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Original Research Article

Germplasm Evaluation for Resistance against Sucking Pest in Sunflower

Nareshkumar E. Jayewar*, Dnyandeo S. Mutkule and Dhirajkumar R. Kadam

Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India
**Corresponding author*

A B S T R A C T

Sunflowers are botanically classified as *Helianthus annuus* L. They are large plant and are grown throughout the world because of their relatively short growing season. Sunflower is an annual herb, with a rough, hairy stem, 3 to 12 feet high, broad, coarsely toothed, rough leaves, 3 to 12 inches long and circular heads of flowers, 3 to 6 inches wide in wild specimens and often a foot or more in cultivation. The flower-heads are composed of many small tubular flowers arranged compactly on a flattish disk: those in the outer row have long strap-shaped corollas, forming the rays of the composite flower. In recent years, the sunflower cultivated area has been steadily increasing due to the breeding of dwarf high yielding hybrids that also facilitate mechanization and the emphasis given to polyunsaturated acids for human consumption.The crop has great potential for diversification of major cropping systems in the country particularly in Maharashtra. However, productivity in sunflower is affected by 251 insect pests by infesting the crop 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 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, entries namely GMU-1008, 1010, 1011, 1041, 1084 and 1090 were free from leaf hopper**,** entries GMU-1009, 1010, 1011, 1032, 1090 and 1096 were free from white fly incidence and entries GMU-1041 and 1084 were found free from thrips incidence.

Keywords

Sunflower, Screening, germplasm line and Leaf hopper, thrips, whiteflies

Introduction

India is considered to be a paradise of oilseed crops having 19 per cent of the world's total area under oilseeds, but accounts for only 10 per cent of world's total oilseeds production. Oilseeds form the second largest agricultural commodity after cereals, sharing 14 per cent of the country's gross cropped area, accounting nearly five per cent of gross national product and ten per cent of the value of all agricultural products (Shankergoud *et al.,* 2006).

Though, India is the third largest producer of the oilseeds, the country is facing an acute shortage of edible oil. The per capita annual consumption of vegetable oils is only nine kg in India as against 22.0 kg in the developed countries.

Presently, in our country sunflower is cultivated over an area of 23.50 lakh hectares with a production of 14.80 lakh tones. The major sunflower growing states

in the country are Karnataka, Maharashtra, Andhra Pradesh and Tamil Nadu. Among these, Karnataka occupies first position accounting 53 per cent of total area and 35 per cent of total production of India (Anon., 2006). In the recent past, the crop is also becoming popular in non-traditional states *viz.*, Punjab, Haryana and Uttar Pradesh. The large scale cultivation of sunflower in India started only in 1972 with the introduction of high yielding Russian varieties. This crop 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 potential yield and ability to withstand drought as compared to other rainfed crops. Sunflower is photo insensitive and thus it can be grown round the year.

The productivity of this crop is affected by several biotic and abiotic constraints. Among the several biotic stresses for successful sunflower production, susceptibility to insect pests and diseases is one of the major constraints.

As many as 251 insect and mite species have been recorded on sunflower at global level (Rajmohan, 1974). In India more than 50 insect species have been found to damage the crop at different phenological stages of the crop growth. Among them, nine are major pests and remaining miner ones. Insect pests of sunflower are broadly classified as seedling pests, sucking pests, soil insects, defoliators and inflorescence pests (Basappa and Prasad, 2005). Sucking pests like leafhoppers, thrips, whiteflies contribute to a considerable extent of loss to the crop. Leafhopper alone can cause damage upto 46 per cent (Anon., 1997). Whiteflies under favourable conditions also pose threat to the crop. Several species of thrips are associated with the crop, which do not cause direct damage but causes enormous loss indirectly as vector of viral diseases, especially sunflower necrosis virus (Chander Rao, 2002). Therefore the present investigation was undertaken with an objective to screen the available breeding material of sunflower for resistance to sucking pest which may be utilized in breeding programmes for developing sucking pest resistant hybrids.

Materials and Methods

Germplasm lines 1001 to 1100 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*). Field experiment was laid out at Oilseeds Research Station, Latur, Maharashtra during *Kharif*, 2012 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 of 4.2m. A known susceptible check 'Morden' was maintained @ one row for every 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 starting after 15 days after sowing. 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 Amala Hyacinth, and Selvanarayanan, 2011 was used to interpret results.

Results and Discussion

Total 100 germplasm lines were screened against major pest of Sunflower. Leaf hopper incidence ranged between 0.0 and 10.2/plant, six entries namely GMU- 1008, 1010, 1011, 1041, 1084 and 1090 were free from leaf hopper incidence whereas GMU-1021 found maximum leaf hopper incidence. Incidence of thrips among the different GMU entries ranged between 0.00 and 2.8 per plant however entries GMU- 1041 and 1084 were found free from thrips incidence. White fly incidence ranged between 0.0 to 3.4/plant. Entries namely GMU-1009, 1010, 1011, 1032, 1090 and 1096 were free from white fly incidence (Table 1). The entries 1003-1006, 1008, 1009, 1013-1020, 1022, 1023, 1027, 1033, 1035, 1038, 1040, 1041, 1045, 1046, 1048, 1055-1069, 1071-1073, 1075-1081, 1083 and 1086-1088 recorded resistant reaction i.e. below 1 thrip /plant, whiteflies remained low in entries GMU-1005, 1007-15, 1027, 1029-1043, 1045, 1047-1055, 1061, 1063, 1064, 1066-1071, 1073-1075, 1077, 1079, 1080, 1083-1097, 1099 and 1100 which were resistant to whitefly whereas for leafhopper entries 1008, 1010, 1011, 1041, 1056, 1084, 1088, 1090, 1093, 1094, 1096 and 1099 given resistant reaction (Table 2).

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 programs.

Table.1 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

Table.2 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-1001	1.4	1.2	5.8	GMU-1027	0.2	0.2	4.4	GMU-1053	1.0	0.6	1.4	GMU-1079	0.6	0.4	1.6
GMU-1002	1.6	1.2	4.8	GMU-1028	1.8	0.4	8.6	GMU-1054	0.4	1.2	1.8	GMU-1080	1.0	0.8	1.2
GMU-1003	1.0	1.0	6.2	GMU-1029	0.4	0.4	9.0	GMU-1055	1.0	1.0	2.2	GMU-1081	**3.4**	0.6	8.2
GMU-1004	1.2	0.6	2.6	GMU-1030	0.2	0.2	6.4	GMU-1056	1.2	1.0	0.6	GMU-1082	2.4	1.8	6.2
GMU-1005	1.0	1.8	5.6	GMU-1031	0.8	0.6	6.6	GMU-1057	1.6	1.0	2.8	GMU-1083	0.4	0.4	4.8
GMU-1006	2.6	0.8	3.4	GMU-1032	**0.0**	0.2	8.2	GMU-1058	1.4	1.0	2.0	GMU-1084	0.6	**2.6**	**0.0**
GMU-1007	1.0	1.2	4.2	GMU-1033	0.4	0.6	6.8	GMU-1059	1.4	0.4	3.2	GMU-1085	0.6	2.2	3.8
GMU-1008	0.4	0.6	**0.0**	GMU-1034	0.6	1.2	6.6	GMU-1060	2.0	1.0	2.2	GMU-1086	0.8	1.0	4.8
GMU-1009	**0.0**	1.0	4.6	GMU-1035	0.4	0.6	5.8	GMU-1061	0.8	0.4	1.8	GMU-1087	0.6	0.8	5.2
GMU-1010	**0.0**	1.4	**0.0**	GMU-1036	0.8	1.2	7.0	GMU-1062	1.2	1.0	1.8	GMU-1088	0.2	0.8	0.6
GMU-1011	**0.0**	1.2	**0.0**	GMU-1037	0.8	0.6	3.8	GMU-1063	0.4	0.4	2.4	GMU-1089	0.4	1.4	1.2
GMU-1012	0.6	1.2	2.0	GMU-1038	0.4	0.8	4.2	GMU-1064	1.0	0.4	1.6	GMU-1090	**0.0**	1.0	**0.0**
GMU-1013	0.4	0.8	4.2	GMU-1039	0.2	2.0	4.8	GMU-1065	1.4	0.4	3.0	GMU-1091	0.6	0.8	6.2
GMU-1014	1.0	0.4	4.2	GMU-1040	1.2	1.0	3.0	GMU-1066	0.6	0.6	3.6	GMU-1092	0.6	1.4	3.2
GMU-1015	0.6	1.0	2.4	GMU-1041	0.6	**0.0**	**0.0**	GMU-1067	0.4	1.6	3.4	GMU-1093	0.2	2.2	0.6
GMU-1016	1.2	0.8	2.6	GMU-1042	1.0	1.6	4.6	GMU-1068	0.4	1.0	3.0	GMU-1094	0.4	1.0	0.4
GMU-1017	1.6	0.6	4.4	GMU-1043	0.6	2.0	5.8	GMU-1069	0.8	0.6	3.8	GMU-1095	0.8	1.6	2.4
GMU-1018	1.6	0.2	2.6	GMU-1044	2.2	1.6	5.6	GMU-1070	0.6	1.6	3.4	GMU-1096	**0.0**	1.2	1.0
GMU-1019	1.8	1.0	2.8	GMU-1045	1.0	1.0	4.8	GMU-1071	0.8	1.0	2.8	GMU-1097	1.0	0.8	2.2
GMU-1020	1.6	0.6	2.4	GMU-1046	1.2	0.8	6.8	GMU-1072	1.2	0.8	2.6	GMU-1098	1.4	0.6	5.0
GMU-1021	2.2	2.4	**10.2**	GMU-1047	0.2	1.2	6.8	GMU-1073	0.4	0.2	3.0	GMU-1099	0.2	0.2	0.2
GMU-1022	2.6	0.8	8.2	GMU-1048	0.8	1.0	4.6	GMU-1074	0.8	1.6	3.8	GMU-1100	0.4	1.0	4.8
GMU-1023	2.0	0.4	6.4	GMU-1049	0.6	0.8	6.8	GMU-1075	0.2	0.6	2.6	Morden(SC)	1.6	2.0	5.2
GMU-1024	2.2	1.2	5.0	GMU-1050	0.4	0.8	3.8	GMU-1076	1.4	1.0	3.6	SC – Susceptible Check.			
GMU-1025	1.8	1.0	5.6	GMU-1051	1.0	0.6	4.0	GMU-1077	0.8	0.6	4.0				
GMU-1026	1.2	3.2	5.2	GMU-1052	0.6	1.0	2.4	GMU-1078	1.2	0.2	2.4				

Table.3 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-1008,1010,1011,1041,1056, 1084, 1088,1090, 1093,1094,1096 And 1099	GMU-1003-1006,1008,1009,1013-1020,1022,10231027,1033,1035,1038,1040,1041,1045,1046,1048,1055-1069,1071-1073,1075-1081,1083, and 1086-1088.	GMU-1005,1007-15,1027,1029-1043,1045,1047-1055, 1061, 1063, 1064, 1066-1071, 1073-1075, 1077, 1079, 1080, 1083-1097, 1099 and 1100
2	1.01 - 2	II	MR	GMU-1012,1053,1054,1058,1061, 1062,1064,1079,1080 and1089.	GMU-1001,1002,1007,1010-1012, 1024,1025,1034,1036,1037,1039,1042-1044,1047,,1070,1074,1082,1089,1095,1096 and Morden.	GMU-1001-1004,1016-1020,1025,1026,1028,1040,1046,1056-1060,1062,1065,1072,1076,1078 and Morden.
3	2.01 - 3	III	S	GMU-1004,1015,1016,1018-1020, 1040,1052,1055,1057,1059,1060, 1063,1065,1071-1073, 1075, 1078, 1095 and 1097.	GMU-1021,1084 and 1085.	GMU-1006,1021-1024,1044 and 1082.
4	Above 3	IV	HS	GMU-1001-1003,1005-1007,1013, 1017,1021-1039,1042-1051,1066-1070, 1074,1076,1077,1081-1083,1085-1087, 1091,1092,1098 and Morden.	GMU-1026.	GMU-1081.

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 (Kati, 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), Ajit Prasad (2004) and Lokesh (2006)].

However these entries were different from the present investigation and hence, cannot be compared.

On the similar lines Sarwan 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) (Table 3).

However, the maximum population of 5.61 adults/ 3 leaves was recorded in PSFH-118. Jayewar *et al.*, (2017), evaluated100 germplasm lines 901-1000 and concluded that 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 and 967 whereas leafhoppers were low in GMU-940. Although these entries were different from the present investigation and hence, cannot be compared.

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