-16, IVT-11-18, IVT-11-19, IVT-11-20, IVT-11-21, IVT-11-22, IVT-11-23, IVT-11-24, IVT-11-25, IVT-11-26, IVT-11-27, IVT-11-28, IVT-11-29, IAHT-I-11-01, IAHT-I-11-02, IAHT-I-11-03, IAHT-I-11-04, IAHT-I-11-05, IAHT-I-11-06, IAHT-I-11-09, AVHT-II-11-01, AVHT-II-11-02, AVHT-II-11-03, AVHT-II-11-04 and HUS 305 (resistant check) registered highly resistant reaction, seven lines were identified as resistant, five lines were moderately resistant and one line was found to be susceptible to root rot.

These findings will help to develop a new set of agronomically desirable disease-resistant hybrids to enhance and sustain safflower productivity. This present study revealed that out of the 44 lines tested; only 32 lines registered high level of resistance (HR) and recorded least disease rating of 1.0, while susceptible check Manjira exhibited maximum rating scale of 4.0. This suggests that the disease development was highly satisfactory and the categorization of materials into different classes is appropriate. Thus, it can be emphasized from the results that the identified highly resistant lines hold excellent promise for resistance against major diseases of safflower and can be used for

Table 3. Disease severity on selected on elite material against *Alternaria* leaf spot caused by *Alternaria carthami.*

S/N	Entries	Mean	Reaction
1	IVT-11-01	20	MR
2	IVT-11-02	17.5	MR
3	IVT-11-03	20	MR
4	IVT-11-04	20	MR
5	IVT-11-05	29.5	S
6	IVT-11-06	24	MR
7	IVT-11-07	22.5	MR
8	IVT-11-08	22.5	MR
9	IVT-11-09	30	S
10	IVT-11-10	17.5	MR
11	IVT-11-11	7.5	R
12	IVT-11-12	17.5	MR
13	IVT-11-13	12.5	MR
14	IVT-11-14	10	R
15	IVT-11-15	5	R
16	IVT-11-16	10	R
17	IVT-11-17	10	R
18	IVT-11-18	9	R
19	IVT-11-19	10	R
20	IVT-11-20	18.5	MR
21	IVT-11-21	12.5	MR
22	IVT-11-22	30	S
23	IVT-11-23	15	MR
24	IVT-11-24	20	MR
25	IVT-11-25	22.5	MR
26	IVT-11-26	17.5	MR
27	IVT-11-27	15	MR
28	IVT-11-28	25	MR
29	IVT-11-29	17.5	MR
30	IAHT-I-11-01,	6.5	R
31	IAHT-I-11-02	3.5	R
32	IAHT-I-11-03	10	R
33	IAHT-I-11-04	5	R
34	IAHT-I-11-05	6.5	R
35	IAHT-I-11-06	4.5	R
36	IAHT-I-11-07	5.5	R
37	IAHT-I-11-08	12.5	MR
38	IAHT-I-11-09	10	R
39	AVHT-II-11-01	5	R
40	AVHT-II-11-02	5	R
41	AVHT-II-11-03	15	MR
42	AVHT-II-11-04	7.5	R
43	AVHT-II-11-05	7.5	R
44	AVHT-II-11-01	9	R
45	Manjira	30	S
46	HUS 305	7.5	R

developing hybrids and composites in future programme of breeding for disease resistance.

Table 4. Disease severity on selected on elite material against wilt caused by *Fusarium oxysporum* f.sp. *carthami.*

S/N	Entries	Mean	Reaction
1	IVT-11-01	16.77	MR
2	IVT-11-02,	8.66	R
3	IVT-11-03	5.71	R
4	IVT-11-04	9.75	R
5	IVT-11-05	12.88	MR
6	IVT-11-06	12.75	MR
7	IVT-11-07	15.74	MR
8	IVT-11-08	14.55	MR
9	IVT-11-09	37.3	S
10	IVT-11-10	11.83	MR
11	IVT-11-11	8.94	R
12	IVT-11-12	11.57	MR
13	IVT-11-13	13.97	MR
14	IVT-11-14	8.44	R
15	IVT-11-15	3.58	R
16	IVT-11-16	8.91	R
17	IVT-11-17	15.07	MR
18	IVT-11-18	12.03	MR
19	IVT-11-19	8.39	R
20	IVT-11-20	8.75	R
21	IVT-11-21	6.39	R
22	IVT-11-22	11.71	MR
23	IVT-11-23	16.75	MR
24	IVT-11-24	15.26	MR
25	IVT-11-25	13.81	MR
26	IVT-11-26	16.33	MR
27	IVT-11-27	11.41	MR
28	IVT-11-28	15.16	MR
29	IVT-11-29	13.38	MR
	IAHT (Trial)		
30	IAHT-I-11-01	13.55	MR
31	IAHT-I-11-02	13.54	MR
32	IAHT-I-11-03	11.13	MR
33	IAHT-I-11-04	12.22	MR
34	IAHT-I-11-05	10.03	MR
35	IAHT-I-11-06	5.705	R
36	IAHT-I-11-07	13.89	MR
37	IAHT-I-11-08	19.90	MR
38	IAHT-I-11-09	13.58	MR
	AVHT (Trial)		
39	AVHT-II-11-01	14.03	MR
40	AVHT-II-11-02	5.46	R
41	AVHT-II-11-03	14.14	MR
42	AVHT-II-11-04	11.08	MR
43	AVHT-II-11-05	6.06	R
44	AVHT-II-11-01	5.64	R
45	Manjira	31	S
46	HUS 305	7.1	R

Table 5. Disease severity on selected on elite material against root rot caused by *Rhizoctonia bataticola.*

S/N	Entries	Mean	Reaction
1	IVT-11-01	0	HR
2	IVT-11-02	5.78	R
3	IVT-11-03	5.45	R
4	IVT-11-04	6.62	R
5	IVT-11-05	0	HR
6	IVT-11-06	12.75	MR
7	IVT-11-07	0	HR
8	IVT-11-08	0	HR
9	IVT-11-09	10.94	R
10	IVT-11-10	5.91	R
11	IVT-11-11	0	HR
12	IVT-11-12	0	HR
13	IVT-11-13	0	HR
14	IVT-11-14	13.58	MR
15	IVT-11-15	0	HR
16	IVT-11-16	0	HR
17	IVT-11-17	17.63	MR
18	IVT-11-18	0	HR
19	IVT-11-19	0	HR
20	IVT-11-20	0	HR
21	IVT-11-21	0	HR
22	IVT-11-22	0	HR
23	IVT-11-23	0	HR
24	IVT-11-24	0	HR
25	IVT-11-25	0	HR
26	IVT-11-26	0	HR
27	IVT-11-27	0	HR
28	IVT-11-28	0	HR
29	IVT-11-29	0	HR
30	IAHT-I-11-01	0	HR
31	IAHT-I-11-02	0	HR
32	IAHT-I-11-03	0	HR
33	IAHT-I-11-04	0	HR
34	IAHT-I-11-05	0	HR
35	IAHT-I-11-06	0	HR
36	IAHT-I-11-07	8.6	R
37	IAHT-I-11-08	14.22	MR
38	IAHT-I-11-09	0	HR
39	AVHT-II-11-01	0	HR
40	AVHT-II-11-02	0	HR
41	AVHT-II-11-03	0	HR
42	AVHT-II-11-04	0	HR
43	AVHT-II-11-05	8.03	R
44	AVHT-II-11-01	13.52	MR
45	Manjira	31.5	S
46	HUS 305	0	HR

Awadhiya (1992) identified *A. carthami, Fusarium moniliforme, Botrytis cinerea, Macrophomina phaseolina, Stachybotrys* spp. and *Oedocephalum* spp. from seeds of 50 safflower cultivars in states of Maharashtra, Karnataka, Andhra Pradesh and Madhya Pradesh in India. *A. carthami* was the only pathogen found in all varieties tested. In studies of healthy, discoloured, wrinkled and deformed seeds of five varieties (APRR 2, HUS 304, JSF 1, NS 99-A and SF 364) no particular association of the pathogen with the condition of seed was found. Chavan and Kakde (2009) isolated nine fungal species from safflower cultivars. Among these, *Aspergillus* spp. showed dominance, followed by *Fusarium* spp. and *Alternaria* spp. Bhima variety showed maximum susceptibility to fungi and got infected by *Aspergillus niger. A. flavus, Fusarium oxysporum, Alternaria dianthicola* and *Alternaria dianthi* while C1L and C1B varieties were least susceptible to fungi.

This study confirms that differences in resistance to major diseases exist in germplasm of safflower. The resistant nature of elite lines observed in present field trials confirmed the reports by Singh et al. (1987), Borkar and Shinde (1988), Zad (1992), Khanam (1993) and Ismail et al. (2004). These findings suggest that it is possible to improve an existing elite line through further selection and screening of the progenies of the parental line.

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