

## SEASONAL ABUNDANCE OF THREE PIERCING-SUCKING INSECTS AND THEIR ASSOCIATED NATURAL ENEMIES ON COTTON PLANTS IN THREE DIFFERENT SOWING DATES IN EL-GHARBIA GOVERNORATE, EGYPT.

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### ABSTRACT

The present study focused on the seasonal abundance of various sucking pests observed on cotton plants in relation to their associated natural enemies at three different sowing dates to determine the best sowing date could escape from the infestation at Gemmeiza Agricultural Research Station, El-Gharbia Governorate during 2006- 2007 cotton seasons. This study clarify that there are three piercing-sucking species infesting cotton plants. Theses species are cotton whitefly, *Bemisia tabaci* (Genn.), cotton leaves Jassid, *Emboasca lybica* (Deg.) and cotton aphid, *Aphis gossypii* Glover. The associated natural enemies were lady bird *Coccinella undecimpunctata* (L.) & *C. septempunctata* (L.), Scymnus *interruptus* (Goeze.) & *S. syriacus* (Marseu), rove beetle, *Paederus alfieri* (Koch); *Orius albidienis* (Reuter), *O. laevigatus* (Fiebern), Green lacewing, *Chryso/la carnea* (Steph.) and true spiders. From this study it could be concluded that the first sowing date was the suitable one for cultivating cotton plants which the suitable date for predator's activation (build up) and resultant in piercing-sucking pest's reduction especially *A. gossypii*. However, the obtained results are of great importance for the sowing date recommendation to improve and develop the crop management program in cotton fields.

**Key words:** Cotton; Seasonal abundance; *Aphis gossypii*; *Bemisia tabaei*; *Emboasca lykica*; Natural enemies and Sowing dates.

### INTRODUCTION

Cotton was considered by far the main crop in Egypt. The cotton Aphid (melon aphid) *Aphis gossypii* (Glover), the white fly, *Bemisia tabaci* (Genn.) and the cotton leaves Jassid, *Emboasca lybica*(Deg.) are among the most serious insects attacking cotton plant under the Egyptian environmental conditions Nassef *et al.*, 2006. Many authors studied the population of cotton pests in relation to the associated predators (El-Refai and Azza, 1994; Nassef *et al.*, 1996; El-Adl *et al.*, 1998; Ragab, 2004; Nassef *et al.*, 2006 and Essa, 2007). The damage of these pests mainly expressed as sap drainage, the toxic effect of the salivary secretions, accumulation of honeydew secretions and aging of the affected tissues. Also, cotton white fly is a major insect-pest in Egypt. It reduces plant dry weight and yield of cotton seed (Hussein and Trehan, 1972).

To minimize the use of insecticides and the negative effects of them on the natural enemies which lead to the outbreaks of secondary pest populations in cotton fields. So, different efforts were made to use one of the integrated pest management control method acted in determining the best sowing date to escape from heavy infestation (Moawad *et al.*, 1992 and Gergis *et al.*, 2001).

Therefore, the present study focuses on the seasonal abundance of various sucking pests observed on cotton plants. Also their associated natural enemies at three different sowing dates to determine the best sowing date could escape from the infestation.

## MATERIAL AND METHODS

### 2.1. Ex/imental area:

A field ex/iment was carried out during the two cotton-growing seasons 2006 and 2007 at Gemmeiza Agricultural Research Station, Middle Delta, Santa, El-Gharbia Governorate, Egypt to evaluate the effect of three sowing dates on piercing-sucking pest infestation and their predators fluctuation. An area of about one Fadden (4200 m<sup>2</sup>) was divided into 12 equal plots. Each treatment represented into equal four replicates (350 m<sup>2</sup> each) in a randomized complete block design. Giza 89 cotton varieties was planted at three sowing dates; March 12<sup>th</sup>, April 2<sup>nd</sup> and April 23<sup>rd</sup> in 2006 season and on March 19<sup>th</sup>, April 3<sup>rd</sup> and April 25<sup>th</sup> in 2007season. In these ex/imental plots no chemical control applied against cotton pests.

### 2.1. Sampling technique of pests and associated predators:

For insect estimation weekly samples of 100 cotton leaves were chosen randomly represented the lower, medium and up/ levels of the plants from each sowing date plot (100 leaf /sample) from 15, April to 30, Sept. during the two successive seasons. Cotton leaves were transferred carefully in pa/ pages to the laboratory to estimate the population of the pest species; white fly, *B. tabaci*; *E.lybica* and cotton aphid (melon aphid) *A. gossypii*. For predators estimation 25 cotton plants / sowing date were directly examined. Associated predators were counted and recorded in the field to estimate their numbers.

### 2.2. Statistical analysis:

Correlation coefficient was estimated between total numbers of each prey species of three piercing sucking insects cotton white fly, *B. tabaci*, cotton aphid, *A. gossypii*, and cotton leaves Jassid *E. Lybica*, and their associated predators in each date and in the two seasons.

Analysis of variance and the simple correlation coefficient and regression coefficient between the predators and the occurred pest species were carried out using Costat-soft ware program.

## 3. RESULTS AND DISCUSSION

This study revealed the occurrence of three piercing sucking insects cotton whitefly, *B. tabaci*, cotton leaves Jassid, *E. lybica* and cotton aphid, *A.gossypii*. Also their associated predators; Lady bird *C. undecimpunctata*, *C.septempunctata*; Scymnus, *S. interruptus* and *S. syriacus*, Rove beetle *P.alfierii*, Orius, *O. albidennis* and *O. laevigatus*, green lacewing *C. carnea* and true spiders.

### 3.1. Seasonal abundance of three different pest species and their natural enemies on cotton plants:

This ex/iment focuses on the seasonal abundance of *E. lybica*, *B. tabaci* and *A. gossypii* in relation to the associated natural enemies over three sowing dates during two successive cotton seasons of 2006 and 2007. The observed results are summarized as follows.

***Embosca lybica*****1. First sowing date**

In the first season (2006) as shown in Figure (1) *E. lybica* appeared in few numbers on cotton plants and increased gradually to reach an average number of 72 individuals /100 leaves on 26<sup>th</sup> Aug. Then its numbers decreased gradually until disappearance on 30<sup>th</sup> Sept.

In the second season (2007) as shown in Figure (2), the population of *E. lybica* was generally higher than in the first season and followed the same trend of occurrence with the highest average number on 26<sup>th</sup> of Aug. (117 individuals / 100 leaves). The same trend of occurrence was found in the average of the two successive cotton seasons Figure (3).

**2. Second sowing date**

In seasons of 2006 and 2007 as shown in Figures (1& 2), in the first season of 2006, *E. lybica* appeared in 22<sup>nd</sup> April, 2006 (5 individuals /100 leaves) on cotton plants and increased gradually to reach its maximum (63 individuals/ 100 leaves) on 16<sup>th</sup> Sept., 2006. Then its numbers decreased gradually until disappearance after 30<sup>th</sup> Sept. In the second season (2007), the population of *E.lybica* was generally higher than in the first season and followed the same trend of occurrence in both seasons with the highest average number also on 16<sup>th</sup> Sept., 2007 (117 individuals/ 100). Then it disappeared after 30<sup>th</sup> Sept., 2007. The same trend of occurrence was found in the average of the two successive cotton seasons figure (3).

**3. Third sowing date**

As shown in Figures (1& 2) , *E. lybica* appeared in the first season of 2006 in few numbers on cotton plants and increased gradually to reach an average number of 72 individuals / 100 leaves on 9<sup>th</sup> Sept. Then its numbers decreased gradually and disappeared after 30<sup>th</sup> Sept.

In the second season (2007) as shown in Figure (2), the population of *E. lybica* was generally higher than in the first season but followed by the same trend of occurrence in both seasons with the highest average number on 16<sup>th</sup> Sept. (95 individuals /100 leaves) and occurred on the plants until the end of the season. The same trend of occurrence was found in the average of the two successive cotton seasons figure (3).

As shown in Table (1) statistical analysis indicated that there were no significant differences between *E. lybica* population and the three sowing dates over the two successive seasons. The sowing dates mean numbers of *E. lybica* can be arranged ascendingly in the sowing dates as 32.94, 37.708 and 40.613 at the first, the second and the third sowing date, respectively.

***B. tabaci*****1. First sowing date**

In the first season (2006) as shown in Figure (1) *B. tabaci* appeared on cotton plants later on 24 Jun. with few numbers (15 individuals / 100 leaves) then it increased gradually to reach its maximum on 9<sup>th</sup> Sept. (230 individuals / 100 leaves). Then it disappeared after that date.

In the second season (2007) as shown in Figure (2), the population of *B. tabaci* was generally higher than in the first season and followed the same trend of occurrence in both seasons with the highest average number on 9<sup>th</sup> Sept. (640 individuals /100 leaves) at the end of the season.

**2. Second sowing date**

As shown in Figure (1), *B.tabaci* appeared on cotton plants in the first season (2006) later on 8<sup>th</sup> July with few numbers (9 individuals/100 leaves) then

it increased gradually to reach its maximum at the end of the season on 16<sup>th</sup> Sept. (473 individuals /100 leaves). Then it disappeared after that date.

In the second season (2007) the population of *B. tabaci* was generally higher than in the first season and followed the same trend of occurrence with the highest average number on 16<sup>th</sup> Sept. (930 individuals /100 leaves) at the end of the season. Then it disappeared after that date Figure (2).

### **3. Third sowing date**

In the first season (2006) *B. tabaci* appeared on 8<sup>th</sup> July with few numbers (11 individuals /100 leaves) then it increased gradually to reach its maximum at the end of the season on 23<sup>rd</sup> Sept. (630 individuals /100 leaves), Figure (1). In the second season (2007) as shown in Figure (2), the population of *B. tabaci* was generally higher than in the first season and followed the same trend of occurrence with the highest average number at the end of the season on 23<sup>rd</sup> Sept. (1026 individuals / 100 leaves).

As shown in Table (1) statistical analysis indicated that there were no significant differences between *B. tabaci* population and the three sowing dates over the two successive seasons. The mean numbers of *B. tabaci* over the two seasons through the three sowing date's can be arranged ascendingly as 113.8, 152.53 and 161.617 at the first, second and third sowing dates, respectively.

## ***Aphis gossypii***

### **1. First sowing date**

In the first season (2006) as shown in Figure (1), *A. gossypii* appeared on cotton plants on 6<sup>th</sup> May (127 individuals /100 leaves) then it decreased gradually to disappear on 3<sup>rd</sup> June. On 1<sup>st</sup> July it appeared with few numbers (25 individuals /100 leaves). Then increased gradually until reaching its maximum (263 individuals /100 leaves) on 29<sup>th</sup> July then its numbers decreased gradually.

In the second season (2007) as shown Figure (2), the population of *A. gossypii* was generally lower than in the first season and followed the same trend of occurrence in both seasons. The highest average number was recorded on 6<sup>th</sup> May. (117 individuals /100 leaves).

### **2. Second sowing date**

In the first season (2006) as shown in Figure (1) *A. gossypii* appeared on cotton plants on 6<sup>th</sup> May (104 individuals /100 leaves) then it decreased gradually to disappear on 3<sup>rd</sup> June until reappearing on 24<sup>th</sup> June with few average numbers (8 individuals /100 leaves). Then increased gradually until reaching its maximum (95 individuals /100 leaves) on 2<sup>nd</sup> Sept. Then its numbers disappeared.

In the second season (2007) as shown in Figure (2), the population of *A. gossypii* was generally lower than in the first season and followed the same trend of occurrence in both seasons. The highest average number was recorded on 6<sup>th</sup> May at the first season. (98 individuals /100 leaves).

### **3. Third sowing date**

In the first season (2006) as shown in Figure (1) *A. gossypii* appeared on cotton plants on 6<sup>th</sup> May (120 individuals /100 leaves) then it decreased gradually to disappear on 3<sup>rd</sup> June until reappearing on 1<sup>st</sup> July with few average numbers (14 individuals /100 leaves). Then it increased gradually in few numbers until disappearing on 9<sup>th</sup> Sept.

The population of *A. gossypii* in the second season (2007) as shown in Figure (2) was generally higher than in the first season and followed the same trend of occurrence in both seasons. The highest average numbers was recorded on 15<sup>th</sup> July (119 individuals /100 leaves) and at the end of the

season on 2<sup>nd</sup> Sept (130 individuals / 100 leaves).

Statistical analysis indicated that there were no significant differences between *A. gossypii* population and the three sowing dates over the two successive seasons as shown in Table (1). The aphid mean numbers can be arranged ascendingly as 56.39, 39.89 and 48.11 at the first, the second and the third sowing dates, respectively. These results are in agreement with the finding by Nassef *et al.* (1996), El-Adl *et al.* (1998), Mohamed (2004) and Nassef *et al.*, (2006).

### 3.2. Associated predators:

#### 1. First sowing date

In the first season (2006) as shown in Figures (1 and 4) there were six different predator species recorded from 6<sup>th</sup> May until 9<sup>th</sup> Sept. The highest total number of these predators was 360 predator species / 25 plants on 8<sup>th</sup> July. The highest average number was recorded for *P. alferii* followed by *C. undecim punctata*; the true spiders; *Scymnus spp.*; *Orius spp.* and *C. carnea* with an average no. of 49; 35.2; 29.4; 25.8; 15.9 and 11.9 predator / plant, respectively.

In the second season (2007) as shown in Figures (2 and 5) the population of different predator species were generally higher than in the first season and followed the same trend of occurrence with the highest total number on 15<sup>th</sup> July. The highest average number of predators was recorded for *P. alferii* 57 followed by *C. undecim punctata* 40.3; the True spiders 26.7; *Scymnus spp.* 24.7; *Orius spp.* 14.7 and *C. carnea* 10.2. Predators were generally higher in numbers in the second season than the first season.

#### 2. Second sowing date

As shown in Figure (4) during the first season (2006) the highest total average number was recorded for *Orius spp.* 13.0 predator/plant followed by *Scymnus spp.* 11.4 predator/plant. The other predator species could be arranged descendingly as *P. alferii*, the true spiders, *C. undecim punctata* then *C. carnea* with an average no. of 11.1; 11.0; 8.7 and 7.1 predator/plant, respectively.

In the second season (2007) as shown in Figures (2 and 5) the population of different predator species were generally higher than in the first season and followed the same trend of occurrence in both seasons with the highest total number on 19<sup>th</sup> August.

The highest total average number of predators / plant was recorded for *Scymnus spp.* (12.7) followed by the True spiders (12.2); *C. undecim punctata* (9.5) and *C. carnea* (4).

#### 3. Third sowing date

In the first season (2006) as shown in Figures (1 and 4) the six different predator species was recorded from 27<sup>th</sup> May until 2<sup>nd</sup> Sept. with the highest total number of these predators (102 predator species / 25 plants) on 5<sup>th</sup> Aug. The highest total average number was recorded for *P. alferii* (7.8) followed by true spiders (6.6); *C. undecim punctata* (5.7); *Orius spp.* (4.6); *C. carnea* (4.2) and *Scymnus spp.* (4) predator / plant. In the second season. (2007) as shown in Figures (2 and 5) the population of different predator species were generally higher than in the first season and followed the same trend of occurrence in 2006 season with the highest total number on 12<sup>th</sup> Aug. (88 predator / 25 plants).

The highest average number of predator species was recorded for the true spiders (8.1) followed by *C. undecim punctata* (7.6); *Scymnus spp.* (7.3); *P. alferii* (5.6); *Orius spp.* (5.5), then *C. carnea* (3.6) predator/plant.

As shown in Table (1) statistical analysis indicated that there were highly significant different between averages number of predators through the three sowing dates over the two successive seasons ( $F= 56.089$ ,  $P= 0.0000^{***}$  and LSD at level 0.05 = 28.097. The sowing date's averages can be arranged descendingly as the first, the second and the third sowing date, respectively.

**Table (1): Mean number of three sucking insects and the associated predators on cotton plants at three different sowing dates in 2006 and 2007 seasons at Gemmeiza, El-Gharbia Governorate**

Sowing Date	insect species			Predators
	<i>Empoasca lybica</i>	<i>Bemisia tabaci</i>	<i>Aphis gossypii</i>	
First	32.94	113.8	56.388	213.527a
Second	37.708	152.53	39.888	79.305b
Third	40.613	161.617	48.111	49.583c
F	Ns	Ns	Ns	56.08916
LSD				28.097165
P				0.0000***

Ns= not significant, Means followed by the same letter are not significantly different at 0.5% level

#### **Pest/Predator Statistical analysis**

Table (2) showed the simple correlation between the piercing-sucking pests and their predators through the three different sowing dates of cotton.

Results indicated that there were no significant correlation between *E. lybica*, *B. tabaci*, *A. gossypii* and the associated predators in the two successive seasons at the first and the third sowing date.

While there was significant correlation between *E. lybica*, *B. tabaci* and *A. gossypii* and the associated predators over the two successive seasons at the second sowing date.

As shown in Table (2) the significant correlation between *A. gossypii* and the associated predators over the two successive seasons at the second sowing date was negative ( $r= -0.4707$  and  $P=0.05$ ). This negative relationship indicates the effective role of predators on *A. gossypii* population.

These results are in agreement with those of Mohamed (2004) who reported that there was significant correlation between the predators and each of whitefly and *A. gossypii* species on cotton plants.

In general, numbers of recorded piercing-sucking pests on cotton (var. Giza 89) in the three different sowing dates were high during 2007 than 2006 cotton season. This might be due to the environmental factors and /or the surrounded host plants.

In addition, *A. gossypii* recorded the highest numbers in the 1<sup>st</sup> sowing date during 2006 (Avg. 64.4 insect / 100 leaves), while *B. tabaci* recorded the highest numbers in 2007 (Avg. 88.8 insect / 100 leaves), and that occurred during 2006 and 2007 experimental seasons at the second and the third sowing dates.

Table (2): Correlation coefficient between the Piercing sucking insect species and the associated predators on cotton plants at three different sowing dates over two experimental seasons of 2006 and 2007 at Gemmeiza, El-Gharbia Governorate.

Sowing Date	Parameter	insect species		
		<i>Empoasca lybica</i>	<i>Bemisia tabaci</i>	<i>Aphis gossypii</i>
First	<i>r</i>	-0.0475±0.249	-0.330±0.2724	-0.0064±0.24999
	<i>t</i>	0.190	1.401	0.026
Second	<i>r</i>	0.6159±0.19694	0.777±0.1815	-0.4707±0.2205
	<i>t</i>	3.13**	4.94**	2.134*
Third	<i>r</i>	0.44136±0.2243	-0.424±0.261	-0.5170±0.21398
	<i>t</i>	1.97	1.88	2.42*

Figures (1 and 2) show that the highest average of predators and the reducing numbers of sucking pests appeared in the 1<sup>st</sup> sowing date. Also, predators play their role in reducing the piercing-sucking insects through the /iod extended from 29<sup>th</sup> April to 9<sup>th</sup> Sept. with three peaks at 20<sup>th</sup> June, 1<sup>st</sup> July and 26<sup>th</sup> August.

*A. gossypii*, *E. lybica* were under natural control while *B. tabaci* increased gradually from 6<sup>th</sup> Aug. to 30<sup>th</sup> Sept. to reach the highest peak in 16<sup>th</sup> of Sept. This pest may need additional Bio-Control agent through this /iod. These results are in contrast with those of Nassef *et al.* (2006) who found that predators (as a total count of the predatory species) affected white fly more than aphid or *E. lybica*

Finally, from this study it could be concluded that the first sowing date was the suitable one for cultivating cotton plants which considered the suitable date for predator's activation (build up) and resultant in piercing-sucking pest's reduction especially *A. gossypii*. However, the obtained results are of great importance for the sowing date recommendation to improve and develop the crop management program in cotton fields.

Fig.1

Fig.2

Fig.3

Fig.4 & 5

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الوفرة الموسمية لثلاثة حشرات ثاقبة ماصة وأعدائها الحيوية المرتبطة بها على نباتات القطن المنزرعة في ثلاث مواعيد زراعية مختلفة بمحافظة الغربية- مصر

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تمت هذه الدراسة بمحطة بحوث الجميزة بمحافظة الغربية على مدار موسمين متتاليين ٢٠٠٦ و ٢٠٠٧م لنباتات القطن صنف جيزة ٨٩ لدراسة الوفرة لثلاثة حشرات ثاقبة ماصة وأعدائها الحيوية المرتبطة بها على نباتات القطن وعلاقة تعدادها بثلاث مواعيد زراعية مختلفة، وتم رصد التعداد على مدار فترة الدراسة، وقد لوحظ من خلال هذه الدراسة ارتفاع معدلات الإصابة في الموسم الثاني عن الموسم الأول وقد سجلت حشرة المن أعلى قدر من الإصابة عن باقي الحشرات أثناء موسم التجربة الأول في حين كانت الذبابة البيضاء هي صاحبة التعداد الأعلى في الموسم الثاني وذلك في ميعاد الزراعة الأول، وقد سجلت الأعداء الحيوية مجتمعة أعلى تعداد لها في الميعاد الأول وصاحب ذلك انخفاض ملحوظ في تعداد الآفات الحشرية مما يشير إلى دور هذه الأعداء الحيوية في خفض التعداد ومما يرجح أيضا" مناسبة هذا الميعاد بدرجة كبيرة في زراعة نباتات القطن حيث يتضح في هذا الميعاد الدور الفعال للأعداء الحيوية في السيطرة على الإصابة الحشرية.