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RESEARCH ARTICLE :

Evaluation of germplasm against sucking pest in sunflower

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SUMMARY : Sunflower (*Helianthus annuus* L.,) is an efficient oilseed crop with high quality edible oil and wider adaptability. The crop has great potential for diversification of major cropping systems in the country particularly in Maharashtra. However, productivity in sunflower is affected by a large number of biotic and abiotic factors. Among the biotic factors, the attack of insect -pests is the major limiting factor in its successful cultivation. About 251 insect pests are reported to infest the sunflower and among these leafhoppers, thrips, whiteflies, defoliators and head borers are key pest of the crop. In Sunflower, the work for the development of insect resistant cultivar /hybrid is still in its infancy .Therefore, the present study was undertaken to screen the available breeding material of sunflower for resistance to leaf hopper, which may be utilized in breeding programmers for developing leaf hopper resistant hybrids. Field experiment was conducted to screen germplasm lines of sunflower against sucking pests in Augmented Block design using infester row technique of susceptible check (morden). Observations on sucking pests count were recorded as per guidelines of AICRP (Sunflower) project. Among entries screened, thrips ranged between 0.20 to 4.80 throughout season. The entries GMU-919,920,921,956 and 958 recorded lowest population i.e. below 1 thrip/plant, whiteflies remained low in entries GMU-938,943 &967whereas leafhoppers were low in GMU-940.

KEY WORDS :
Sunflower, Screening, germplasmline, Leaf hopper, Thrips, Whiteflies

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BACKGROUND AND OBJECTIVES

Sunflower (*Helianthus annuus* L.) is an important oil seed crop of the family Asteraceae. Sunflower has shown distinct superiority over other oilseed crops owing to its wider adaptability to different agro-climatic conditions ,highest oil production per unit area, short duration, high yield potential, ability to withstand drought, photoperiod insensitivity, lower seed rate, high seed multiplication ratio and high quality edible oil (Sindagi and Virupakshappa, 1986). During 2013-14, the area under sunflower cultivation in India was 0.691 million ha, with a total annual production of 0.547 million tones and productivity of 729 kg/ha. Sunflower is largely confined to southern parts of the country comprising the states of erstwhile Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu.

These four states contribute about 90 per cent of total acreage and 78 per cent of total production (Chanderrao *et al*., 2015).

The productivity of this crop is affected by several biotic and abiotic constraints. Biotic factors like insect pests are major threats to the crop. Leafhoppers, thrips, whiteflies, defoliators and head borers are key pest of the crop. The major insect pest attacking sunflower crop include aphid, whitefly, leaf miner, green leaf hopper, painted bug and seed weevil (Butt,1989). Among these Sunflower Leaf hoppers, *Amrasca biguttula biguttula* Ishida (Homoptera : Cicadellidae),is one of the economically important pest as it is causing complete crop failure in case of severe infestation. Next important sucking pest of sunflower in India are Whitefly (*Bemisia tabaci* Gen.), Thrips (*Scirtothrips dorsalis*) (Rana and Sheoran, 2004). Both nymphs and adults these sucking pest suck the plant sap and their severe infestation leads to curling of leaves which reduces the seed and oil yield.

Insect resistance in crop plants is an important component of Integrated Pest Management (IPM) and it is considered as non-monetary input at farmers end. Resistant and tolerant cultivars form the basic component of Integrated Pest Management (IPM) over which other components are to be built up. Even a low level of tolerance in plants has a dramatic effect, which in fact reduces the need of insecticides. Use of resistant or less-susceptible cultivars is one of the most important methods of keeping insect populations below economic threshold levels (Kavitha and Dharma Reddy, 2012). Similarly, host-plant resistance is not a panacea for all pest problems but can be effectively exploited and utilized against sucking pests (Saritha *et al*., 2008). Therefore the present investigation was undertaken with a objective to screen the available breeding material of sunflower for resistance to leaf hopper, which may be utilized in breeding programmes for developing sucking pest resistant hybrids.

RESOURCES AND METHODS

Hundred germplasm lines along with infester rows of susceptible check morden obtained from Indian Institute of Oilseeds Research and were screened for their resistance against sucking pest of sunflower *i.e.* leaf hopper (*A. biguttula biguttula*), whitefly (*Bemisia tabaci* Gen.) and thrips (*Scirtothrips dorsalis*). This field experiment was conducted during *Kharif*, 2011 at Oilseeds Research Station, Latur, Maharashtra in Augmented Block Design. Sunflower seeds were sown on the ridges at a spacing of 60 x 30 cm. Twelve plants were maintained per row. A known susceptible check 'Morden' was maintained @ one row for every ten test accessions as infester rows. Two rows of the susceptible check were also maintained around the experimental field as infester crop. Recommended agronomic practices were followed except plant protection measures. Observations on the number of leaf hoppers, thrips and whiteflies were made at weekly interval by counting the number of nymphs and adults present in six leaves two each from top, middle and bottom portion of three plants in a row. Using these data, the mean population per plant was worked out and further analysis and categorization of entries were made.On the basis of the mean number of insects present per plant, a mean scale index as furnished below, formulated to evaluate the level of resistance of the screened accessions,after some modification as given by Hyacinth and Selvanarayanan (2011) was used to interpret results.

Table A : Scale to categorize germplasm lines

Leaf hopper population/ plant	Resistance grade	Resistance rating
0 - 1	I	R
1.01 - 2	II	MR
2.01 - 3	III	S
Above 3	IV	HS

OBSERVATIONS AND ANALYSIS

Total 100 germplasm lines were screened against major pest of Sunflower. Data presented in Table 1 revealed that, the germplasm lines GMU-901, 954, 955, 966, 991 and 996 did not germinate at all but among rest 94 germplasm lines population of sucking pest was remained medium to high during season. Mean thrips population ranged between 0.20 to 4.80/ plant, mean leafhopper population was in the range of 2.00 - 6.40 / plant whereas whiteflies population ranged between 0.80 - 5.90/ plant throughout season (Table 1). The entries GMU-919, 920, 921, 956 and 958 recorded resistant reaction *i.e.* below 1 thrip /plant, whiteflies remained low in entry GMU-938, 943 and 967 which were resistant to whitefly whereas for leafhopper no entry given resistant reaction. Germplasm lines GMU-922, 930,931, 932, 949, 951, 952, 981, 983 and 986 recorded moderately resistant reaction for thrips; for whiteflies GMU-931, 932, 933, 937, 940, 941, 942, 944, 945, 950, 951, 952, 968, 969, 972,

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Table 1 : Germplasm lines screened for pest resistance/ tolerance in sunflower

Name of germplasm	Av. white fly/6 l	Av. thrips/ 6 leaves	Av. leafhoppers /6 leaves	Name of germplasm	Av. white fly/6 l	Av. thrips/ 6 leaves	Av. leafhoppers /6 leaves	Name of germplasm	Av. white Fly/6 l	Av. thrips/ 6 leaves	Av. leafhoppers /6 leaves	Name of germplasm	Av. white Fly/6 l	Av. thrips/ 6 leaves	Av. leafhoppers /6 leaves
GMU-901	NG	NG	NG	GMU-927	3.00	2.80	3.80	GMU-953	2.60	1.50	3.70	GMU-979	2.60	3.00	4.40
GMU-902	2.80	2.80	5.10	GMU-928	2.10	3.60	3.20	GMU-954	NG	NG	NG	GMU-980	2.50	2.40	5.20
GMU-903	3.60	2.60	3.50	GMU-929	3.90	3.20	3.80	GMU-955	NG	NG	NG	GMU-981	2.10	1.60	4.20
GMU-904	5.40	2.40	3.20	GMU-930	2.40	2.00	4.40	GMU-956	2.30	0.50	2.80	GMU-982	NG	NG	NG
GMU-905	2.10	2.60	4.20	GMU-931	1.10	1.40	3.30	GMU-957	2.80	1.60	4.40	GMU-983	2.20	1.60	4.50
GMU-906	3.50	2.80	3.80	GMU-932	1.50	1.40	3.60	GMU-958	3.60	0.80	4.30	GMU-984	NG	NG	NG
GMU-907	3.20	2.80	4.60	GMU-933	1.30	3.40	4.60	GMU-959	3.30	2.80	5.00	GMU-985	1.80	1.80	3.50
GMU-908	3.40	2.60	5.50	GMU-934	4.90	4.80	5.00	GMU-960	3.20	2.20	2.30	GMU-986	2.10	1.50	2.90
GMU-909	3.20	2.60	3.20	GMU-935	3.60	2.40	4.50	GMU-961	2.40	2.40	4.70	GMU-987	2.80	2.20	2.20
GMU-910	4.60	2.60	4.50	GMU-936	2.60	2.60	5.50	GMU-962	2.80	2.80	3.30	GMU-988	2.50	2.60	3.30
GMU-911	1.50	3.00	4.50	GMU-937	1.20	2.20	5.80	GMU-963	2.60	2.60	3.00	GMU-989	2.60	2.80	2.90
GMU-912	NG	NG	NG	GMU-938	0.80	2.40	4.40	GMU-964	2.60	2.40	3.60	GMU-990	3.80	2.60	2.80
GMU-913	2.50	3.20	4.80	GMU-939	3.50	3.20	5.10	GMU-965	2.50	3.20	3.20	GMU-991	NG	NG	NG
GMU-914	4.10	3.00	4.60	GMU-940	1.90	2.80	2.00	GMU-966	NG	NG	NG	GMU-992	2.00	2.40	3.90
GMU-915	3.00	2.80	4.40	GMU-941	1.40	2.60	4.20	GMU-967	1.00	2.20	2.30	GMU-993	3.60	2.40	3.90
GMU-916	3.20	2.00	4.60	GMU-942	1.70	2.40	4.80	GMU-968	2.00	2.80	3.80	GMU-994	NG	NG	NG
GMU-917	5.90	2.20	4.20	GMU-943	1.00	2.60	2.80	GMU-969	2.00	3.60	3.60	GMU-995	2.70	3.00	3.80
GMU-918	NG	NG	NG	GMU-944	1.60	2.10	2.70	GMU-970	2.60	2.40	3.00	GMU-996	NG	NG	NG
GMU-919	2.50	0.70	5.40	GMU-945	1.40	3.40	3.90	GMU-971	3.10	2.80	6.40	GMU-997	2.80	3.60	2.30
GMU-920	2.50	0.90	3.00	GMU-946	3.00	3.00	5.90	GMU-972	2.00	3.20	4.70	GMU-998	2.80	2.10	2.60
GMU-921	3.00	0.20	5.30	GMU-947	2.60	4.00	5.50	GMU-973	2.60	2.60	3.10	GMU-999	2.10	2.00	4.30
GMU-922	3.70	1.20	3.40	GMU-948	2.60	3.40	4.60	GMU-974	2.70	2.90	5.30	GMU-1000	2.40	2.40	4.50
GMU-923	3.60	2.10	3.00	GMU-949	2.20	1.60	3.70	GMU-975	2.60	2.80	3.30	Morden(SC)	3.40	4.60	5.64
GMU-924	3.50	2.40	4.00	GMU-950	1.10	3.40	4.00	GMU-976	2.80	3.20	3.80	SC – Susceptible Check ,			
GMU-925	4.10	2.80	4.00	GMU-951	1.90	1.20	3.80	GMU-977	2.40	4.00	3.90	NG- No Germination			
GMU-926	3.90	2.60	3.60	GMU-952	1.60	1.40	2.30	GMU-978	3.00	3.60	5.60				

Table 2 : Rating of sunflower germplasm lines for leaf hopper, thrips and whiteflies

Sr. No.	Pest population/ plant	Resistance rating	Resistance grade	Name of the accessions (Leaf hopper)	Name of the accessions (Thrips)	Name of the accessions (Whiteflies)
1.	0 - 1	I	R	---	GMU-919, 920, 921, 956 and 958	GMU-938, 943 and 967
2.	1.01 - 2	II	MR	GMU-940	GMU-922, 930, 931, 932, 949, 951,952, 981, 983 and 986.	GMU-931, 932, 933, 937, 940, 941, 942, 944, 945, 950, 951, 952, 968, 969, 972, 985 and 992
3.	2.01 - 3	III	S	GMU-923, 943, 944, 952, 956, 960, 967, 970, 986, 987, 989, 990, 997 and GMU- 998.	GMU-902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 914, 915, 916, 917, 923, 924, 925, 926, 927, 936, 937, 938, 940, 941, 942, 943, 944, 946, 959, 960, 961, 962, 963, 964, 967, 968, 970, 971, 973, 974, 975, 987, 988, 989, 990, 992, 993, 998, 999 and 1000.	GMU-902, 905, 913, 919, 920, 921, 927, 928, 930, 936, 946, 947, 948, 949, 953, 956, 957, 961, 962, 963, 964, 965, 970, 973, 974, 975, 976, 977, 978, 979, 980, 981, 983, 986, 987, 988, 989, 997, 998, 999 and 1000
4.	Above 3	IV	HS	GMU-902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 913, 914, 915, 916, 917, 919, 920, 921, 922, 923, 924, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 941, 942, 945, 946, 947, 948, 949, 950, 951, 957, 958, 959, 961, 962, 964, 965, 968, 969, 970, 971, 972, 973, 975, 976, 977, 978, 979, 980, 981, 983, 985, 988, 992, 993, 995, 999, 1000 and Morden.	GMU-913, 928, 929, 939, 945, 947, 948, 950, 969, 972, 976, 977, 978, 997and Morden.	GMU-903, 904, 906, 907, 908, 909, 910, 914, 916, 917, 922, 923, 924, 925, 926, 929, 934, 935, 939, 958, 959, 960, 971, 990, 993 and Morden

985 and 992 gives moderate resistant reaction and for leafhoppers moderate resistant was recorded by only GMU-940. Rest of the entries shown either susceptible or highly susceptible reaction in the present study (Table 2).

Germplasm lines GMU-931, 932, 951 and 952 shown multiple resistant towards thrips and whiteflies, therefore can be utilized for further resistant improvement and hybrid development programme.

Suganthy and Uma (2010) reported a maximum of 28 hoppers per plant in Morden. Based on the mean scale index, in first season, four accessions *viz.*, KBSH 1, AHT 14, GK 2002 and GMU 698 had less leaf hopper population (< 1.0 hopper/plant) than other accessions and were grouped as resistant varieties (Table 1). Another six accessions *viz.*, AHT 17, IHT 751, GMU 606, GMU 647, K 578 and GMU 621 recorded higher mean population (1.0 to 2.0 hoppers/plant) and based on the mean, these were grouped as moderately resistant varieties. Among the remaining accessions, 95 accessions were rated as susceptible and seven accessions were rated as highly susceptible. Rana and Sheoran (2004) reported that the hopper population ranged from a minimum of 2 on HSFH 848 to a maximum of 4 per plant on KBSH 1. This result was in contradictory with the present findings whereas Bhat and Virupakshappa (1993) observed some hybrids such as KBSH 8 and KBSH 1 to record less damage. In the second season, KBSH 1 recorded the least mean population and was rated as resistant (Table 2) while 7, 18 and 86 accessions were rated as moderately resistant, susceptible and highly susceptible, respectively. Similarly, Saritha *et al.* (2008) also reported the least mean population of leaf hoppers in KBSH 1. Based on this study, the accessions KBSH 1, AHT 14, GK 2002 and GMU 698 recorded the least hopper population and can be used for further genetic improvement programmes.

Similarly, entries were also screened for their resistance to thrips population for two years. The range of thrips in the pooled data of two years was between 2.95 to 8.85 thrips per plant, with a maximum of 8.85 thrips in the entry 376 and a minimum of 2.95 in the entry 363. When these entries were grouped by following the procedure adopted by Painter (1951), three entries *viz.*, 307, 35 and 373 were found resistant, 15 entries were classified under moderately resistant category, 67 entries were grouped as susceptible and 15 entries were found highly susceptible (Katti, 2007). The thrips population was more in the early stage of the crop than the later stage. Similar work has been carried out at

various stations across the country by AICRP centres (Anonymous, 2000, 2001, 2002, 2003, 2004, 2005 and 2006; Jagadish *et al*., 2002; Prasad, 2004 and Lokesh, 2006). However these entries were different from the present investigation and hence, cannot be compared.

On the similar lines Kumar and Dhillon (2014) also reported that from the two years' pooled data it is evident that the entry Jawalamukhi recorded the minimum whitefly population (2.26 adults/ 3 leaves). It was followed by GKSFH 2002 and PSH 652 (2.76 and 2.93 adults/ 3 leaves). However, the maximum population of 5.61 adults/ 3 leaves was recorded in PSFH-118. Although these entries were different from the present investigation and hence, cannot be compared.

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