

THE CHANGES IN THE POPULATION FLUCTUATIONS OF THE WHITEFLY, *BEMISIA TABACI* (GENNADIUS), HOMOPTERA: ALEYRODIDAE IN COTTON FIELDS.

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ABSTRACT

Seasonal population activity of the whitefly, *Bemisia tabaci* (Genn.) in cotton Giza 86 was studied during 1999 cotton season. The experiment was carried out at Sakha district, Kafr El-Sheikh Governorate, from January to early of November. The occurrence of *B.tabaci* lasted about 15-17 weeks from the beginning of Sowing.

This pest had different numbers of population peaks, showing 5 peaks during the season of activity. Immature stages of *B.tabaci* occurred in high numbers on cotton leaves during the growing period and 3-4 peaks of population were noticed. An assessment of occurrence and abundance of annual broods was approximated.

Concerning mid to late season; the population of whitefly adults showed a fluctuation of four peaks on July, August, September and October representing by 320, 850, 760 and 1850 individuals /100 leaves, respectively. For nymphs, four peaks were also observed on July, September and October representing by 300, 56, 42 and 16 individuals /100 leaves, respectively.

INTRODUCTION

Recently the production of cotton crop *Gossypium barbadense* has pronouncedly increased to cover our local consumption and a portion of export needs. However, this crop is liable to attack by many serious pests.

The whitefly, *Bemisia tabaci* (Genn.) is a well known pest of cotton in Egypt, Sudan, India and several parts of the world. It infests various other crops, particularly tobacco. For the economic importance of *B.tabaci*, many authors studied the changes in the population dynamics and number of field generations of this insect pest (Azab *et al.*1972; Melamed-Madjar *et al.*1979; Gerling *et al.*1980; Xu Rumei,1982; Gerling and Horowitz,1984; Von Arx *et al.*1984; Horowitz,1985; Baumgartner *et al.*1986; Ougur and Sekeroghn,1989; Watson *et al.*1992; Nadihalli *et al.*1993). In Egypt, during the last few years, cotton became vulnerable to attack by this pest at late cotton season. In some years the attack was so severe that honeydew had spread all over the infested leaves and led to the formation of the black sooty mold. This may be due to the use of pesticides which affected badly the natural balance of the pest. It damages the leaves by disapping them and inject its saliva therein, which consequently get disfigured and discoloured and inflicted on cotton crop (Husain and Trehan,1936 and Ibrahim and Abo El-Dahab,1960).

Since it is important to produce marketable lint undamaged by pests and un- contaminated by stains or honeydew, attempts were carried out to modify the present cotton pest survey program. Because maintaining cotton health is essential to demonstrate its complete natural resistance against pests, and

also for profitable cotton production, several attempts regimes were evaluated.

Therefore, it is of interesting to shed additional light on whitefly insect attacking cotton fields at Kafr El-Sheikh Governorate and to limit the economic threshold level for infestation of this pest so, chemical or control program can be use.

MATERIAL AND METHODS

An experiment was conducted at Sakha district, Kafr El-Sheikh Governorate, during 1999 cotton growing season to evaluate the seasonal changes in the abundance of the sucking insect pest, *Bemisia tabaci* Genn.

One area of 4 feddans was divided into 4 plots of one feddan each, the field was cultivated with cotton variety Giza 86 on late March. The normal agricultural practices were followed. When the plants were 15 weeks old and by the beginning of July, samples were collected at random from both diagonals of the inner square area of each experimental plot until harvest. The species of cotton whitefly, *B. tabaci* were taken into account.

For counting the mid and late season whiteflies population, 25 cotton leaves were sampled at weekly intervals from each plot early in the morning from different levels of the plant (2,1 and 2 leaves /plant from upper, middle and lower level, respectively). The upper and lower surfaces of the leaf were examined carefully (Hassanein *et al.*1971). The count included both adults and nymphs, using manual magnifying lens in the field for adult individuals, while for the immature stages (nymphs), bionocular microscope was used in the laboratory, according to the method adopted by Mohamed (1977). Any insecticides application not be done throughout the whole season against the sucking insects especially the whiteflies.

Statistical analysis of the data:

The absolute figures of the pest were transformed by using $(X + 1)$ (Standard deviation) to have a normal distribution of the populations.

RESULTS AND DISCUSSION

Data presented in Table (1) reveals the population density of the whitefly from July to late October and early of November,1999.

It is obvious that infestation mean level fluctuated between 13.5 in the beginning of July to 880 individuals /100 leaves at the first half of August.

Between this period it was observed that the level of infestation decreased suddenly at July 8 and became 2 individuals /100 leaves only, then increased greatly to 107 individuals /100 cotton leaves throughout one week only (July 15). At the end of July, the level was going to increase till it reached 338 insects /100 leaves then it decreased sharply again (66.25 adults /100 leaves) after one week; August 5. It is astonishing that this level increased greatly to reach 880 insects/100 leaves (the first peak) one week after in August 12. This was the first period of the pest activity. The second period of the fly's activity began by August 19 to mid of September. At the

beginning of this period (August 19) the infestation was 316.5 /100 cotton leaves and this level is also a high one. After one week only (August 26) it dropped suddenly to 15.5 insects /100 cotton leaves, then it increased to 115 individuals /100 leaves at September 2 and decreased again to 9.25 adults /100 leaves by September 9 and reached its second peak (731.25 individuals /100 leaves) in September 16, the end of the

Table 1: Seasonal abundance of *Bemisia tabaci* weekly during cotton season at Sakha, Kafr El-Sheikh Governorate during 1999.

Weekly sampling dates	Plant age/ week	Number of adults / 100 leaf				Total	Mean	Standard deviation
		Replicates						
		a	b	c	d			
1/7/1999	18	18	22	0	14	54	13.5	- 256.4
8/7	19	3	2	1	2	8	2	- 267.9
15/7	20	108	98	134	88	428	107	- 162.9
22/7	21	305	258	240	242	1045	261.25	- 8.65
29/7	22	216	398	386	352	1352	338	68.1
5/8	23	66	58	48	93	265	66.25	-203.65
12/8	24	760	790	1012	958	3520	880	610.1
19/8	25	318	288	510	150	1266	316.5	46.6
26/8	26	12	28	20	2	62	15.5	- 254.4
2/9	27	148	99	132	81	460	115	- 154.9
9/9	28	7	9	11	10	37	9.25	-260.65
16/9	29	748	532	752	895	2927	731.75	461.85
23/9	30	19	25	29	21	94	23.5	-246.4
30/9	31	9	11	2	1	23	5.75	-264.15
7/10	32	240	182	250	154	826	206.5	-63.4
14/10	33	2110	1096	2026	2070	7302	1825.5	1555.6
21/10	34	92	69	108	82	351	87.75	- 182.15
28/10	35	54	68	77	59	258	64.5	- 205.4
4/11/1999	36	33	79	80	42	234	58.5	- 211.4
Total						20512	5128	
Mean						1079.6	269.9	

second activity period. The third activity period began by September 23 and lasted to 14 October. The beginning of infestation level was 23.5 insects /100 leaves at September 23, then decreased to 5.75 adults /100 leaves in September 30, increased sharply to 206.5 insects /100 leaves at October 7, reaching to the third peak (1825.5 adults /100 leaves) one week after (October 14).

Table (2) demonstrated the weekly activity of nymphs throughout the periods extended from July 1st to Sept 4th. It is clear that the nymphs have two periods of activity throughout the season of infestation. The first period began at early July by 12 nymphal individuals, then increased to 42.75, 53.75 and 309.5 individuals /100 leaves (the peak level) during July 15, 22 and 29, respectively (the first period of activity).

Table 2: Seasonal abundance of *Bemisia tabaci* nymphs weekly during cotton season at Sakha, Kafr El-Sheikh Governorate during 1999.

Weekly sampling dates	Plant age/ week	Number of adults / 100 leaf				Total	Mean	Standard deviation
		Replicates						
		a	b	c	d			
1/7/1999	18	9	0	37	2	48	12	- 25.8
8/7	19	0	1	0	2	3	0.75	- 37.05
15/7	20	35	53	61	22	171	42.75	4.95
22/7	21	170	4	2	39	215	53.75	15.95
29/7	22	502	164	244	328	1238	309.5	271.7
5/8	23	29	51	18	32	130	32.5	- 5.3
12/8	24	37	12	19	87	155	38.75	0.95
19/8	25	30	29	32	16	107	26.75	- 11.05
26/8	26	0	9	3	0	12	3	- 34.8
2/9	27	29	45	22	39	135	33.75	- 4.05
9/9	28	62	37	58	49	206	51.5	13.7
16/9	29	8	0	17	3	28	7	- 30.8
23/9	30	4	5	9	16	34	8.5	- 29.3
30/9	31	11	8	12	30	61	15.25	- 22.55
7/10	32	39	45	44	37	165	41.25	3.45
14/10	33	3	4	11	2	20	5	-32.8
21/10	34	10	23	8	15	56	14	- 28.8
28/10	35	27	25	13	2	67	16.75	- 21.05
4/11/1999	36	3	9	6	2	20	5	- 32.85
Total						2871	717.75	
Mean						151.1	37.8	

The second activity period extended from August 5 by 32.5 individuals to 38.75, 26.75, 3, 33.75 and 51.5 individuals /100 cotton leaves, representing the second peak.

On the other hand, table (3 and 4) showed the mean and accumulated numbers of *B.tabaci* adults and nymphs, respectively on cotton plants during the whole periods of activity.

Data recorded before revealed that the whitefly population density fluctuated greatly during July and August. In July it reached a peak suddenly at mid of the same month to reach its maximum (338 individuals /100 leaves) at the end of July. This fluctuation may due to the change in the weather factors happen yearly in this month. After one week (at the beginning of August) the density decreased suddenly to 66.25 individuals /100 cotton leaves. But after one week the population increased gradually to reach its first peak (880 individuals /100 leaves). So we must put in mind that this pest has a very high and swift reproduction for one season or another. Yet it must be recommended to treat any degree of infestation by this pest as if was small, to avoid the sudden out- break . This is for adults or nymphs, the same trend can be followed.

The fluctuation of whiteflies population:

The mean number of whitefly adults show that there are three periods of activity, occurred from the first week of July to the end of October. Meanwhile, two periods of activity for the nymphal stages were occurred throughout the whole season. These results could be summarized as follows:

(One) – Whitefly adults:

1 – The first period of activity:

This period extended from the beginning of July to the first half of August, it considered the principal period of activity because of the high numbers of the insect appearance coincided with the highest flowering and fruiting stage of the plants. It contains two peaks for activity (338 and 880 individuals / 100 leaves at July 29 and August 12, respectively.

2 – The second period of activity:

The peaks of this period appeared around the second half of August till the first half of September. It considered of lower density than the first period, containing two peaks, these were; 316.5 and 115 individuals /100 leaves at August 19 and September 2, respectively.

3 – The third period of activity:

It covered a period of about six weeks from the second half of September till late October, and the population size was considerably high. This period has one peak of activity and existed with the full growing plants and completely maturity. This peak was represented by 1825.5 individuals /100 leaves at September 16.

(b)– Whitefly nymphs:

It could be divided to two periods as follows:

1 – The first period of activity:

It extended from the beginning of July till the second half of August and its high peak was found in the end of July and early August (summer months). This period represents the insect high activity . This period included two peaks of activity, represented by 309.5 and 38.75 individuals /100 leaves at July 29 and August 12, respectively.

2 – The second period of activity:

It covered a period from the end of August and early September till the end of October and included three equal peaks. At the same time, these peaks were smaller than that of the first period because of plant maturity, hence, the infestation became low.

These peaks were represented by 33.75, 51.5 and 41.25 individuals /100 leaves at September 2, 9 and October 7, respectively.

Table 3: Mean and accumulated number of *Bemisia tabaci* adult at Sakha, Kafr El-Sheikh Governorate during 1999 cotton season.

No.	Date of inspection	Days accumulated	Mean No.of isect / inspection	No.of accumulated insects	%Accumulated insects for total
1	1/7/1999	7	13.5	13.5	0.26
2	8/7	14	2	15.5	0.30
3	15/7	21	107	122.5	2.39
4	22/7	28	261.25	383.75	7.48
5	29/7	35	338	721.75	14.07
6	5/8	42	66.25	788	15.37
7	12/8	49	880	1668	32.53
8	19/8	56	316.5	1984.5	38.69
9	26/8	63	115.5	2000	39
10	2/9	70	115	2115	41.24
11	9/9	77	9.25	2124.25	41.42
12	16/9	84	731.75	2856	55.69
13	23/9	91	23.5	2879.5	56.15
14	30/9	98	5.75	2885.25	56.26
15	7/10	105	206.5	3091.75	60.29
16	14/10	112	1825.5	4917.25	95.89
17	21/10	119	87.75	5005	97.60
18	28/10	126	64.5	5069.5	98.86
19	4/11	133	58.5	5128	100

***Bemisia tabaci* generations:**

A – Approximated number of *Bemisia tabaci* Adult generations:

Data showed that, this insect has four overlapping generations on cotton plants throughout the whole season which extended from the beginning of July to the end of October (Table 5).

1 – First generation:

This generation occurred in high population density from the second week of July till the second week of August, lasting approximately one month. On the other hand, it considered one of the strong generations because of its existence coincided with the period of plant flowering and fruiting stage.

2 – The second generation:

This generation appeared around the second week of August till the first week of September. In the same time, it considered as a strong generation,

hence, it was the highest important economic generation with the first one because they (together) represented the first period of activity which had occurred at July and August months (the plant age was 90 –100 days).

Table 4: Mean and accumulated number of *Bemisia tabaci* nymphs at Sakha, Kafr El-Sheikh Governorate during 1999 cotton season.

No.	Date of inspection	Days accumulated	Mean No. of isect / inspection	No. of accumulated insects	%Accumulated insects for total
1	1/7/1999	7	12	12	1.67
2	8/7	14	0.75	12.75	1.78
3	15/7	21	42.75	55.5	7.73
4	22/7	28	53.75	109.25	15.22
5	29/7	35	309.5	418.75	58.34
6	5/8	42	32.5	451.25	62.87
7	12/8	49	38.75	490	68.29
8	19/8	56	26.75	516.75	71.99
9	26/8	63	3	519.75	72.41
10	2/9	70	33.75	553.5	77.12
11	9/9	77	51.5	605	84.29
12	16/9	84	7	612	85.27
13	23/9	91	8.5	620.5	86.45
14	30/9	98	15.25	635.75	88.58
15	7/10	105	41.25	677	94.32
16	14/10	112	5	682	95.02
17	21/10	119	14	696	96.97
18	28/10	126	16.75	712.75	99.3
19	4/11	133	5	717.75	100

3 – The third generation:

This generation extended from the first week of September to the first week of October, hence, the fluctuation in the population density was very clear here, and it may be attributed to one or more of the unsuitable bio or physical factors.

4 – The fourth generation:

This generation lasted from the first week of October to the end of that month and represented the third period of activity. Its persistence was in close up with the plant complete maturity, consequently, its economic harmful was very slight.

Table 5: Period of adults occurrence and number of *Bemisia tabaci* generations at Sakha, Kafr El-Sheikh Governorate during 1999 cotton season.

Generation number	Date of adult occurrence		Generation period /week
1 st	2 nd week of July	2 nd week of August	4 weeks
2 nd	1 st week of August	Last week of August	3 weeks
3 rd	1 st week of September	1 st week of October	4 weeks
4 th	1 st week of October	Last week of October and 1 st week of November	4 weeks

B – Approximated number of Bemisia tabaci nymph generations :

Table (6) determined the approximated number and duration of *Bemisia tabaci* nymph generations

1 – The first generation:

This one extended from the third week of July till the third week of August (about one month). It considered one of the important economic generations because the cotton plants, in that time, were in its high activity for flowering and fruiting stages.

2 - The second generation:

This generation considered one of the serious economic generations which occurred from the second week of August till the second week of September. It represented with the first generation the most important generations because their occurrence were simultaneous with the first period of insect activity.

3 – The third generation:

This generation started from the second week of August and lasted to the second week of September and the first week of October and fluctuated between decreasing and increasing in its population density as a result of the effect of one or more of the bio or physical factors.

4 – The fourth generation:

It covered a period of one month starting from the first week of October to the end of that month. At the same time, it represented the third period of insect activity and occurred on the old age of plants, sequently, its economic harmful was lower than the previous generations.

Finally, from the previously mentioned results, it could be concluded that, there was clearly applicable between the peak of the first generation for both adults and nymphal stages. It could be also reffered that, there was a similar time for the existance between adults and nymphs for the second generation (the fourth week of August) but there are highly differentiation between them for the population density whenever it was low owing to the nymphal stage.

This phenomenon may be due to the mortality factors at this period for the nymphs than adults. Adding, the existance of the whitefly nymphs was one week before whitefly adults. This may be probably attributed to the variability in adult reproductive activity being positively correlated with temperature (El - Serwiy *et al.*1984). It seems that faster insect development occurred at optimum temperature and relative humidity (approximately 30 °C and 65 – 70% R.H.) (Powel and Bellows,1992 a).

Higher and lower temperatures and relative humidity exerted their action in supressing *Bemisia tabaci* populations (Powel and Bellows,1992 a). A strong correlation was found between the whitefly populations and both temperature and relative humidity during the experimental season.

Similar findings were reported by Bhardwaj and Kushwaha,1984 in Rajasthan and Nadihalli *et al.*1993 in India.

Table 6: Period of nymphs occurrence and number of *Bemisia tabaci* generations at Sakha, Kafr El-Sheikh Governorate during 1999 cotton season.

Generation number	Date of nymphs occurrence		Generation period /week
1 st	2 nd week of July	2 nd week of August	4 weeks
2 nd	1 st week of August	1 st week of September	4 weeks
3 rd	1 st week of September	Last week of September	3 weeks
4 th	Last week of September	Last week of October	4 weeks

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التغيرات التي تحدث في حركة مجاميع ونشاط الذبابة البيضاء في حقول القطن

**محمد عبدالحميد روميله - محسن محمد محمد على
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة**

درس النشاط الموسمي لمجاميع حشرة الذبابة البيضاء خلال موسم نمو القطن سنة 1999 . أجريت هذه التجربة بمنطقة سخا - محافظة كفر الشيخ ابتداء من شهر يوليو حتى أوائل شهر نوفمبر . وقد وجد أن هذه الحشرة تبدأ في الظهور بحقول القطن بعد بداية الزراعة بحوالي 15 - 17 اسبوع . كما تبين أن لهذه الحشرة 5 قمم نشاط أثناء موسم النمو . وتظهر الاطوار الكاملة لهذه الحشرة بأعداد كبيرة على أوراق نباتات القطن خلال فترة نموه (مع ظهور 3-4 قمم نشاط) . وقد قدرت أعداد أجيال هذه الحشرة التي تظهر التي تطهر على نباتات القطن ب 3 - 4 أجيال . وبالإشارة الى موسم النشاط والتذبذبات التي تحدث في تعداد الاطوار الكاملة لهذه الحشرة وجد أن قمم هذه الأعداد تحدث في شهر يوليو وأغسطس وسبتمبر وأكتوبر (ويمثلها 320 و 850 و 760 و 1850 حشرة / 100 ورقة من النباتات على التوالي) . أما بالنسبة لهذه القمم في الاطوار الغير كاملة فكانت تمثلها الأعداد 300 و 56 و 42 و 16 حورية / 100 ورقة خلال شهر يوليو وسبتمبر وأكتوبر فقط على التوالي . كما بينت النتائج أيضا أن الحد الحرج للاصابة بهذه الحشرة ليس له حدود معينة سواء كان للاعمار الكاملة أو للحوريات .