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**RESEARCH ARTICLE :**

# Evaluation of germplasm against major lepidopteron pest in sunflower

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**SUMMARY :** In the Indian subcontinent the sunflower (*Helianthus annuus* L.) crop is fast expanding to different agroecological niches and cropping systems due to its wide adaptability.Among biological constraints in the sunflower production, pests dominate the scenario. A diverse assemblage of both beneficial and harmful insect species is associated with the sunflower ecosystem. Though more than fifty insect species have been reported on sunflower, cutworms (*Agrotis* spp.), sucking pests, leaf and plant hoppers (*Amrasca biguttula biguttula* Ishida, *Empoasca* spp.), thrips (*Thrips palmi*), whitefly (*Bemisia tabaci* Gennadius), defoliators (*Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius, and *Plusia orichalcea* Fab.) and capitulum borer (*Helicoverpa armigera* Hubner) are major pests of economic concern. Therefore, the present experiment was undertaken to screen the available germplasm of sunflower for resistance to defoliators (*Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius, and *Plusia orichalcea* Fab.), and capitulum borer (*Helicoverpa armigera* Hubner), which may be further used for conversion in to resistant hybrids, in Augmented Block design consisiting of 4.5 m row of each germplasm with infester row of susceptible check (morden). Among entries screened, the population of defoliators (*Spodoptera, Trichoplusia* and *Spilosoma*) was moderate ranged between 0.53(GMU-973)- 1.48/plant (GMU-902) and *Helicoverpa* 0.1 to 1.20 /head. The entries GMU-942 and 948 has minimum incidence *i.e.* 0.1 larva/head of sunflower.

**KEY WORDS :**
Sunflower, Screening, germplasm lines and defoliators, Capitulum borer

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## BACKGROUND AND OBJECTIVES

Sunflower (*Helianthus annuus* L.) is one of the important oilseed crops in the world which ranks third in area after soybean and groundnut. Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu contribute about 90 per cent of total acreage and 78 per cent of total production (Chanderrao *et al*., 2015) in India. Cultivated sunflower, a member of the family Asteraceae (Compositae) is believed to have been first domesticated in the central part of the United States.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 9 kg in India as against 22.0 kg in the developed countries.

The constraints for low productivity of this crop are attack of several biotic and abiotic factors. Among biological constraints in the sunflower production, pests dominate the scenario.

A diverse assemblage of both beneficial and harmful insect species is associated with the sunflower ecosystem. Though more than fifty insect species have been reported on sunflower, cutworms (*Agrotis* spp.), sucking pests, leaf and plant hoppers (*Amrasca biguttula biguttula* Ishida, *Empoasca* spp.), thrips (*Thrips palmi*), whitefly (*Bemisia tabaci* Gennadius), defoliators (*Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius and *Plusia orichalcea* Fab.) and capitulum borer (*Helicoverpa armigera* Hubner) are major pests of economic concern. Among insect pests of sunflower, *H. armigera* is a highly polyphagous and destructive pest pest with more than 180 host plants including important crop plants such as oilseeds, pulses, cotton, vegetables, etc.Various pest species damage different parts of the sunflower plant at different phenological stages. Soil insects damage roots and emerging seedlings. Defoliators and sucking pests cause losses in food reserves. Inflorescence pests like *H.armigera* destroy floral parts and developing seeds and cause direct damage. (Basappa, 1998).

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 Reddy, 2012). Therefore, the present investigation was undertaken with a objective to screen the available breeding material of sunflower for resistance to defoliators and capitulum borer which may be utilized in breeding programmes for developing resistant hybrids.

## RESOURCES AND METHODS

Filed experiment with 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 defoliators (*Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius, and *Plusia orichalcea* Fab.), and capitulum borer (*Helicoverpa armigera*Hubner) during *Kharif*, 2011-12 at Oilseeds Research Station, Latur, Maharashtra in Augmented Block Design. Sunflower seeds were dibbled on the ridges at a spacing of 60 X 30 cm, fifteen 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 sown around the experimental field as infester crop. Recommended agronomic practices were followed except plant protection measures. Observations on the number of defoliators and capitulum borer were made at weekly interval by as follow :

**Head borer:**

Randomly 5 plants were selected, % seed damage head and the larval number flower bud -1 and flower head-1 were recorded.

**Damage by defoliators:**

Defoliation by *Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius and *Plusia orichalcea* Fab were recorded by 5 randomly selected plants, counting the total and affected leaves and express their damage in per cent. Using these data, the mean population per plant and mean per cent was worked out and further analysis and categorization of entries were made. Using scale to evaluate the level of resistance of the screened accessions, after some modification as furnished by Kavitha and Reddy (2012) to interpret results.

**Table A : Scale to categorize germplasm lines**

| Pest per cent damage /plant | Resistance grade | Resistance rating |
|---|---|---|
| 0 | I | HR |
| 0.01-1 | II | R |
| 1.1 – 2.5 | III | MR |
| 2.6-3.5 | IV | S |
| 3.6 and above | v | HS |

## OBSERVATIONS AND ANALYSIS

Field evaluation of total 100 germplasm lines was conducted to screen germplasm against defoliators (*Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius, and *Plusia orichalcea* Fab.), and capitulum borer (*Helicoverpa armigera* Hubner) of Sunflower. Data presented in Table 1 to 3 revealed that, the germplasm lines GMU-901, 912, 918, 954, 955, 966, 991 and 996 did not germinate at all but among rest 92 germplasm lines population of pest was remained moderate during season which was above economic threshold level . Mean defoliators (*Spilosoma obliqua* Walker, *Spodoptera litura* Fabricius, and *Plusia orichalcea* Fab.) population ranged between 0.53 to 1.48 larvae / plant, Mean per cent defoliation was in the range of 0.42 to 28.00 per cent whereas capitulum borer (*Helicoverpa armigera* Hubner) population ranged between 0.10 – 1,20 larvae / plant and Mean head damage per cent was in the range of 0.24 to 15.96 per cent throughout season. The susceptible check Morden recorded highest mean per cent defoliation and mean head damage per cent. The entries GMU-973 and GMU-924 recorded minimum defoliator population and defoliation per cent, while the entry GMU-942 recorded minimum capitulum borer population and Mean head damage per cent. The entries GMU-924, 943, 965, 980 and 990 recorded resistant reaction where as for head borer entries GMU-904, 924,942 and 992 given resistant reaction. Germplasm lines GMU-904, 905, 914, 919, 922, 925, 927, 934, 940, 956 and 992 recorded moderately resistant reaction for defoliator; for capitulum borer GMU 905, 914, 925, 927, 934, 944, 947, 960, 964 and 965 gives moderate resistant reaction. Entries GMU-913, 923 and 928 susceptible reaction for capitulum borer whereas for

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

| Name of germplasm | Av. head borer/Pl | Av. defoliators /pl | Name of germplasm | Av. head borer/Pl | Av. defoliators /pl | Name of germplasm | Av. head borer/Pl | Av. defoliators /pl | Name of germplasm | Av. Head borer/Pl | Av. Defoliators /pl |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GMU-901 | NG | NG | GMU-927 | 0.20 | 1.07 | GMU-953 | 0.60 | 0.93 | GMU-979 | 0.20 | 0.99 |
| GMU-902 | 1.20 | 1.48 | GMU-928 | 0.20 | 0.86 | GMU-954 | NG | NG | GMU-980 | 0.40 | 1.42 |
| GMU-903 | 0.60 | 1.25 | GMU-929 | 0.20 | 1.07 | GMU-955 | NG | NG | GMU-981 | 0.60 | 1.04 |
| GMU-904 | 0.40 | 1.32 | GMU-930 | 0.60 | 0.98 | GMU-956 | 0.20 | 0.87 | GMU-982 | NG | NG |
| GMU-905 | 0.80 | 1.12 | GMU-931 | 0.60 | 1.02 | GMU-957 | 0.40 | 1.22 | GMU-983 | 0.20 | 0.95 |
| GMU-906 | 0.60 | 0.87 | GMU-932 | 0.20 | 0.99 | GMU-958 | 0.60 | 0.75 | GMU-984 | NG | NG |
| GMU-907 | 0.40 | 0.88 | GMU-933 | 0.60 | 0.81 | GMU-959 | 0.20 | 1.03 | GMU-985 | 0.20 | 0.91 |
| GMU-908 | 0.80 | 1.21 | GMU-934 | 0.20 | 1.03 | GMU-960 | 0.20 | 0.75 | GMU-986 | 0.40 | 0.99 |
| GMU-909 | 0.20 | 0.95 | GMU-935 | 0.60 | 1.03 | GMU-961 | 0.40 | 1.04 | GMU-987 | 0.40 | 0.87 |
| GMU-910 | 0.60 | 1.28 | GMU-936 | 0.80 | 0.74 | GMU-962 | 0.60 | 1.02 | GMU-988 | 0.80 | 1.08 |
| GMU-911 | 0.80 | 1.28 | GMU-937 | 0.40 | 1.08 | GMU-963 | 0.40 | 0.83 | GMU-989 | 0.20 | 1.00 |
| GMU-912 | NG | NG | GMU-938 | 0.40 | 1.22 | GMU-964 | 0.80 | 1.14 | GMU-990 | 0.40 | 0.92 |
| GMU-913 | 0.20 | 0.98 | GMU-939 | 0.40 | 1.34 | GMU-965 | 0.60 | 1.08 | GMU-991 | NG | NG |
| GMU-914 | 0.20 | 1.08 | GMU-940 | 0.20 | 1.03 | GMU-966 | NG | NG | GMU-992 | 0.20 | 1.10 |
| GMU-915 | 0.60 | 1.28 | GMU-941 | 0.20 | 1.08 | GMU-967 | 0.40 | 1.14 | GMU-993 | 0.20 | 1.03 |
| GMU-916 | 0.20 | 1.13 | GMU-942 | 0.10 | 1.06 | GMU-968 | 0.20 | 1.01 | GMU-994 | NG | NG |
| GMU-917 | 0.40 | 1.38 | GMU-943 | 0.20 | 0.76 | GMU-969 | 0.80 | 1.03 | GMU-995 | 0.80 | 1.15 |
| GMU-918 | NG | NG | GMU-944 | 0.60 | 1.10 | GMU-970 | 0.60 | 1.13 | GMU-996 | NG | NG |
| GMU-919 | 0.40 | 0.79 | GMU-945 | 0.40 | 1.11 | GMU-971 | 0.20 | 1.17 | GMU-997 | 0.40 | 0.88 |
| GMU-920 | 0.80 | 0.57 | GMU-946 | 0.20 | 1.22 | GMU-972 | 0.40 | 1.11 | GMU-998 | 0.20 | 1.08 |
| GMU-921 | 0.60 | 1.18 | GMU-947 | 0.60 | 1.10 | GMU-973 | 0.20 | 0.53 | GMU-999 | 0.80 | 1.23 |
| GMU-922 | 0.40 | 0.93 | GMU-948 | 0.10 | 1.11 | GMU-974 | 0.40 | 1.18 | GMU-1000 | 0.60 | 1.12 |
| GMU-923 | 0.60 | 0.89 | GMU-949 | 0.80 | 1.08 | GMU-975 | 0.20 | 1.03 | Morden(SC) | 0.80 | 1.44 |
| GMU-924 | 0.20 | 0.93 | GMU-950 | 0.60 | 1.12 | GMU-976 | 0.40 | 1.23 | | | |
| GMU-925 | 0.20 | 0.94 | GMU-951 | 0.80 | 1.12 | GMU-977 | 0.80 | 1.36 | | | |
| GMU-926 | 0.40 | 0.94 | GMU-952 | 0.40 | 0.81 | GMU-978 | 0.60 | 1.08 | | | |

defoliators no entry recorded susceptible reaction. Rest of the entries showed highly susceptible reaction for defoliators and capitulum borer in this experiment (Table 3).

Germplasm lines GMU-924 shown multiple resistant towards defoliators and capitulum borer, therefore can

**Table 2 : Germplasm lines screened for pest resistance/ tolerance in sunflower**

| Name of germplasm | Av. head borer damage/ Pl (%) | Av. defoliation/ pl (%) | Name of germplasm | Av. head borer damage/ Pl (%) | Av. defoliation /pl (%) | Name of germplasm | Av. head borer damage /Pl(%) | Av. defoliation /pl (%) | Name of germplasm | Av. head borer damage / Pl(%) | Av. defoliation /pl (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GMU-901 | NG | NG | GMU-927 | 1.88 | 1.84 | GMU-953 | 8.46 | 12.00 | GMU-979 | 11.28 | 12.00 |
| GMU-902 | 5.66 | 12.46 | GMU-928 | 3.48 | 10.00 | GMU-954 | NG | NG | GMU-980 | 9.56 | 0.86 |
| GMU-903 | 4.38 | 14.48 | GMU-929 | 4.88 | 12.00 | GMU-955 | NG | NG | GMU-981 | 4.52 | 15.00 |
| GMU-904 | 0.86 | 1.48 | GMU-930 | 5.24 | 11.00 | GMU-956 | 1.68 | 1.86 | GMU-982 | NG | NG |
| GMU-905 | 2.48 | 1.96 | GMU-931 | 5.00 | 10.00 | GMU-957 | 5.40 | 10.00 | GMU-983 | 5.48 | 14.00 |
| GMU-906 | 4.00 | 10.00 | GMU-932 | 6.24 | 9.00 | GMU-958 | 12.66 | 12.00 | GMU-984 | NG | NG |
| GMU-907 | 5.66 | 12.00 | GMU-933 | 3.84 | 9.00 | GMU-959 | 11.00 | 15.00 | GMU-985 | 4.58 | 12.00 |
| GMU-908 | 6.24 | 14.00 | GMU-934 | 2.48 | 1.28 | GMU-960 | 2.18 | 16.00 | GMU-986 | 4.62 | 14.00 |
| GMU-909 | 6.38 | 14.68 | GMU-935 | 4.86 | 8.46 | GMU-961 | 9.00 | 18.00 | GMU-987 | 12.00 | 15.00 |
| GMU-910 | 6.00 | 11.58 | GMU-936 | 4.00 | 9.46 | GMU-962 | 8.66 | 14.00 | GMU-988 | 11.86 | 18.00 |
| GMU-911 | 4.28 | 12.68 | GMU-937 | 5.62 | 10.00 | GMU-963 | 4.52 | 12.00 | GMU-989 | 10.24 | 24.86 |
| GMU-912 | NG | NG | GMU-938 | 5.28 | 10.00 | GMU-964 | 3.65 | 16.00 | GMU-990 | 8.66 | 0.46 |
| GMU-913 | 3.28 | 10.24 | GMU-939 | 5.12 | 12.00 | GMU-965 | 1.14 | 3.86 | GMU-991 | 4.28 | 18.96 |
| GMU-914 | 2.28 | 2.46 | GMU-940 | 1.96 | 2.48 | GMU-966 | NG | NG | GMU-992 | 0.84 | 1.46 |
| GMU-915 | 5.00 | 4.86 | GMU-941 | 12.00 | 8.46 | GMU-967 | 5.28 | 10.00 | GMU-993 | 4.88 | 12.00 |
| GMU-916 | 4.00 | 5.98 | GMU-942 | 0.24 | 10.00 | GMU-968 | 4.28 | 8.96 | GMU-994 | NG | NG |
| GMU-917 | 4.18 | 4.68 | GMU-943 | 8.96 | 0.98 | GMU-969 | 6.38 | 12.46 | GMU-995 | 12.48 | 14.00 |
| GMU-918 | NG | NG | GMU-944 | 2.16 | 10.00 | GMU-970 | 8.68 | 10.00 | GMU-996 | NG | NG |
| GMU-919 | 5.00 | 2.00 | GMU-945 | 3.64 | 8.46 | GMU-971 | 12.00 | 12.00 | GMU-997 | 11.56 | 18.00 |
| GMU-920 | 5.24 | 4.66 | GMU-946 | 3.22 | 11.00 | GMU-972 | 11.48 | 11.00 | GMU-998 | 14.58 | 24.00 |
| GMU-921 | 3.86 | 3.86 | GMU-947 | 2.46 | 10.00 | GMU-973 | 12.56 | 12.86 | GMU-999 | 11.24 | 18.46 |
| GMU-922 | 3.54 | 2.48 | GMU-948 | 14.28 | 10.00 | GMU-974 | 11.46 | 14.00 | GMU-1000 | 9.86 | 12.00 |
| GMU-923 | 3.14 | 4.48 | GMU-949 | 10.00 | 10.00 | GMU-975 | 12.34 | 16.00 | Morden(SC) | 15.96 | 28.00 |
| GMU-924 | 0.86 | 0.42 | GMU-950 | 12.00 | 12.00 | GMU-976 | 11.00 | 18.00 | | | |
| GMU-925 | 1.96 | 2.36 | GMU-951 | 10.00 | 14.00 | GMU-977 | 12.46 | 10.00 | | | |
| GMU-926 | 3.24 | 3.84 | GMU-952 | 10.62 | 12.00 | GMU-978 | 14.28 | 12.00 | | | |

**Table 3 : Rating of sunflower germplasm lines for defoliators and head borer**

| Sr. No. | Pest population/ plant | Resistance rating | Resistance grade | Name of the accessions (Head borer) | Name of the accessions (Defoliators) |
|---|---|---|---|---|---|
| 1. | 0 | I | HR | --- | -- |
| 2. | 0.01-1 | II | R | GMU-904, 924,942 and 992. | GMU-924,943,965,980 & 990. |
| 3. | 1.1 – 2.5 | III | MR | GMU-905,914,925,927,934,944,947,960 , 964 and 965 | GMU-904,905,914, 919,922,925,927,934,940,956 and 992. |
| 4. | 2.6-3.5 | IV | S | GMU-913,923 and 928. | -- |
| 5. | 3.6-5 and above | V | HS | GMU-902, 903, 906, 905, 906, 907, 908, 909, 910, 911, 915, 916, 917, 919, 920, 921, 922, 926, 929, 930, 931, 932, 933, 935, 936, 937, 938, 939, 941, 942, 943, 945, 946, 948, 949, 950, 951, 952, 953, 955, 956, 957, 958, 959, 961, 962, 963, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 983, 984, 985, 986, 987, 988, 989, 990, 993, 994, 995, 997, 998, 999, 1000 and Morden | GMU-902, 903, 906, 906, 907, 908, 909, 910, 911, 913, 915, 916, 917, 920, 921, 923, 926, 928, 929, 930, 931, 932, 933, 935, 936, 937, 938, 939, 941, 942, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 955, 957, 958, 959, 960, 961, 962, 963, 964, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 983, 984, 985, 986, 987, 988, 989, 993, 994, 995, 997, 998, 999, 1000 and Morden |

be utilized for further resistant improvement and hybrid development programme.

Suganthy and Uma (2007) screen the promising germplasm entries of sunflower for confirmation of reaction to key pests *viz*., leafhoppers, thrips, whiteflies,defoliators and head borer. Results revealed that all the five germplasm entries *viz*., GMU 407,GMU 415, GMU 424, GMU 473 and GMU 493 were promising to the key pests of sunflower. GMU 473 recorded the maximum of 5.0 thrips and 3.0 *S. litura* larvae per plant with the defoliation of 25 per cent as against 7 and 0 per cent defoliation in the checks, Morden and TCSH 1,respectively.

Kumar and Dhillon (2014), evaluated the reaction of 8 sunf lower hybrids *viz*. PSH 930, PSH 569, PSH 652, NSFH 36, PSFH 118, SH 3322, GKSFH 2002 and Jawalamukhi to insect -pests infestat ion during spring 2006 and 2007 at Punjab Agricul tural University, Ludhiana. During the early stage of crop growth sucking pests *viz*., jassid and whi tef ly were abundant . Among the 08 hybrids evaluated, PSH 569 and GKSFH 2002 harboured lower populat ion of jassid nymphs than the rest of the hybrids while Jawalamukhi, PSH 652, GKSFH 2002 and PSH 652 were found promising against whitefly. Similarly, GKSFH 2002, PSH 652, SH 3322 and Jawalamukhi were promising against head borer. Among the different hybrids, the population of leafhopper, whitefly and head borer was lower on GKSFH 2002 than the other hybrids.Similarly, entries GKSFH 2002, SH 3322 and PSH 652 recorded lower population (0.08, 0.08 and 0.09 larvae/plant, respectively) of head borer than PSH 569 (0.2 larvae/ plant ) (Anonymous, 2004a). Similar work has been carried out at various stations across the country by AICRP centres (Anonymous, 2000, 2001, 2002, 2003, 2004, 2005, 2006 and 2011). However these entries were different from the present investigation and hence, cannot be compared.

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