# MONITORING APHIDS' POPULATION AND THEIR ASSOCIATED PARASITOID AND PREDATORY SPECIES ON PEACH TREES IN NORTH SINAI, EGYPT

**EL-HENEIDY, A. H.[1], S. A. AHMED[2] AND M. G. A.EL-DEEB[2]**

1. *Plant Protection Res. Institute, A R C, Dokki, Giza, Egypt*
2. *Plant Production Dept., Faculty of Environmental Agricultural Sciences, Suez Canal University, El-Arish, North Sinai, Egypt*

***Abstract***

Population dynamics of *Pterochloroides persicae* Chol. and *Brachycaudus schwartzi* (Borner) and associated natural enemies harbored on peach trees at Rafah, in North Sinai Governorate, Egypt was undertaken for two successive years starting from February 2005 until January 2007. Occurrence period of the aphid species, *P. persicae* extended from February until April. Highest numbers (777 and 665 aphids / 40 stems) were recorded in the 3rd and 4th weeks of March, in 2005 and 2006 seasons, respectively. Occurrence period of the aphid species, *B. schwartzi* extended from early February until early June. Highest numbers (432 and 802 aphids/40 leaves) were recorded in the 4th week of May and the 4th week of April in 2005 and 2006 seasons, respectively. Seven species of predators, 3 species of primary parasitoids and 5 hyperparasitoid species were recorded associated with the aphids on the peach trees in North Sinai region. Insignificant correlation was found between the total numbers of *P. persicae* and associated natural enemies.

## INTRODUCTION

Peach (*Prunus persicae*) is among the most important economic fruit crops in North Sinai Governorate, Egypt. It occupies about 60446 (62.8 %) feddans from the cultivated area with fruit crops in the region, 96306 feddans in year 2007 (Statement of the Directorate of Agriculture in Northern Sinai). It is constrained by a variety of insect pests and diseases. Aphids (Homoptera: Aphididae) are among the serious insect pests attacking peach trees in the region. Aphids are also efficient vectors of different strains of plant viruses.

*Brachycaudus (Appelia) schwartzi* (Borner) was recorded on the peach trees for the first time in Egypt by Attia and El-Hamaky (1992). Thus, the knowledge on population dynamics and abundances of the aphid species and their natural enemies has to be considered in conjunction with the range of hosts in the region for proper pest control strategies. Few studies have been carried out on the aphids' fauna on several economic crops in North Sinai, Ismail *et al.*, 1991, Attia and El-Hamaky 1992, Abdel-Salam, Shahinaz 1999, Semeada *et al.*, 2004 and El-Deeb (2008).

Monitoring the population dynamics and abundances of the aphid species and their associated natural enemies on the peach trees in North Sinai Governorate, Egypt was the objective of this study.

## METHODS AND TECHNIQUES

### 1- Population dynamics of certain aphid species and their natural enemies on peach trees in North Sinai

These studies were carried out on peach trees at Rafah, in North Sinai Governorate, during the growing seasons 2005 and 2006. An orchard of about 200 peach trees was chosen for this study. All-agricultural practices were regularly applied according to the recommendations. Ten peach trees, same size and age were chosen randomly for inspection. The insecticide (Dimethoate) was applied on the peach trees foliage only once on April, 18th 2005.

### Sampling technique

Weekly samples took place as soon as the newly vegetative growths appeared to record the first date of occurrence of certain aphid species. Infestation rate and aphids' population fluctuations throughout the experimental periods were estimated (El-Deeb 2008). The population density of the two dominant aphid species was determined as follows:

1 - *Pterochloroides persicae* Chol., weekly samples of forty randomized twigs were chosen from different cardinal directions from ten trees. The 40 twigs were examined and aphids' individuals were counted as alate and/or apterae per sample/date.

2- *Brachycaudus schwartzi* (Borner), weekly samples of forty leaves from the cardinal directions, south, east, north and west of ten peach trees, were chosen randomly in the experimental peach orchard. Numbers of aphid individuals were recorded as alate and/or apterae individuals/sample/date.

At each weekly sampling date, associated common predatory species were counted on ten trees. Samples from infested plant parts were collected, transferred to the laboratory and kept in plastic transparent jars until emergence of parasitoids' adults for parasitoid species identification (Hala *et al.* 2004 and El-Deeb 2008).

### 2- Effect of some climatic factors on population dynamics of aphid species and their predators & parasitoids on peach:-

Daily records of both max., min. temperatures along with mean relative humidity in addition to the rain quantity were obtained from the meteorological authority at El-Arish office, North Sinai Governorate for 2005 and 2006 peach growing

seasons. The correlation between the weekly sample numbers of aphid species and corresponding weekly maximum & minimum temperature and mean relative humidity were statically analyzed. Partial regression was applied to show the effect of both factors on population dynamics of the dominant aphid species and associated natural enemies under the present investigation. Also, multiple correlation as ($R^2$) present combined effect of the tested factors on the population of aphid species and associated natural enemies was deduced also using costat computer program.

## RESULTS AND DISCUSSION

### 1-Population dynamics of certain aphid species on peach trees

#### 1-1- *Pterochloroides persicae* Chol

Data in fig. (1) showed that *P. persicae* alate occurred throughout the period extended from February until April. The total numbers of alate and apterae cleared that the peaks of apterae were higher than those of alate. Three peaks (alate & apterae) of 394.0, 777.0 and 360.0 aphids / 40 twigs were recorded at the same timing of apterous peaks, by the end of February, the 3rd week of March and early April and two peaks of 516.0 and 665.0 in the 2nd week and end of March, in 2005 and 2006 seasons, respectively. It can be concluded that the alatae gave its first peak earlier than the apterae, followed by a highest infestation period of apterae.

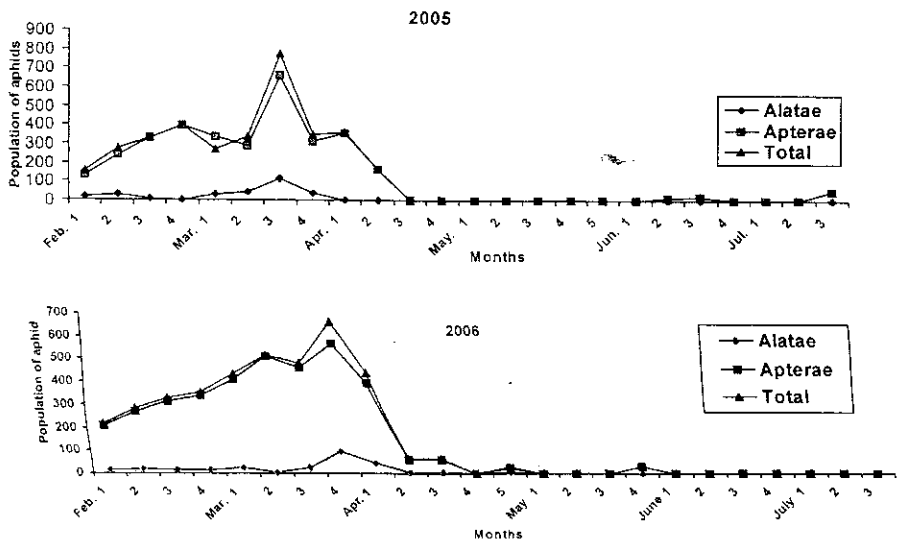


Fig. 1. Weekly total numbers of the brown bark aphid *Pterochloroides persicae* on peach trees at Rafah during 2005 & 2006 seasons.

**1-2- *Brachycaudus schwartzi* (Borner)**

Data in fig. (2) showed that occurrence period of *B. schwartzi* extended from early February until early June when four peaks of 420.0, 325.0, 383.0 and 432.0 aphids/40 leaves were recorded by the end of March, the 2nd week of April, the 2nd and the 4th weeks of May, and two peaks of 802.0 and 375.0 aphids/40 leaves in the 4th week of April and the 2nd week of May, in 2005 and 2006 seasons, respectively. It can be concluded that the alate individuals started their first peak earlier than the apterae except at the end of activity period of the alatae. The reduction of the population of *B. schwartzi* starting end of May was probably due to the competition with the mites on peach leaves which dominated at this period. During the study, ants were noted from July to Sept. transferring the nymphs of aphids from twig to another on the peach branches.

These results are in agreement with those of Attia and El-Hamaky (1992) and Abd El-salam (1999) who found that the *P. persicae* and *B. schwartzi* occurred on peach trees throughout the period, Feb. to Oct. and Feb. to Aug., respectively.

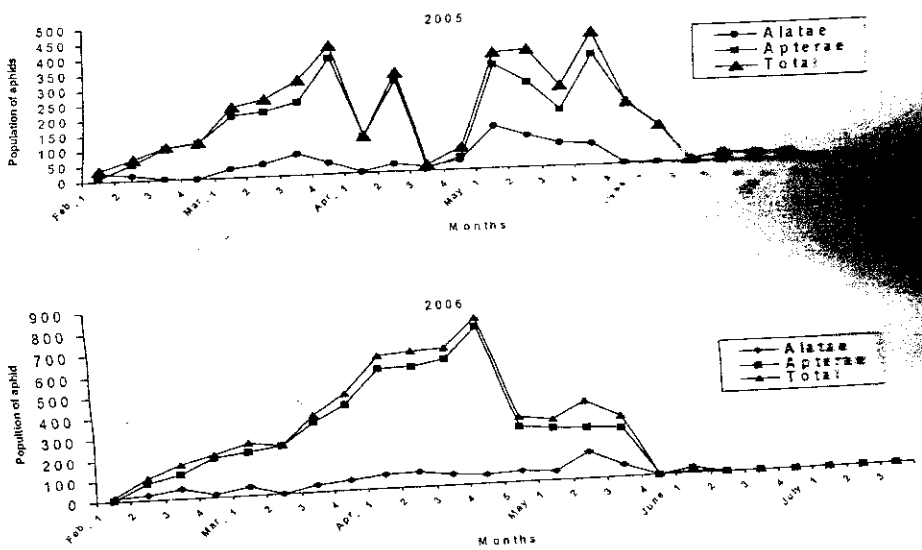


Fig. 2. Weekly total numbers of the peach aphid, *Brachycaudus schwartzi* on peach trees at Rafah during 2005 & 2006 seasons.

**2- Effect of certain climatic factors on population dynamics of aphid's species infesting peach trees**

Effect of min. & max. temperatures, mean relative humidity and rain on the population dynamics of the two aphid species infesting peach trees (*P. persicae* and *B. schwartzi*) was studied. Obtained results showed that numbers *P. persicae*

correlated negatively and highly significantly with min. and max. temperature in the two study seasons. It was negative and insignificant with R.H. % during 2005 season and negative and highly significantly during 2006. Significant and insignificant correlations were found with rains in 2005 and 2006, respectively. The same trend was found in *B. schwartzi*.

### 3- Effect of the cardinal directions of peach trees on the population dynamics of *P. persicae* and *B. schwartzi*

The populations of the two aphid species varied significantly according to the peach tree's directions.

**A- 2005 season**

***P. persicae***

Data in fig. (3) showed that the total high number (1066 aphids/ ten trees) of *P. persicae* was recorded from the samples collected from the north direction and the relatively lowest number of 570 aphid/ ten trees was recorded at the west direction.

***B. schwartzi***

Data in fig. (3) showed that the total highest number (1257.0 aphids/ ten trees) of *B. schwartzi* was recorded from the samples collected from the south direction and the relatively lowest number (702 aphids/ ten trees) was found at the west direction.

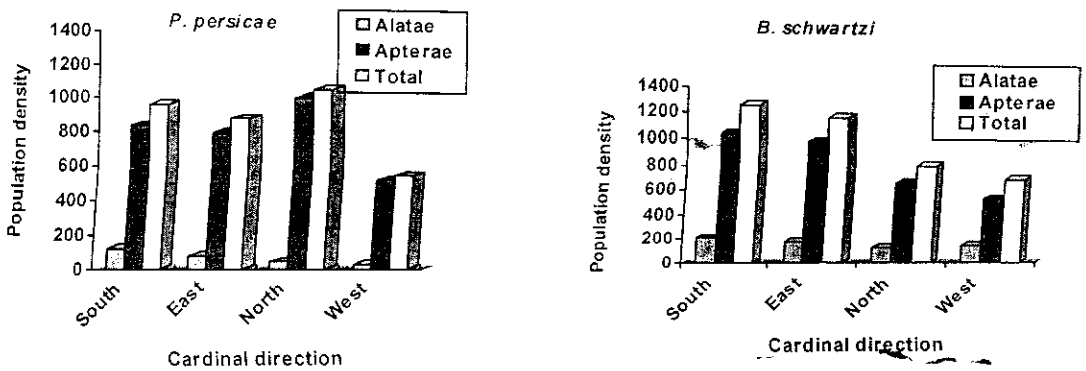


Fig. 3. Effect of cardinal directions of peach tree on the population density of the aphid species, *Pterochloroides persicae* & *Brachycaudus schwartzi* at Rafah during season 2005.

Insignificant variations between the two species at different directions ($LSD_{0.05}$ = 22.53) but highly significant variations among the directions for the two aphid species ($LSD_{0.05}$ = 31.86) were found. As comparison, the highest number of the two species (2222.0 individuals/ten trees) was recorded at the south direction, while the lowest number (1272.0 individuals/ten trees) was recorded at the west direction. Also, the

highest number of the four directions (3930 individual/ten trees) was recorded for *B. schwartzi* (Fig. 4).

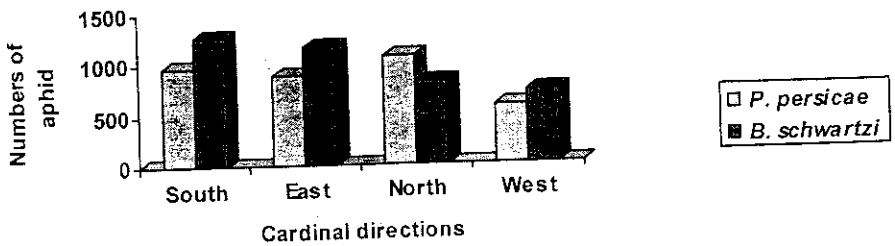


Fig. 4. Total numbers of *B. schwartzi and P. persicae* /10 trees on peach trees at the cardinal directions at Rafah during season 2005.

**B- 2006 season**

**1 - *P. persicae***

Data in fig.(5) cleared that the total highest number of the two forms was counted as 1332 aphids/ten trees at the south direction while the lowest number (420 aphids/ten trees) was recorded at the west direction (LSD $_{0.05}$ =53).

**2- *B. schwartzi***

Data in fig.(5) cleared that the total highest number of the two forms, (1907 aphid/ten trees) was recorded at the east direction and the lowest (1095 aphid/ten trees) was found at the west direction (LSD $_{0.05}$ =36.9).

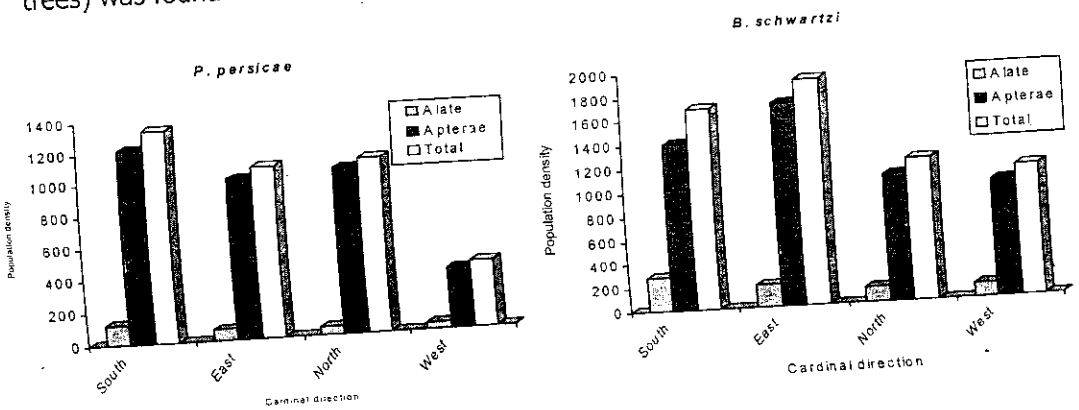


Fig. 5. Total numbers of *B. schwartzi and P. persicae* /10 trees on peach trees at the cardinal directions at Rafah during season 2006.

Highly significant variations between the totals of the two species at different directions was found ($LSD_{0.05}$ = 22.45) as well highly significant variations among the directions for the two species ($LSD_{0.05}$ = 31.75) were recorded. Highest number of the

two species (3020.0 individ. /10 trees) was recorded at the south direction, while the lowest number (1515.0 individuals/10 trees), was recorded at the west direction. Also, the highest number on all the four directions reached 5895 /10 trees for *B. schwartzi* species (Fig. 6).

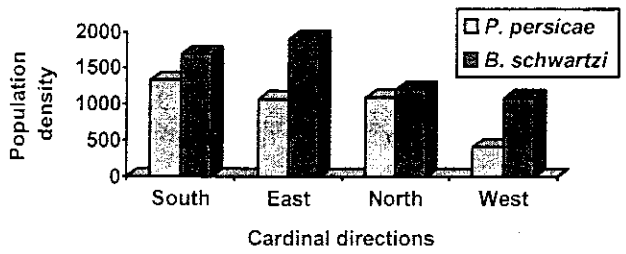


Fig. 6. Total numbers of *B. schwartzi and P. persicae* on peach trees at the cardinal directions at Rafah during 2006 season.

**4- Survey of common predatory and parasitoid species on peach aphids**

Obtained results are presented in table (1). The survey revealed the presence of 7 species of predators, *Coccinella undecimpunctata* L, *C. septempuncatata* L., *Hippodamia convergens* Guerin, *Scymnus interruptus* Mars., *Chrysoperla carnae* Steph., *Syrphus* spp. and *Orius* spp. and 3 species of primary parasitoids (*Aphidius matricariae* Haliday, *Aphidius* sp. and *Aphelinus* sp.) and 5 hyperparasitoid species (*Asaphes* sp., *Pachyneuron* sp., *Dendrocerus* sp., *Alloxysta* sp. and a *cynipid* sp.). In North Sinai, no sufficient studies were carried out on natural enemies of peach aphids.

Table 1. Survey of the predators and parasitoids species associated with peach aphid on peach trees at North Sinai during 2005-2007 seasons.

| Predators species | | | | Parasitoids species | | | |
|---|---|---|---|---|---|---|---|
| Order | Family | Species | Rate | | Family | Species | Rate |
| Coleoptera | Coccinellid | *Coccinella undecimpunctata* L. | +++ | Primary parasitoids | Aphididae | *Aphidius matricariae* Haliday | +++ |
| | | *Coccinella septempuncatata* L. | + | | | *Aphidius* sp. | +++ |
| | | *Hippodamia convergens* | + | | Aphelinidae | *Aphelinus* sp. | + |
| | | *Scymnus interruptus* | ++ | Hyperparasitoids | Pteromalidae | *Asaphes* sp. *Pachyneuron* sp. | +++ |
| Neuroptera | Chrysopidae | *Chrysoperla carnae* (Steph) | +++ | | Megaspilidae | *Dendrocer* sp. | + |
| Diptera | Syrphidae | *Syrphus* spp. | + | | Cynipidae | *Alloxysta* sp. | + |
| Hemiptera | Anthocoridae | *Orius* spp. | + | | | *cynipid* sp. | |

+ Low numbers ++ Medium numbers +++ High numbers

**5- Population dynamics of the associated predators and parasitoids with aphids on peach trees in North Sinai**

Population dynamics of the dominant predatory species *i.e.* the green lacewing, *C. carnea* and the lady bird beetle, *C. undecimpunctata* and the total number of mummified *B. schwartzi* individuals were studied.

**Predators**

**1- *Coccinella undecimpunctata***

During 2005 season, the population of *C. undecimpunctata* started with relatively high numbers of 65.0 individ. /ten trees in the 3rd week of Feb. and fluctuated to give three main peaks, 65.0, 41.0 and 22.0 individ./ten trees in the 3rd week of Feb., early -March and the 3rd week of April, respectively (Fig. 7). During 2006 season, the predator's population occurred throughout the period extended from early-Feb. until early-June, but it started with relatively low numbers 5 individ./ ten trees and fluctuated to give five peaks, 26.0, 54.0, 105.0, 66.0 and 15.0 individ./ ten trees in the 2nd week of Feb., end - Feb., the 2nd week of March, the 2nd week of April and mid - May, respectively (Fig. 8).

**2- *Chrysoperla carnea***

In 2005 season, population of *C. carnea* occurred throughout the period extended from mid. - March until the 2nd week of July. It started with low numbers of 2.0 individ./ten trees by mid. - March and fluctuated to give five peaks, 7.0, 14.0, 16.0, 25.0 and 30.0 individ./ten trees by end - March, the 1st ,3rd and 5th weeks of May and the 2nd week of June, respectively (Fig. 7). In 2006 season, the population was recorded in relatively high numbers of 16.0 individ./ten trees by early - March, and fluctuated to give four peeks, 16.0, 20.0, 26.0 and 6.0 by early - March, end - March, mid - April and the 3rd week of May, respectively (Fig. 8).

**Mummies of *B. schwartzi***

In 2005 season, mummies of *B. schwartzi* was recorded throughout the period extended from the 3rd week of March until the 3rd week of June and fluctuated to give two main peaks, 21.0 and 12.0 individ. /ten trees on the 2nd of April and by end of May, respectively (Fig. 7). In 2006 season, *B. schwartzi* mummies were recorded throughout the aphid infestation period from the end of March until the 3rd week of May and fluctuated to give three peaks, 19.0, 23.0 and 22.0 by the end of March, the 4th week of April and the 2nd of May, respectively (Fig. 8). These results were in harmony with the findings of Auad, *et al.* (1997) and Kato, *et al.* (1999) in Brazil.

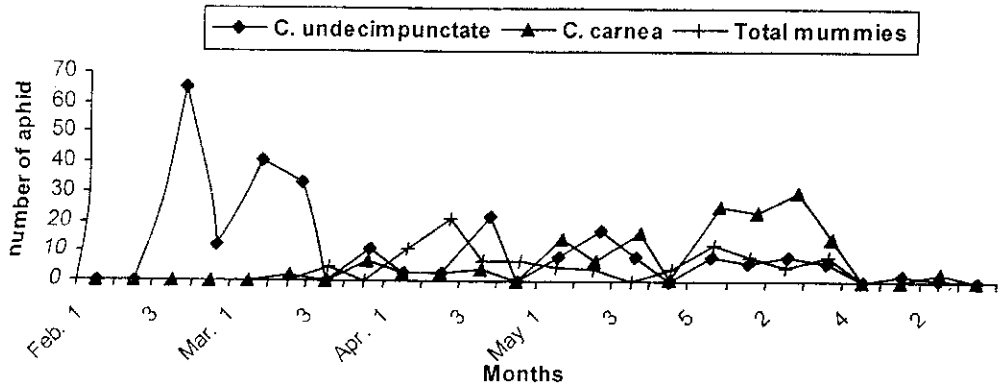


Fig. 7. Weekly total numbers of certain predators and aphid mummies associated with the peach aphids, *Brachycaudus schwartzi* and *Pterochloroides persicae* per 10 trees on peach trees at Rafah during 2005 season.

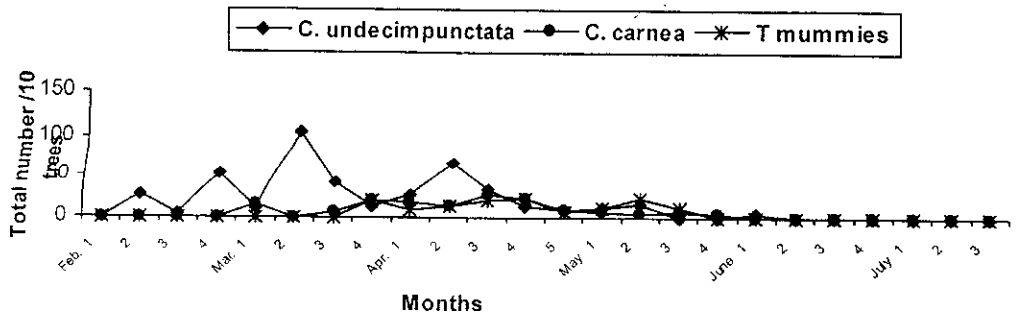


Fig. 8. Weekly total numbers of certain predators and aphids' mummies associated with the peach aphids, *Brachycaudus schwartzi* and *Pterochloroides persicae* per 10 peach trees at Rafah during 2006 season.

### 6- The correlation between aphid species and associated predators and parasitoids on peach trees

Insignificant correlation was found between the total numbers of each of the aphid species, *P. persicae* and *B. schwartzi* and the total number of predators (r = -0.173 and r = 0.352) during 2005 and 2006, respectively in case of *P. persicae* and (r = 0.272 and r = 0.177), respectively during 2005 in case of *B. schwartzi* while highly significant correlations (r = 0.876 and r = 0.812) were found during 2006 with the total numbers of predators and the total numbers of mummies in case of *B. schwartzi* only, respectively.

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# مراقبة تعداد المن وأنواع الطفيليات والمفترسات المصاحبة له على أشجار الخوخ فى شمال سيناء – مصر

**أحمد حسين الهنيدي[1] ، سيد علي أحمد [2] ، محمد غريب أحمد الديب[2]**

١. *معهد بحوث وقاية النباتات – مركز البحوث الزراعية –الجيزة- مصر.*

٢. *كلية العلوم الزراعية البيئية – جامعه قناة السويس- العريش- شمال سيناء- مصر*

أجريت دراسة على ديناميكية تعداد نوعى المن *Pterochloroides persicae* Chol. & *Brachycaudus schwartzi* (Borner) والأعداء الطبيعية المصاحبة لهما على أشجار الخوخ بمنطقة رفح، محافظة شمال سيناء، مصر لمدة عاميين متتاليين، بدأت من شهر فبراير ٢٠٠٥ حتى شهر يناير ٢٠٠٧. امتدت فترة ظهور نوع المن *P. persicae* من شهر فبراير حتى شهر أبريل. سجل أعلى تعداد (٧٧٧ & ٦٦٥ فرد من/٤٠ فرع) فى الأسبوع الثالث والأخير من شهر مارس موسمي ٢٠٠٥ & ٢٠٠٦، على التوالي. امتدت فترة ظهور نوع المن *B. schwartzi* من أوائل شهر فبراير حتى أوائل شهر يونيو. سجل أعلى تعداد (٣٤٢ & ٨٠٢ فرد من/٤٠ ورقة) فى الأسبوع الرابع من شهر مايو والأسبوع الرابع من شهر أبريل موسمي ٢٠٠٥ & ٢٠٠٦، على التوالي. سجلت ٧ أنواع من المفترسات و٣ أنواع من الطفيليات الأولية و٥ أنواع من الطفيليات الثانوية مصاحبة للمن على أشجار الخوخ فى منطقة شمال سيناء. وجد ارتباط غير معنوي بين العدد الكلى للنوع *B. schwartzi* والأعداء الطبيعية المصاحبة له.