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## Screening of sunflower germplasm lines for resistance/tolerance to leafhopper and whitefly

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### Abstract

An experiment was carried out during *Rabi* season 2017 at Oilseed Research Station, Latur, Maharashtra, India. The present study was made to screen 30 sunflower germplasm lines for their resistance against sunflower leafhopper and whitefly. The cultivar Modern was included as a susceptible check and KBSH-44 as moderately resistant check. It was found that out of 30 germplasm lines, none of the entry was found 'Highly Resistant' against leafhoppers while only two germplasm lines *viz.*, GMU-520 and AKSF-6-39 were categorized as 'Resistant' germplasms. Sixteen germplasm lines were found as 'Moderately Resistant' and eleven as 'Susceptible'. Among 30 germplasm lines screened for whiteflies incidence, none of the germplasm was found 'Highly Resistant' against whiteflies while three germplasm lines *viz.*, IIOSH-15-10, GMU-520 and AKSF-6-39 were categorized as 'Resistant' germplasms. Twenty germplasm lines were found as 'Moderately Resistant' and six as 'Susceptible'. The check Modern was found 'Highly Susceptible' to leafhopper and whiteflies.

**Keywords:** Screening, resistance, leafhopper (*Amrasca biguttula biguttula*) and whitefly (*Bemisia tabaci*)

### Introduction

Sunflower (*Helianthus annuus* L.) belongs to family Compositae and it is native to Mexico and Peru, introduced into India in 16<sup>th</sup> century. Sunflower is one of the important oilseed crops. It contains 32 to 44 per cent oil. In India during 2017-18 sunflower was grown on an area of 0.33 million hectares with 0.23 million metric tons of production and 0.70 metric tons per hectare of productivity (Anonymous, 2019) [1]. Amongst several factors responsible for low productivity of sunflower, the damage caused by insect-pests is major one. The major insect-pests which drew the attention of both farmers and scientists are sucking pests like leafhoppers (*Amrasca biguttula biguttula* (Ishida)) and whitefly (*Bemisia tabaci* (Gennadius)). Infestation of sucking insect-pests is becoming a major concern in obtaining expected yield from sunflower crop because its incidence starts from seedling stage and prevails through the entire plant life. Both nymphs and adults of leafhopper and whitefly suck the cell sap from the leaves and show symptoms like stunted growth, burning of leaf margins, cupped and crinkled leaves. In severe case if infestation occurs, characteristic "hopper burn" are noticed.

Insect resistance in crop plants is an important component of integrated pest management (IPM) and it is considered as non-monetary input at farmer's ends. Resistant and tolerant cultivars form the basic component of IPM over which other components are to be built up. Use of resistant or less susceptible cultivars is one of the most significant methods of keeping insect populations below economic threshold levels. It is most helpful when carefully utilized with other components of pest management. Screening techniques vary with crop and pest (Kavitha and Reddy 2012) [7]. Keeping this view few sunflower lines were screened against leafhopper and whitefly under natural field conditions.

### Materials and Methods

The experiment was conducted during *Rabi* season 2017 at Oilseed Research Station, Latur, Maharashtra, India. The experiment was laid out in a randomized block design (RBD) with 30 sunflower entries with three replications. The crop was sown on 21 November, 2017 in single row of 4.2 m length with spacing 60cm x 30cm. The date of sowing was adjusted in such way that the volunteer stages of crop synchronize with peak incidence of pest. One row of okra was sown as infester row after every two rows of sunflower to increase leafhopper population

while susceptible check was sown after every 10 germplasm lines. The observation on leafhopper and whitefly were taken from 5 randomly selected plants at seedling and star bud stage from two leaves each from upper middle and lower canopy of the sunflower plant. Also, the injury damage was recorded and damage grade was worked out. To record the damage grade, injury on the five randomly selected plants in a row was scored and grades was given as below

0 - Free from leaf hopper injury.

1 - Slight yellowish on edges of leaves up to 30%.

2 - Yellowing and curling up to 40% leaves.

3 -Yellowing and curling up to 60% leaves.

4 -Yellowing and curling up to 80% leaves.

5 - Maximum yellowing, cupping and curling up to 100% leaves.

Finally entries were classified as follows:

Resistance category	Damage grade
Highly resistant	0
Resistant	0.1 to 1.0
Moderately resistant	1.1 to 2.5
Susceptible	2.6 to 3.5
Highly susceptible	3.6 to 5.0

The data on leafhoppers and whiteflies were transformed using Poisson formula ( $x + 0.5$ ) before statistical analysis. The data was statistically analyzed by standard 'analysis of variance'. The null hypothesis was tested by F test of significance at 5 per cent level (Gomez and Gomez, 1984) [4].

## Results and Discussion

### Leafhopper (*Amrasca biguttula biguttula*)

Data presented in Table 1 and depicted in figure 1 revealed that the leafhopper incidence was observed in the range of 10.2 to 40.22 per six leaves per plant. Lowest leafhopper was recorded on germplasm AKSF-6-39 i.e. 10.2 leafhoppers per six leaves per plant followed by KBSH-80 (11.95 leafhoppers per six leaves per plant), GMU-520 (13.70 leafhoppers per six leaves per plant), BLSFH-15005 (18.5 leafhoppers per six leaves per plant) and ID-1079 (19.00 leafhoppers per six leaves per plant). Highest numbers of leafhoppers were reported on susceptible check Modern (40.22 per six leaves per plant).

The foliage yellowing and drying ranged in between 20.00 to 72.50 per cent while the damage grade lies in between 1.0 to 4.0. The susceptible check Modern recorded highest 72.5 per cent yellowing and drying and also scored a highest of 4.0 damage grade.

Further the germplasm lines were categorized into five different categories based on damage grades. Out of 30 germplasm screened for leafhopper incidence, none of the entry was found 'Highly Resistant' against leafhoppers while only two germplasm lines viz., GMU-520 and AKSF-6-39 were categorized as 'Resistant' germplasms. Sixteen germplasm lines were found as 'Moderately Resistant' and eleven as 'Susceptible'. The check Modern was found 'Highly Susceptible' to leafhoppers.

**Table 1:** Per cent foliage yellowing and drying of sunflower germplasm

Sr. No.	Germplasm	% foliage yellowing and drying	Leafhopper count per six leaves per pl	Damage grade	Category
1	Modern (Ch)	72.5	40.22 (6.36)*	4.0	Highly susceptible
2	KBSH-44 (Ch)	57.5	31.00 (5.59)	2.9	Susceptible
3	IIOSH-15-10	20.5	23.50 (4.88)	2.5	Moderately resistant
4	KBSH-80	27.5	11.95 (3.50)	1.5	Moderately resistant
5	AKSFI-33	27.5	20.40 (4.56)	2.2	Moderately resistant
6	NCSH-2431	45.5	30.50 (4.55)	3.2	Susceptible
7	BLSFH-15005	30.0	18.50 (4.34)	2.1	Moderately resistant
8	CSFH-14638	32.5	20.10 (4.52)	1.5	Moderately resistant
9	SVSH-498	30.0	25.30 (5.07)	1.7	Moderately resistant
10	RSFH-130	40.0	27.00 (5.24)	3.0	Susceptible
11	CSFH-15020	45.0	31.20 (5.60)	2.9	Susceptible
12	KBSH-79	47.5	31.00 (5.61)	2.6	Susceptible
13	LSFH-171	27.5	23.80 (4.91)	2.5	Susceptible
14	SVSH-475	40.0	33.00 (5.78)	3.5	Susceptible
15	SH-2150	40.0	32.20 (5.70)	3.0	Susceptible
16	SS-1319	47.5	36.20 (6.04)	3.0	Susceptible
17	DRSH-1	27.5	27.95 (5.33)	3.0	Susceptible
18	LSFH-1751	57.5	24.60 (5.00)	1.7	Moderately resistant
19	IIOSH-2	27.5	19.85 (4.51)	1.6	Moderately resistant
20	AKSF-52-4	22.5	20.15 (4.54)	2.3	Moderately resistant
21	BLSFH-15001	25.0	20.50 (4.57)	2.0	Moderately resistant
22	GMU-520	20.0	13.70 (3.76)	1.0	Resistant
23	GP6-442	42.5	32.00 (5.69)	2.7	Susceptible
24	LSFH-4951	47.5	32.80 (5.77)	3.1	Susceptible
25	GMU-490	30.0	21.20 (4.66)	2.1	Moderately resistant
26	GPN-219-2	22.5	19.40 (4.46)	2.0	Moderately resistant
27	ID-1079	25.0	19.20 (4.43)	1.5	Moderately resistant
28	R-64	30.0	24.40 (4.98)	1.5	Moderately resistant
29	RHF-138-R	30.0	22.40 (4.76)	1.5	Moderately resistant
30	AKSF-6-39	30.0	10.20 (3.25)	1.0	Resistant
	SE ±	-	0.35		
	CD at 5%	-	1.02		
	CV %	-	10.11		

\* Figures in parentheses are square root ( $x + 0.5$ ) transformed values

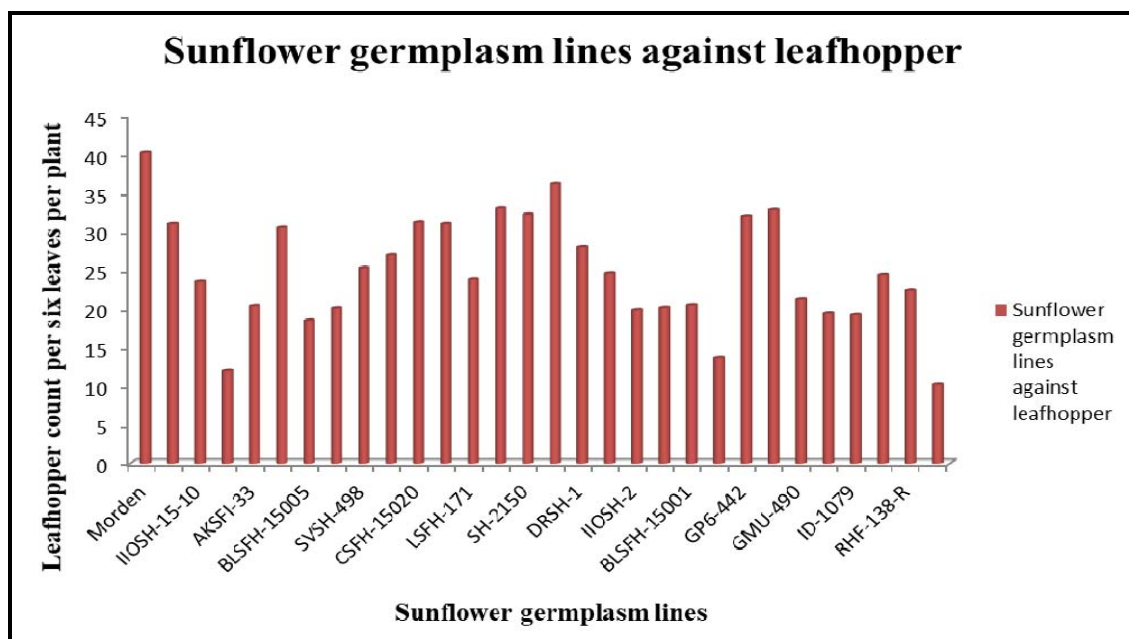


Fig 1: Screening of sunflower germplasm lines resistance/tolerance to leafhoppers

### Whitefly (*Bemisia tabaci*)

Data presented in table 2 and depicted in figure 2 revealed that the whitefly incidence was observed in the range of 8.90 to 43.50 per six leaves per plant. The best five germplasm lines which recorded comparatively lowest whiteflies were AKSF-6-39 i.e. 8.90 whiteflies per six leaves per plant

followed by IIOSH-2 (11.40 whiteflies per six leaves per plant), RHF-138-R (13.10 whiteflies per six leaves per plant), IIOSH-15-10 (13.90 whiteflies per six leaves per plant) and SVSH-475 (15.20 whiteflies per six leaves per plant). Highest number of whiteflies was reported on susceptible check Modern (43.50 per six leaves per plant).

Table 2: Percent foliage cupping and curling of sunflower germplasm

Sr. No.	Name of entries	% foliage cupping and curling	Whitefly count per six leaves	Damage grade	Category
1	Modern (Ch)	72.5	43.50 (6.62)*	4.0	Highly susceptible
2	KBSH-44(Ch)	20.0	15.90 (4.02)	1.5	Moderately resistant
3	IIOSH-15-10	15.0	13.90 (3.78)	1.0	Resistant
4	KBSH-80	30.5	25.60 (5.11)	3.0	Susceptible
5	AKSFI-33	22.5	15.70 (3.96)	1.5	Moderately resistant
6	NCSH-2431	22.5	25.00 (5.03)	3.0	Susceptible
7	BLSFH-15005	22.5	19.80 (4.50)	2.5	Moderately resistant
8	CSFH-14638	30.5	24.50 (4.99)	3.0	Susceptible
9	SVSH-498	20.0	17.80 (4.27)	2.5	Moderately resistant
10	RSFH-130	22.5	19.00 (4.39)	1.5	Moderately resistant
11	CSFH-15020	27.5	19.70 (4.49)	1.5	Moderately resistant
12	KBSH-79	23.33	19.90 (4.50)	2.0	Moderately resistant
13	LSFH-171	27.5	21.00 (4.63)	3.0	Moderately resistant
14	SVSH-475	25.0	15.20 (3.93)	1.5	Moderately resistant
15	SH-2150	22.5	17.75 (4.26)	2.5	Moderately resistant
16	SS-1319	25.0	19.30 (4.43)	1.5	Moderately resistant
17	DRSH-1	30.0	21.10 (4.61)	3.0	Susceptible
18	LSFH-1751	27.5	15.70 (4.01)	2.0	Moderately resistant
19	IIOSH-2	22.5	11.40 (3.43)	1.5	Moderately resistant
20	AKSF-52-4	27.5	19.40 (4.43)	2.5	Moderately resistant
21	BLSFH-15001	40.8	25.80 (5.13)	3.5	Susceptible
22	GMU-520	32.5	16.90 (4.11)	1.0	Resistant
23	GP6-442	27.5	17.55 (4.24)	1.5	Moderately resistant
24	LSFH-4951	27.5	16.60 (4.13)	1.5	Moderately resistant
25	GMU-490	27.5	18.90 (4.37)	1.5	Moderately resistant
26	GPN-219-2	27.5	17.30 (4.22)	1.5	Moderately resistant
27	ID-1079	25.5	16.90 (4.16)	1.5	Moderately resistant
28	R-64	22.0	19.80 (4.50)	2.5	Moderately resistant
29	RHF-138-R	20.0	13.10 (3.66)	1.5	Moderately resistant
30	AKSF-6-39	15.5	8.90 (3.05)	1.0	Resistant
	SE ±	-	0.40		
	CD at 5%	-	1.16		
	CV %	-	13.03		

\* Figures in parentheses are square root ( $x + 0.5$ ) transformed values.

The foliage cupping and curling ranged in between 15.00 to 72.50 per cent while the damage grade lies in between 1.0 to 4.0. The susceptible check Modern recorded a highest of 72.5 per cent cupping and curling also scored a highest of 4.0 damage grade.

Further the germplasm lines were categorized into five different categories based on damage grades. Among 30 germplasm screened for whiteflies incidence, none of the germplasm was found 'Highly Resistant' against whiteflies while three germplasm lines viz., IIOSH-15-10, GMU-520 and AKSF-6-39 were categorized as 'Resistant' germplasms. Twenty germplasm lines were found as 'Moderately Resistant' and six as 'Susceptible'. The check Modern was found 'Highly Susceptible' to whiteflies.

Some earlier researcher viz., (Bhat and Virupakshappa 1993)<sup>[3]</sup>, (Muhammad and Hafeez-jr-Rehman 2000)<sup>[10]</sup>, (Muhammad and Muhammad 2001)<sup>[9]</sup>, (Azza and Saffa 2013)<sup>[2]</sup>, (Kumar and Dhillon 2014)<sup>[8]</sup> and (Jayewar *et al.*, 2017)<sup>[6]</sup>, (Saritha *et al.*, 2008)<sup>[13]</sup> screened some sunflower genotypes and observed KBSH-1 as promising accession

against whitefly while (Jayewar *et al.*, 2018)<sup>[5]</sup> found GMU-938,943 and 967 as promising against sunflower whitefly. In present study KBSH-44, KBSH-79 and GMU-490 accessions were found moderately resistant against whitefly. Also, the results of present findings are analogous to the findings of (Muhammad *et al.*, 2017)<sup>[11]</sup> The varieties Armoni, Hysun-33, NK-Singi, S-278 and US-666 were screened against sucking pests namely jassids, aphid, whitefly, thrips, dusky cotton bugs and recorded significantly lowest population in S-278 as 16.43. (Mohammad *et al.*, 2018)<sup>[12]</sup> screened nineteen sunflower hybrids under field condition and reported that the hybrids showed significant variation regarding the insect susceptibility as observed in present study where the leafhopper incidence was observed in the range of 10.2 to 40.22 per six leaves per plant while whiteflies ranged in between 8.90 to 43.50 per six leaves per plant distributing the screened entries in various categories from highly susceptible to highly resistant. Thus, the present findings are more or less in agreement with the findings of all the above earlier workers.

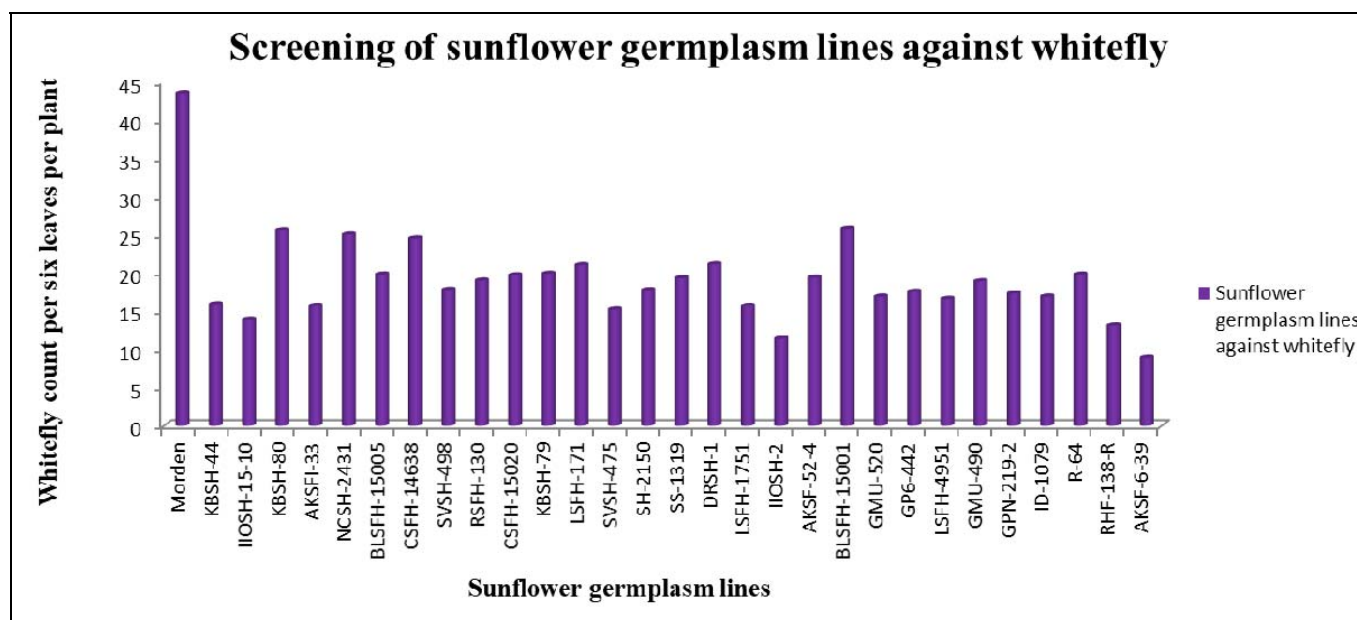


Fig 2: Screening of sunflower germplasm lines resistance/tolerance to whitefly

## Conclusion

The present study it is concluded that among 30 germplasm lines screened against sucking insect-pests of sunflower, the most of the germplasm lines were found moderately resistant to leafhoppers and whiteflies.

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