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Identification of Resistance Sources for Sunflower Leaf Curl Virus Disease Caused by Begomovirus

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A B S T R A C T

Sunflower (*Helianthus annuus* L.) is an important edible oilseed crop in the country next to groundnut and soybean. One of the major factors for reduction in area of the crop is being attributed to the occurrence of fungal and viral diseases like sunflower necrosis disease (SND) and Sunflower leaf curl virus (SuLCV) resulting in yield loss in most of the sunflower growing regions of Southern and Northern India. In Karnataka, SuLCV has been reported to occur in almost all the popular sunflower hybrids grown during kharif, rabi and summer seasons with varied intensity. Cultivation of resistant varieties is the most economical way of managing virus diseases of plants as the control of vector borne virus diseases is very difficult to contemplate. 37 germplasm lines of sunflower were evaluated against SuLCV disease in field condition. Of thirty seven germplasm lines screened, four hybrids namely RSFH-1887, DRSH-1, RSFH-10-600 and NSFH-1009 recorded moderately resistant reaction (5.1-10%). Further, eight hybrids recorded moderately susceptible reaction (10.1-25%) *viz.*, NDSH-11, SVSH-478, KBSH-70, LSFH-234, KBSH-1, Sunshine, PAC-339 and NDSH-12.

Introduction

Sunflower (*Helianthus annuus* L.) is one of the most important oilseed crops in India, is cultivated in an area of 0.691 million ha with an average production and productivity of 0.546 million tonnes and 791 kg ha^{-1} respectively during the year 2013-14 (Annon, 2015). Presently Karnataka is the leading state in India contributing 64 and 54% of total area and production respectively. It is the second important oilseed crop after groundnut in the state having an area of 0.443 million hectares with production of 0.297 million tonnes. However, productivity (670 kg ha^{-1}) is lesser than the national average of 791 kg ha^{-1} (Anon., 2015). The most serious diseases of sunflower are caused by fungi and next viral diseases Necrosis and now a day's Sunflower leaf curl virus (SuLCV) becoming severe in India (Govindappa *et al.*, 2011).

Materials and Methods

A field experiment was conducted at MARS, Raichur to identify the resistance source for sunflower leaf curl virus disease. A total 36 genotypes were received from private and public institutes at AICRP Centre, Raichur, Karnataka. These genotypes were grouped under different trials *viz.*, initial hybrid trial (IHT), initial advanced hybrid trial (IAHT) and initial advanced hybrid trial under oleic acid (IAHT-O) and sent by Directorate of

Oilseeds Research, Hyderabad. Each genotype was sown with a spacing of 60 x 30 cm in seven rows of 3 m length. The susceptible check (Morden) was sown as an infector row after each entry. The crop was raised as per the recommended package of practices except the plant protection measures against SuLCV. The screening against SuLCV was done under field condition as the disease incidence was very high during the season and observations were taken at 30 DAS, 60 DAS and 90 DAS of the crop. For recording observations, total number plants and number of SuLCV infected plants in each genotype were actually counted. Later, per cent disease was worked out by using the following formula.

$$\text{Percent disease} = \frac{\text{Number of plants infected}}{\text{Total number of plants observed}} \times 100$$

Later, the genotypes were categorized into different categories by using 0-5 scale on the basis of their reaction against SuLCV (Gururaj Sunkad, 2002)

Results and Discussion

Thirty six hybrids were screened for their resistance against SuLCV with morden as susceptible check. The incidence of the leaf curl virus varied from 6.94 to 75.71% in different hybrids and the susceptible check, Morden recorded an incidence of 48 per cent.

The highest incidence was observed in KSFH-280 (75.71%), while lowest incidence was in NSFH-1009 (6.94%) at 90 DAS.

Based on the performance of hybrids over the season, they were categorized into six reaction groups namely highly resistant (0 to 1% infection), resistant (1.1 to 5% infection), moderately resistant (5.1 to 10%), moderately susceptible (10.1 to 25%), susceptible (25.1 to 50%) and highly susceptible (50.1% and above).

Fig.1 Comparative differences in plants of diseased and resistance plants in screening plots

Table.1 Reaction of sunflower hybrids against sunflower leaf curl virus disease

Sl. No.	Name of the Hybrids	SuLCV (%)		
		At 30 DAS	At 60 DAS	At 90 DAS
1.	BRSSC-3	16.67	51.39	66.67
2.	BSFH-111	32.95	45.00	58.00
3.	BSFH-700	14.29	37.14	52.86
4.	CSFH-8714	0.00	43.08	64.62
5.	CSFH-8031	3.13	10.94	26.56
6.	DRSH-1	4.55	6.06	9.09
7.	DOLLER	20.34	38.67	44.00
8.	KBSH-1	4.35	14.49	24.64
9.	KBSH-44	12.86	32.86	45.2
10.	KBSH-68	24.00	52.67	68.00
11.	KBSH-69	16.00	46.67	62.67
12.	KBSH-70	21.43	15.71	24.29
13.	KSFH-280	45.71	60.00	75.71
14.	KSFH-284	20.00	27.14	62.86
15.	KSFH-384	21.43	52.86	64.29
16.	KSFH-335	16.42	50.75	59.70
17.	LSFH-176	28.42	37.75	45.00
18.	LSFH-234	0.00	10.77	21.54
19.	LSFH-3436	14.29	44.29	74.29
20.	NDSH-11	6.67	14.67	18.67
21.	NDSH-12	5.71	15.71	24.29
22.	NSFH-1001	32.90	43.87	56.00
23.	NSFH-1007	10.00	41.43	50.80
24.	NSFH-1009	0.00	0.00	6.94
25.	NSSH-1084	20.55	39.00	45.25
26.	NSSH-1201	10.00	22.86	42.86
27.	PAC-339	0.00	4.62	13.85
28.	PAC-3793	28.45	42.56	52.77
29.	PAC-3794	22.00	37.31	43.71
30.	PKVSH-592	6.67	21.33	30.67
31.	PSFH-18	12.33	34.25	43.84
32.	RSFH-10-600	0.00	2.94	8.82
33.	RSFH-1887	2.67	6.67	9.33
34.	SVSH-478	5.71	14.29	21.43
35.	Sunshine	1.54	4.62	10.77
36.	VSFH-2043	14.25	23.86	30.00
37	**Morden (Check)**	**29.55**	**36.10**	**48.0**

Table.2 Categorization of sunflower hybrids against sunflower leaf curl virus disease

Sl. No.	Disease scale (0-5 scale)	Disease grade (% incidence)	Hybrids
1.	0	Highly resistant (0 to1%)	-
2.	1	Resistant (1.1 to 5%)	-
3.	2	Moderately resistant (5.1 to 10%)	RSFH-1887, DRSH-1, RSFH-10-600, NSFH-1009,
4.	3	Moderately susceptible (10.1 to 25)	NDSH-11, SVSH-478, KBSH-70, LSFH-234, KBSH-1, Sunshine, PAC-339, NDSH-12
5.	4	Susceptible (25.1 to 50%)	NSSH-1201, PSFH-18, PKVSH-592, NSSH-1084, LSFH-176, VSFH-2043, PAC-3794, CSFH-8031

The genotypes were categorized into different categories by using 0-5 scale on the basis of their reaction against SuLCV (Gururaj Sunkad, 2002)

Scale	Per cent disease (%)	Disease reaction
0	0-1	Highly resistant
1	1.1-5	Resistant
2	5.1-10	Moderately resistant
3	10.1-25	Moderately susceptible
4	25.1-50	Susceptible
5	Above 50	Highly susceptible

Out of 36 hybrids screened (Table 1) at MARS farm, none of the hybrids were found either immune or highly resistant/resistant. However, four hybrids namely RSFH-1887, DRSH-1, RSFH-10-600 and NSFH-1009 recorded moderately resistant reaction by recording less than 10 per cent SuLCV disease against the highest incidence of 48% in susceptible check variety morden. Further, eight hybrids recorded moderately susceptible reaction and they are NDSH-11, SVSH-478, KBSH-70, LSFH-234, KBSH-1, Sunshine, PAC-339 and NDSH-12. The hybrids NSSH-1201, PSFH-18, PKVSH-592, NSSH-1084, LSFH-176, VSFH-2043, PAC-3794 and CSFH-8031 were found to be susceptible and rest of the sixteen hybrids were highly susceptible to SuLCV disease.

In screening, four hybrids namely RSFH-1887, DRSH-1, RSFH-10-600 and NSFH-1009 recorded moderately resistant reaction (5.1-10%) (Table 2). Further, eight hybrids recorded moderately susceptible reaction (10.1-25%) *viz.*, NDSH-11, SVSH-478, KBSH-70, LSFH-234, KBSH-1, Sunshine, PAC-339 and NDSH-12. The hybrids NSSH-1201, PSFH-18, PKVSH-592, NSSH-1084, LSFH-176, VSFH-2043, PAC-3794 and CSFH-8031 were found to be susceptible and rest of the sixteen hybrids were highly susceptible to SuLCV disease.

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