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Resistance of Different Sunflower (*Helianthus annuus* Linnaeus, Compositae) Genotypes Against the Attack of *Aphis gossypii* Glover, *Nezara viridula* (L.) and *Thrips tabaci* Lind. in Field

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Abstract: The resistance of different sunflower genotypes against some insect pests was investigated in the field. Fourteen sunflower genotypes were screened against *Aphis gossypii* Glover (Aphids), *Nezara viridula* (L.) (Green stink bug) and *Thrips tabaci* Lind. (Thrips). In case of Aphids, the sunflower genotype 9705 was partially resistant whereas $JH_2$99S, $JH_1$99S, Hysun-777, T-562 and PSF-025 were found partially susceptible genotypes. The germplasms XF-263 and 1435 were taken as intermediately susceptible. The susceptible genotypes were PNSF-1 and 9706 when compared with standard germplasm. Parsun-1 and Award were found highly susceptible to Aphids population. In case of *Nezara viridula*, conclusion was made that the sunflower germplasms 9705, $JH_2$99S and $JH_1$99S were partially resistant against this pest as compare to Hysun-33 whereas Hysun-777 was found partially susceptible. PSF-025, T-562 and 1435 were declared as intermediately susceptible. PNSF-1 was susceptible. The sunflower germplasms XF-263, Parsun-1, 9706, 9707 and Award were taken as highly susceptible having highest number of pest as compare to Hysun-33. Results of *Thrips tabaci* concluded that 9706 and $JH_2$99S were partially resistant whereas XF-263 and Award were found highly susceptible to pest as compare to Hysun-33. The genotypes 9707, $JH_1$99S and Parsun-1 were partially susceptible to pest population. Hysun-777, T-562, PSF-025 and 1435 were taken as intermediately susceptible against thrips whereas PNSF-1 and 9706 were found susceptible. A negative correlation was also found between pest population and the yield of sunflower genotypes.

Key words: *Helianthus annuus*, host plant resistance, *Aphis gossypii* Glov., *Nezara viridula* (L.), *Thrips tabaci* Lind

Introduction

Sunflower (*Helianthus annuus* Linnaeus) is an important oil seed crop. In Pakistan, its commercial cultivation for oil production started during early 1965. It was originated from Mexico and South Western USA from where it had been spread worldwide (Gibbon and Pain, 1985). In Canada, Romania, Russia, Hungary, Yugoslavia and Chile, it is grown as ornamental as well as oil seed crop (Ram, 1980). The world production of sunflower for oil is about 3.5 million MT, down from 1974 (Metcalfe and Elkins, 1980).

Sunflower cultivation is also on rise in Pakistan (Quresh, 1997) and was cultivated on an area of 144191 ha in 1998 (Govt. of Pakistan, 1998-99). Sunflower can be planted twice a year i.e in spring and autumn. In India, it can be grown in any season viz. kharif, rabi and summer (Ram, 1980). The seeds of sunflower contain 40-50 % oil. The oil is quite palatable, contains soluble vitamins A, D, E, K and is used in salads, cooking and margarines and as a lubricant.

The major hazards to sunflower seed production are insects. These insect pests serve as vector for virus and other diseases. Leaf curling, chlorosis and premature senescence of plants can be due to severe infestation on sunflower by *Empoasca abrupta* (Rogers, 1981). Insect pests attacking this crop include Aphid (*Aphis gossypii*), Whitefly (*Bemicia tabaci*), Leaf miner (*Phytomyza atricornis*), Green leaf hopper (*Empoasca* spp.) Painted bug (*Bagrada* spp.) and Seed weevil (*Smicronyx* spp.). Butt (1989) discussed that major insect pests found on sunflower genotypes were *Amrasca devastans*, *Thrips tabaci*, *Bemisia tabaci*, Tingid bug and *Eutetranychus* spp. Kakakhel *et al.* (2000) reported that the insect pests attack on sunflower are *Bemisia tabaci*, *Empoasca* spp., *Thysanoplusia orichalcea*, *Diacretia obliqua*, *Nezara viridula*, *Helicoverpa armigera* and *Nysius inconspicuus*. Sethi *et al.* (1978) observed the incidence of insect pests on five sunflower varieties during winter and found *Bemisia tabaci* and *Amrasca bigutella* as the major pests. Das and Thukral (1999) observed in a field trial carried out in Madhva Pradesh; India, the sunflower genotypes (IAHS-1 and, MSFH-8.), highly susceptible to *Amrasca biguttela*; *Amrasca devastans* and less preferred by *Aphis gossypii*, significantly higher on middle and lower canopy respectively.

The excessive use of chemicals for these insect pests is hazardous to environment. Development of resistant cultivars is one of the most useful methods in which pesticides use in an agro-ecosystm can greatly be reduced. Host plant resistance may be defined as the relative amount of heritable qualities possessed by the plant which influence the ultimate degree of damage done by the insect. The varietal resistance of sunflower genotypes has been reported by many research workers such as Aslam and Rehman (2000), Anderson and Brewer (1992), Brewer and Charlet (1995), Das and Thukral (1999), Gao and Brewer (1998), Rafiullah *et al.* (1998), Rogers (1981), Rogers *et al.* (1980), Rogers and Selier (1985), Sethi *et al.* (1978), Singh *et al.* (1994), Teets *et al.* (1971) and Vendramim and Bioca Jr. (1994).

The objective of this study was to observe the resistance of different sunflower varieties against insect pests. By sowing such genotypes the dependence on heavy use of pesticides will be minimized so as to save environment from pollution. Another aim of the study was enhance the cultivation of sunflower in the area by demonstrating such research trials to the growers of the area through discussing with them the problems pertaining to insect pests and their proper solutions.

Materials and Methods

The resistance of different sunflower genotypes against some insect pests in the field was studied under UGC/UAAR sunflower project at Pind Gondal. The insect pests found on sunflower (*Helianthus annuus* L.) genotypes were Aphids (*Aphis gossypii*), Green stink bug (*Nezara viridula*) and Thrips (*Thrips tabaci*).

The seed of fourteen genotypes of sunflower (Hysun-777, XF-263, Award, T-562, 9706, 9707, 9705, PSF-025, Parsun-1, 1435, $JH_1$99S, $JH_2$99S, PNSF1, Hysun-33) were collected

from UGC/UAAR Sunflower Project and NARC, Islamabad.

The available germplasms of sunflower (*Helianthus annuus* L.) were planted in Randomized Complete Block Design in a experimental plot (150 x 5300 cm^2) with 25 cm plant to plant and 75 cm row to row distance during autumn, 2000 at Pind Gondal. Planting was done by dibbling with three seeds $hill^{-1}$. After germination of all genotypes one plant per hill was maintained by manual thinning.

The fertilizer and other intercultural practices including thinning, hoeing, weeding out and earthing up etc. that required for sunflower crop were also carried out at appropriate timings.

The data were collected by selecting ten plants on weekly basis. The numbers of insect pests were collected on whole plant basis. A total number of 4620 observations were taken for aphids and bugs, were taken separately in eleven weeks. For thrips, a total number of 2100 observations were carried out during five weeks. The leaves were turned upward through forceps carefully for green stink bug and aphid so the pests may not be disturbed. After the maturity of sunflower genotypes, the yield of each genotype was also recorded. All the collected information regarding the response of different insect pests to some sunflower genotypes under field conditions were analyzed statistically by using statistical package, SPSS 10.01 for Windows (1999) on computer.

The sunflower genotype, Hysun-33 was kept as standard susceptible check because it was the commercial variety in Punjab. Following Aslam *et al.* (1999) the lines, which show higher response by different insect pests when compared with Hysun-33, were classified as highly susceptible. The genotypes which did not differ from Hysun-33 in showing the response by insect pests were classified as susceptible, while the lines which show significantly less response by insect pests than susceptible cultivar were classified as intermediately susceptible, partially resistant, resistant or highly resistant depending upon nature of groupings of the means. The yield of different sunflower genotypes was also correlated with the population of insect pests found on different genotypes of sunflower to see the impact of infestation on the yield.

Results and Discussion

Aphids, *Aphis gossypii* Glov., (Aphididae: Homoptera): The infestation of Aphid started from 39th week of the year till the end of the crop season at Pind Gondal (Research area). Its peak population (9.988 ± 0.674) per plant was observed during 43rd week of the year (Table 1 and Fig. 1). Highly significant results among different sunflower genotypes (Table 2) were observed. By comparing Hysun-33 with Award, Parsun-1 and 9707, it was found that these genotypes had significant difference having highest population mean.

The sunflower varieties PNSF-1 and 9706 did not differ from Hysun-33 whereas XF-263 and 1435 slightly less significant difference in population mean as compare to Hysun-33. $JH_2$99S, $JH_1$99S, Hysun-777, T-562 and PSF-025 had the smaller numbers of Aphids / plant as compare to other genotypes. The sunflower germplasm 9705 had the lowest number of aphids.

The population mean of aphid on different sunflower germplasms was also correlated (Table 3) with yield of different sunflower genotypes (Fig. 2) and was found that when the population of pest increased, the yield decreased, it means that a negative correlation (-0.057) was present between pest population and yield of different sunflower genotypes.

Green stink bug, *Nezara viridula* (L.), (Pentatomidae: Hemiptera): *Nezara viridula* is a sap-sucking pest and its pest status has been reported by Hassan *et al.* (1984). During autumn 2000, its attack was started from 39th week of the year with subsequent steadily increase in population up to the peak (0.69 ± .067/ plant) during the 46th week of the year (Table 4 and Fig. 3).

The pest population of *Nezara viridula* was observed in smaller number as compare to other pests discussed but significant response was observed against different sunflower genotypes (Table 5). The genotypes 9705, $JH_2$99S, and $JH_1$99S had the lowest number of pest per plant as compare to Hysun-33. More pest population was attracted toward Hysun-777 than $JH_1$99S whereas PSF-025, T-562 and 1435 had pest population greater than Hysun-777. PNSF-1 did not differ from Hysun-33. The highest mean population per plant was found on Award (0.815 ± 0.080). The correlation was also applied between population of bug and different sunflower genotypes (Table 6) to check whether any effect of pest population on sunflower germplasms or not. There was negative correlation (-0.296) between Bug population and yield of different sunflower varieties.

Thrips, *Thrips tabaci* Lind., (*Thripidae:* Thysanoptera): The sunflower thrips feed on the flower of the plant. Butt (1989) had previously reported the attack of thrips on sunflower. At Pind Gondal, its infestation was observed only for a period of five weeks (from 43rd to 47th week of the year). Its peak population was recorded during 45th week of the year when the anthesis of all sunflower genotypes was completed (Table 7 and Fig. 4).

Table 8 indicates significant difference in mean population of thrips among different sunflower germplasms. By comparing Hysun-33 (a susceptible standard check) with other thirteen genotypes, we found that Award and XF-263 had significant population difference having highest population mean i.e. 5.493 ± 0.901fg and 4.413 ± 0.888 respectively whereas the lowest numbers were seen on 9705 (0.573a ± 0.144) and $JH_2$99S (0.880ab ± 0.234). The sunflower genotypes 9707, $JH_1$99S and Parsun-1 had attracted more insect pests as compared to 9705 and $JH_2$99S. Hysun-777, T-562, PSF-025 and 1435 had mean population per plant smaller than Hysun-33.The sunflower varieties PNSF-1 and 9706 are almost similar to standard genotype.

The yield recorded (Fig. 2) of different sunflower germplasms was negatively correlated (Table 9). The correlation was significant. Yield of sunflower genotypes decreased significantly when population of thrips increased.

From results of *Aphis gossypii*, it is concluded that the sunflower variety was 9705 partially resistant whereas $JH_2$99S, $JH_1$99S, Hysun-777, T-562 and PSF-025 were found partially susceptible genotypes. The germplasms XF-263 and 1435 were taken as intermediately susceptible. The susceptible genotypes were PNSF-1 and 9706 when compared with standard germplasm. Parsun-1, 9707 and Award were found highly susceptible to Aphid population. Aslam and Rehman (2000) had also conducted an experiment on sunflower genotypes and found that there was significant difference among sunflower genotypes against *Aphis gossypii*. The results for *Nezara viridula* concluded that 9705, $JH_2$99S and $JH_1$99S were partially resistant against *Nezara* spp. as compare to Hysun-33 whereas Hysun-777 was found partially susceptible. PSF-025, T-562 and 1435 were declared as intermediately susceptible. PNSF-1 was susceptible because of similar to standard susceptible check. The sunflower

Table 1: Weekly population trend of Aphids on sunflower (*Helianthus annuus* L.)

Weeks	Mean population
39	0.129 ± 0.025
40	0.717 ± 0.064
41	2.314 ± 0.301
42	5.998 ± 0.674
43	9.988 ± 1.230
44	5.886 ± 0.854
45	2.921 ± 0.491
46	1.552 ± 0.250
47	0.883 ± 0.136
48	0.467 ± 0.071
49	0.057 ± 0.018

Table 2: Mean population of Aphids per plant on 14 germplasms of sunflower

Genotypes	Mean Population
9705	0.527 ± 0.115 a
JH_2 99S	0.703 ± 0.154 ab
JH_1 99S	0.936 ± 0.208 ab
Hysun-777	1.073 ± 0.229 ab
T-562	1.215 ± 0.255 ab
PSF-025	1.424 ± 0.312 ab
XF-263	2.018 ± 0.292 abc
1435	2.152 ± 0.425 abc
Hysun-33	2.712 ± 0.578 abcd
PNSF1	2.948 ± 0.585 bcd
9706	3.945 ± 0.680 cd
9707	4.612 ± 0.976 de
Parsun-1	6.073 ± 1.229 e
Award	9.003 ± 1.613 e

Means followed by the same letters do not have significant difference at P = 0.05

Table 3: Correlation between population of Aphids and yield of sunflower genotypes

		Yield	Aphids
Yield	Pearson Correlation	1.000	-0.057
	Sig. (2- tailed)		0.846
	N	14	14
Aphids	Pearson Correlation	-0.057	1.000
	Sig. (2- tailed)	0.846	
	N	14	14

Table 4 Weekly population Trend of *Nezara viridula* on sunflower (*Helianthus annuus* L.)

Weeks	Mean population
39	0.040 ± 0.011
40	0.117 ± 0.025
41	0.210 ± 0.033
42	0.298 ± 0.433
43	0.448 ± 0.055
44	0.452 ± 0.052
45	0.543 ± 0.058
46	0.690 ± 0.067
47	0.336 ± 0.040
48	0.140 ± 0.022
49	0.028 ± 0.008

Table 5: Mean population of *Nezara viridula* per plant on 14 genotypes of sunflower (*Helianthus annuus* L.)

Genotypes	Mean Population
9705	0.0333 ± 0.008 a
JH_2 99S	0.0454 ± 0.010 a
JH_1 99S	0.0727 ± 0.016 a
Hysun-777	0.115 ± 0.020 ab
PSF-025	0.161 ± 0.026 abc
T-562	0.164 ± 0.027 abc
1435	0.218 ± 0.035 bc
Hysun-33	0.282 ± 0.039 cd
PNSF1	0.373 ± 0.052 de
XF-263	0.439 ± 0.053 ef
Parsun-1	0.461 ± 0.065 ef
9706	0.50 ± 0.064 ef
9707	0.524 ± 0.065 f
Award	0.815 ± 0.080 g

Means followed by the same letters do not have significant difference at P = 0.05

Table 6: Correlation between population of Green stink bug and yield of sunflower genotypes

		Yield	Bug
Yield	Pearson Correlation	1.000	-0.296
	Sig. (2- tailed)		0.304
	N	14	14
Bug	Pearson Correlation	-0.296	1.000
	Sig. (2- tailed)	0.304	
	N	14	14

Table 7: Weekly population Trend of *Thrips tabaci.* on sunflower (*Helianthus annuus* L.)

Weeks	Mean population
43	0.605 ± 0.063
44	2.105 ± 0.201
45	5.938 ± 0.436
46	2.776 ± 0.273
47	0.662 ± 0.111

Table 8: Mean population of *Thrips tabaci.* per plant on 14 genotypes of sunflower (*Helianthus annuus* L.)

Genotypes	Mean Population
9705	0.573 ± 0.144 a
JH_2 99S	0.880 ± 0.234 ab
9707	1.00 ± 0.241 abc
JH_1 99S	1.287 ± 0.336 abcd
Parsun-1	1.593 ± 0.403 abcd
Hysun-777	1.927 ± 0.469 abcde
T-562	2.133 ± 0.500 abcde
PSF-025	2.447 ± 0.563 bcde
1435	2.633 ± 0.601 bcde
Hysun-33	2.793 ± 0.616 cdef
PNSF1	3.133 ± 0.702 def
9706	3.533 ± 0.765 ef
XF-263	4.413 ± 0.888 fg
Award	5.493 ± 0.901 g

Means followed by the same letters do not have significant difference at P = 0.05

Table 9: Correlation between population of Flower Thrips and yield of sunflower genotypes at Pind Gondal

		Yield	Thrips
Yield	Pearson Correlation	1.000	-0.574*
	Sig. (2- tailed)		0.032
	N	14	14
Thrips	Pearson Correlation	-0.574*	1.000
	Sig. (2- tailed)	0.032	
	N	14	14

* Correlation is significant at the 0.05 level.

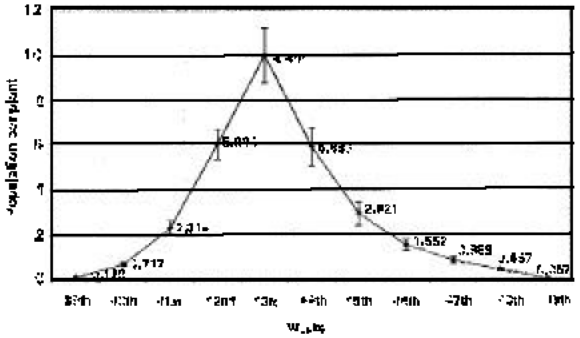

Fig. 1: Weekly population trend of *Aphis gossypii* per plant of *Helianthus annuus* L.

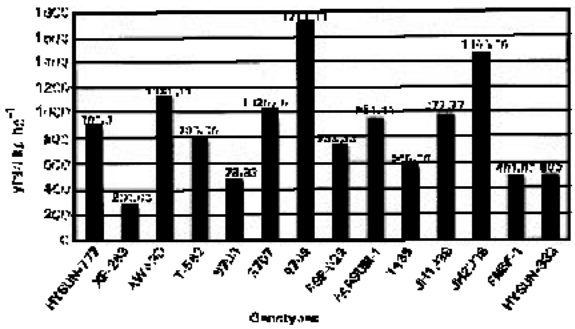

Fig. 2: Average yield (kg ha^{-1}) produced in fourteen genotypes of sunflower at Pind Gondal

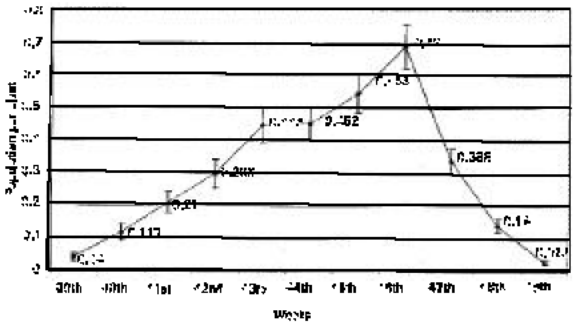

Fig. 3: Weekly population trend of *Nezara viridula* (L.) Per plant of *Helianthus annuus* L.

germplasms XF-263, Parsun-1, 9706, 9797 and Award were taken as highly susceptible having highest number of pest as compare to Hysun-33. The negative correlation was found between pest population and yield of sunflower genotypes.

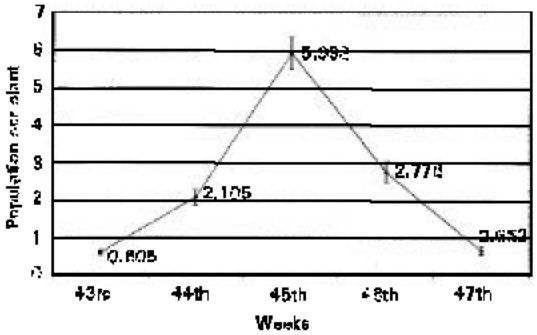

Fig. 4: Weekly population trend of *Thrips tabaci* per plant of sunflower (*Helianthus annuus* L.)

Aslam *et al.* (2000) had also found green stink bug on sunflower in Pothohar.

The results described for *Thrips tabaci* concluded that 9705 and JH$_2$99S were partially resistant whereas XF-263 and Award were found highly susceptible to pest as compare to Hysun-33. The genotypes 9707, JH$_1$99S and Parsun-1 were partially susceptible to pest population. Hysun-777, T-562, PSF-025 and 1435 were taken as intermediately susceptible against thrips whereas PNSF-1 and 9706 were found susceptible. There was negative correlation between yield of sunflower genotypes and Thrips. So there were great variations in the sunflower genotypes as regards numbers of insect pests attracted to them. All pests observed have negative correlation with yield of sunflower genotypes. The variation in the results proved very helpful in selecting sunflower plant resistant to insect. By planting the resistant genotypes, the dependence on the use of pesticide will be reduced and planting the resistant genotypes will minimize pollution problems due to heavy use of insecticides.

References

Anderson, M. D and G. J. Brewer, 1992. Sensitivity to 2, 4-D in sunflower as an indicator of tolerance to the sunflower midge (Diptera: cecidomyiidae). J. Econ. Entomol., 85: 299-303; 15 ref.

Aslam, M., R. B. Chalfant and G. A. Herzog, 1999. Resistance of high Gossypol Cotton Strains to *Heliothis* spp. (Lepidoptera: Noctuidae) under field conditions. Scientific Khyber, 12: 65-72.

Aslam, M., N. Suleman, A. Riaz, A. Rehman and Q. Zia, 2000. Insect Pests found on *Helianthus annuus* L. (Compositae) in the Potohar Region of Pakistan. Pak. J. Biol. Sci., 3: 963-964

Aslam, M. and H. Rehman, 2000. Screening of some sunflower (*Helianthus annuus* L. Compositae) genotypes against insect pests. Pak. J. Bio. Sci., 3: 2241-2243.

Brewer, G. J. and L. D. Charlet, 1995. Mechanism of resistance to the red sunflower seed weevil in sunflower accessions. Crop Prot., 14: 500-503.

Butt, A., 1989. Varietal susceptibility of some hybrid sunflower varieties to insect and mite pests. M. Sc. Thesis, Deptt. of Entomol. Univ. Agric., Faisalabad, Pakistan.

Das, S. and B. V. Thukral, 1999. Varietal susceptibility of sunflower to sucking pests and their distribution at different level of plant canopy. Insect-Environ. Madhya Pradesh; India, 5: 65-66.

Gao, H. and G. J. Brewer, 1998. Sunflower resistance to the red sunflower seed weevil. J. Econ. Entomol., 19: 779-783.

Gibbon, D. and A. Pain, 1985. Crops of the drier regions of the tropics. Intermediate Tropical Agric. Series. Univ. East Anglia, UK.Longman London and New York. p: 129-130.

Govt. of Pakistan, 1998-99. Economic Survey of Pakistan. Ministryo f Finance, Economic Advisor Wing, Islambad. P-11.

Hassan, A. M., T. Mahmood and M. Ahmad, 1984. Insect pests of sunflower at Faisalabad. Proceeding of the National Workshop (April 28-30, 1984). Barani Agriculture and Development Project, NARC, Islamabad. pp: 39-42.

Kakakhel, S.A., N. Islam, M. Amjad and M. A. Malik, 2000. Insect Pest Complex of Sunflower, *Helianthus annuus* L. Pak J. of Biol. Sci., 3: 669-671.

Metcalfe, D. S. and D. M. Elkins, 1980. Crop Production Principles and Practices Macmillan Publishing Co. Inc. New York. pp: 495-497.

Quresh, Z., 1997. Oil Seed Research Development in NWFP Annual report, PODB, ARI, Tarnab, Peshawer.

Rafiullah, S., Farmanullah., Fazle Subhan and Riaz Ahmad, 1998. Screening of Sunflower Genotypes against Insect Pests under field conditions. Sarhad J. Agric., 14 : 591-595.

Ram, M., 1980. High Yielding Varieties of Crops. Oxford and Ibh. Publishing Co. New Delhi, Bombay, Pvt. Ltd. p: 684-685.

Rogers, C.E., 1981. Resistance sunflower species to the Western Potato Leaf hopper. Environ. Entomol., 10 : 697-700.

Rogers C. E., T. E. Thompson and M. J. Wellik, 1980. Survival of *Bothynus gibbosus* on *Helianthus* spp. J. Kanas. Ento. Soc., 53 : 400-494.

Rogers, C. E. and G. J. Salier, 1985. Sunflower (*Helianthus*) resistance to a stem weevil *Cylindrocpturus adspersus*. Environ. Ento., 14: 624-628

Sethi, G. R., K. M. Singh, and H. H. Prasad, 1978. Incidence of insect pests on different varieties of sunflower. Indian J. Ento., 40: 101-103.

Singh, G., I. Singh, G. Singh and I. Singh, 1994. Comparative incidence of Bihar hairy caterpillar, *Spilosoma obliqua* Walker on different cultivars of sunflower. J. Insect Sci., 7: 26-27.

SPSS, 1999. A statistical analysis package for windows. Rel. Oct. 27, 1999. Standard Version, Copyright SPSS Inc., 1989-1999.

Teets, G. L., M. L. Kinman and N. M. Randolph, 1971. Difference in susceptibility of certain sunflower varieties and hybrids to sunflower moth. J. Eco. Ento., 64: 1285-1287.

Vendramim, J. D. and A. L. Bioca Jr., 1994. Effect d sunflower cultivars on development and feeding preference of *Chlosyne lacinia Saundersii* Doubl. and Hew (Lepidoptera: Nymphalidae). Anais-da-Sociedade-Entomologica-do-Brasil., 23:1.81-86.