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Resistance of Different Genotypes of *Helianthus annuus* Linnaeus Against *Bemisia tabaci* and *Empoasca* spp. and their Correlation with Yield

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Abstract: The research work was carried out to study the resistance of 9 genotypes (65 A 24, DK 3915, FH 81, PN 2KS, PARSUN I, IBD 2KS, HYSUN 33, SH 3322, PG 2KA) of sunflower against *Bemisia tabaci and Empoasca* spp. in autumn 2001 at Dhoke Wajjan. In case of whitefly (*Bemisia tabaci*) and green leaf hopper (*Empoasca* spp), the highest population (7.63±0.37 and 7.71±0.41 respectively) was recorded in the 39 week of the year 2001. The genotype PN 2KS, SH 3322 and IBD−2KS were found to be resistant against *Bemisia tabaci*.. Whereas DK 3915 found to be susceptible. Other genotypes, 65 A 24, PG 2KA, PARSUN I and FH 81 were found to be highly susceptible. The correlation was found to be negative between pest population and yield of genotypes. The results for green leaf hopper (*Empoasca* spp) revealed that SH 3322, PN 2KS and IBD−2KS were found to be resistant. Whereas DK 3915 and 65 A 24 were susceptible. FH 81 was found to be highly susceptible. Correlation was found to be negative between yield and pest population ($P<0.01$).

Key words: Host plant resistance, sunflower genotypes, susceptible, highly susceptible

Introduction

In Pakistan, sunflower is a relatively new oil seed crop. It was introduced in 1960 in Pakistan. It is grown both in irrigated as well as arid zones in Pakistan during spring and autumn to furnish raw material to the oil and ghee manufacturing industries. (Aslam *et al*., 2000). Efforts are underway to increase the area under sunflower as well as its yield to bridge the edible oil gap in the country which is increasing at the rate of 11.0% per annum (Beg, 1983). The large gap between yield obtained at research institutes and at the farmer fields suggests that efforts must be intensified to raise yield potential on national level. (Ahmed *et al* ., 2000).

Several natural factors are involved in lowering sunflower yield and damaging its performance but the important ones are hail storm, wind storms and insect pest attack. 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.) while fly (*Bemisia tabaci* Genn) leaf minor (*Phytomyza attricornis*) green sting bug (*Nazara viridula* Z). Green leaf Hopper (*Empoasca spp*) and sunflower seed weevil (*Semicronyx* spp) (Aslam *et al*., 2000) Khalifa and El−Khidir (1964) found heavy rains lethal for whiteflies and every heavy rain, more than 10 mm, brought a sharp decline in its population densities.

El−Khider (1965) reported that whitefly bred rapidly from September to the middle of November; its number, then declined due to very low number from March to May due to high mortality rates of eggs and juvenile stages as a result of high temperature and very low humidity. 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. Madjar *et al*. (1980) observed that the population of *Bemisia tabaci* increased on cotton in recent years where sunflower in Israel was sown earlier than cotton and therefore, the pest then migrated to adjacent cotton fields. 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. They suggested to evolve hairy varieties of sunflower and other economic crops to decrease their susceptibility against *Bemisia tabaci* and to enhance production/parasite activity on them.

Diraviam and Uthamasamy (1993) monitored the *Bemisia tabaci* Gennad on sunflower in Tamil Nadu, India in 1991−92, using yellow sticky traps. Traps were placed 30 cm above the ground level in kharif than in rabi season and maximum numbers (1904.6 adults/trap/week) was captured in the 4th week of December.

Singh *et al*. (1994) reported that cotton leaf curl virus (CLCV) occurred widely in Pakistan and parts of

Northwest India. Cotton varieties intercropped in citrus orchards exhibited more severe disease symptoms and higher incidences of its vector, *Bemisia tabaci* Gennad. Sunflower, potatoes, tomatoes, chilies, capsicum, cucurbits and rape were the main crops harboring the vector during rabi season. Men *et al.* (1997) conducted field studies during the rabi season of 1984-91 in Moharashtra India, to determine the abundance of whitefly on sunflower and its peak population was observed during 51st week of each year.

Rafiullah *et al.* (1998) conducted experiment for screening of sunflower genotypes against different insect pests. They screened 23 genotypes for the presences of looper, white fly and jassid. At seedling stage Peshawar-28 and parental line RHA-274 showed resistance to whitefly at both stages of growth. Aslam *et al.* (2000) surveyed the Potohar region of Pakistan during the early, growing and anthesis stages of sunflower plants for spring an autumn 1999 and reported *Bemisia tabaci* (whitefly) and *Empoasca* spp. attacking sunflower.

Kakakhel *et al.* (2000) reported that most important insects attacking sunflower included whitefly (*Bemicia tabaci*) and Plant hopper (*Empoasca* spp). They evaluated that whitefly was serious pest of autumn sunflower with high population of plant hopper was observed during both the seasons.

Ashfaq and Aslam (2001) carried out studies for response of different insect pests to some sunflower genotypes and their correlation with yield component. The most important species attacking the fourteen sunflower genotypes were whitefly *Bemesia tabaci* gannad) and *Empoasca spp.*. As far as the infestations of whitefly are concerned, the sunflower genotype 9705 was found partially resistant whereas JH1 99 S and JH2 99 S were partially susceptible. Genotypes 9705 and JH2 99 S were found partially resistant. A negative correlation was found between the insect pests population and the yield of sunflower genotypes. The present research work was therefore, planned to observe *Bemisia tabaci* (Bt) and *Empoasca* spp.(Es) on sunflower genotypes, their peak activity periods, to find the resistance of genotypes against these insect pests and to see the correlation of different insect pest infestations with the yield of different sunflower genotypes.

Materials and Methods

Nine genotypes of sunflower were planted in randomized complete block design with three replications in autumn August 7,

22001 at Dhoke Wajjan. Plot size was 3 m x 1.5 m whereas row to row distance was 0.75 m and plant to plant distance was 0.25 m. The name of genotypes were 65A24, DK 3915, FH 81, PN 2 KS, PARSUN-1, IBD 2KS, HYSUN-33, SH 3322, PG2KA. Planting was done by dibbling three seeds per hill. After germination of all genotypes one plant per hill was maintained by manual thinning.

For the collection of data five plants were selected randomly from each plot. Then population of different insects pests were counted on each of the selected plant on whole plant basis. After maturity, data of the yield was also taken to correlate it with population of insect pests.

The lines which showed higher response to the population of insects pests as compared to the Hysun-33 were classified as highly susceptible, while the lines which showed same response when compared to Hysun-33, were 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 (Aslam 1999). Data were analyzed by using SPSS (1999) package.

Results and Discussion

Whitefly (*Bemisia Tabaci*): Whitefly is a sucking insect pest of sunflower and had already been reported by Khalifa and El-Khidi (1964), Sethi *et al.* (1978), Singh *et al.* (1994) and Aslam and Ashfaq (2001).

Data recorded revealed that the infestation started from 35th week of the calendar year and remained throughout the cropping season. The highest population was found in 39th week. After that it gradually decreased and was found to be minimum in 45th week. The significant($P<0.05$) difference was found in population as time passed (Table 2).

Kakakhel (2000) and Rafiullah *et al.* (1998) had also observed that there was significant difference in population of whitefly as day passed.

It was found that PN 2 KS had the lowest number of Bt (1.61 ± 0.11) and was significantly different ($P<0.05$) from HYSUN 33 i.e standard genotype. SH 3322 and IBD-2KS were also found to significantly different from HYSUN 33 as they had less mean number of Bt than it. Whereas DK 3915 were found to be similar to HYSUN 33. All other genotypes including 65 A 24, PARSUN I and FH 81 were significantly different as they had higher mean population of whitefly (Table 1).

Green Leaf Hopper (*Empoasca Spp*): Green leaf hopper was also found to be major sucking pest of sunflower, as already been reported by Ashfaq and Aslam (2001) and Khan *et al.* (1978).

In this experiment the infestation started from 34th week of the calendar year. The mean population in this week was

Table 1: Mean number of *Bemisia* tabaci, and *Empoasa* spp. on sunflower genotypes and yield of the genotypes

S.No.	Mean Population±SE Genotype	Mean *(Bemisia tabaci)*	Population±SE (Empoasca spp)	Yield (kg/ha)
1	65 A 24	4.38 ± 0.26d	3.63 ± 0.20b	1153.33
2	DK 3915	3.04 ± 0.17bc	2.95 ± 0.15b	1350.66
3	FH 81	7.54 ± 0.45f	7.44 ± 0.42f	749.33
4	PN 2KS	1.61 ± 0.11a	1.73 ± 0.13a	1818.66
5	PARSUN-I	5.56 ± 0.34e	6.19 ± 0.33e	1013.33
6	IBD-2KS	2.63 ± 0.15b	1.91 ± 0.13a	1460.00
7	HYSUN 33	3.49 ± 0.19c	3.31 ± 0.19ab	1339.00
8	SH 3322	2.38 ± 0.15b	1.58 ± 0.11a	1480.00
9	PG 2KA	5.39 ± 0.30e	4.67 ± 0.23d	1119.00

Table 2: Mean population of *Bemisia tabaci* and *Empoasca spp.* in cropping weeks of sunflower at Dhoke Wajjan

Week of the Year	Mean Population±SE *(Bemisia tabaci)*	Mean Population±SE *(Empoasca spp)*
34	0.00 ± 0.00a	0.54 ± 0.066a
35	0.83 ± 0.066b	1.37 ± 0.10b
36	4.85 ± 0.34f	3.61 ± 0.16d
37	5.94 ± 0.37g	4.90 ± 0.17e
38	7.01 ± 0.33h	6.75 ± 0.36f
39	7.63 ± 0.37h	7.71 ± 0.41g
40	7.11 ± 0.33h	6.25 ± 0.40f
41	5.13 ± 0.24f	4.72 ± 0.32e
42	3.76 ± 0.16e	3.30 ± 0.22d
43	2.61 ± 0.15d	2.47 ± 0.16c
44	1.91 ± 0.14c	1.64 ± 0.12b
45	1.24 ± 0.11bc	1.27 ± 0.11b

Means followed by different letters differ significantly at P<0.05

Table 3: Correlation between yield of genotypes of sunflower and population of *Bemisia tabaci*) and *Empoasca* spp) at Dhoke Wajjan

	Yield	*Bemisia tabaci*	*Empoasca* spp
Yield	1.00	-.969**	-.925
Bemisia tabaci	-.969**	1.00	-
Empoasca spp	-.925	-	1.00

**P<0.01

0.54±0.066, which increased by days and highest population was recorded in 39th week of the year (7.71±0.41).There was significant difference in the population of hopper as day passed (Table 2). According to Table 1, SH 3322, PN 2KS and IBD-2KS had less population than standard genotype HYSUN 33. Whereas DK 3915 found to be almost similar to it. The highest mean population was recorded on the FH 81 (7.44±0.42). Other genotypes including 65 A 24, PG 2KA and PARSUN I also had higher mean population than HYSUN 33.

After maturity the yield data were also recorded (Table 1) and it was correlated with the population of green leaf hopper (*Empoasca spp*) and found that they are negatively correlated, as the number of ES increased, the yield decreased. (Table 3).

Keeping in view the results of different insect pests we concluded that:

The results for whitefly (*Bemesia tabaci*) revealed that PN 2KS, SH 3322 and IBD–2KS found to be resistant whereas DK 3915 found to be susceptible as it had almost similar mean number of pest as HYSUN 33. Other genotypes including 65 A 24, PG 2KA, PARSUN I and FH 81 had significantly higher population of pest than standard genotype.

The correlation between yield and population was negative which means, as the population increased the yield decreased, Ashfaq and Aslam (2001) had found that there was significant difference between genotype when they were tested against the whitefly.

After harvesting, yield of different genotypes was also recorded and correlated with whitefly population and it was found that they were negatively correlated (Table 3). As number of Bt increased, yield of sunflower decreased.

The results for Green leaf hopper revealed that SH 3322, PN 2KS and IBD-2KS were found to be resistant, as they had less population than standard genotype HYSUN 33. Whereas DK 3915 and 65 A 24 found to be susceptible and other genotypes including PG 2KA, PARSUN I and FH 81 were found to be highly susceptible as they had significantly higher population of *Empoasca* spp than HYSUN 33. Correlation was found to be negative and significant (P<0.01).

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