COMBINED EFFECT OF CERTAIN PREDATORS AND WEATHERING FACTORS (TEMPERATURE AND RELATIVE HUMIDITY) ON THE POPULATION OF SOME SUCKING PESTS ATTACKING COTTON PLANTS

Salama, A. E., A. H. Hosny, A. Masoud, N. A. Hasan, A. A. Ismail and M. H. El-Dewy*

Pesticides Department, Fac. Of Agric. Kafr El-Sheikh, Univ., Egypt.
**Plant protection Research institute, Agric. Res. Center Dokki, Giza, Egypt.*

ABSTRACT

The population dynamics of some sucking pests as wall as their associated predators were evaluated under field conditions in Kafe El-Sheilk province. The data showed that, the number of pest-generations in each cotton-season might varied from one season to another. i.e. *T. tabaci* (Lind) which considered the earliest insect among sucking pests showed two peaks during 2003 cotton-season while it recorded three peaks during 2004 cotton-season.

Sometime, the variation in the number of pest-generations might resulted from the pest-stage under investigation. In other words, the whitefly recorded three peaks if the estimation occurred on the immature stage while the adult stage showed two generations only. However, most sucking pests particularly Aphids, Jassids and spider mites showed three distinct peaks noticed during both cotton-seasons. With respect to the population, dynamics of some of the associated predators, (nomely *Coccinella* spp., *Scymnus* spp., *Paeederus alfierii* and the true spiders) recorded two distinct peaks in each growing season.

Concerning the effect of prevailing weather factors on the population dynamics of some sucking pest, the data indicated that, the simple correlation coefficient between temperature and sucking pests differed according to the pest species. It was highy significant positive with whitefly and aphids in both seasons while insignificant positive with jassid, and spider mites. High temperature encouraged the reproduction of whitefly, aphids, jassid, and thrips and thus positive correlation were computed. Although relative humidity negatively affected thrips but it positively affected aphids, jassid, and whitefly. The joint effect between weather factors and predators had the greatest effect on whitefly and aphids, but they caused moderate effect on thrips and jassids.

INTRODUCTION

Because of the economic importance of cotton and its high quality, it becomes a must to recommend measures of the control of its early season sucking pests by new chemical groups (heterocyclic nitromethelenes), (**Saba, 1991; Diehr *et al*, 1991 and Anonymous, 1992**).

Owing to the economic injuries caused by sucking pests to cotton and to the difficulties encountered in their chemical control, it is important to find out new methods for controlling these pests by means of their natural enemies. The study of population fluctuations of the predators and their preys believed to be one of almost important in enlightening integrated control (**Holling, 1960**). The interactions between insects and their natural enemies are essential ecological processes that contribute to the regulation of insects population (**Dent, 1991**).

The main objective of our study could be summarized in two points. The first, is studying the population dynamics of some sucking pests and their associated predators to select the proper time for insect control. The second is evaluating the effect of prevailing weather factors (temperature and relative humidity) and predators on population dynamics of sucking pests.

MATERIALS AND METHODS

1-Design of field experiments:

The present work was carried out in the farm of Sakha Agricultural Research Station, Kafr El-Sheikh during two successive growing cotton seasons 2003 and 2004. An area of one feddan was divided into plots each of 1/100 of feddan. A complete randomized block design was adopted. All normal agricultural practices were followed as usual during the two seasons.

2- Population dynamics of some sucking pests:

For counting the population-densities of cotton thrips, *Thrips tabac* (Lind.),cotton aphid, Aphis gosyypii (Glover), cotton jassid, *Empoasca* spp. whiteflies, *Bemisia tabaci* (Gennadius) and spider mites, tetranychus spp., samples were collected at random from both diagonals of the inner square area of each experimental plot. Samples of 25 seedlings for each replicate were collected separately every week starting approximately on the 7^{th} day after planting. The upper and lower surfaces of the randomly chosen cotton leaves were carefully examined using lens (5x) to count sucking pests, while immature stages of whitefly were counted by transmitting the same 25 cotton leaves which were chosen above after picking them up to the laboratory in peper bags, where binocular-microscope was used to count nymphal and pupal stages.

For more accurate evaluation of the actual seasonal fluctuation of *T. tabaci* population, the percent degree of fluctuation (D.F) was calculated according to the equation described by **Salama *et al.*, (2006)**. In this equation, the number of recorded individuals of thrips/100 cotton seedlings / 7 days of the first inspection period in each cotton season was considered the base value for comparison. Accordingly, the percent degree of fluctuation at any period during the season could be calculated from the following equation:

$$\%\ D.F. = \left[\frac{A - B}{A}\right] x\ 100$$

Where:

A = Total recorded individuals of thrips/100 cotton seedlings /7 days at any period.

B = Total recorded individuals of thrips /100 cotton seedlings /7 days at the first inspection period.

3- Population density of some associated predators:

At the same time during which counts of sucking pests were carried out, the number of *predacios* species (i.e. true spiders, *Scymus* spp., *Coccinella* spp. and *Paeederus alfierii*) found on 10 cotton plants chosen randomly from each plot was performed directly in the field using lens (5x). According to **Hafez (1960)** technique, samples were taken from both diagonals of the inner square area of each plot.

4- The effect of prevailing predators and weathering factors on population dynamics of sucking pests:

The mean records of temperature, relative humidity throughout the season were obtained daily from the Meteorological Station, Sakha Research Station. Weekly data were recorded to study the relationship between the numbers of sucking pests and their predators under different temperatures and relative humidity. Sample correlation and partial regressions were calculated according to **Fisher (1950)**.

RESULTS AND DISCUSSION

1- Population dynamics of some sucking pests and their associated predators:

1.1- Population dynamics of some sucking pests:

Data presented in Tables (1 and 2) showed the population density of *T. tabaci*, *A. gossypii*, *Empoasca* spp., *B. tabaci* (immature and adult) and *Tetranychus* spp. during 2003 and 2004 cotton growing seasons, respectively.

1.1.1- Population dynamics of *T. tabaci* (Lind.):

The data presented in Tables (1 and 2) quite indicate that *T. tabaci* (Lind) considered the earliest insect among sucking pests, which attack cotton seedlings in both cotton growing seasons. *T. tabaci* showed two peaks during 2003 cotton season, the first peak was recorded on April 30 (540 individuals/100 cotton seedlings), while the second peak was recorded on June 25 (261 individuals/100 leaves). However, in case of 2004 cotton season, the insect showed three peaks, the first peak on May 5th (482 individuals/100 cotton seedlings), the second peak occurred on May 28 (348 individuals/100 seedlings), while the third peak was recorded on August 13 (202 individuals/100 leaves), respectively. Moreover, the data presented in Tables (1 and 2) revealed that the average numbers of *T. tabaci* were higher in 2004 than that of 2003 cotton-season.

In general, the foregoing results concerning the presence of 2-3 sharp generations of *T. tabaci* during the growing cotton-seasons agreed to a great extent with the previous finding of many investigators (**Khan and ullah, 1994; Nassef *et al.*, 1996a and Abo-Sholoa, 2001**).

Based on D.F. values presented in Tables (1 and 2), it is quite evident that there was an extreme fluctuation of thrips occurred during both seasons. The thrips population jumped during the last week of April 2003 from 70 to 540 individuals within 7 days only. Moreover, the population remained at this high level no longer than the first week of May, then dropped drastically from 199 to 50 within one week (Table 1). The extreme fluctuation of any insect reflect a case of unstability of this population due to unfavorable weather or conditions. With regard to the magnitude and economic important of the two generations of *T. tabaci* and their prospective damage to cotton yield, the data presented in Tables (1 and 2) revealed the following points:

1- With respect to the first generation which almost attack cotton seedlings during late April and continued till the first week of May, it is quite evident that in spite of the high magnitude of this generation (suicide generation as that of bollworms), but it had relatively no injurious effects on cotton plants due to availability of quick thinning during this period. Accordingly, cotton growers should be aware with the proper time of cotton plantation.

2- Concerning the second generation of *T. tabaci* which attacked cotton plant during late May (May 28, 2004) or late June (June 25, 2003), it is obvious that this generation almost attacked the flowering stage and caused few damage of squares and resulted in weak plants which in turn affect the yield. These might be behind the damaging effect of the second generation of *T. tabaci* on cotton yield.

1.1.2. Population dynamics of *A. gossypii* (Glover):

a- In early season:

The population dynamics of aphids was studied during two successive seasons, 2003 and 2004, respectively and the data are presented in Tables (1 and 2). It is quite clear that one peak of abundance only was recorded on April 24 (2003) and on May 7 (2004) and was represented by a mean of 24 and 12 individuals/100 cotton seedlings/7 days during 2003 and 2004 cotton seasons, respectively.

b- Mid to late season:

The data presented in Tables (1 and 2) showed that the population density of *A. gossypii* appeared during the first week of July in both seasons, and its abundance increased gradually until the mid of September in both tested seasons. *A. gossypii* population fluctuated and reached its maximum level on September 3rd during 2003 cotton season while it reached its maximum level on August 27 during 2004 cotton-season. However, the population of aphids in general was higher during 2004 cotton season than that during 2003 cotton-seasons.

Reviewing the previous results one could noticed that, the fluctuation of *A. gossypi* during 2003 cotton-season was almost steady and accompanied with gradual increase of aphid population from the first week of July till the end of July. Then the D.F. increased vigorously as the number of aphids/100 leaves Jumped from 36 individual/100 leaves on July 30 to 1378 individuals/100 leaves on August 20th. This jump represent the start of forming a peak which reached its maximum (2556 individuals/100 leaves) on Sept. 3rd.

Table (1) Average number of each pest/100 cotton seeding as well as their degrees of fluctuation during 2003 season.

Series of inspection		*T. tabaci*			*A. gossypii*			*Empoasca* spp			Adults stage (*B. tabaci*)			immature (*B. tabaci*)			*Tetranychus* spp		
		A	B	D	A	B	D	A	B	D	A	B	D	A	B	D	A	B	D
April	23	70	10	0.0	9	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	1.0	0.0
	30	540	77.1	87.04	24	3.4	62.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18	2.57	61.10
May	7	199	28.4	64.82	5	0.7	0.0	4	0.57	0.0	0.0	0.0	0.0	80	11.4	0.0	48	6.86	85.42
	14	50	7.1	0.0	3	0.4	0.0	4	0.57	0.0	0.0	0.0	0.0	119	17.0	32.94	44	6.29	89.10
	21	22	3.1	0.0	0.0	0.0	0.0	18	2.57	77.82	0.0	0.0	0.0	100	14.3	25.44	33	4.71	78.77
	28	9	1.3	0.0	0.0	0.0	0.0	24	3.43	83.38	0.0	0.0	0.0	100	14.3	25.44	24	3.43	70.85
June	4	132	18.9	47.1	0.0	0.0	0.0	24	3.43	83.38	0.0	0.0	0.0	4	0.6	0.0	66	9.43	89.40
	11	200	28.6	65.0	0.0	0.0	0.0	9	1.29	55.81	1	0.14	0.0	21	3.0	0.0	64	9.14	89.10
	18	220	31.4	68.2	0.0	0.0	0.0	15	2.14	73.36	1	0.14	0.0	21	3.0	0.0	63	9.0	88.89
	25	261	37.3	73.2	4	0.6	0.0	21	3.0	81.0	0.0	0.0	0.0	34	4.9	0.0	62	8.86	88.71
July	2	161	23.0	56.5	6	0.9	0.0	17	2.43	76.54	0.0	0.0	0.0	14	2.0	0.0	20	2.86	65.00
	9	61	8.7	15.0	9	1.3	0.0	5	0.71	19.72	0.0	0.0	0.0	35	5.0	0.0	44	6.29	84.10
	16	26	3.7	0.0	9	1.3	0.0	12	2.14	66.67	15	2.14	33.3	24	3.4	0.0	195	27.86	96.41
	23	12	1.7	0.0	35	5.0	74.29	15	5.14	73.36	46	6.60	97.83	29	4.1	0.0	328	46.86	97.87
	30	0.0	0.0	0.0	36	5.1	75.0	36	5.14	88.91	47	6.71	97.91	311	44.4	74.32	210	30.0	96.67
Aug.	6	0.0	0.0	0.0	234	33.4	96.1	52	7.43	92.33	49	7.0	98.0	356	50.9	77.60	146	20.86	95.21
	13	0.0	0.0	0.0	486	69.4	98.1	74	10.57	94.61	341	48.71	99.71	300	42.9	73.43	22	3.14	68.15
	20	0.0	0.0	0.0	1378	196.9	99.3	108	15.43	96.31	1224	174.86	99.92	396	56.6	79.86	2	0.29	0.0
	27	0.0	0.0	0.0	1884	269.1	99.5	64	9.14	93.76	788	112.57	99.88	442	63.1	81.93	0.0	0.0	0.0
Sep.	3	0.0	0.0	0.0	2556	365.1	99.6	44	6.29	90.94	495	70.71	99.80	900	128.6	91.14	0.0	0.0	0.0
	10	0.0	0.0	0.0	948	135.4	99.0	8	1.14	50.0	796	113.71	99.88	1077	153.9	92.59	0.0	0.0	0.0
	17	0.0	0.0	0.0	776	110.9	98.8	6	0.86	33.72	1250	178.57	99.92	1082	154.6	92.63	0.0	0.0	0.0

A = Total individuals/100 seedlings/7 days, B = Average pests /100 seedlings/7 days andD = the percent degree of fluctuation

Table (2) Average number of each pest/100 cotton seeding as well as their degrees of fluctuation during 2004 season.

Series of inspection	*T. tabaci*			*A. gossypii*			*Empoasca* spp			Adults stage (*B. tabaci*)			immature (*B. tabaci*)			*Tetranychus* spp		
	A	B	D	A	B	D	A	B	D	A	B	D	A	B	D	A	B	D
April 23	38	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	0.43	0.0
30	101	14.4	62.38	5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	0.14	0.0	13	1.86	76.88
May 7	482	68.9	92.2	12	1.7	58.3	2	0.29	0.0	0.0	0.0	0.0	2	0.29	51.72	9	1.29	66.67
14	332	47.4	88.6	4	0.6	0.0	16	2.29	87.34	0.0	0.0	0.0	3	0.43	67.44	7	1.00	75.00
21	315	45.0	88.0	0.0	0.0	0.0	69	9.86	97.10	0.0	0.0	0.0	33	4.71	97.03	13	1.86	76.88
28	348	49.7	89.1	0.0	0.0	0.0	93	13.29	97.81	0.0	0.0	0.0	7	1.00	86.00	15	2.14	79.91
June 4	141	20.1	73.1	0.0	0.0	0.0	121	17.29	98.32	0.0	0.0	0.0	3	0.43	67.44	0.0	0.0	0.0
11	2	0.29	0.0	0.0	0.0	0.0	134	19.14	98.48	0.0	0.0	0.0	3	0.43	67.44	0.0	0.0	0.0
18	4	0.57	0.0	0.0	0.0	0.0	149	21.29	98.64	0.0	0.0	0.0	3	0.43	67.44	0.0	0.0	0.0
25	8	1.14	0.0	0.0	0.0	0.0	134	19.14	98.48	2	0.29	0.0	1	0.14	0.0	2	0.29	0.0
July 2	7	1.0	0.0	9	1.3	44.4	59	8.43	96.56	1	0.14	0.0	8	1.14	87.72	21	3.0	85.67
9	6	0.86	0.0	6	0.9	6.67	48	6.86	95.77	2	0.29	0.0	12	1.71	91.81	20	2.86	89.97
16	0.0	0.0	0.0	60	8.6	91.67	66	9.43	96.92	0.0	0.0	0.0	28	4.00	96.50	78	11.14	96.14
23	10	1.43	0.0	136	19.4	96.32	64	9.14	96.83	6	0.86	66.67	104	14.86	99.10	208	29.71	98.55
30	20	2.86	0.0	264	37.7	98.11	76	10.86	97.33	4	0.57	50.0	66	9.43	98.52	148	21.14	97.97
Aug. 6	164	23.7	76.9	702	100.3	99.29	30	4.29	93.24	20	2.86	89.86	132	18.86	99.26	36	5.14	91.63
13	202	28.9	81.29	670	95.7	99.25	82	11.71	97.52	84	12.00	97.62	178	25.43	99.45	38	5.43	92.10
20	110	15.7	65.45	2056	293.7	99.76	134	19.14	98.48	148	21.14	98.63	288	41.14	99.66	0.0	0.0	0.0
27	0.0	0.0	0.0	2550	364.3	99.8	52	7.43	96.10	858	122.57	99.76	132	18.86	99.26	0.0	0.0	0.0
Sep. 3	57	8.14	33.33	1150	164.3	99.57	54	7.71	46.24	554	79.14	99.63	109	15.57	99.10	0.0	0.0	0.0
10	0.0	0.0	0.0	563	80.4	99.1	56	8.00	96.38	291	41.57	99.30	90	12.86	98.91	0.0	0.0	0.0
17	0.0	0.0	0.0	413	59.0	98.79	44	6.29	95.38	323	46.14	99.37	80	11.43	98.78	0.0	0.0	0.0

A = Total individuals/100 seedlings/7 days, B = Average pests /100 seedlings/7 days and D = the percent degree of fluctuation

The same trend of results occurred during 2004 cotton-season, as the number of aphids/100 seedlings jumped from 264 individuals/100 leaves on July 30 to 2056 on August 20th. Then the peak reached its maximum on August 27 (2550 aphid/100 leaves/7 days). The current results agreed fully with the previous findings of **Nassef *et al.*, (1996b) and El-Zahi (2005).**

1.1.3. Population dynamics of *Empoasca* spp.:

Concerning the population dynamics of *Empoasca* spp., the data presented in Tables (1 and 2) indicated that the population of jassids appeared on May 1st in both seasons then increased gradually recording 24 and 149 individuals/100 leaves during 2003 and 2004 cotton seasons, respectively.

Reviewing the foregoing resultes, it could fairly concluded that, a part of April the abundance of jassids extended from the first May till the end of September during both cotton-seasons. The average number of jassids is higher during 2004 cotton-season than that of 2003 cotton-season. Three distinct moderate peaks are noticed during both cotton-seasons occurred during 2003 on June 4th, June 25 and August 20th, respectively, while the peaks which were noticed during 2004-season occurred on June 18th, July 30 and August 20th , respectively. The number of total individuals recorded/100 cotton leaves/7 days during 2003-season are 24, 21 and 108 in the first, second and third peaks, respectively. The corresponding values of individuals during 2004-season are 149, 76 and 134, respectively. Most of the calculated D.F. values are high. However, there is a positive correlation between the D.F. values and the peak of the fluctuation curve. In other words, the peak of the fluctuation curve must has the highest D.F. value. Thus we can use the D.F. values for precise determination of the peak in case of having interactions between several points. The current result confirmed the previous finding of **Nassef *et al.*, (1996a and b) and El-Srand (2005).**

1.1.4. Population dynamics of B. *tabaci* (Genn.):
a. *B. tabaci* adults:

Data presented in Tables (1 and 2) showed that, the population of adult stage of whitefly was first appeared as a single insect on June 11th 2003 and as two individuals/100 cotton leaves/7 days only on June 25 during 2004 cotton season. The abundance of whitefly adults increased gradually to reach a maximum level on Auguost 20th (1224 individuals/100 leaves/7 days) and on August 27th (858 individuals/100 leaves/7 days) during 2003 and 2004 cotton seasons, respectively. The population abundance of whitefly adults was in general, much more higher during 2003 cotton-season than that recorded during 2004-season.

Concerning the number of *B. tabaci* adult-peaks, the data showed that two peaks were quite observed during 2003 cotton-season, the first peak occurred on August 20^{th} estimating by 1224 adults/100 leaves/7 days while the second peak was observed on September 17th accounting 1250 adults/100 leaves/7 days.

With regards to the number of adult-peaks recorded during 2004 cotton season, the current results revealed that one peak only was recordrd as adult population increased slowly up to the first week of August, then the rate of population built-up increased vigorously to reach its maximum peak on August 27^{th} (858 adults/100 leaves/7 days). Thereafter, a sharp drop in adult population was recorded with a mean of 323 midividuals/100 leaves at the end of 2004 cotton season.

a. *B. tabaci* (immature stages):

Another estimation of the population density was done by using the immature stages/100 leaves instead of using the number of adults. The data are presented in Tables (1 and 2). The results quite indicate that the populations of immature stages of whitefly started to appear on the first week of May during both successive cotton seasons; 2003 and 2004. Then the population increased gradually and fluctuated several times until the end of the season. However, the population of the immature stages of the whitefly show three distinct peaks *in each cotton-seasons. These peaks occurred during 2003 season on May 14^{th} (119 individuals/100 cotton leaves), on August 6^{th} (356 individuals/100 cotton leaves) and on September 17^{th} (1082 individuals/100 leaves), respectively.

With regards to 2004 cotton-season, the fluctuation of *B. tabaci* was similar to that occurred during 2003, as three peaks were recorded on May 21 (33 individuals/100 seedlings), on July 23 (104 individuals/100 leaves) and on August 20^{th} (288 midividuals/100 leaves), respectively.

Reviewing the current results, it could concluded that, the population dynamics of the immature stages of whitefly showed three distinct peaks in each growing-season. However, the population abundance of the immature stages of *B. tabaci* was, in general, higher during 2003 than those recorded through 2004 growing seasons. These results coincide with many investigators **(Luo *et al.*, 1989; El-mezayyen and Abou-Attia, 1996; Nassef *et al.*, 1996 b and c and Lin-Kejian *et al.*, 2002).**

Now the question raised in mind which estimation is more accurate and could be relied upon to determine the population density of B. tabaci. If we return back to our results presented in Tables (1 and 2), we stated that the population of adult stage of whitefly was first appeared as a single insect on June 11th during 2003 and as two individuals on June.25 during 2004 cotton season. This statement contradict with our previous results presented in Tables (1 and 2) which indicated that the population of immature stage of whitefly started to appear on the first week of May during both successive seasons. This contradiction could be interpreted by the fact that the feeding behavior of *B. tabaci* is to visit its host to feed and left before sunshine. Thus, if the investigator for any reason reached the field and started after sunshine, he will record false data. Accordingly, it is preferable to collect samples and return to the laboratory to investigate for the presence of life mobile-nymphs with the aid of a simple binocular in order to get accurate results.

1.1.5. Population dynamics of *Tetranychus* spp.:

Data in Tables (1 and 2) represent the population density of spider mites during both 2003 and 2004 cotton seasons. It is quite clear that the spider mites started to appear within the 1st week of April and the populations increased gradually until July 23 as represented by 328 and 208 individuals/100 leaves in both seasons, respectively. The population density was declined until Augusts 13. Regarding 2003 season, the population abundance recorded three peaks, the first on May 7 (48.0 individuals/100 seedlings) and the two other peaks on June 4th and July 23, showing means of 66.0 and 328 individuals/100 cotton leave/7 days, respectively. In 2004 season, the population of mites recorded two peaks on April 30 and May 28, represented by 13.0 and 15.0 individuals/100 leaves/7 days, respectively, while mites decreased to low numbers and disappeared in June, then started to increase again recording, the highest peak on July 23 (208.0 mites/100 leaves). In general, the foregoing results agreed to a great extent with the previous findings of many investigators (**Taha and El-Raies, 1996 and Taha *et al.*, 2001**)

2. Population dynamics of some associated predators:

The population dynamics of certain predators namely; *Coccinella* spp.; *Scymnus* spp.; *Paederus alfierii* (Koch) and true spiders were surveyed weekly and the data are presented in Table (3).

2.1. Population dynamics of Coceinella spp:

Data presented in Table (3) showed that, the population of *Coccinella* spp. started to appear on the 3rd week of May and continued to increase gradually up to the first week of August, then the population increased remarkably until the end of the season. However, two peaks were recorded; the first occurred on August 20, showing a mean of 60 beetles/100 cotton plants; the second peak occurred on September 3rd with a mean of 130 beetles/100 plants/7 days. The results also showed that in spite of the population density of *Coccinella* spp. is relatively more abundant during 2004 cotton season (1015 beetles) than 2003 season (519 beetles), but only 2 peaks were recorded on August 13 and September 10 with a mean of 190 beetles/100 cotton plants in both peaks, respectively.

In general, our results agreed with the previous findings of many investigators. **Hassanein *et al.*, (1970)** found that *C. undecimpunctata* was commonly found in cotton fields. Moreover, **Abbas and El-Deeb (1993)** mentioned that the population density of *C. undecimpunctata* was high in July, and then decreased gradually until the end of the season. In addition, **Salama *et al.*, (2006)** indicated that this predator is commonly found in cotton fields but relatively in small numbers. They also mentioned that the abundance of *C. undecimpunctata* was very low during June and reached the highest peaks during July and August. El-Zahi (2005) stated that the population density of *Coccinella* spp. larvae recorded 3 peaks on cotton (of March 21 sowing data) while formed 2 peaks on cotton (of April 10 sowing data). This variation in number of peaks is not a case of contradiction but it is acceptable data since the number of peaks is not absolute values depend on insect species but it is a variable value resulted form the interactions between insect species, weathering, abundance of food....etc.

The current data also reveal that a part of *Coccinella* spp. all tested predators were more abundant during 2003 cotton season (4979 beetles) than that during 2004 cotton-season (2860 beetles). In term of figures, the population size of tested predators from one season to another dropped drastically from 4790 to 2860 beetles with a percentage reduction of 57.4%. This result might explain the reason responsible for the noticed increase of the populations of sucking pests during 2004 than 2003 cotton season.

2.2. Population dynamics of *Scymnus* spp.:

With regard to the population dynamics of ladybird beetles *Scymnus* spp., two peaks were recorded in both cotton seasons (Table 3). In the first cotton season the data revealed that the first peak occurred on June 11 (85 beetles/100 cotton plants/7 days), while the second peak was observed on July 23 (295 beetles/100 cotton plants/7 days). As for the second cotton-season, the lady bird fluctuated recording 2 peaks on July 9th and August 13 showing means values of 230 and 60 beetles/100 cotton plants, respectively.

The data also revealed that the average numbers of *Scymnus* spp. were higher during 2003 cotton-season compared with the corresponding value of 2004 cotton-season. In term of figures, the population of the ladybird decreased from 1940 beetles during 2003 cotton-season to 869 beetles during 2004 cotton-season with percent of reduction of 55.21%.

The foregoing results agreed with the previous finding of **Wang *et al.*, (1995), El-Mezayyen, and Abou-Attia (1996)** who mentioned that the ladybirds were abundant predator of cotton insects and the population of the predator had two peaks.

2.3. Population dynamics of *Paederus alfierii* (Koch.):

Data presented in Table (3) showed that the population dynamics of *Paederus alfierii* appeared within the first half of June in both seasons recording 2 peaks in each cotton-season. During 2003 cotton season the first peak occurred on July 9th, representing 211 beetles/100 cotton plants whereas the second peak was noticed on August 13 recording 95 beetles/100 cotton plans. As for 2004 cotton-season, the first peak reached its maximum on July 16 with an average of 30 beetles/ 100 cotton plants while the second peak occurred on August 6, representing 30 beetles/100 plants.

With regard to the population size of *P. alfierii* during both successive cotton-seasons, one can noticed that the recorded population was relatively in high number during 2003 cotton season (1101 beetles/ 100 cotton plants) then it dropped drastically to 145/beetles/100 cotton plants during 2004 with a percent of reduction of 86.83%. However, such reduction might be due to unfavorable conditions such as rarity of food (hosts) and/or decrease in temperature and/or windy climate. However, we shall take into consideration the interactions between the predators, weathering and host-prey.

Concenning the number of peaks/season, the current results showed 2 peaks/season. On the other hand, **Nassef *et al.*, (1996b) and El-Srand (2005)** reported that *Paederus alfierii* had 3 peaks/season whereas **El-Mezayyen and Abou-Attia (1996)** reported that *Paederus alfierii* had only one peak which associated with the highest peak of aphid and jassid in the first season.

2.4. Population dynamics of true spiders:

The population dynamics of the true spiders are studied under cotton field conditions through two successive seasons; 2003 and 2004, and the data are presented in Table (3) It is quite clear that the population of the true spiders appeared almost on May 1st in both seasons. Concerning 2003 cotton season, the population dynamics of the true spiders recorded two peaks; the first on June 11 represented by 125 spiders/100 cotton plants, while the second peak occurred on August 13 with a mean value of 185 spiders/100 plants. Regarding 2004 cotton-season, the fluctuation of the true spiders confirm the presence of 3 peaks; the first on June 11 (75 spiders/100 plant), while the second occurred on July 9th (60 spiders/100 plant) whereas, the third peak was noticed on August 27 (70 spiders/100 plants). The data presented in 2003 season revealed that the average numbers of the true spiders are much higher (1419 spiders) in 2003 season than that of 2004 season. The percent reduction in true spiders within the two seasons was calculated to be 41.44%.

In general, the current results are in full agreement with the previous findings of many investigators **(Wang *et al.*, 1995; El-Naggar *et al.*, 2000)**.

II. The effects of prevailing predators and weathering factors on population dynamics of sucking pests:

The effects of prevailing predators and weathering factors on the seasonal abundance of sucking pests were studied under field conditions at Kafr El-Sheikh province during two successive cotton-seasons; 2003 and 2004. In both seasons, the study was extended from mid-April to the end of the season.

II.1. The effects of prevailing predators on the population dynamics of sucking pests:

The correlations between the seasonal abundance of some predators (i.e. *Coccinella* SPP; *Scymnus* spp., *Paederus alfierii* and true spiders) and certain sucking pests [thrips, aphids, jassids, whitefly (immature and adult stages) and spider mites] are studied during two successive cotton-seasons, 2003 and 2004. The obtained results presented in Table (4), indicated that thrips, in both seasons, showed insignificant negative correlation with all tested predators (Table 4) while *Coccinella* spp. exhibited highly positive correlations with aphids and whitefly (adult and immature stages) with r values of (0.718, 0.822, 0.904) and (0.708, 0.761, 0.699) for 2003 and 2004-cotton seasons, respectively.

Table (3) Average number of each predator/100 cotton plants commonly found in cotton fields during 2003 and 2004 cotton-seasons.

Predators	Average number of each predator/100 cotton plant at indicated dates of inspection														
	April		May				June				July				
	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30
Predators (2003)															
***Coccinella* spp**					1	1	-	5	4	5	5	-	-	-	3
***Scymnus* spp**					1			85	75	100	189	245	265	295	250
Paederus alfierii			1	-	-	-	-	55	59	75	85	211	175	125	100
true spiders	-	-	10	12	20	18	28	125	121	105	75	75	60	50	75
Predators (2004)															
***Coccinella* spp**	-	-	-	-	-	-	-	-	5	5	-	10	-	10	-
***Scymnus* spp**						4	40	40	35	100	130	230	70	60	50
Paederus alfierii							10	-	10	-	5	20	30	20	20
true spiders			1	8	9	75	20	75	20	15	45	60	30	100	40

Table (3) Continued

Predators	Average number of each predator/100 cotton plant at indicated dates of inspection							Total sum of each predator	% of each Predator with respect to the whole predictions complex
	August				September				
	6	13	20	27	3	10	17		
Predators (2003)									
***Coccinella* spp**	5	5	60	40	130	80	175	519	10.40
***Scymnus* spp**	210	150	10	10	10	10	35	1940	38.89
Paederus alfierii	90	95	10	10	10	-	-	1101	22.27
true spiders	125	185	90	60	50	65	70	1419	28.44
Predators (2004)									
***Coccinella* spp**	40	190	110	160	170	190	125	1015	35.49
***Scymnus* spp**	50	60	-	-	-	-	-	869	30.38
Paederus alfierii	30	-	-	-	-	-	-	145	5.07
true spiders	30	50	40	70	56	40	47	831	29.06

The results also revealed that *Paederus alfierii* exhibited insignificant negative correlations between all tested sucking pests except spider mites which showed highly positive correlations (r = 0.583, 0.609) in 2003 and 2004 seasons. As for the true spiders, the data exhibited insignificant positive correlations with all tested sucking pests except thrips, which showed insignificant negative correlations as mentioned before.

However, the literatures showed many contradictions, i.e. **El-Mezayyen and Abou-Attia (1996)** found that *C undecimpunctata* exhibited significant positive correlation between aphid and jassid populations, while the correlation was insignificantly positive with whitefly. Moreover, **Gamieh and El-Bassuony (2001)** mentioned that the population of predatory mites was negatively correlated with population densities of moving stages of spider mite and whitefly nymphs, but it was positively correlated with spider mite eggs and aphids. On the other hand, a negative correlation was found between predatory insects and moving stages and eggs of spider mite, whitefly adults and aphids, while a positive correlation was recorded between predatory insects and whitefly nymphs and jassids. **Taha *et al.*, (2001)** reported that insignificant correlation coefficient was found between the population of certain sucking pests infesting cotton and their natural enemies except that of spider mites; whereas correlation was generally negative while it was positive for whitefly.

II.2. Effect of prevailing weather factors (temperature and relative humidity) on population dynamics of sucking pests:

The effect of prevailing weather factors on the seasonal abundance of certain sucking pests were studied under field conditions at Kafr El-Sheikh Province during two successive seasons, 2003 and 2004. The obtained results are given in Table (5).

Regarding the simple correlations coefficient between temperature and sucking pests during 2003 cotton season (Table 5), the data showed that it was highly significant positive with whitefly (r = 0.553, 0.573), while insignificant negative with thrips (-0.177); jassids (-0.106) and spider mites (-0.157). Whereas, the relative humidity exhibited highly significant positive correlation between aphids (0.579) and jassids (0.603), while thrips was highly significant negative (-0.604), but insignificantly positive with whitefly [immature stages (0.334) and adult (0.415)].

Concerning 2004 cotton season, temperature exhibited significant positive correlation with aphids (0.530) and immature stages of whitefly

(0.522), while insignificant positive with jassid; adult whitefly and spider mites with values of 0.379, 0.411 and 0.281, respectively. Whereas, relative humidity was highly significant negative with thrips (-0.600), while significantly positive with aphids (0.513) and whitefly/immature (0.582) and adult (0.434). These contradictions between the results of the two climatic factors in the two successive seasons attract our attention for the presence of unknown masked effects of other climatic factors (i.e. wind speed and direction, moon light, ultrasounds, short waves pressure, radiation...etc.) might be behind the final observed effects. However, such contradiction are commonly observed by many investigators, **Bishnoi *et al.*, (1996)** observed that significant relationship between build-up of jassids, whitefly and the mean air temperature and relative humidity. On the other hand, **Gupta *et al.*, (1998)** found that minimum temperature and evening relative humidity were significantly correlated with the whitefly population over time. Moreover, **Abo-Shaeshae (2001)** found that the population density of predators *C. carnea, P. alfierii, C. Undecimpunctata*, *Scymnus syriacus* and *Orius* sp. and sucking insect pests (aphid and whitefly) were positive significant correlation in 1999 and 2000 season.

II.3. Combined effect of weather factors (temperature and relative humidity) and predators on the population of the tested pests:

Data presented in Table (6) revealed that the interactions effects of temperature, R.H. and predators were significantly effective on sucking pests populations during both successive seasons.

Concerning 2003 season, the joint effect between the two climatic factors and predators on sucking pests induced the greatest effect against immature stages of whitefly; aphids and jassids were 95.1, 91.4 and 83.1%, respectively, thus the residual factors for these pests were 4.9, 8.6 and 16.9% respectively . Whitefly (adult) and spider mites came in the second order with corresponding values of 79.4 and 72.4%, while the residual factors were 20.6 and 27.6%. Thrips had the lowest joint effect (R^2 = 56.2%).

Regarding 2004 season: the joint effect between weather factors, predators and the tested pests had the same trend of results of 2003 season which had the lowest value (R^2= 44.7%). The descending order of joint effects were, 76.3, 74.9, 72.7, 64.0, 52.4 and 44.7% for immature stage of whitefly, adult whitefly, aphids, spider unites, thrips and jassids, respectively, thus the residual factors for these pests were 23.7, 23.7, 27.3, 36.0, 47.6 and 55.0, respectively.

Table (4): Simple correlation between weekly population of sucking pests and their associated predator, during 2003 and 2004 cotton-season at kafr El-Sheikh

Predators	Simple correlation (r)											
	2003 cotton-season						2004 cotton-season					
	A	B	C	D	E	F	A	B	C	D	E	F
Coccinella spp	-0.321	0.718**	0.177	0.822**	0.904**	-0.363	-0.191	0.708**	-0.011	0.761**	0.699**	-0.125
Scymnus spp	-1.92	-0.303	-.059	-0.306	-0.224	0.736**	-0.384	-0.299	0.125	-0.313	-0.268	0.195
Paederus alfierii	-0.119	-0.300	-0.081	-0.333	-0.305	0.583**	-0.268	-0.169	-0.014	-0.296	0.005	0.609**
true spiders	-0.165	0.094	0.3883	0.176	0. 146	0.086	-0.342	0.306	0.285	0.336	0.340	0.406

A = *T. tabaci* , B = *A. gossypii*, C = *Empoasca* spp, D = *B. tabaci* (mature stage), E = *B. tabaci* immature (stages), F = *Tetranychus* spp, and ** = highly significant

Table (5): Simple correlation between population of sucking pests on cotton and certain climatic factors during 2003 and 2004 seasons at kafr El-Sheikh

Season	Climatic factors	Simple correlation (r)					
		T. tabaci	*A. gossypii*	*Empoasca* spp	Immature (*B. tabaci*)	Mature stages (*B. tabaci*)	*Tetranychus* spp
2003	Mean temp. °C	-0.177	0.142	-0.106	0.553**	0.573**	-0.157
	Mean R.H.%	-.0604**	0.579**	0.603**	0.334	0.415	0.063
2004	Mean temp. °C	-0.417	0.530*	0.379	0.522*	0.411	0.281
	Mean R.H.%	-0.600**	0.513*	0.308	0.582*	0.434*	0.210

* = significant (P< 0.05) and ** = highly significant (P< 0.01)

Table (6): Direct and joint effect of climatic factors (temp. and R.H.) and predators on the populations of sucking pests during 2003 and 2004 cotton-season at kafr El-Sheikh

Variables	Simple correlation (r)											
	2003 cotton-season						2004 cotton-season					
	A	B	C	D	E	F	A	B	C	D	E	F
Temp. (°C)	0.301	-8.339	2.063	15.391	6.76**	-1.042	19.763	122.97	7.783	49.05	-3.005	-3.686
R.H. (%)	-17.05*	35.57*	-0.15*	0.333	-2.553	-0.0105	-32.49	32.023	8.301	-11.68	11.09	2.384
Coccinella spp	-0.68	16.75**	0.161	5.934*	7.506	-9.674	1.069	4.603	-0.69*	1.459	0.479	-0.299
Scymnus spp	0.218	-2.529	8.367	-1.204	-1.29	1.321*	-9.529	-5.021	0.335	-0.516	-0.69*	-0.337
Paederus alfierii	-0.975	-1.014	-0.292	0.477	0.131	-1.181	1.43	-6.348	-2.741	-3.071	0.93	2.92*
true spiders	0.110	2.682	0.556	2.935	1.789	-0.215	-1.191	-2.052	-1.200	-8.537	7.698	0.95*
Joint effect (R^2)	0.562	0.914	0.831	0.794	0.951	0.724	0.524	0.727	0.447	0.749	0.763	0.641
Residual factors	0.438	0.086	0.169	0.206	0.049	0.276	0.476	0.273	0.553	0.237	0.237	0.360

A = *T. tabaci* , B = *A. gossypii*, C = *Empoasca* spp, D = *B. tabaci* (mature stage), E = *B. tabaci* immature (stages), F = *Tetranychus* spp, * = significant and ** = highly significant

Reviewing the previous results, it could figure out the following points:

1. The simple correlation coefficient between the population dynamics of sucking pests and their predators was insignificant.
2. High temperature encouraged the reproduction of whitefly, aphid and Jassids and thus positive correlation were computed.
3. Relative humidity negatively affected on thrips and positively affected on aphids, jassids and whitefly.
4. The joint effect between weather factors (temperature and relative humidity) and predators had the greatest effect on whitefly and aphids, but moderate effect on thrips and Jassids.

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الملخص العربي

التأثير المشترك لعديد من المفترسات والعوامل الجوية (درجة حرارة ونسبة الرطوبة) على تعداد بعض الحشرات الثاقبة الماصه التى تهاجم نباتات القطن

أحمد السيد سلامه ، عبد العزيز حسن حسنى ،أحمد حافظ مسعود ، ناهد السيد حسن ، أحمد عبد الحميد أبو زيد إسماعيل، *مديحة الصباحى الديوي
قسم المبيدات ـــ كلية الزراعة ـــ بكفر الشيخ ـــ جامعة كفر الشيخ
*معهد بحوث وقاية النبات – الدقى – الجيزة – القاهرة

تم دراسة اعداد وحركية بعض الحشرات الثاقبة الماصة والمفترسات المصاحبة لها وذلك تحت الظروف الحقلية في محافظة كفر الشيخ. وقد اوضحت النتائج ان عدد أجيال الحشرة قد يتفاوت من موسم زراعى الى اخر ،فعلى سبيل المثال نلاحظ ان الكثافة العددية لحشرة التربس (التى تعتبر من اوائل الحشرات الثاقبة الماصّة التى تصيب القطن) تتمثل بوجود قمتين فى الموسم الزراعى ٢٠٠٣ بينما سجلت ثلاث قمم أثناء موسم القطن ٢٠٠٤.

وقد ينتج الإختلاف في عدد أجيال الحشرة من موسم لاخر نتيجة لاختلاف التطور الحشرى المستخدم فى القياس، بمعنى اخر فان حشرة الذبابة البيضاء قد سجلت ثلاث قمم إذا تم التقيم على للاطوار الغير البالغة بينما اذا استخدم الطور البالغ فى القياس فان النتائج سجلت جيلين فقط لهذه الحشرة. وعموما فان معظم الافات الثاقبة الماصّة (المن ،الجاسيد ، العنكبوت الاحمر) قد سجلة ثلاث اجيال واضحة فى كلا الموسمين تحت الدراسة.

وفيما يتعلق بتعداد المفترسات ، فقد اوضحت النتائج ان بعض المفترسات (ابو العيد ، الاسكمنس ، الرواغة ، العناكب الحقيقية) سجلت جيلين واضحين فى كلا الموسمين الزراعين للقطن.

اما بخصوص دراسة تاثير المناخ على التعداد لافات الثاقبة الماصة ،فقد اوضحت النتائج وجود معامل ارتباط بسيط بين درجة الحرارة و الحشرات الثاقبة الماصة يختلف طبقا لنوع الافة. وعموما فان هذا الارتباط موجبا وعالى المعنوية فى حالة الذبابة البيضاء و المن فى كلا الموسمين. بينما كان معدل معامل الارتباط غير معنوى فى حالة التربس والعنكبوت الاحمر. هذا قد شجّعت ارتفاع درجة الحرارة على زيادة اعداد كلا من الذبابة البيضاء و المن والجاسيد والتربس بالاضافة الى وجود معدل ارتباط ايجابى بين الحرارة والتكاثر لهذه الحشرات. اما بخصوص تاثير الرطوبة النسبية فقد اوضحت النتائج ان تاثيرها كان سلبيا على التربس وايجابيا على المن و الجاسيد والذبابة البيضاء. التأثير المشترك بين العوامل الجوية والمفترسات كان لها اعلى تاثير على الذبابة البيضاء والمن ولكن كان لهم تاثير معتدل على التربس و الجاسيد.