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Full length Research Paper

Influence of abiotic factors on population development of *Bemisia tabaci* infesting *Abelmoschus esculentus*

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The experiment was carried out in the Experimental Field, Model Farm, CABI, South Asia, unit Mirpur Khas, Sindh during spring season 2011. Okra variety Sabzpari was shown on 10th, 28th February and 20th March 2011. Weekly observations were taken on *Bemisia tabaci* population. Meteorological record was obtained from Meteorological Record Center, Sindh Horticulture Research Institute, Mirpur Khas.The results showed that the crop sown on 10th February had one population peak of whitefly (5.00 ± 0.75 per leaf). The fluctuation in the population of whitefly was observed throughout cropping season on okra sown on 28th February. Two peaks in population were recorded i.e. 1st peak (6.04 ± 0.62, whitefly per leaf) in 4th week of March and 2nd peak (7.72 ± 1.08) in 3rd week of April. The okra crop sown on 20th March showed three population peaks of whitefly i.e. (7.42 ± 0.94 per leaf in 2nd week of April), (8.46 ± 1.04 in 1st week of May) and (5.98 ± 1.01 in the end of 2nd week of June). The overall mean populations record were 1.76 ± 0.31, 2.73 ± 0.55 and 3.37 ± 0.61 on the crops sown on 10th, 28th February and 20th March, respectively. The regression analysis showed significant negative correlation of whitefly population with temperature ^{0}C and relative humidity percent.

Key words: Whitefly, okra, temperature, relative humidity

INTRODUCTION

Okra, *Abelmoschus esculentus* L., family Malvaceae is a main kharif vegetable of Pakistan. The people with great interest eat it. The origin of this vegetable is considered as Africa and Asia. Okra is a good source of vitamins, minerals, salts and has a good caloric value. The edible portion contains 89.8, 0.8, 0.2, 7.4 and 1.8 percent water, protein, fat, carbohydrate and ash, respectively. It has 175 calories per pound. It is one of the cash crops of Sindh (Khoso, 1992). So many insect pests attack okra plants from sowing up to harvesting. The most destructive insect pests are whitefly, thrip, jassid, aphid, spotted bollworm, American bollworm etc. Among these insect pests the whitefly is the injurious one, which destroys the okra plant by sucking the sap from the leaves and transmitting certain viral diseases (Atwal, 1994).

Whitefly is highly polyphagous and has been recorded on a very wide range of cultivated and wild plants. However, the magnitude of infestation and the nature of extent of injury vary with plant species, seasons and localities. Greathead, (1986) enlisted 506 plant species belonging to 74 plant families while many families are represented by a single species that serves as host of *B. tabaci*. There are as many as 99 species in *Leguminosae* at the other extreme. It is pointed out that 50% of the total number of host plants belongs to only five families, namely, *Leguminosae, Compositae, Solanaceae, Malvaceae* and *Suphorbiaceae*. It is widely distributed throughout the northern and western regions of Indo-Pak continent damaging many different cash crops i.e. cotton,

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brinjal, sweet potato, *Alfa alfa,* cucurbits, etc. (Brown and Nelson, 1986) seasonal migration of whitefly indicated that the first adult of the year to emerge around mid January usually on weeds such as *Convolvulus arvensis* and *Euphorbia* spp., or cultivated plants such as *Brassica* spp., (Basu, 1995). Van Gent, (1982) reported that various host plants and weeds harbor *B. tabaci* population around the year proved as source of infestation for cotton crop. B. tabaci appears over winters between cropping seasons as actively developing population on winter weeds such as cheese weed and sow thistle from October to March, in the spring, Helianthus annuus and Convolvulus arvensis (Coudriet, et al. 1986).

Looking at the seasonal and host plant variation on population regulation of whitefly an experiment was conducted to observe the impact of abiotic factors on occurrence of whitefly on okra crop. This will help the growers to manage the whitefly on the main crops as in cotton crop in kharif season.

MATERIALS AND METHODS

In order to assess the occurrence of the whitefly, Bemisia tabaci and its correlation with abiotic factors, an experiment was conducted in the Experimental Field, Model Farm, CABI, South Asia, Mirpur Khas, Sindh during spring season 2011.

Okra variety Sabzpari was shown on 10th, 28th February and 20th March 2011 on plots measuring 15x10 meter area each. The plants were grown on ridges, therefore, plant to plant and row to row distance was maintained 9 and 18 inches, respectively. Weekly observations on the occurrence of whitefly were taken after germination till harvesting of the crop. The counting of whitefly was made by examining 50 leaves on different nodes i.e. 2, 3, 4, 5, 7 and 9 of main stem of okra plant. Ten leaves were randomly selected from each the row. Adult and 4th instar nymphs were counted on the leaves. Meteorological record for the study period was obtained from the Meteorological record was obtained from Meteorological Record Center, Sindh Horticulture Research Institute, Mirpur Khas.

Regression analysis was carried out of whitefly population with abiotic factors such as temperature and relative humidity.

RESULTS

The results on population of whitefly on okra in relation to abiotic factors (Temperature and R.H.) at different dates are presented here under:

Population of Whitefly on okra sown on 10th February

The data on the population of whitefly are presented in Table1.It reveals that the pest build up gradually from seedling stage of the crop and reduced towards its harvesting.

Initially, the population 1.06 ± 0.23 per leaf appeared during 4th week of February, which gradually peaked to 5.00 ± 0.75 per leaf after 4 weeks time in 1st week of April. Then the population of whitefly remained low in subsequent weeks till the maturity of crop. It was observed that the crop sown on 10th February has slow and low population processes. Before peak population the activities of whitefly almost remained non-significant. After 1st week of April the population of whitefly continuously declined to the end of the crop. Only one peak in population was recorded throughout cropping season. The overall mean number (1.76 ± 0.31) was recorded during cropping period.

Population of whitefly v/s temperature and relation humidity

Table1 shows that the population appeared during cropping season. The highest population of whitefly 5.00 ± 0.75 per leaf was recorded when temperature and R.H. were 28.39 ± 0.76 and 35.28 ± 2.56, respectively. During the course of study the temperature and relative humidity ranged 15.75 ± 1.57 to 35.89 ± 3.17 and 35.28 ± 2.56 to 73.28±3.31, respectively.

The regression analysis showed that there was non-significant negative correlation between whitefly population and temperature and highly significant negative correlation with R. humidity (Figures1and 2).

Population of Whitefly on okra sown on 28th February

The data presented in Table 2 showed that whitefly appeared on the crop after germination till harvest of the crop. The fluctuation in the population of whitefly was observed throughout cropping season on okra sown on 28th February. The Number of whitefly 1.70 ± 0.36 per leaf was appeared on very 1st day of observation, which gradually increased and reached to its 1st peak 6.04 ± 0.62 whitefly per leaf in 4th week of March. The 2nd peak in population 7.72 ± 1.08 was recorded in 3rd week of April. It is clear from the data that the okra crop sown on 28th February had two peaks in population, which were recorded in early phase of crop growth. The overall mean number 2.73 ± 0.55 was recorded on okra sown on 28th February which is more than the overall mean Number

Table 1. Mean number of B. *tabaci* in relation to temperature °C and relative humility on okra grown on 10th February, 2011.

	Mean ± S.E	Mean Temp. ± S.E	Mean R.H ± S.E
Feb 25	1.06 ± 0.23	15.75 ± 1.59	72.12 ± 3.02
March 04	1.72 ± 0.28	19.00 ± 0.82	68.14 ± 1.38
11	2.06 ± 0.52	18.92 ± 0.97	70.71 ± 2.06
18	2.20 ± 0.35	18.64 ± 0.46	69.42 ± 2.35
25	2.38 ± 0.57	18.67 ± 0.43	53.00 ± 2.10
April 01	5.00 ± 0.75	28.39 ± 0.79	35.28 ± 2.56
08	3.08 ± 0.40	24.25 ± 0.99	39.14 ± 2.00
15	2.54 ± 0.35	30.57 ± 2.51	60.14 ± 2.28
22	2.28 ± 0.35	35.89 ± 3.17	69.57 ± 2.28
29	1.34 ± 0.27	34.00 ± 1.24	64.12 ± 2.02
May 06	1.20 ± 0.21	29.96 ± 0.43	48.14 ± 1.76
13	0.88 ± 0.20	28.85 ± 1.26	59.71 ± 5.73
20	0.57 ± 0.16	31.92 ± 1.26	73.28 ± 3.31
27	0.44 ± 0.10	33.03 ± 0.85	59.57 ± 2.28
June 03	0.14 ± 0.05	33.82 ± 1.12	68.14 ± 2.43
Mean	1.76± 0.31	26.77± 1.77	60.69± 3.08

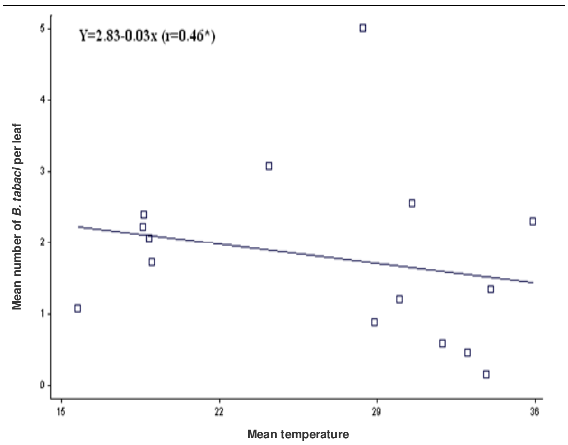

Figure 1. Regression analysis of whitefly with temperature on okra crop grown on 10th February 2011.

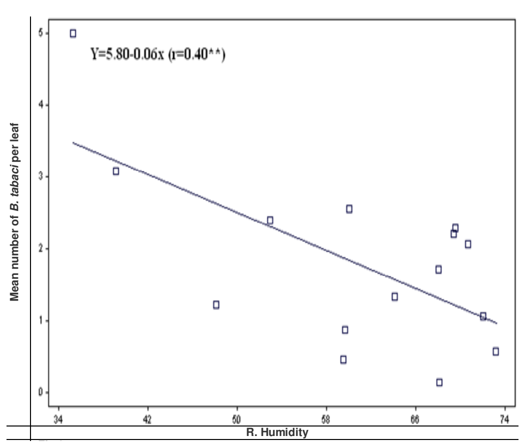

Figure 2. Regression analysis of whitefly with R.H % on okra crop grown on 10th February 2011.

Table 2. Mean number of B. *tabaci* in relation to temperature °C and relative humility on okra grown on 28th February, 2011.

Dates	Mean ± S.E	Mean Temp. ± S.E	Mean R.H ± S.E
March 13	1.70 ± 0.36	18.92 ± 0.97	70.71 ± 2.06
20	3.20 ± 0.44	18.64 ± 0.46	69.42 ± 2.35
27	6.04 ± 0.62	18.67 ± 0.43	53.00 ± 2.10
April 03	5.52 ± 0.74	28.39 ± 0.79	35.28 ± 2.56
10	3.88 ± 0.64	24.25 ± 0.99	39.14 ± 2.00
17	7.72 ± 1.08	30.57 ± 2.51	60.14 ± 2.28
25	2.66 ± 0.47	35.89 ± 3.17	69.57 ± 2.28
May 20	1.72 ± 0.30	34.00 ± 1.24	64.12 ± 2.02
09	1.52 ± 0.29	29.96 ± 0.43	48.14 ± 1.76
16	2.44 ± 0.36	28.85 ± 1.26	59.71 ± 5.73
23	1.60 ± 0.27	31.92 ± 1.26	73.28 ± 3.31
30	1.16 ± 0.24	33.03 ± 0.85	59.57 ± 2.28
June 06	0.92 ± 0.22	33.82 ± 1.12	68.14 ± 2.43
13	0.66 ± 0.15	29.73 ± 0.95	73.28 ± 3.31
20	0.34 ± 0.10	31.14 ± 0.92	69.28 ± 2.29
Mean	2.73± 0.55	28.51± 1.48	60.85± 3.11

recorded for the crop sown on 10th February.

Population of whitefly v/s temperature and relation humidity

The populations of whitefly 5.52 ± 0.74 and 7.72 ± 1.08 were recorded at 1st and 2nd peaks during crop season. The temperatures at peaks were 28.39 ± 0.79 and 30.57 ± 2.51 respectively. Relative humidity 35.28 ± 2.56 and 60.14 ± 2.28 were recorded at the peaks. During cropping period the temperature and relative humidity ranged 18.29 ± 0.97 to 35.89 ± 3.17 and 39.14 ± 2.00 to 73.28 ± 3.31 respectively.

The regression analysis showed that there was significant negative correlation between whitefly population with temperature and relative humidity (Figures 3 and 4).

Population of Whitefly on okra sown on 20th March

Table 3 showed the population of whitefly on okra sown on 20 March. Initially very low population 2.27 ± 0.36 per leaf was recorded, which immediately peaked in very following week (7.42 ± 094 per leaf in 2nd week of April). The 2nd peak 8.46 ± 1.04 was recorded in 1st week of May. After 2nd peak the population declined to 2.60 ± 0.36 per leaf. The number of whitefly remained non-significant for further 4 weeks time. The 3rd peak in population 5.98 ± 1.01 was recorded in the end of 2nd week of June. The population pattern of March sown crop was significantly different from the crops sown on 10th and 28th February. Because the March sown crop had three peaks and it had more Number of whiteflies per leaf as compared to the crops sown in February. The overall mean Number 3.37 ± 0.61was recorded on March sown crop, which was also significantly greater that the crops sown in February.

Population of whitefly v/s temperature and relation humidity

The temperature during the cropping period ranged 24.25 ± 0.99 to 33.57 ± 0.49. However, at the time of peaks the temperatures were 24.99 ± 0.99, 34.00 ± 1.24 and 29.73 ± 0.95 respectively. The regression analysis showed that there was negative non-significant correlation between temperature and whitefly population (Figure-5).

Relative humidity percent during this period was ranged between 35.28 ± 2.56 to 73.28 ± 3.31. At the time of peaks in population the relative humidity % was recorded as 39.14 ± 2.00, 64.12 ± 2.02 and 73.28 ± 3.31 respectively.

The regression analysis showed negative significant correlation between whitefly population and relative humidity percent. As relative humidity percent decreased it promoted the whitefly population (Figure 6).

DISCUSSION

The results of present studies indicated that the whitefly appeared from germination up to harvesting on okra sown on different dates i.e. 10th, 28th February and 20th

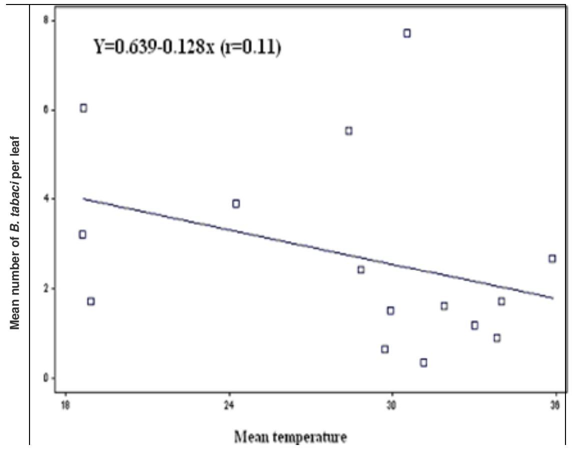

Figure 3. Regression analysis of whitefly with temperature on okra crop grown on 28th February 2011.

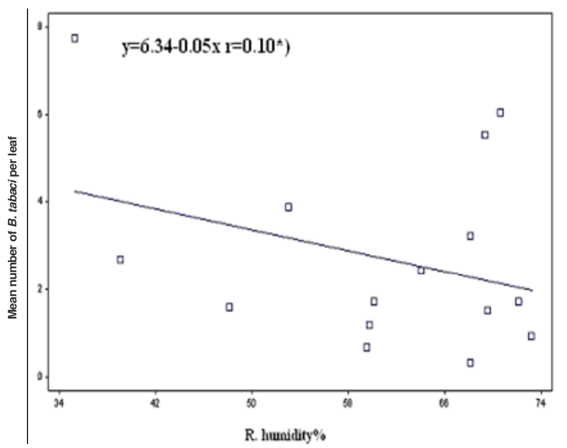

Figure 4. Regression analysis of whitefly with R.H % on okra crop grown on 28th February 2011.

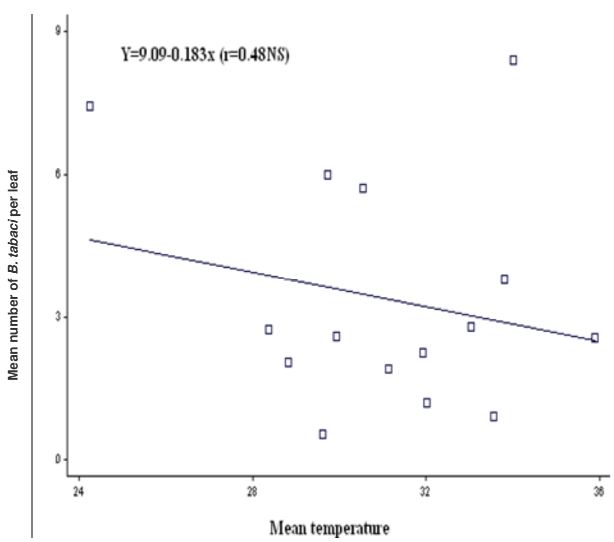

Figure 5. Regression analysis of whitefly with temperature on okra crop grown on 20th March 2011.

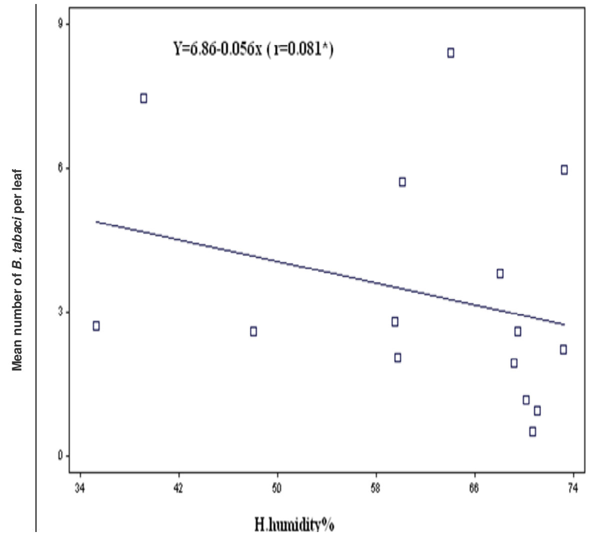

Figure 6. Regression analysis of whitefly with R.H % on okra crop grown on 20th March 2011.

Table 3. Mean number of B. *tabaci* in relation to temperature °C and relative humility oh okra grown on 20yh March, 2011.

Dates	Mean ± S.E	Mean Temp. ± S.E	Mean R.H ± S.E
April 05	2.72 ± 0.36	28.39 ± 0.79	35.28 ± 2.56
12	7.42 ± 0.94	24.25 ± 0.99	39.14 ± 2.00
19	5.68 ± 0.74	30.57 ± 2.51	60.14 ± 2.28
26	2.58 ± 0.35	35.89 ± 3.17	69.57 ± 2.28
May 03	8.40 ± 1.04	34.00 ± 1.24	64.12 ± 2.02
10	2.60 ± 0.36	29.96 ± 0.43	48.14 ± 1.76
17	2.04 ± 0.29	28.85 ± 1.26	59.71 ± 5.73
24	2.24 ± 0.45	31.92 ± 1.26	73.28 ± 3.31
31	2.78 ± 0.39	33.03 ± 0.85	59.57 ± 2.28
June 07	3.76 ± 0.48	33.82 ± 1.12	68.14 ± 2.43
14	5.98 ± 1.01	29.73 ± 0.95	73.28 ± 3.31
21	1.91 ± 0.33	31.14 ± 0.92	69.28 ± 2.29
28	1.16 ± 0.24	32.01 ± 0.96	70.14 ± 2.64
July 07	0.90 ± 0.23	33.57 ± 0.49	71.14 ± 0.53
12	0.52 ± 0.11	29.64 ± 1.12	70.70 ± 2.06
Mean	3.37± 0.61	31.11± 0.73	62.1± 3.14

March, respectively. Fluctuation in the populations of whitefly was recorded during cropping period. As a result, only one peak in the population was recorded on the crop sown on 10th February with low activities of whitefly. Two peaks in the population of whitefly were recorded on crop sown on 28th February and the activity of whitefly was a bit higher than the crops sown on 10th February. Whitefly displayed three peaks in its population when the crop was shown on 20th March with maximum activities of whitefly. The present result is in agreement with those of Liu, (2000**)** who reported that the populations of whitefly adults and immature fluctuated greatly from April to June during the two seasons, the relative values were similar. Adult whiteflies first appeared on the plants in early April, increased rapidly within a month, peaked in May, and declined at the end of the season in early or mid-June. Whitefly eggs appeared on plants soon after adults were found, but high numbers of eggs were observed on foliage until late May**.** Leite *et al.*, (2005) reported that the attack of *B. tabaci* on two plantation of okra crop. They further mentioned that second plantation was strongly attacked by the whitefly. Mikhael, (2004) reported infestation of *B. tabaci* on okra throughout two successive summer seasons of 2001 and 2002. Rizwan and Mansoor (1999) tested efficacy of some insecticides against the whitefly, *Bemisia tabaci* on okra due to its active population during March-July. Praveen and Dhandapani, (2001) studied eco-friendly management against insect pest of okra including whitefly during January-March. Mazumder *et al*., (1996) reported lower whitefly populations were revealed in crops sown between February 25 and March 20 as compared to the crops sown between April and July.

The result further indicated that the highest population of whitefly was recorded when temperature and R.H. were 28.39 ± 0.76 and 35.28 ± 2.56 respectively. During the course of study the temperature and relative humidity ranged 15.75 ± 1.57 to 35.89 ± 3.17 and 35.28 ± 2.56 to 73.28 ± 3.31 respectively when sown on 10^{th} February. The regression analysis showed that there was non-significant negative correlation between whitefly population and temperature and highly significant negative correlation with R. humidity. Result further indicated that whitefly population showed significant negative correlation with temperature and R. humidity on the crop sown on 28^{th} February and 20^{th} March respectively. The results disagree with those of Safdar *et al*., (2005) they reported minimum temperature and relative humidity had significant correlation with whitefly population. Kumawat *et al*., (2000) investigated the seasonal incidence whitefly (*Bemisia tabaci*) on okra and reported that maximum temperature was significantly correlated with whitefly density. Deepesh *et al*., (1997) mentioned that *Bemisia tabaci* (Gennadius) population showed a significant positive association with temperature

The present study indicated that *Bemisia tabaci* is dominant pest of cotton and okra as alternate host during spring season in both unsprayed field. The fluctuation of pest in unsprayed filed was observed common in okra crop with the abiotic factors at CABI, Model Farm Mirpur Khas, Sindh.

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REFERENCES

Atwal SN(1994). Agric. pests of India and Sout Eash Asia. Kalyani Publishers New Delhi, India. Pp. 529.

Basu AN(1995). *Bemisia tabaci* (Gennedius) crop pest and principal whitefly vector of plant viruses. West view press, Boulder. San Francisco, Oxford. Pp. 183.

Brown JK, MR Nelson(1986). Characterization of watermelon curly mottle virus, a geminivirus from squash leaf curl virus. Ann. Apple. Biol. 15 (2): 243 – 252.

Coudriet DL, DE Meyerdrik, N Prabhaker, AN Kishaba(1986). Bionomic of sweet potato whitefly (Homoptera: Aleyrodidae) on weed hosts in imperial valley, California. Environ. Entomol. 15: 1179 – 1183.

Deepesh S, A Bagmare, A Gupta(1997). Effect of weather parameters on population build-up of key pests of soybean. J. of Insect Sci. 10 (2): 120-124.

Greathead AH(1986). Host plants. In *Bemisia tabaci* a literature survey (M.J.W. Cock, ed). C.A.B. Int. practices for mana. *Bemisia tabaci*. Manjo Integrado de Plagas. 56: 22 - 30.

Khoso AW (1992). Growing vegetable in Sindh. 1st ed. Department of Agron. S.A.U. Tando Jam. 115 – 118.

Kumawat RL, BL Pareek,BL Meena(2000). Seasonal incidence of jassid and whitefly on okra and their correlation with abiotic factors. Annals of Biol. 16(2): 167-169.

Leite GLD, M Picanço, GN Jham, MD Moreira(2005). Whitefly population dynamics in okra plantations. Pesquisa Agropecuaria Brasileira. 40 (1): 19-25.

Liu TX(2000). Population dynamics of *Bemisia argentifolii* (Homoptera: Aleyrodidae) on spring collard and relationship to yield in the Lower Rio Grande Valley of Texas. J. of Eco. Ento. 93 (3): 750-756.

Mazumder N, U Borthakur, D Choudhury(1996). Incidence of yellow vein mosaic virus of bhindi (*Abelmoschus esculentus* L., Moench) in relation to cultivar and vector population under different sowing dates. Indian J. Virol. 12 (2): 137-141.

Mikhael RHG(2004). Ecol. studies on the whitefly, *Bemisia tabaci* (Genn.) on some vegatable crops. (Homoptera: Aleyrodidae). Egyptian J. Agric. Res. 82 (2): 631-646.

Parveen PM, N Dhandapani(2001). Eco-friendly mana. of major pests of okra (*Abelmoschus esculentus* L.) Moench. J. Vegetable Crop Prod. 7 (2): 3-12.

Rizwan A, H Mansoor (1999). Comparative efficacy of some traditional and non-traditional insecticides against insect pests of okra. Pak. Entomol. 21 (1/2): 77-80.

Safdar A, MA Khan, A Habib, S Rasheed, Y Iftikhar (2005). A Correlation of environ. conditions with okra yellow vein mosaic virus and *Bemisia tabaci* population density. Int. J. Agric. and Biol. 7 (1): 142-144.