Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

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Asian Journal of Plant Sciences 2 (3): 331-335, 2003
ISSN 1682-3974

Impact of Different Genotypes of Sunflower (*Helianthus annuus* Linnaeus.) on the Number of *Nezara viridula* L., *Aphis gossypii* Glover. and *Bemisia tabaci* Gennad

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Abstract: The impact of different genotypes of sunflower (*Helianthus annuus* Linnaeus) were seen on some important insects like and green stink bug (*Nezara viridula*), aphid (*Aphis gossypii*) whitefly (*Bemisia tabaci*) and their population was correlated with the yield. Viewing the results of green stink bug (*Nezara viridula*) it was found that 64 A 93 had significantly less mean population than HYSUN 33. Whereas SUPER 25, CRN 1435 and 65 A 24 were found to be partially susceptible. The genotypes 6451, SMH 9707, PARSUN I and SMH 9706 were found to be susceptible because they all had almost similar mean population as HYSUN 33. All other genotypes found to be highly susceptible. In case of aphid (*Aphis gossypii*) it was found that 64 A 93 was resistant because it had significantly less number of population than standard cultivar. Whereas SUPER 25, CRN 1435 were found to be partially resistant because they had less significant difference as compared to 64 A 93, 65 A 24, 6451 and SMH 9707 were found to be intermediately susceptible, whereas PARSUN I and SMH 9706 were susceptible and they were found to be similar to HYSUN 33. Other varieties found to be highly susceptible. The results for whitefly (*Bemisia tabaci*) revealed that the genotype 64 A 93, SUPER 25 and CRN 1435 were found to resistant, whereas 65 A 24 found to be intermediately susceptible. The genotypes SMH 9707 PARSUN I and SMH 9706 were found to be susceptible. Other varieties including SF 187, S-278, DK 3915, SH 3322, SS 2, SS 1 and SF 177 found to be highly susceptible when they were compared with standard genotype i.e. Hysun 33. Correlation was found to be negative for all the above insect pests i.e. as population increased the yield decreased as a result.

Key words: *Helianthus annuus,* host plant resistance, *Bemisia tabaci, Aphis gossypii, Nezara viridula*

Introduction

Sunflower (*Helianthus annuus* Linnaeus, Composite) is one of the most important source of edible oil in the world; having seed oil contents as 40-50%. Worldwide interest in cultivation of sunflower crop was aroused during the 1960 and by 1980 it was the second most important source of vegetable oil in the world (Sackston, 1981). The world production of sunflower for oil is 3.5 million tons from 1971 (Metcalfe and Elkins, 1980).

It was introduced in 1960 in Pakistan. Efforts are underway to increase the area under sunflower as well as its yield to bridge the edible oil gap in Pakistan which is increasing @ 11.0% per annum (Beg, 1983). The large gap between yield obtained at research institutes and at the farmer field suggests that efforts must be intensified to raise yield potential on national level (Ahmed *et al.,* 2000). Pakistan economy is agriculture based, the import bill of edible oil (Rs. 36.496 millions) is the second largest after petroleum and consumes more than 75% of the total foreign exchange allocated for the import of food, which will be continuous up to year 2010. (Khan *et al.,* 2000).

The present edible oil production is not capable of matching the demand. The gap is being bridged by importing edible oil, costing a substantial chunk of resources from national exchanges (Khan *et al.*, 2000). Being such an important crop of Pakistan, there is a need of the day that its area, cultivation production, protection should be enhanced (Aslam *et al.*, 2000).

Sunflower is vulnerable to attack by different insect pests and various insect species assail it in diverse ecological zones. Makhdoomi (1984) reported 43 insect species attacking sunflower. The major insect pests attacking this crop include aphids (*Aphis gossypii* Glov.) whitefly (*Bemisia tabaci* Genn) and green sting bug (*Nazara viridula* Z) (Aslam *et al.*, 2000). Kakakhel et *al.* (2000) reported that most important species attacking sunflower included whitefly (*Bemisia tabaci*) and green stink bug (*Nezara viridula*). They evaluated that whitefly was serious pest of autumn and green stink bug was found to be minor pest. 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. Taylor (1981) stated that the aleyrodids, especially *Bemisia tabaci* (Gennad.), had been recorded on sunflower, cotton and tomato and was known to infest various drops and ornamentals in Zimbabwe. Inayatullah

et al. (1985) reported that the attack of whitefly in the semi desert areas of Punjab (Bahawalpur and Multan) was higher due to high temperature and scanty rainfall as compared to cooler and humid areas like Rawalpindi.

Bedford *et al.* (1994) studied that whitefly acted as major pest of agriculture crops and its new biotype "B" colonized many crops including phytotoxic response in some cases. Das and Thukral (1999) reported in the field trial carried out in Madhya Pardesh India, the sunflower genotypes (Jash-1 an dMSFH-8), highly susceptible to *Amrasca, biguttela, Amrasca devastans* and less preferred by the *Aphis gossypii*, significantly higher on middle and lower canopy respectively. Ashfaq and Aslam (2001) carried out studied for response of different insect pests to some sunflower genotypes and their correlation with yield component. The most important species attacking on the fourteen sunflower genotypes was whitefly (*Bemisia tabaci* Gannad). Ashfaq and Aslam (2001) studied the resistance of different sunflower genotypes against some insect pests in the field conditions. Fourteen genotypes were screened against *Aphis gossypii* Glover (aphids) and *Nezara vridula* (L.) (green stink bug). In case of aphids, the sunflower genotype 9705 was partially resistant whereas in case of green stink bug conclusion was made that the germplasm 9705, JH2 99S and JH1 99S were partially resistant. A negative correlation was also found between pest population and the yield of sunflower genotypes.

The objective was to evaluate of resistance of different sunflower's genotypes and their impact on number of insect pests and correlation were also seen between pest population and the yield of different genotypes of sunflower.

Materials and Methods

Sixteen varieties of sunflower (*Helianthus annuus* L.) were planted in randomized complete block design during spring, 2001 at National Agricultural Research Center. The experimental plot was 5 x 3 m^2 whereas 0.75 m was the row to row distance and 4 was the number of rows of each genotype. The names of genotypes planted were SH3322, DK 3915, HYSUN 33, 65 A 24, PARSUN I, CRN 1435, SF 187, 64 51, SMH 9706, 64A93, SF 177, SMH 9707, S-278, SUPER 25, SS I and SS2.

Firstly three seeds were sown per hill but after germination of all genotypes one plant per hill was maintained by manual thinning.

For the collection of data, ten plants were selected randomly from each plot and the data for various insects and the damage done by them etc. was recorded on whole plant basis at different plant stages. After maturity the data of yield was recorded. All the collected information regarding the response of different insect pests to sunflower genotypes under field conditions was analyzed statistically. The purpose was to evaluate of resistance of different sunflower genotypes and the impact of number of insect pests on yield component.

Following Aslam (1999), the lines which showed higher response to the population of insects pests as compared to the Hysun-33, classified as highly susceptible, while the lines which showed same response when compared to Hysun-33, classified as susceptible, while the lines which showed significantly less response to insect pests than the susceptible cultivar were classified as intermediately susceptible, partially susceptible, partially resistant, intermediately resistant, resistant and highly resistant depending upon the grouping of the means. Data analyzed by using SPSS package.

Results and Discussion

Green stink bug (*Nezara viridula*): Green stink bug (*Nezara viridula*) attack started from 8th week of the calendar year. The population kept on increasing until it was 15th week and after that it started decreasing and lowest population was recorded in 19th week when mean population was 0.34±0.0575. In 46th week maximum population was observed (1.10±0.11 plant^{-1}) (Fig. 1).

The genotype 64 A 93 had lowest mean number of pest population and it was significantly different from standard variety i.e Hysun 33. Other varieties like SUPER 25, CRN 1435, 65 A 24, 6451 and SMH 9707 had less mean population than Hysun 33 but these are not significantly different from it. Similarly PARSUN I, SMH 9706, SF 187, S-278 had relatively higher mean population but not significantly different. Whereas DK 3915, SH 3322, SS 2, SS 1 and SF 177 have higher mean population and significantly different from Hysun 33 (Table 1). The highest population was found on SF 177 (1.37±0.13) Ashfaq and Aslam (2001) also reported green stinkbug as pest.

Correlation between mean population and yield found to be negative, which means as the population increased the yield decreased as a result (Table 2).

Aphid (*Aphis gosspii*): The infestation of *Aphis gossypii* on sunflower genotype had been observed by Aslam and Rehman (2000) and Ashfaq and Aslam (2001). At NARC, the infestation started from 8th week of the year and remained till the end of cropping season. The highest population was recorded in the 11th week. In this week the mean population was 5.08±0.35 (Fig. 2). After that population decreased and was lowest in the 19th week (0.71±0.075).

Data revealed that 64 A 93, SUPER 25 and CRN 1435 are

Table 1: Mean population of whitefly (*Bemisia tabaci*), aphid *(Aphis gossypii)* and green stink bug *(Nezara viridula)* per plant and average yield of 16 genotypes of sunflower at NARC

Genotypes	Mean population± S.E of whitefly	Mean population± S.E of aphid	Mean population± S.E of green stink bug	Yield (Kg ha^{-1})
SH 3322	4.12±0.21g	3.76±0.30h	0.98±0.12g-I	975.75
DK 3915	3.32±0.20f	2.94±0.23g	0.87 ±0.12f-h	1085.5
HYSUN 33	1.39±0.12b-d	1.15±0.12b-d	0.51±0.084b-e	1566.5
65 A 24	0.80±0.090ab	0.72±0.091a-c	0.33±0.060a-c	1705.0
PARSUN I	1.25±0.12a-c	1.32±0.13c-e	0.57±0.091c-e	1538.5
CRN 1435	0.66±0.081c	0.58±0.077ab	0.29±0.056a-c	1813.5
SF 187	2.11±0.12e	1.91±0.16f	0.72±0.11e-g	1319.5
6451	0.97±0.10a-c	0.83±0.096a-c	0.41±0.07a-d	1636.5
SMH 9706	1.72±0.13de	1.65±0.14de	0.64±0.10de	1504.0
64 A 93	0.43±0.065a	0.36±0.06a	0.18±0.042a	1962.5
SF 177	11.23±0.65a	6.43±0.44k	1.37±0.13j	787.0
SMH 9707	1.05±0.10a-c	0.94±0.11a-c	0.47±0.077a-e	1582.0
S – 278	2.73±0.17f	2.57±0.20g	0.75±0.11e-g	1105.5
SUPER 25	0.55±0.07b	0.49±0.065ab	0.22±0.052ab	1912.25
SS I	7.98±0.38i	5.49±0.39j	1.22±0.12ij	898.5
SS 2	6.16±0.34h	4.74±0.34i	1.10±0.12h-j	1015.7

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

Table 2: Correlation between green stink bug (*Nezara viridula*), aphid (*Aphis gossypii*) and whitefly (*Bemisia tabaci*) population and yield of genotypes of sunflower at NARC

		Correlations			
		Yield	Bug	Aphid	Whitefly
Yield	Pearson correlation	1.000	−0.975**	−0.934**	−0.859**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	16.000	16.000	16.000	16.000
Bug	Pearson correlation	−0.975**	1.000	0.978**	0.931
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	16.000	16.000	16.000	16.000
Aphid	Pearson correlation	-0.934**	0.978**	1.000	0.976**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	16.000	16.000	16.000	16.000
Whitefly	Pearson correlation	−0.859**	0.931**	0.976**	1.000
	Sig. (2-tailed)	0.000	0.000	0.000	0.000
	N	16.000	16.000	16.000	16.000

** Correlation is significant at the 0.01 level (2-tailed)

significantly different from Hysun 33 (Table 1). These were genotypes which had less number of pest population than standard variety. Whereas 65 A 24, 6451, SMH 9707 are same as Hysun 33. The highest population was found on the genotype SF 187, S – 278, DK 3915, SH 3322, SS 2 and SS 1 had significantly higher number of pest population than Hysun 33.

When mean population of Aphid correlated with the yield of different genotype. It was found that they are negatively correlated i.e. as population increased the yield decreased as a result (Table 2).

Whitefly (*Bemisia tabaci*): Data were recorded for the preference and non preference of whitefly for the different 19 genotypes of sunflower. Ashfaq and Aslam (2001), Kakakhel *et al.* (2000) and Khan *et al.* (1994) had also worked to see the infestation of *Bemisia tabaci* on sunflower. Data were recorded for the evaluation of response and non-preference against whitefly and found that its infestation started from 8th week of the calendar year and remained throughout the crop season. The highest population was recorded during the 13th week. The mean population in this week was 5.16±0.43 plant^{-1}. There was significant difference as the weeks passed (Fig. 3) in the population of whitefly. The lowest population was recorded in the 19th week when crop was about to mature.

According to the results, sunflower genotype 64 A 93 had the lowest number of pest population (0.43±0.065) and was found to be significantly different from standard

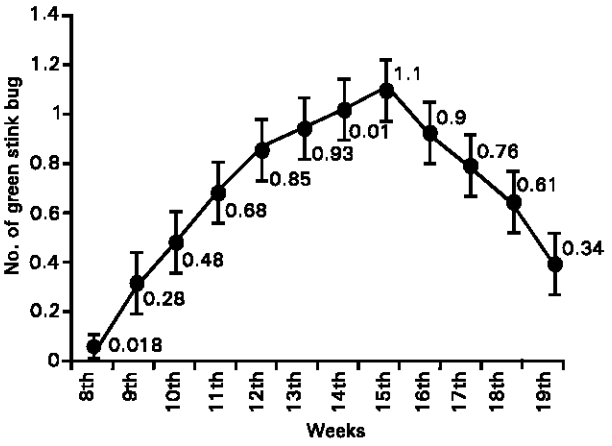

Fig. 1: Weekly mean population trend of green stink bug (*Nezara viridula*) on sunflower (*Helianthus annuus* L.) at NARC

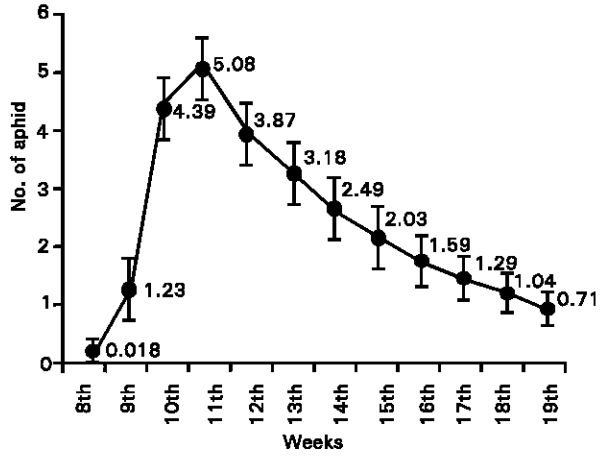

Fig. 2: Weekly mean population trend of aphid (*Aphis gossypii*) on sunflower (*Helianthus annuus* L.) at NARC

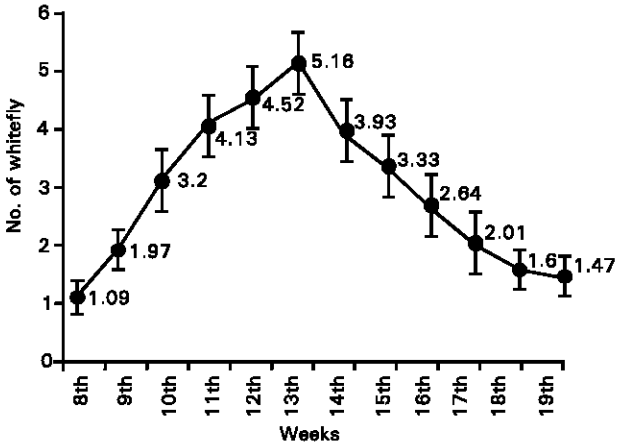

Fig. 3: Weekly mean population trend of whitefly (*Bemisia tabaci*) on sunflower (*Helianthus annuus* L.) at NARC

variety i.e., HYSUN 33. Similarly SUPER 25 and CRN 1435 had almost similar population as 64 A 93. Whereas 65 A 24, 6451 and SMH 9707 were not significantly different from Hysun 33 (Table 1). When other varieties were compared with it, it is found that PARSUN I, SMH 9706, SF 187 S-278, SH 3322, DK 3915, SS 2, SSI and SF 177 were significantly different and had higher number of pest population. The highest number of pest population was found on SF 177 (11.23±0.56), which means this variety was highly susceptible variety.

After harvesting, yield of different genotype was also recorded. The average yield of sunflower genotype ranged from 787 to 1962.5 kg ha^{-1} (Table 1).

When population of whitefly was correlated with yield of genotypes it was found that they were negatively correlated, which means that as the population increased, the yield decreased (Table 2).

Keeping in view the results of different insect pests we concluded that: viewing the results of green stink bug (*Nezara viridula*) it was found that 64 A 93 had significantly less mean population than HYSUN 33. whereas SUPER 25, CRN 1435 and 65 A 24 were found to be partially susceptible. The genotypes 6451, SMH 9707, PARSUN I and SMH 9706 found to be susceptible because they all had almost similar mean population as HYSUN 33. All other genotypes found to be highly susceptible. Correlation was negative as population increased the yield decreased as a result. Aslam *et al.* (2000) had also found it as pest of sunflower.

Keeping in view the results of aphids (*Aphis gossypii*) it was found that 64 A 93 was resistant because it had significantly less number of population than standard cultivar. Whereas SUPER 25, CRN 1435 were found to be partially resistant because they had less significant difference as compared to 64 A 93, 65 A 24, 6451 and SMH 9707 were found to be intermediately susceptible, whereas PARSUN I and SMH 9706 were susceptible and they were found to be similar to HYSUN 33. Other varieties found to be highly susceptible. Aslam and Ashfaq (2000) also conducted an experiment on sunflower genotypes and found that there was significant difference between the genotypes against *Aphis gossypii*.

The results for whitefly (*Bemisia tabaci*) revealed that the genotype 64 A 93, SUPER 25 and CRN 1435 were found to resistant as they were significantly different from Hysun 33 and had less mean number of population, whereas 65 A 24 found to be intermediately susceptible and SMH 9707 found to be susceptible as it was found to be similar as Hysun 33. Similarly PARSUN I and SMH 9706 were found to be susceptible as they were almost

similar to Hysun 33. Other varieties including SF 187, S-278, DK 3915, SH 3322, SS 2, SS 1 and SF 177 found to be highly susceptible as they were having significantly higher number of mean population. when mean population of these genotypes correlated with the yield of these genotypes, negative correlation found to be existing between them. Aslam and Rehman (2000) and Ashfaq and Aslam (2001) had also found significant difference between the genotypes of sunflower against whitefly. They also found negative correlation between yield and mean population.

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