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Population Development of Whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) on Some Cucurbit Crops

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Abstract.- A field experiment was conducted to assess the population development of whitefly, *Bemisia tabaci* (Gennadius) on some cucurbit crops *i.e.*, water melon (*Citrullus lanatus* Thumbs.), Indian squash/squash melon (*Citrullus vulgaris* var. *fistulosus*) and melon (*Cucumis melo* L.) on experimental area of Sindh Agricultuure University, Tandojam, during summer season of 1999. The results showed that three spp. of cucurbit were affected by the whitefly and have some resistance against whitefly. The correlation between pest population and meterorological factors indicated that maximum and minimum air temperature correlated positively with the whitefly population, whereas, relative humidity displayed negative association to the pest.

Key words: Cucurbit, Whitefly population, Sindh.

INTRODUCTION

Whitefly, *Bemisia tabaci* (Genn.), is a highly polyphagous insect feeding on a large number of plants in the world. In Pakistan, it is known to attack 104 plants belonging to 24 families; of these, 16 belong to Malvaceae, 15 to Leguminosae, 13 to Cucurbitaceae, 11 to Cruciferae, 10 to Solanaceae, 8 to Compositae and 7 to Euphorbiaceae (Inayatullah *et al*., 1985). Inayatullah and Goraya (1980) surveyed the Punjab and Peshawar valley and reported its average attacks: at Multan on sunflower, melon, pumpkin, brinjal, luffa, urdbean and hollyhock; at Khanewal and Sahiwal on urdbean; at Faisalabad on watermelon, soybean, sunflower, and melon; at Sialkot on melon, cucumber and guava; at Rawalpindi on hollyhock; at Peshawar and Kohat on Lantana.

Oviposition and nymphal development ceased when the temperature falls below 14.5°C and 12°C, respectively. Neither eggs nor nymphs are affected by atmospheric humidity because they are very close to leaf surface, and relative humidity 60% or less and temperature above 46°C are lethal for adults (Avidov, 1956). Adults prefer temperature above 33°C for oviposition. Active multiplication, therefore, takes place from May to September in the Punjab and Sindh, when average maximum temperature ranges between 33°C and 41°C (Terehan, 1944; Naraiani, 1960; Yunus, 1976).

Rains are lethal for adults and more than 10 mm rains bring about sharp decline in population densities (Khalifa and El-Khidir, 1964). Well distributed showers of rain during its active period, exert a good check on its multiplication. In Sindh province population of whitefly is higher in east-west rows than in north-south rows because of wind direction (Naqvi and Qureshi, 1973).

Whitefly damages the plant in two ways; directly by feeding host juices, and indirectly by transmitting the viral diseases and secreting honey dew on which sooty mould develops that hinders photosynthesis (Inayatullah *et al*., 1985; Bellows *et al*., 1988). The pest changes its population position due to availability and type of food (Rahoo, 1999). Attique *et al*. (2003) studied population position dynamics and carry over of *Bemisia tabaci* from weed hosts, where the infestation was found on 46 weeds, these hosts play critical role in its shifting.

Keeping in view the importance on high value crops, population development of whitefly was undertaken on some cucurbit crops. The main objective of present study was to observe average population trend of adult, nymph and adult + nymph of whitefly on per leaf basis for curcurbits under

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consideration for effective control of this important pest.

MATERIALS AND METHODS

An experiment was laid out to assess the population development of whitefly on some cucurbit crops at the experimental area of Sindh Agriculture University, Tandojam during summer season of 1999. Seeds of three cucurbits *viz*., watermelon, Indian squash and melon were sown on ridges, in five replications using randomized complete block design. Total area of the experiment was about one acre. All the necessary agronomic practices were adopted throughout the growing period. Insecticide of any kind was not applied for proper exploitation of pest.

For recording data on whitefly population, 30 plants were selected randomly for each variety (watermelon, Indian squash and melon), and 6 plants from each replication were tagged. The pest counting was carried out on the 3rd and 4th node of the plant at weekly interval from May to throughout July. Both upper and lower surface of each selected leaf was examined and population of both adult and nymph were recorded. Meteorological data such as maximum and minimum air temperature (°C) and % relative humidity were recorded during each observation data.

The data on pest population thus collected were subjected to analysis of variance, to test the superiority of mean values LSD test was applied at 5% level of probability. Further analysis of correlation between meteorological factor and population of pest on each variety was performed to see their interrelation, while, regression was also tabulated to see the amount of change in the pest population due to variation in weather factors as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Population fluctuation

Average population of adult, nymph and adult + nymph of whitefly recorded on water melon, Indian squash/squash melon and melon/leaf are summarized in Tables I, II and III. The Tables show that population of pest increased gradually from 1st week of observation recording and reached its peak during 1st, 2nd and 3rd week of June and declined thereafter, on all three crops.

Table I.- Average population of whitefly/leaf recorded on watermelon (*Citrullus lanatus* Thumb.) during summer 1999 at Tandojam.

Observation dates	Adult	Nymph	Adult + nymph
21-5-1999	3.70±0.33	1.36±0.27	5.06±0.20
27-5-1999	4.50±0.35	5.40±0.17	9.90±0.91
2-6-1999	8.32±0.36	9.88±0.11	18.20±0.47
9-6-1999	3.88±0.35	12.94±0.16	16.82±0.47
16-6-1999	2.20±0.20	18.29±0.15	20.44±0.44
22-6-1999	4.78±0.37	20.90±0.19	25.68±1.48
28-6-1999	4.02±0.64	10.28±0.24	14.30±0.29
5-7-1999	6.22±0.18	9.22±0.28	15.44±0.36
11-7-1999	5.54±0.66	20.16±0.35	23.70±1.20
18-7-1999	1.22±0.53	10.28±0.18	11.25±0.23
23-7-1999	7.06±0.35	5.68±0.35	12.74±0.25
29-7-199	2.92±0.24	1.88±0.12	4.80±0.12
Mean	4.53±0.58	10.51±0.90	15.04±1.25

LSD at P<0.05 = 5.41

Table II.- Population of whitefly/leaf recorded on Indian squash/squash melon (*Citrullus vulgaris* var. *fisulosus*) during summer 1999 at Tandojam.

Observation dates	Adult	Nymph	Adult + nymph
21-5-1999	3.70±0.33	8.84±0.81	19.37±0.23
27-5-1999	4.50±0.35	14.02±0.28	26.58±0.26
2-6-1999	8.32±0.36	11.58±1.23	25.50±0.52
9-6-1999	3.88±0.35	20.20±2.01	31.00±0.80
16-6-1999	2.20±0.29	15.10±1.34	35.38±0.52
22-6-1999	4.78±0.37	23.51±2.22	21.88±0.86
28-6-1999	4.02±0.64	12.82±3.01	27.86±0.55
5-7-1999	6.22±0.18	20.92±1.27	29.89±1.50
11-7-1999	5.54±0.66	25.21±4.10	19.67±0.88
18-7-1999	1.22±0.57	13.04±2.21	18.61±0.49
23-7-1999	7.06±0.35	8.93±1.13	18.28±0.86
29-7-199	2.92±0.24	10.52±2.20	24.40±2.30
Mean	4.53±0.58	15.44±1.36	24.40±2.03

LSD at P<0.05 = 3.65

The population of whitefly adult on watermelon ranged between 1.22±0.5 – 8.32±0.36/ leaf, and nymph 1.36±0.27 – 20.90±0.19/leaf. On overall, the population ranged from 04.80±0.12 – 25.68±1.48/leaf. While, on Indian squash/squash melon the population of adult whitefly ranged

between 1.22±0.53 – 8.32±0.36/leaf and nymph from 8.84±0.81 – 25.21±4.10/leaf, on the whole the population of pest ranged from 18.26±0.86 – 31.00±0.80/leaf. Similarly, on melon adult whitefly ranged between 1.50±0.21/1.50±0.21 – 12.78±0.16/ leaf, while nymphal population ranged from 10.16±0.13 – 28.82±6.24/leaf. However, overall population of whitefly ranged between 14.72±1.13 to 41.60±2.10/leaf.

Table III.- Population of whitefly/leaf recorded on melon (*Cucumis melo* L.) during summer 1999 at Tandojam.

Observation dates	Adult	Nymph	Adult + nymph
21-5-1999	2.46±0.36	10.16±0.13	12.62±0.13
27-5-1999	4.70±0.19	22.22±2.14	26.96±0.77
2-6-1999	2.42±0.23	18.92±1.16	21.34±0.46
9-6-1999	5.48±0.24	10.10±2.10	15.58±0.78
16-6-1999	4.48±0.14	12.81±0.43	17.29±0.19
22-6-1999	9.96±0.18	20.34±1.13	30.30±0.43
28-6-1999	12.78±9.16	28.82±6.24	41.60±2.10
5-7-1999	8.20±0.20	17.19±3.15	25.39±1.11
11-7-1999	3.30±0.35	11.99±2.01	15.29±0.75
18-7-1999	41.38±0.23	19.10±2.82	33.48±1.01
23-7-1999	4.96±0.26	22.11±4.12	13.07±1.46
19-7-199	1.50±0.21	13.22±2.20	14.72±1.14
Mean	6.22±1.21	16.08±1.75	22.30±1.85

LSD at P<0.05 = 6.28

The overall performance of three cucurbit crops for harbouring whitefly population are illustrated in Figure 1. The results demonstrated that Indian squash/squash melon and melon were susceptible against whitefly, while watermelon proved some what resistant against whitefly incidence. Ohnesorge and Rapp (1981) and Butter *et al*. (1990) reported that population of *B. tabaci* fluctuated due to age of the host leaf. Further, the differences in pest population among the three crops may be attributed due to hairiness v/s glabrousness. However, Berlinger (1986) reported that stickey granular trichomes, internal chemistry of the leaf, pH of the leaf sap and protein level of the leaf sap play a decisive role in the population build-up. Rahoo (1999) also reported that whitefly can change its population position due to availability and type of food.

*Watermelon (*Citrullus lanatus *Thumb.)*

Population of whitefly displayed positive and significant correlation with maximum and minimum air with value (r = 0-.745**) and (r=0.440**), respectively and relative humidity. These results explains, that 55.3%, 19.30% and 1.4% variation in pest population were due to the variation in maximum and minimum temperature and relative humidity. While, regression coefficients (b=1.963, 3.260, and –0.219) and minimum temperature corresponding increased in whitefly population by 1.96 and 3.26/leaf, while decreased by 0.22/leaf with increase in relative humidity.

Indian squash/squash melon
(Citrullus vulgaris *var.* fistulasus)

A positive and significant association was existed between whitefly population and maximum and minimum air temperature (r = 0.752**, 0.413*), while negative and significant with relative humidity (r = -0.386*), indicating that 56.6, 17.10 and 14.90% variation was accounted for in whitefly population by the variation in maximum and minimum air temperature and relative humidity.

The regression analysis (b = 1.432, 2.131 and –0.504) reveals that for an increase of one centigrade in maximum and minimum temperature would increased whitefly population by 1.43 and 2.13/leaf, while, increasing one percent in relative humidity would decreased whitefly population by 0.5/leaf.

Melon (Cucumis melon *L.*)

In melon, the population of whitefly positive and significantly correlated with the maximum and minimum temperature (r = 0.485*, r=0.369*) whereas negative and significant with relative humidity (-0.372*).

Relationship of population of whitefly with some meteorological factors

The results on relationship between population of whitefly and some meteorological factors for each crop are shown in Table IV.

The coefficient of determination (r^2 = 0.235, 0.136 and 0.120) depicts that there was 23.5, 13.6 and 12.0% change in whitefly population due to variation in maximum and minimum air temperature

Fig. 1. Seasonal mean population of whitefly/leaf recorded on watermelon, Indian squash and melon during 1999.

Table IV.- Coefficient of correlation ® coefficient for determination (r^2), and regression coefficient between meteorological factors and population of whitefly (both adult + nymph) in cucurbits.

Characters correlated	Coefficient of correlation ®	Coefficient of determination (r^2)	Regression	Regression coefficient (b)
Watermelon				
Maximum temperature °C	0.745**	0.553	-58.510	1.963
Minimum temperature °C	0.440*	0.193	-72.196	3.260
Relative humidity (%)	-.117^{NS}	0.014	29.810	-.219
Indian Squash/squash melon				
Maximum temperature °C	0.752*	0.566	-29.66	51.432
Minimum temperature °C	0.413*	0.171	-32.588	2.131
Relative humidity (%)	-0.386	0.149	58.786	-0.504
Melon				
Maximum temperature °C	0.485**	0.235	-9.554	0.675
Minimum temperature °C	0.369*	0.136	-11.520	0.430
Relative humidity (%)	-0.347	0.120	12.147	-0.156

*Significant at **P<0.05; NSP<0.01.

and relative humidity. The regression coefficient (b=0.475, 0.430 and –0.156) demonstrates that for a unit increase in maximum and minimum temperature there was proportionally increased in whitefly population by 0.48, increasing in relative humidity would decreased in pest population by 0.16/leaf.

These results explains that high maximum and minimum air temperature appreciated whitefly population build-up, while, high relative humidity discouraged pest build-up in all three cucurbit crops evaluated. Similar results have also been reported by Khalifa and El-Khidir (1964).

On the basis of present studies, it may be agreed that for successful cropping of cucurbits like water melon, Indian squash/squash melon and muskmelon hairy variety should be preferred for cultivation to minimize pest population.

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