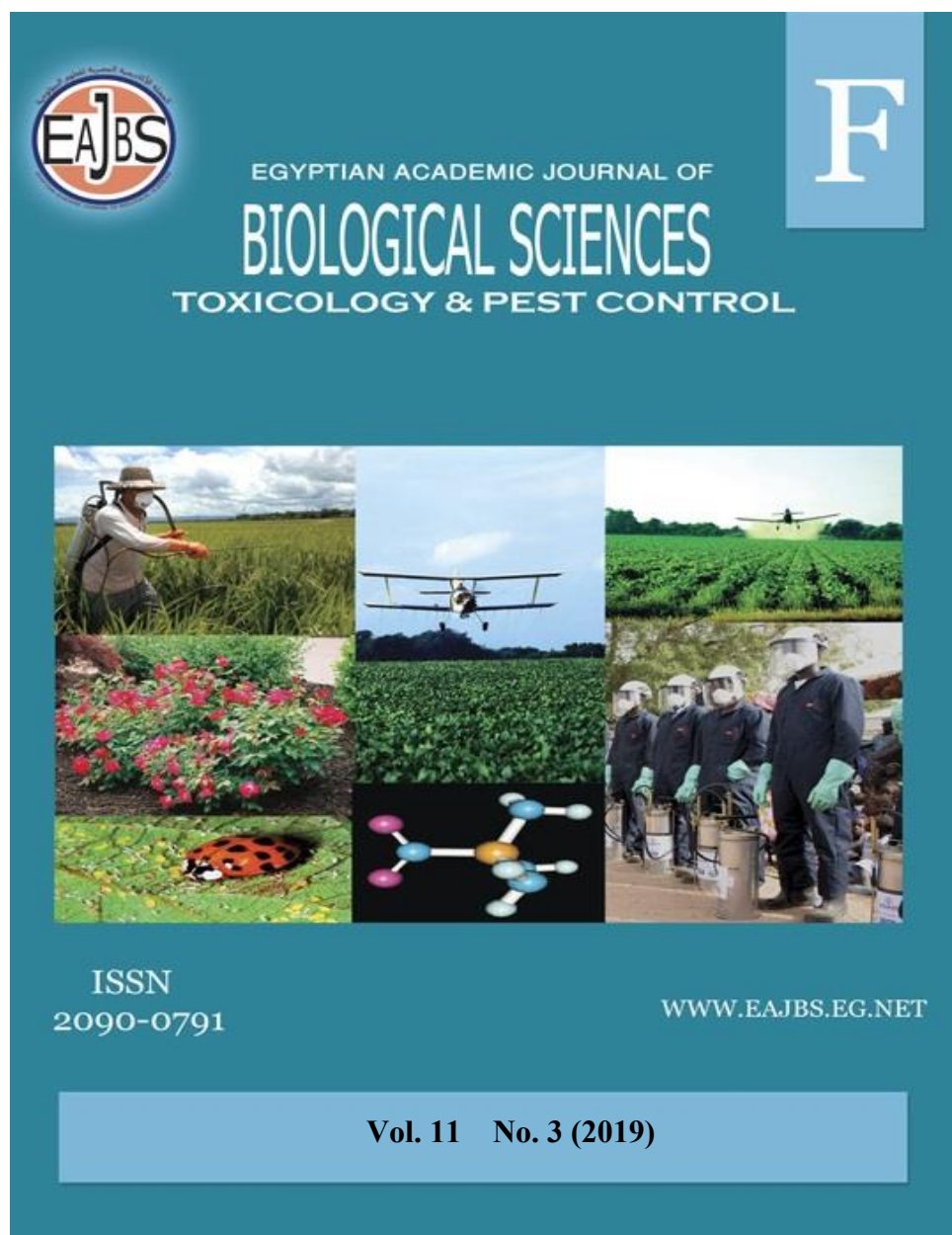


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A Comparison of the Effect of Some Ecological Parameters on the Occurrence of the Cotton Aphid, *Aphis gossypii* (Glov.) and Their Common Predators of Family Coccinellidae, on the Guava Trees in Qalubia Governorate, with Performing an Applied Biological Pest Control Experiment.

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ABSTRACT

The present study was made in a guava orchard (variety Baladi) during the two successive seasons, 2018 and 2019, in Sariqous district (Qalubia Governorate). It was proposed mainly to compare the effect of seven different ecological parameters concerning the population density of the cotton aphid *Aphis gossypii* infesting the guava trees and also to record the common observed predatory coccinellids (in relation to the presence of these seven parameters). These parameters were: the position of the trees found in the guava orchard (a- the trees were in the borders of the orchard & b- the trees were inside the orchard); the levels of the tree leaves in the guava orchard (a- the leaves were located in the top of the tree, b- the leaves were located in the middle of the tree & c- the leaves were located in the trunk of the tree). Finally, the condition of the leaves located in the guava orchard (a- the old leaves found on the trees & b- the new leaves found on the trees). Obtained results indicated that, the cotton aphid *A. gossypii* had the highest critical periods of infestation of the trees, in April, 2018 & 2019 (in case of the trees that were in the borders of the orchard) and during May, 2018 & June, 2019 (in case of the trees that were inside the orchard). The mean total numbers of aphid' individuals (winged adults & wingless individuals) were found to be lower on the trees that were located in the borders of the guava orchard (695.25 (0-4666)) than those located inside the orchard (912.60 (0-5071)). The pest had also highly critical periods of infestation of the trees, in May 2018 and 2019 (for the leaves that were in the top of the tree & in case of the leaves that were in the middle of the tree), but was during May, 2018 & June, 2019 for the leaves that were in the trunk of the tree. The aphid infestation was the highest on the leaves located on the middle (1014.85 (0-7814)) of the tree, in comparing with those leaves located either on the top (656.60 (0-4654)) or on the trunk of the tree (559.30 (0-3134)), respectively. Besides, the pest had very low periods of infestation of the trees for the old leaves found on the trees, while the highly critical period was during April, 2018 & May 2019 in case of the new leaves found on the trees. The aphid infestation on the new leaves was greatly higher than those recorded on the old ones in seasons, 2018 and 2019. Generally, it could be concluded that the three successive months; April, May, and June had the highest months of aphid infestation on the guava trees during the present study. Four predators of family Coccinellidae were recorded in relation to the occurrence of the cotton aphid *A. gossypii* including: *Coccinella undecimpunctata* L., *Hippodamia convergens* (Geur.), *Cydonia vicina nilotica* and *Cydonia vicina isis*. The sequence of the common recorded four predatory coccinellids adults for the two seasons together on the guava trees were as follows: *H. convergens* (the mean was 49%) > *C. vicina isis* (22%) > *C. undecimpunctata* (19%) > *C. vicina nilotica* (10%), i.e., the occurrence of the predator *H. convergens* was the highest in comparing with the

other recorded predators. For this reason, a biological control experiment was performed by laboratory mass-rearing and releasing the predator *H. convergens* adults (pairs of males & females), for controlling the cotton aphid *A. gossypii* on the guava trees during season, 2019 (in a guava orchard near the orchard used in comparing the seven parameters). The percentages of reduction in the experimental area (in which the predator *H. convergens* were released) were; 17.19%, 53.98%, 73.85%, 76.26%, 72.65% and 55.16% in comparing with the control area (in which the predator *H. convergens* was not released at all) in case of the following features: the mean of infested trees/10 trees, the mean of infested leaves/500 leaves, the mean number of cotton aphid *A. gossypii*/one guava leaf, the total number individuals of winged aphid adults, the total number of wingless aphid individuals and the total number of the aphid species/season 2019, respectively. So, the predator *H. convergens* is a useful biocontrol agent for the cotton aphid *A. gossypii* and could be laboratory mass-reared and field released on a large scale against the pest on the guava trees or other fruit trees, side by side with other available safe control methods in the frame of Integrated Pest Management (I.P.M.) programs, for protecting man health and the surrounding environment from pollution.

INTRODUCTION

In Egypt, guava trees (*Psidium guava* L.), represent one of the most economical and popular fruit crop, where great attention has been done to increase the areas of their cultivation, searching for improving the quality and quantity of the guava fruits (Abdel-Samad *et al.*, 2005). These trees are subjected to attack by many insect pests' species. However, aphids from the economic point of view are by all means classified and recorded among the most important insect's pests of different crops all over the world, representing complicated pests' problems in agriculture (Yeo, 2000). The damage caused by aphids attack is directly occurred by their feeding on plants sap (Arif *et al.*, 2006) and/or indirectly by transmitting many virus diseases to plants (Bayhan *et al.*, 2003). They are also able to build up high pest population densities in a short time (Lefort *et al.*, 2014); infesting plants' leaves, stems, fruits and roots (Al-Antary & Abdel-Wali, 2015). The cotton aphid *Aphis gossypii* (Glov.) was recorded as one of the most aphids pests that attack much agricultural fruit production including the guava trees (Ismail *et al.*, 1991).

The excessive use of the harmful insecticides particularly those of long residual effects has disrupted the natural balance existed between pests and their associated natural enemies (Moussa *et al.*, 2014 and Ackca *et al.*, 2015). Protecting these beneficial biocontrol agents from the undesirable uses of these harmful insecticides is very important and becomes more necessary (El-Khawas, 2005). The continuous sharp use of chemical insecticides practices including aphids' control had resulted in many environmental problems such as pollution (Scorsetti *et al.*, 2007). In this way, Integrated Pest Management (I.P.M.) strategies are now recognized as preferred good programs to achieve sustainable agricultural production (Rimaz & Valizadegan, 2013). An important and essential component in I.P.M. programs is the biological control techniques that are widely developed and continuously encouraged worldwide (Bue *et al.*, 2012; Kibar *et al.*, 2014 and Rashad *et al.*, 2015). Applying biological control offers one of the safe pest control methods that keep insect pests under the economic threshold levels (El-Husseini *et al.*, 2012). It is often recommended as the first main defense line to face the menace of the economic pests attack (El-Zahi, 2012). Surely, the principal advantages of using the biological control methods are concentrated on: the suppression of the target insect pest species below the economic injury level, self-perpetuating characteristics and reduce the environmental and health risks (Ehlers, 1996). The role of the natural enemies in agriculture (as main components of biological control), is widely encouraged through studying their population densities and thus searching for the most available conditions for their reproduction and release (Dent, 1995 and El-Khawas & Shoeb, 2004). For more successful pests' control, the recent developed control strategies have now been directed to know the pest-enemy relationship, where detailed knowledge is hardly required such

as; pest biology, population dynamics, as well as, the natural enemies associated with the pest and their impact, to achieve such acceptable control (Mostafa, 2006). Many of the most efficient natural enemies such as predators play a noticeable and vital role against different insect pests in agriculture ecosystems (Nawar *et al.*, 2008 and Kacar, 2015). Of them the coleopteran predators that belong to family Coccinellidae comprise one of the most active groups of the predatory species attacking many insect pests that are characterized by their ability to feed during the larval and the adult stages on different sap-sucking pests such as aphids (Bahy El-Din *et al.*, 2013). Several predatory coccinellids' species are widely recorded on different fields, vegetable and fruit crops in several parts of the world (Al-Khateeb & El-Heneidy, 2008). To magnify their applied role in the field of biological control, they have received very high attention through studying their mass-rearing and releasing to control agriculture pests (Mondor & Warren, 2000).

Therefore, the present study was made during the two successive seasons, 2018 and 2019, in Sariqous district (Qalubia Governorate). It was mainly proposed to compare the effect of seven different ecological parameters on the population density of the cotton aphid *Aphis gossypii* infesting the guava trees and also to record the common observed predatory coccinellids (in relation to the presence of these parameters). These seven studied ecological parameters were: 1- the position of the trees found in the guava orchard (a- the trees were in the borders of the guava orchard & b- the trees were inside the guava orchard); 2- the levels of the tree leaves in the guava orchard (a- the leaves were located in the top of the guava tree, b- the leaves were located in the middle of the guava tree & c- the leaves were located in the trunk of the guava tree) and finally, 3- the condition of the leaves located in the guava orchard (a- the old leaves located on the guava trees & b- the new leaves located on the guava trees). Moreover, a biological control experiment was performed by laboratory mass rearing and field releasing of the coccinellid predator *Hippodamia convergens* (Geur.), for controlling the cotton aphid *A. gossypii* on the guava trees, during season, 2019 in a guava orchard located near the tat used for the ecological parameters. The use of the adults (pairs of males & females) of the predator *H. convergens* was done, where this predator had the highest occurrence percentages among the other recorded common predatory coccinellids (from the obtained survey results).

MATERIALS AND METHODS

The Population Density of the Cotton Aphid *A. gossypii* and the Common Predatory Coccinellids:

The present study was carried out in a guava orchard (one feddan), located at Sariqous district (Qalubia Governorate), during the period extended from mid. February till the last week of June, in the two successive seasons, 2018 and 2019. Twenty cultivated guava trees (variety Baladi), with the same age (nearly 15 years old) and size were selected for sampling and serve as replicates during the study. No chemical insecticides were applied in the guava orchard for the two periods of investigation; only the normal agricultural practices were performed. The biweekly total sample of 1400 guava leaves were randomly collected and carefully directly examined in the guava orchard (= 5 branches × 2 leaves/one branch × 7 comparison ecological parameters × 20 guava trees), during the two studied periods; (14/2- 20/6/2018) in season, 2018 and (13/2- 19/6/2019) in season, 2019. The five branches represented the four main directions and the central core of each guava tree. The seven comparison ecological parameters were as follow: 1- the position of the trees in the guava orchard (a- the trees were in the orchard

borders & b- the trees were inside the orchard), 2- the levels of the leaves of the tree in the guava orchard (a- leaves were located in the top, b- leaves were located in the middle & c- leaves were located in the trunk) and finally, 3- the condition of the leaves in the guava orchard (a- the old leaves found on the tree & b- the new leaves found on the tree). These biweekly total samples were used for recording the population density of the cotton aphid *A. gossypii* attacking the guava trees and also their common associated predatory coccinellids. Where, they were directly identified and counted in the experimental orchard, in relation to the seven tested parameters. The following ecological features were recorded: the total numbers of aphid' individuals (winged adults & wingless individuals), the mean total number of aphid individuals/season, the monthly total numbers of observed predatory coccinellids, the ratios between (aphid' individuals: all predatory coccinellids) and also the percentages of occurrence of predatory coccinellids to each others, during 2018 and 2019 seasons.

The Biological Control of the Cotton Aphid *A. gossypii* on the Guava Trees, by Releasing the Predatory Ladybird Coccinellid Adults of *H. convergens*:

At the same time in season, 2019, a biological control experiment was performed including the laboratory mass rearing and field releasing of the emerged adults (pairs of males & females) of the predatory ladybird beetle *H. convergens*, in a guava orchard (near the orchard used for comparing the ecological parameters), to control the cotton aphid *A. gossypii* during the period of the highest aphid species infestation (that was recorded during the season).

The adults of the predator *H. convergens* were collected by using a sweep net from clover fields at Qalubia Governorate. In the beginning, the collected coccinellids' adults were directly brought in paper bags to the laboratory in the Biological control Department, for separating the ladybird predatory *H. convergens* adults (males & females), to begin a laboratory mass predatory rearing on the cowpea aphid *Aphis craccivora* Koch. (Homoptera: Aphididae, as prey), according to the technique previously described by Bahy El-Din (2006). The emerged *H. convergens* adults (males & females) were carefully separated after seven days from their emergence from the formed predatory pupae (El-Heneidy *et al.*, 2008), where, they were directly used by their releasing in the experimental releasing area in the guava orchard. The field control experiment was carried out in a guava orchard (this area selected was ½ feddan =2100 m² and was designed as illustrated in Fig., 1). The field experiment of the biological control was performed by using the predatory *H. convergens* adults (males & females), against the cotton aphid *A. gossypii* according to the following points:

- 1- The biological control experiment started on 13/3/2019 and continued till 26/6/2019.
- 2- Twenty guava trees (variety Baladi), of the same age (15 years old) and size were used: representing ten trees for the releasing area equal 10 replicates that the predator *H. convergens* adults was released and another ten guava trees for the control area equal 10 replicates that no predatory *H. convergens* adults were released. All the agricultural practices were regularly followed, except the chemical insecticidal treatments which were entirely avoided.
- 3- A total sample of 500 guava leaves (10 trees×5 branches/tree×10 leaves/one branch); was directly investigated in the field (every 3 days) during the period of the biological control experiment, from either the releasing area or the control one.
- 4- The predatory emerged adults of the ladybird beetle *H. convergens* (seven days-old) were taken from the mass laboratory rearing and released only once in 29/5/2019, against the cotton aphid *A. gossypii* on the guava trees. The ratio taken between (predatory adults of *H. convergens*: aphids' individuals), was one predator: 30 aphid' individuals (according to the results previously shown by Al-Arnaouty *et al.*, 2000 and Zibai &

Hatami, 2001). The sex ratio of the predatory *H. convergens* adults was 1:1 (males: females), at a rate of 5 adult pairs/one guava tree (= 5 emerged adults' males + 5 emerged adults' females). These predatory pairs were put in plastic cups (5cm×10 cm), for their directly uses in the releasing purpose. A total number of 100 emerged predatory *H. convergens* adults were released (=10 experimental guava trees replicate in the releasing area ×10 emerged predatory adults of *H. convergens* males and females), i.e., the total number of the predatory *H. convergens* adults necessary to be released in one feddan of guava trees will be 1000 predators.

Where nearly a total of 100 cultivated guava trees were found in one feddan, therefore the total numbers of the predatory *H. convergens* adults =100 trees×10 predators/tree.6- The following ecological features were evaluated: the percentages of infested guava trees by the cotton aphid *A. gossypii* /10 trees, the percentages of infested leaves/500 leaves sample, the mean total numbers of aphids' individuals/one guava leaf, the percentages of reduction of aphids' individuals and the total numbers of the predatory coccinellids stages of *H. convergens* (egg, larvae, pupae & adults). These features were compared in case of the releasing area (the area where *H. convergens* were released), with those of the control area (area where no *H. convergens* predators were released). Obtained data were statistically analyzed according to SPSS program version (15.0), for evaluating the means values and also for calculating the correlation coefficient (r-value) in relation to the weather factors (including the means of temperature and relative humidity) that were obtained from the Meteorological Station at A.R.C.

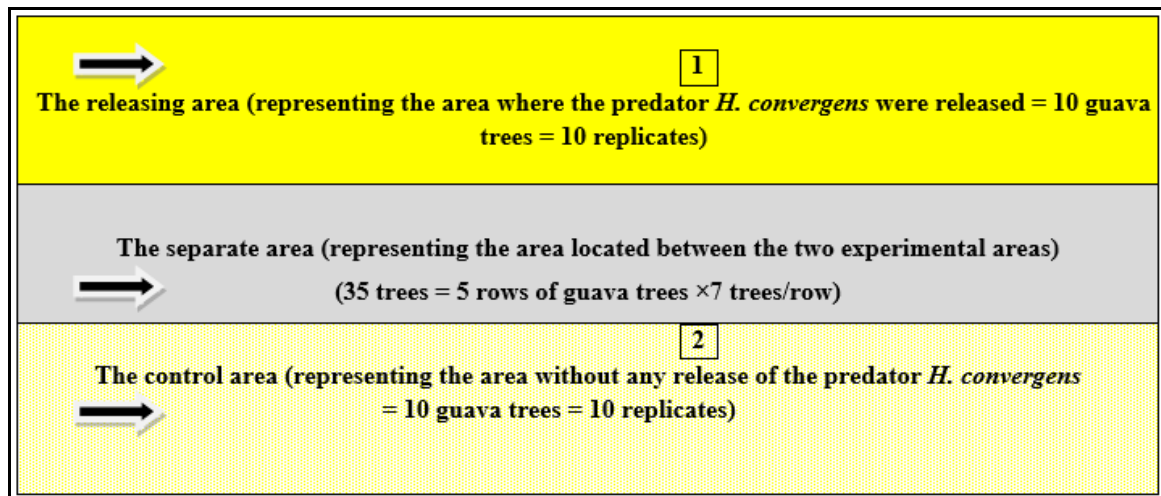


Fig. (1): A diagram that represents the release of the predatory *H. convergens* adults (males&females) in the releasing area (where these predators were released in equal ratio 1:1), on the guava trees, in comparing with the control area (where no predators were released in it), during season, 2019, in a guava orchard located in Qalubia Governorate.

RESULTS AND DISCUSSION

The Population Density of the Cotton Aphid *A. gossypii* in the Guava Orchard:

The cotton aphid *A. gossypii* was the only aphid species that were recorded attacking the guava trees during the two successive seasons, 2018 and 2019, in Qalubia Governorate (Fig., 2). Data obtained concerning the population density of the aphid species infesting the guava trees were recorded in Tables (1A, 1B & 1C). Seven different

experimental ecological parameters were compared to each other in case of the occurrence of the pest species in the two successive seasons, 2018 and 2019.

The Position of the Trees Found In the Guava Orchard:

Two ecological parameters were compared concerning the infestation by the cotton aphid *A. gossypii* in relation to the position of the trees found in the guava orchard; a- the trees were in the borders of the guava orchard & b- the trees were inside the guava orchard (Table, 1A).

a- The Trees Were In the Borders of the Orchard:

The winged adults (viviparous alate form) of the cotton aphid *A. gossypii* firstly appeared in the borders of the guava orchard with only one winged adult in the second half of February 2018. After that, the wingless (apterous form) individuals started to appear during the first half of March. The aphid population (winged adults & wingless individuals) gradually increased until reaching their maximum total number (4666 individuals) during the second half of April, 2018. In 2019 season, the winged adults started to appear with low very number (4 individuals). The maximum total number of 1218 individuals was recorded during the second half of April, 2019. Then, the aphid population decreased until vanishing at the end of the season in the second half of June, 2018 (no recorded aphid individuals) and with low number in the second half of June, 2019 (the total number was 14 individuals). The occurrence of the pest covered the five months of the study from February to June in both seasons, 2018 and 2019. The mean total numbers of the aphid population per season were; 895.00 ± 472.25 and 492.30 ± 147.42 individuals in seasons, 2018 and 2019, respectively, while the mean total number of the pest for the two seasons was $695.25(0-4666)$ individuals (Table, 1A).

b- The Trees Were Inside the Orchard:

The winged adults of aphid species firstly appeared only with two & one individuals during the second and first half of February, 2018 and 2019, respectively. The aphid population (winged adults & wingless individuals), gradually increased until reaching their maximum total numbers of 3171 & 5071 individuals, during the second half of June, 2018 and 2019, in 2018 and 2019 seasons, respectively. The occurrence of the aphid species covered the whole period of months from February to June in both 2018 and 2019 seasons. The mean total numbers of the aphid species per season were; 866.70 ± 307.40 and 958.50 ± 478.34 , in 2018 and 2019 seasons, respectively, while the mean total number of the aphid population for the two seasons together was $912.60(0-5071)$ individuals (Table, 1A).

From Table (1A), it could be shown that, the guava trees had the highest critical periods of infestation by the cotton aphid *A. gossypii*, in April, 2018 & 2019 (in case of the trees that were in the borders of the guava orchard) and during May, 2018 & June, 2019 (in case of the trees that were inside the guava orchard). Also, the mean total number of aphid' individuals were found to be lower (for the two seasons together), on the trees that were located in the borders of the guava orchard than those located inside the orchard.

The Levels of the Leaves of the Tree in the Guava Orchard:

Three ecological parameters were compared concerning the infestation by the cotton aphid *A. gossypii* in relation to the levels of the leaves of the tree in the guava orchard including; a- the leaves were in the top of the guava tree, b- the leaves were in the middle of the guava tree & c- the leaves were in the trunk of the guava tree (Table, 1B).

a- The Leaves Were Located At the Top of the Tree.

In 2018 season, both the winged adults and wingless individuals of the cotton aphid *A. gossypii*; firstly appeared with very low numbers (2&4 individuals), in the second half of February, 2018, in the guava orchard, respectively. The aphid population

(winged adults & wingless individuals) gradually increased until reaching the peak number of 4654 individuals, during the first half of May, 2018. But, in 2019 season, the winged adults appeared with only one adult in the second half of February, while, the wingless individuals appeared in the first half of March (5 wingless individuals). The maximum total number of 2814 individuals was recorded during the first half of May. Then, the aphid population decreased until reaching the end of the season in the second half of June (the total numbers were; 373&52 individuals in seasons, 2018 and 2019, respectively). The occurrence of the pest covered the whole season from February to June in 2018 and 2019 seasons. The mean total numbers of aphid individuals per season were; 887.30 ± 484.06 and 425.00 ± 282.49 individuals, in seasons 2018 and 2019, respectively, while the mean total number of the pest individuals for seasons, 2018 and 2019 together was 656.60 (0-4654) individuals (Table, 1B).

b- The Leaves Were Located In the Middle of the Tree.

The winged adults of the cotton aphid *A. gossypii* firstly appeared with only one & one-winged adults in seasons, 2018 and 2019, respectively. The population of winged adults and wingless individuals gradually increased to reach their maximum totals numbers of 7814 & 3280 individuals, during the first half of May, 2018 and 2019, respectively. After that, the aphid population gradually decreased till reaching the total numbers of 988 & 366 individuals, at the end of the season in both 2018 and 2019 seasons, respectively. The occurrence of the pest covered the whole months from February to June. The mean total numbers of the pest individuals per season were; 1345.10 ± 766.15 and 684.60 ± 323.62 , in 2018 and 2019 seasons, respectively, while the mean total number of the aphid species for seasons, 2018 and 2019 together were 1014.85 (0-7814) individuals (Table, 1B).

c- The Leaves Were Located In the Trunk of the Tree.

The winged adults of the cotton aphid *A. gossypii* started to appear on the guava trees with only one & one-winged adults during the second half of February & the first half of February, 2018 and 2019, respectively. Then, the aphid population (winged adults & wingless individuals) appeared until reaching the maximum total numbers of 3134&1945 individuals during the first half of May and the first half of June, for 2018 and 2019 seasons, respectively. They decreased until reaching the end of the season in the second half of June, 2018 and 2019 (where the total numbers of the pest were 227&1211 individuals, respectively). The occurrence of the aphid species covered the whole months from February to June of seasons, 2018 and 2019. The mean total numbers of aphid population per season were; 627.60 ± 310.72 and 491.00 ± 208.54 , for 2018 and 2019 seasons, respectively, while the mean total number of the aphid species for seasons, 2018 and 2019 together was 559.30 (0-3134) individuals (Table, 1B).

From Table (1B), it could be firstly found that the aphid infestation (winged adults & wingless individuals) was the highest on the leaves located in the middle of the guava tree in comparing with the leaves located either in the top or in the trunk of the guava tree, respectively. Secondly, the pest had a highly critical period of infestation of guava trees, in May 2018 and 2019 (for the leaves that were located in the top of the guava tree & also in case of the leaves that were located in the middle of the guava tree), But these periods were during May, 2018 and June, 2019 for the leaves that were located in the trunk of the guava tree.

The Condition of the Leaves Located In the Guava Orchard:

Two ecological parameters were compared concerning the condition of the leaves located in the guava orchard; a- the old leaves located on the trees & b- the new leaves located on the tree (Table, 1C).

a- The Old Leaves Found on the Trees.

The winged adults of the cotton aphid *A. gossypii* were firstly detected on the guava trees during the second half of May (two & three-winged adults), in 2018 and 2019 seasons, respectively. After that, the winged adults and wingless individuals started to appear during the first half of March (23 & 533 individuals) in seasons, 2018 and 2019, respectively. The aphid population gradually increased until reaching their maximum total numbers of 95 & 58 individuals, during the first half of April, 2018 & 2019, in seasons, 2018 and 2019, respectively. The mean total numbers of aphid individuals per season were; 24.70 ± 11.25 and 14.20 ± 6.23 individuals, in seasons 2018 and 2019, respectively, while the mean total number of aphid population for the two seasons together was 19.90 (0-95) individuals. The old guava leaves were not suitable and preferred for aphid feeding, so very few numbers of aphid individuals were recorded on these leaves in the guava orchard during seasons, 2018 and 2019 (Table, 1C).

b- The New Leaves Found on the Tree.

Data recorded in Table (1C) demonstrated that the winged adults of the cotton aphid *A. gossypii* firstly appeared on the guava trees with very low numbers (3 & 1 winged adults), during the second half of February, 2018 & the first half of February, 2019, respectively. The aphid species population (winged adults & wingless individuals), gradually increased to reach their maximum total numbers of 12301 & 3359 individuals, during the second half of April, 2018 & the first half of May, 2019, respectively. Then, the population of the cotton aphid *A. gossypii* decreased till vanishing in the second half of June, 2018 (season, 2018), while, in season 2019, the aphid population was 198 individuals, during the second week of June, 2019. The occurrence of the aphid species was during the whole season from February to May, in seasons, 2018 and 2019. The mean total numbers of the pest individuals per season were; 2522.80 ± 1282.89 & 1069.50 ± 394.05 , in seasons, 2018 and 2019, respectively, while the mean total number for the two seasons, 2018 and 2019 together were 1796.15 (0-12301) individuals.

From the obtained data in Table (1C), it could be indicated that the cotton aphid *A. gossypii* had a critical period of infestation extended from April to May in seasons, 2018 and 2019. Moreover, the aphid infestation on the new leaves of the guava trees was greatly higher than that infestation recorded on the old ones in seasons, 2018 and 2019.

In conclusion, the obtained data in Tables (1A, 1B & 1C) revealed that the three months; April, May, and June had the highest occurrence of aphid infestation on the guava trees during the present study. Similar results were shown by Ismail *et al.*, (1991) who found that the winged adults of the cotton aphid *A. gossypii* were seen on the new leaves of nine different fruit trees including the guava trees, during March and April. Its seasonal occurrence was during the period extended from the last week of February until the last week of September. Also, the cotton aphid *A. gossypii* was observed to have two main peaks on the guava trees during mid. May and at the end of April (El-Serafi *et al.*, 2004). Moreover, Abdel-Samad *et al.* (2005) cleared that, the winged adults of the cotton aphid *A. gossypii* started to appear on the guava trees during the first week of March. Their population (winged adults & wingless individuals) appeared until reaching their maximum weekly total numbers during the first week of May. Then, the aphid population decreased until reaching the first week of July, in the two seasons of their study

Table (1A): Biweekly total numbers of the cotton aphid *A. gossypii* individuals that were recorded in relation to the position of the trees found in the guava orchard (a- the trees were in the borders of the orchard & b- the trees were inside the orchard) during the two successive seasons, 2018 and 2019, in Qalubia Governorate.

Months	1- The position of the trees found in the guava orchard						Weather factors	
	a- The trees were in the borders of the guava orchard			b- The trees were inside the guava orchard			Mean c°	Mean R.H.%
	WA	WI	Total no.	WA	WI	Total no.		
1 st half of Feb., 2018	0	0	0	0	0	0	19.29	53.14
2 nd half of Feb.	1	0	1	2	0	2	22.21	48.86
1 st half of Mar.	6	354	360	35	68	103	21.86	45.50
2 nd half of Mar.	12	547	559	73	101	174	22.24	42.06
1 st half of Apr.	23	2218	2241	89	621	710	22.36	49.61
2 nd half of Apr.	101	4565	4666	154	576	730	24.63	39.17
1 st half of May	4	893	897	13	1074	1087	26.79	47.07
2 nd half of May	0	204	204	18	1123	1141	29.35	43.35
1 st half of Jun.	0	22	22	21	1528	1549	28.86	49.04
2 nd half of Jun.	0	0	0	34	3137	3171	30.86	44.68
Total/season	147 (0-101)	8803 (0-4565)	8950 (0-4666)	439 (0-154)	8228 (0-3137)	8667 (0-3171)	24.85 c° (19.29-30.86)	46.25 % (39.17-53.14%)
Mean/season	14.70 ± 9.87	880.30 ± 462.76	895.00 ± 472.25	43.90 ± 15.28	822.80 ± 308.26	866.70 ± 307.40		
1 st half of Feb., 2019	0	1	1	1	8	9	15.57	49.89
2 nd half of Feb.	1	3	4	2	23	25	17.50	49.54
1 st half of Mar.	2	211	213	15	47	62	16.64	54.07
2 nd half of Mar.	17	715	732	41	213	254	18.65	49.71
1 st half of Apr.	3	1190	1193	72	489	561	21.14	45.93
2 nd half of Apr.	10	1208	1218	93	507	600	20.88	44.81
1 st half of May	2	481	483	8	620	628	25.00	37.11
2 nd half of May	3	745	748	6	951	957	27.65	38.12
1 st half of Jun.	4	313	317	14	1404	1418	28.93	47.82
2 nd half of Jun.	0	14	14	57	5014	5071	31.00	48.91
Total/season	42 (0-17)	4881 (1-1208)	4923 (1-1218)	309 (1-93)	9276 (8-5014)	9585 (9-5071)	22.30 c° (15.57-31.00)	46.59 % (38.12-54.07%)
Mean/season	4.20 ± 1.69	488.10 ± 146.56	492.30 ± 147.42	30.90 ± 10.40	927.60 ± 475.40	958.50 ± 478.34		
Mean/2 seasons	9.45 (0-101)	685.00 (0-4565)	695.25 (0-4666)	37.40 (0-154)	875.20 (0-5014)	912.60 (0-5071)	23.58 c° (15.57-31.00)	46.42 % (38.12-54.07%)

WA= Winged adults

WI= Wingless individuals

Table (1B): Biweekly total numbers of the cotton aphid *A. gossypii* individuals that were recorded in relation to the three different leaves level of the guava tree (a- in the top, b- in the middle & c- in the trunk) during the two successive seasons, 2018 and 2019, in Qalubia Governorate.

Months	2- The levels of the leaves of the tree in the guava orchard								
	a- In the top			b- In the middle			c- In the trunk		
	WA	WI	Total no.	WA	WI	Total no.	WA	WI	Total no.
1 st half of Feb., 2018	0	0	0	0	0	0	0	0	0
2 nd half of Feb.	2	4	6	1	0	1	1	7	8
1 st half of Mar.	3	7	10	1	3	4	8	35	43
2 nd half of Mar.	6	47	53	3	40	43	11	116	127
1 st half of Apr.	16	134	150	9	257	266	6	363	369
2 nd half of Apr.	60	416	476	18	1794	1812	3	525	538
1 st half of May	306	4348	4654	909	6905	7814	339	2795	3134
2 nd half of May	9	2553	2562	30	2315	2345	25	1454	1479
1 st half of Jun.	0	589	589	9	169	178	9	342	351
2 nd half of Jun.	0	373	373	2	986	988	4	223	227
Total / season	402 (0-306)	8471 (0-4348)	8873 (0-4654)	982 (0-909)	12469 (0-6905)	13451 (0-7814)	406 (0-339)	5860 (0-2795)	6276 (0-3134)
Mean/ season	40.20 ± 30.09	847.10 ± 458.58	887.30 ± 484.06	98.20 ± 90.14	1246.90 ± 681.32	1345.10 ± 766.15	40.60 ± 33.23	586.00 ± 280.50	627.60 ± 310.72
1 st half of Feb., 2019	0	0	0	0	1	1	1	2	3
2 nd half of Feb.	1	0	1	1	2	3	3	4	7
1 st half of Mar.	1	5	6	4	19	23	12	11	23
2 nd half of Mar.	2	35	37	6	224	230	16	83	99
1 st half of Apr.	7	51	58	10	129	139	96	20	116
2 nd half of Apr.	48	147	195	36	1121	1157	113	28	141
1 st half of May	61	2753	2814	171	3109	3280	157	302	459
2 nd half of May	3	1006	1009	82	1217	1299	34	872	906
1 st half of Jun.	0	78	78	8	340	348	11	1934	1945
2 nd half of Jun.	0	52	52	7	359	366	18	1193	1211
Total / season	123 (0-61)	4127 (0-2753)	4250 (0-2814)	325 (0-171)	6521 (1-3109)	6846 (1-3280)	461 (1-157)	4449 (2-1934)	4910 (3-1945)
Mean/ season	12.30 ± 7.13	412.70 ± 277.33	425.00 ± 282.49	32.50 ± 17.31	652.10 ± 306.65	684.60 ± 323.62	46.10 ± 17.45	444.90 ± 211.98	491.00 ± 208.54
Mean/2 seasons	26.25 (0-306)	629.90 (0-4348)	656.60 (0-4654)	65.35 (0-909)	949.50 (0-6905)	1014.85 (0-7814)	43.35 (0-339)	515.45 (0-2795)	559.30 (0-3134)

WA = Winged adults

WI = Wingless individuals

Table (1C): Biweekly total numbers of the cotton aphid *A. gossypii* individuals that were recorded in relation to the condition of the leaves in the guava orchard (a- the old leaves located on the guava trees & b- the new leaves located on the guava tree), during the two successive seasons, 2018 and 2019, in Qalubia Governorate.

Months	3- The condition of the leaves in the guava orchard					
	The old leaves found on the tree			The new leaves found on the tree		
	WA	WI	Total no.	WA	WI	Total no.
1 st half of Feb., 2018	0	0	0	0	0	0
2 nd half of Feb.	2	0	2	3	0	3
1 st half of Mar.	11	23	34	9	533	542
2 nd half of Mar.	24	52	76	38	864	902
1 st half of Apr.	31	64	95	915	1683	2598
2 nd half of Apr.	2	37	39	3243	9058	12301
1 st half of May	0	0	0	1826	5267	7093
2 nd half of May	0	0	0	162	1318	1480
1 st half of Jun.	1	0	1	18	291	309
2 nd half of Jun.	0	0	0	0	0	0
Total/season	71 (0-31)	176 (0-64)	247 (0-95)	6214 (0-3243)	19014 (0-9058)	25537 (0-12301)
Mean / season	7.10 ± 3.59	17.60 ± 7.89	24.70 ± 11.25	621.40 ± 347.30	1901.40 ± 938.80	2522.80 ± 1282.89
1 st half of Feb., 2019	0	0	0	1	6	7
2 nd half of Feb.	1	0	1	5	18	23
1 st half of Mar.	6	0	6	7	43	50
2 nd half of Mar.	9	11	20	21	688	709
1 st half of Apr.	11	26	37	181	1572	1753
2 nd half of Apr.	18	40	58	190	2833	3023
1 st half of May	2	16	18	1745	1614	3359
2 nd half of May	1	0	1	16	1032	1048
1 st half of Jun.	1	0	1	9	516	525
2 nd half of Jun.	0	0	0	7	191	198
Total/season	49 (0-18)	93 (0-40)	142 (0-58)	2182 (0-1745)	8513 (0-2833)	10695 (0-3359)
Mean / season	4.90 ± 1.91	9.30 ± 4.46	14.20 ± 6.23	218.20 ± 171.23	851.30 ± 292.47	1069.50 ± 394.05
Mean/2 seasons	6.30 (0-31)	13.60 (0-64)	19.90 (0-95)	455.60 (0-3243)	1376.30 (0-9058)	1796.15 (0-12301)

WA = Winged adults WI = Wingless individuals

The Population Density of the Predatory Coccinellids:

Data illustrated in Fig.(3) and summarized in Tables (2,3,4&5), represented the field observations of the most common predatory coccinellids (Order: Coleoptera), that was recorded associated with the cotton aphid *A. gossypii* on the guava trees during seasons, 2018 and 2019, in Qalubia Governorate. Four predators were recorded including: *Coccinella undecimpunctata* L., *Hippodamia convergens* (Geur.), *Cydonia vicina nilotica* and *Cydonia vicina isis*. The sequence of the occurrence of the common recorded four predatory coccinellids adults on the guava trees for the two seasons together were as follows: *H. convergens* (the mean was 49%) > *C. vicina isis* (22%) > *C. undecimpunctata* (19%) > *C. vicina nilotica* (10%).

Data obtained concerning the population density of the common predatory coccinellids' species (observed in association with the infestation by the cotton aphid *A.*

gossypii on the guava trees), were compared in case of the seven different experimental ecological parameters during seasons, 2018 and 2019.



Fig. (2): The infestation of the guava leaves by the cotton aphid *A. gossypii* individuals that was recorded attacking the guava trees during the present study, in Qalubia Governorate.

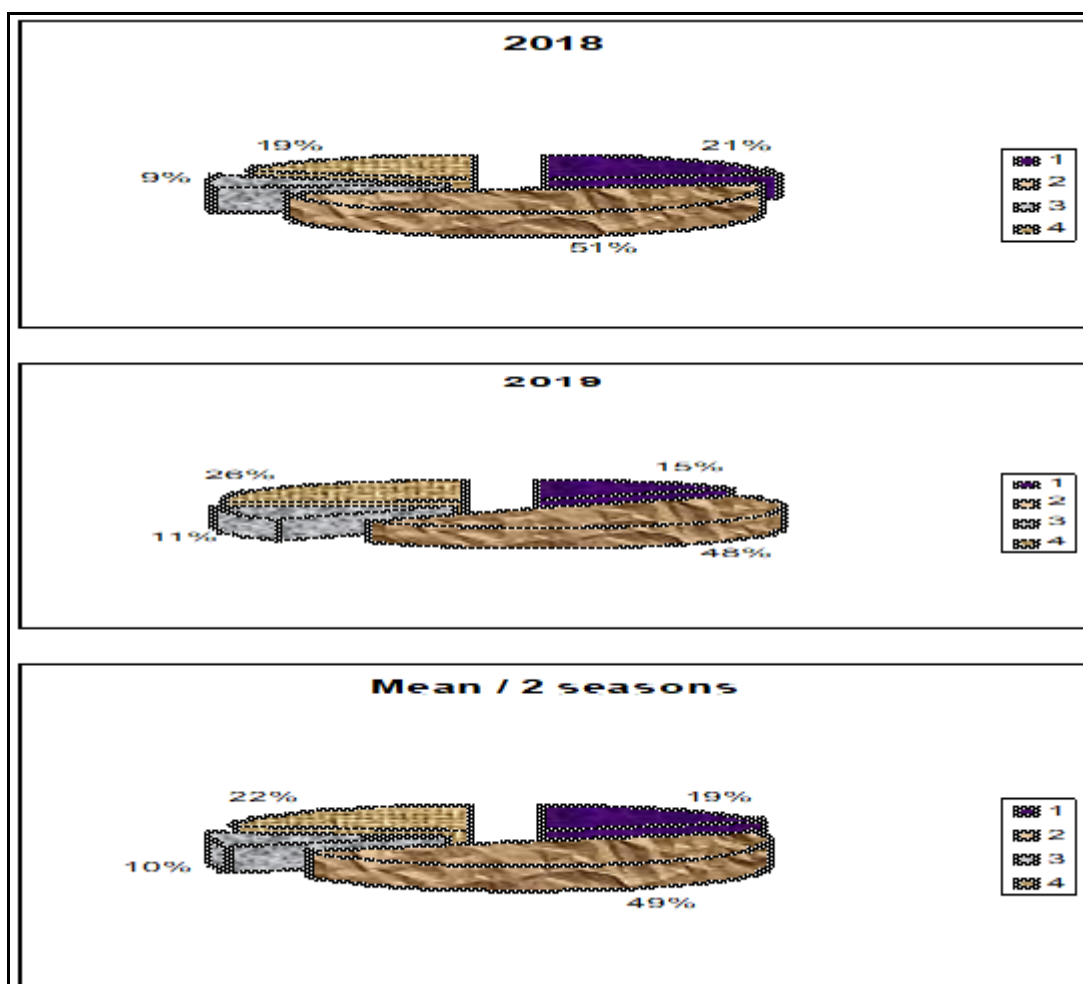


Fig. (3): Seasonal percentages of occurrence of the four different predatory coccinellids' species to each other that was recorded in the guava orchard during the two successive seasons, 2018 and 2019, in Qalubia Governorate

1= *C. undecimpunctata* 2= *C. vicina isis* 3= *C. vicina nilotica* 4= *H. convergens*

The Position of the Trees Found In the Guava Orchard:

a- The Trees Were Located In the Borders of the Orchard:

Numbers of the predatory individuals of coccinellids' were peaked during April, 2018 & June 2019 (the total numbers of the individuals of the predators were 133&26 individuals in 2018 and 2019 seasons, respectively). The period of all predators' occurrence extended from April until June, in both 2018 and 2019 seasons. The total numbers of individuals of the predators per season were; 211 (0-133) and 97 (0-39) individuals, in 2018 and 2019 seasons, respectively (Table, 2). The total numbers of the predators were; (11&3), (21&13), (3&3) and (5&12) adults, in case of the predators: *C. undecimpunctata*, *H. convergens*, *C. vicina nilotica* and *C. vicina isis*, in 2018 and 2019 seasons, respectively (Table, 3). The recorded predators were arranged as follows: *H. convergens* (the mean for 2018 and 2019 seasons together was 17.0) > *C. vicina isis* (8.5) > *C. undecimpunctata* (7.0) > *C. vicina nilotica* (3.0), (Table, 3). The ratio between (the cotton aphid *A. gossypii*: all observed predators) was; 42.32:1 & 51.12:1, for 2018 and 2019 seasons, respectively, while the general ratio for the two seasons together was 45.09:1 (Table, 4). As for the relationship between the cotton aphid *A. gossypii* & predatory coccinellids with the means of temperature, the r-values were; (0.122&0.092 in season, 2018) and (0.017&0.880 in season, 2019), while the corresponding r-values for the relative humidity were; (0.514&0.453) and (0.419&0.522), in 2018 and 2019 seasons, respectively.

b- The Trees Were Located Inside the Orchard.

The maximum total numbers of 143&118 coccinellids' individuals were counted during May, 2018 and 2019, respectively. The period of all predators' occurrence extended from May to June, in seasons, 2018 and 2019, respectively. The total numbers of the individuals of all predators per season were; 257 (0-143) and 235 (0-118) individuals in seasons, 2018 and 2019, respectively (Table, 2). The total numbers of the predators were; (17&10), (36&25), (6&3) and (12&8) adults, in case of *C. undecimpunctata*, *H. convergens*, *C. vicina nilotica* and *C. vicina isis*, for 2018 and 2019 seasons, respectively (Table, 3). The recorded predators were arranged as follows: *H. convergens* (30.5) > *C. undecimpunctata* (13.5) > *C. vicina isis* (10.0) > *C. vicina nilotica* (4.5), in case of the means of seasons, 2018 and 2019 together on the guava trees (Table, 3). The ratio between (the cotton aphid *A. gossypii*: predators observed) were; 33.72:1 & 40.79:1, for 2018 and 2019 seasons, respectively, while the general ratio for the two seasons together was 37.10:1 (Table, 4). As for the relationship between the cotton aphid *A. gossypii* & predatory coccinellids with the means of temperature, the r-values were; (0.87&0.163, in season, 2018) and (0.766&0.688 in season, 2019), while the corresponding r-values in case of the relationship with the means of the relative humidity were; (0.197&0.428 in season, 2018) and (0.090&0.954 in season, 2019), (Table, 5).

From the obtained data, it could be mentioned that the total numbers of all observed predatory coccinellids were higher on the guava trees located inside the guava orchard in comparing with the predatory ones located on the trees in the borders of the guava orchard. Their occurrence was mainly directly related with the highest population density of the cotton aphid *A. gossypii* (as prey) on the trees located inside the guava orchard.

The Levels of the Leaves of the Tree in the Guava Orchard.

a- The leaves were located at the top of the tree.

Numbers of predatory coccinellids' individuals were peaked during May, 2018 and 2019 (the total numbers of the predators were; 233&93 individuals, in 2018 and 2019 seasons, respectively). The period of all predators' occurrence extended from April to June, in seasons, 2018 and 2019, respectively. The total numbers of predators per season were; 254 (0-233) and 119 (0-93) individuals in 2018 and 2019 seasons, respectively

(Table, 2). The total numbers of the predators were; (2&0), (17&11), (1&0) and (3&4) adults, in case of *C. undecimpunctata*, *H. convergens*, *C. vicina nilotica*, and *C. vicina isis*, for 2018 and 2019 seasons, respectively (Table, 3). The predators were arranged according to the following sequence: *H. convergens* (14.0) > *C. vicina isis* (3.5) > *C. undecimpunctata* (1.0) > *C. vicina nilotica* (0.5), in case of the means of seasons, 2018 and 2019 together on the guava trees (Table, 3). The ratio between (the cotton aphid *A. gossypii*: predators observed) was; 34.93:1 & 35.79:1, for 2018 and 2019 seasons, respectively, while the general ratio for the two seasons together was 35.21:1 (Table, 4). As for the relationship between the cotton aphid *A. gossypii* & predatory coccinellids with the means of temperature, the r-values were; (0.458&0.229 in season, 2018) and (0.304&0.414 in season, 2019), while the corresponding r-values for the relative humidity were; (0.108&0.197 in season, 2018) and (0.819&0.969 in season, 2019), (Table, 5).

Table (2): Monthly total numbers of all predatory coccinellids' individuals that were recorded in the guava orchard during the two successive seasons, 2018 and 2019, in Qalubia Governorate.

Mon.	1-The position of the trees found in the guava orchard														
	a- The trees were in the borders of the guava orchard					b- The trees were inside the guava orchard									
	E	L	P	A	To.	E	L	P	A	To.					
Feb.	0	0	0	0	0	0	0	0	0	0					
Mar.	0	0	0	0	0	0	0	0	0	0					
Apr.	80	30	0	23	133	97	4	1	0	102					
May	5	38	6	8	57	14	43	34	52	143					
Jun.	0	1	1	19	21	0	2	1	9	12					
Total/ 2018	85	69	7	50	211	111	49	36	61	257					
	(0-80)	(0-38)	(0-6)	(0-23)	(0-133)	(0-97)	(0-43)	(0-54)	(0-52)	(0-143)					
Feb.	0	0	0	0	0	0	0	0	0	0					
Mar.	0	0	0	0	0	0	0	0	0	0					
Apr.	28	1	0	2	31	55	7	0	4	66					
May	0	23	1	3	27	41	30	17	30	118					
Jun.	0	10	3	26	39	26	11	2	12	51					
Total/ 2019	28	34	4	31	97	122	48	19	46	235					
	(0-28)	(0-23)	(0-3)	(0-52)	(0-39)	(0-55)	(0-30)	(0-17)	(0-30)	(0-118)					
Mon.	2-The levels of the leaves of the tree in the orchard														
	a- In the top					b- In the middle					c- In the trunk				
	E	L	P	A	To.	E	L	P	A	To.	E	L	P	A	To.
Feb.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr.	9	2	3	1	15	0	5	0	7	12	0	0	0	1	1
May	151	26	36	20	233	50	156	2	29	237	11	113	1	26	151
Jun.	0	0	4	2	6	2	8	7	18	35	18	6	15	8	47
Total/ 2018	160	28	43	23	254	52	169	9	54	284	29	119	16	35	199
	(0-151)	(0-26)	(0-36)	(0-20)	(0-233)	(0-50)	(0-156)	(0-7)	(0-29)	(0-237)	(0-18)	(0-113)	(0-15)	(0-26)	(0-151)
Feb.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mar.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apr.	4	1	16	1	22	0	1	0	3	4	0	0	0	2	2
May	67	12	3	11	93	108	71	1	14	194	7	60	4	17	88
Jun.	0	1	0	3	4	7	15	3	9	34	8	16	3	6	33
Total/ 2019	71	14	19	15	119	113	87	4	26	232	15	76	7	25	123
	(0-67)	(0-12)	(0-16)	(0-11)	(0-93)	(0-108)	(0-71)	(0-3)	(0-14)	(0-194)	(0-8)	(0-60)	(0-4)	(0-17)	(0-88)
Mon.	3- The condition of the leaves in the guava orchard														
	a- The old leaves found on the tree					b- The new leaves found on the tree									
	E	L	P	A	To.	E	L	P	A	To.					
Feb.	0	0	0	0	0	0	0	0	0	0					
Mar.	0	0	0	0	0	0	0	0	0	0					
Apr.	0	3	0	0	3	28	11	0	0	39					
May	13	4	2	5	24	40	15	20	28	103					
Jun.	0	0	0	1	1	0	116	0	1	117					
Total/ 2018	13	7	2	6	28	68	142	20	29	259					
	(0-13)	(0-4)	(0-2)	(0-5)	(0-24)	(0-40)	(0-116)	(0-20)	(0-28)	(0-117)					
Feb.	0	0	0	0	0	0	0	0	0	0					
Mar.	0	0	3	0	3	0	0	3	3	6					
Apr.	0	2	0	0	2	13	9	0	2	24					
May	5	0	0	1	6	29	37	6	5	77					
Jun.	0	0	0	1	1	4	2	3	21	30					
Total/ 2019	5	2	3	2	12	46	48	12	31	137					
	(0-5)	(0-2)	(0-3)	(0-1)	(0-6)	(0-29)	(0-37)	(0-6)	(0-21)	(0-77)					

E= Eggs L= Larvae P= Pupae A= Adults To. = Total no

Table (3): Monthly total numbers of each of the observed adults of the predatory coccinellids that were recorded in the guava orchard during seasons, 2018 and 2019, in Qalubia Governorate.

Mon.	1- The position of the trees in the orchard				2-The the levels of leaves of the tree in the orchard						3- The condition of the leaves in the orchard				Total no. of different predatory species	All total no.	
	a- In the orchard borders		b- Inside the orchard		a- In the top		b- In the middle		c- In the trunk		a- The old leaves		b- The new leaves				
Feb., 2018	A0*	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	0
	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	
Mar.	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	0
	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	
Apr.	A8	B13	A0	B0	A0	B1	A0	B5	A0	B1	A0	B0	A0	B0	A8	B20	32
	C0	D2	C0	D0	C0	D0	C0	D2	C0	D0	C0	D0	C0	D0	C0	D4	
May	A2	B4	A15	B27	A2	B15	A8	B16	A8	B12	A1	B5	A6	B8	A42	B85	168
	C1	D1	C3	D7	C1	D2	C2	D3	C2	D4	C0	D1	C5	D9	C14	D27	
Jun.	A1	B4	A2	B9	A0	B1	A1	B7	A1	B5	A0	B0	A0	B1	A5	B25	58
	C2	D2	C3	D5	C0	D1	C4	D6	C1	D3	C0	D0	C0	D1	C10	D18	
Total	A11	B21	A17	B36	A2	B17	A9	B28	A9	B16	A1	B5	A6	B9	A55	B150	258
	C3	D5	C6	D12	C1	D3	C6	D11	C3	D7	C0	D1	C5	D10	C24	D49	
Feb., 2019	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	0
	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	
Mar.	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A0	B0	A1	B2	A1	B2	3
	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	C0	D0	
Apr.	A1	B1	A1	B2	A0	B1	A0	B2	A1	B1	A0	B0	A1	B1	A4	B8	14
	C0	D0	C0	D1	C0	D0	C0	D1	C0	D0	C0	D0	C0	D0	C0	D2	
May	A0	B1	A6	B19	A0	B8	A3	B7	A3	B7	A0	B1	A1	B2	A15	B45	81
	C0	D2	C2	D3	C0	D3	C0	D4	C4	D3	C0	D0	C1	D1	C7	D16	
Jun.	A2	B11	A3	B4	A0	B2	A0	B0	A0	B2	A0	B1	A4	B9	A9	B29	78
	C3	D10	C1	D4	C0	D1	C4	D5	C1	D3	C0	D0	C3	D5	C12	D28	
Total	A3	B13	A10	B25	A0	B11	A3	B9	A4	B10	A0	B2	A7	B14	A27	B84	176
	C3	D12	C3	D8	C0	D4	C4	D10	C3	D6	C0	D0	C4	D6	C19	D46	

* = Numbers of the predatory coccinellids' adults species

A= *C. undecimpunctata* B= *H. convergens* C= *C. vicina nilotica* D= *C. vicina isis***b- The Leaves Were Located In the Middle of the Tree.**

The maximum total numbers of 237 & 194 individuals were recorded during May, 2018 and 2019, respectively. The period of all predators' occurrence extended from April to June in seasons, 2018 and 2019. The total numbers of all predators per season were; 284 (0-237) and 232 (0-194) individuals in seasons, 2018 and 2019, respectively (Table, 2). The total numbers of the predators were; (9&3), (28&9), (6&4) and (11&10) adults, for *C. undecimpunctata*, *H. convergens*, *C. vicina nilotica* and *C. vicina isis*, for 2018 and

2019 seasons, respectively (Table, 3). The predators were arranged according to the following sequence: *H. convergens* (13.5) > *C. vicina isis* (10.5) > *C. undecimpunctata* (6.0) > *C. vicina nilotica* (5.0), in case of the means of the two seasons, 2018 and 2019 together on the guava trees (Table, 3). The ratio between (the cotton aphid *A. gossypii*: predators observed) was; 47.36:1 & 29.51:1, for 2018 and 2019 seasons, respectively, while the general ratio for the two seasons together was 39.34:1 (Table, 4). As for the relationship between the cotton aphid *A. gossypii* & predatory coccinellids with the means of temperature, the r-values were; (0.368&0.326 in season, 2018) and (0.366&0.541 in season, 2019), while the corresponding r-values for the relative humidity were; (0.161&0.209 in season, 2018) and (0.854&0.907 in season, 2019), (Table, 5).

c- The Leaves Were Located In the Trunk of the Tree.

The maximum total numbers of 151 & 88 coccinellids' individuals were counted during May, 2018 and 2019, respectively. The period of all predators occurrence extended from April to June, in seasons, 2018 and 2019, respectively. The total numbers of all predators per season were; 199 (0-151) and 123 (0-88) individuals, in seasons, 2018 and 2019, respectively (Table, 2). The total numbers of the predatory species were; (9&4), (16&10) (3&5) and (7&6) adults, in case of: *C. undecimpunctata*, *H. convergens*, *C. vicina nilotica*, and *C. vicina isis*, for 2018 and 2019 seasons, respectively (Table, 3). The predators were arranged according to the following sequence: *H. convergens* (13.0) > *C. vicina isis* (6.5) = *C. undecimpunctata* (6.5) > *C. vicina nilotica* (4.0), in case of the two seasons, 2018 and 2019 together on the guava trees (Table, 3). The ratio between (the cotton aphid *A. gossypii*: predators observed) were; 31.54:1 & 39.92:1 for 2018 and 2019 seasons, respectively, while the general ratio for the two seasons together was 34.74:1 (Table, 4). As for the relationship between the cotton aphid *A. gossypii* & predatory coccinellids with the means of temperature, the r-values were; (0.408&0.475, in season, 2018) and (0.877&0.541, in season, 2019), while the corresponding r-values for the relative humidity were; (0.124&0.171, in season, 2018) and (0.209&0.868, in season, 2019), (Table, 5).

From the obtained data, it could be observed that the total numbers of all predatory coccinellids were the highest on the guava leaves located in the middle of the tree, in comparing with those leaves that were located either in the trunk or in the top of the guava tree, respectively. Also, their higher occurrence was directly related to the highest population density of the cotton aphid *A. gossypii* on leaves located in the middle of the guava tree.

Table (4): Seasonal ratios between (the cotton aphid *A. gossypii* individuals: the four ladybirds predatory coccinellids) that were recorded in the guava orchard during the two successive seasons, 2018 and 2019, in Qalubia Governorate.

Months	The ratios between (the cotton aphid <i>A. gossypii</i> : the four ladybird predatory coccinellids)						
	1- The position of the trees found in the guava orchard		2- The levels of the leaves of the tree in the guava orchard			3- The condition of the leaves in the guava orchard	
	a- The trees were in the borders of the orchard	b- The trees were inside the orchard	a- In the top	b- In the middle	c- In the trunk	a- The old leaves	b- The new leaves
season, 2018	42.32:1	33.72:1	34.93:1	47.36:1	31.54:1	9.50:1	97.41:1
season, 2019	51.12:1	40.79:1	35.79:1	29.51:1	39.92:1	11.00:1	86.45:1
General ratio /2 seasons	45.09:1	37.10:1	35.21:1	39.34:1	34.74:1	9.95:1	93.71:1

Table (5): The statistical analysis relationships (the calculation of the correlation coefficient r-values) that were recorded in the guava orchard between the cotton aphid *A. gossypii* individuals & the four ladybirds predatory coccinellids, with the weather factors (means of the temperature & relative humidity) during the two successive seasons, 2018 and 2019 in Qalubia Governorate

Statistical analysis: (the calculation of the correlation coefficient r-values)								
Tested factors	Means of the weather factors	Tested factors × the position of the trees found in the guava orchard		Tested factors × the levels of the leaves of the tree in the guava orchard			Tested factors × the condition of the leaves in the guava orchard	
		a-The trees were in the borders of the orchard	b-The trees were inside the orchard	a- The leaves were in the top	b- The leaves were in the middle	c- The leaves were in the trunk	a- The old leaves	b- The newly leaves
1- Season, 2018 a- <i>A. gossypii</i>	Means of temp.	0.122	0.878***	0.458	0.368	0.408	0.438	0.135
	Means of R.H.%	0.514*	0.197	0.108	0.161	0.124	0.203	0.670**
b- Predatory ladybirds	Means of temp.	0.092	0.163	0.229	0.326	0.475	0.219	0.930****
	Means of R.H.%	0.453	0.428	0.197	0.209	0.171	0.249	0.167
2- Season, 2019 a- <i>A. gossypii</i>	Means of temp.	0.017	0.766**	0.304	0.366	0.877***	0.181	0.120
	Means of R.H.%	0.419	0.090	0.819***	0.854***	0.209	0.207	0.492
b- Predatory ladybirds	Means of temp.	0.880***	0.688**	0.414	0.541*	0.541*	0.291	0.692**
	Means of R.H.%	0.522*	0.954****	0.969****	0.907****	0.868***	0.756**	0.943****

*= Significant (r- value = 0.500-0.600)

**= Moderate significant (r- value = 0.600-0.800)

***= Highly significant (r- value = 0.800-0.900)

****= Very highly significant (r- value > 0.900)

The Condition of the Leaves in the Guava Orchard.

a- The Old Leaves Found on the Trees.

Numbers of predatory coccinellids' individuals were peaked during May, 2018 and 2019 (the total numbers of the predators were; 24&6 individuals, in 2018 and 2019 seasons, respectively). The period of all predators' occurrence was extended from (April to June, 2018) and from (March to June, 2019), in seasons, 2018 and 2019, respectively. The total numbers of all predators per season were; 28(0-24) and 12(0-6) individuals, in 2018 and 2019 seasons, respectively (Table, 2). The total numbers of the predatory species recorded were; (1&0), (3&2) and (1&0) adults, in case of *C. undecimpunctata*, *H. convergens* and *C. vicina isis*, for 2018 and 2019 seasons, respectively (Table, 3). The predators were arranged according to the following sequence: *H. convergens* (2.5) > *C. undecimpunctata* = *C. vicina isis* (0.5), in case of the mean of the two seasons, 2018 and 2019 together on the guava trees (Table, 3). The ratio between (the cotton aphid *A. gossypii*: predators observed) were; 9.50:1 & 11.00:1 for 2018 and 2019 seasons, respectively, while the general ratio for the two seasons together was 9.95:1 (Table, 4). As for the relationship between the cotton aphid *A. gossypii* & predatory coccinellids with the means of temperature, the r-values were; (0.438&0.219, in season, 2018) and (0.181&0.291, in season, 2019), while, the corresponding r-values for the relative

humidity were; (0.670&0.167, in season, 2018) and (0.492&0.943, in season, 2019), (Table, 5).

b- The new leaves found on the trees.

The maximum total numbers of 117&77 coccinellids' individuals were counted during May in both 2018 and 2019 seasons. The period of all predators' occurrence was extended from (April-June, 2018) and from (March-June, 2019), in 2018 and 2019 seasons, respectively. The total numbers of all predators per season were; 259 (0-117) and 132 (0-77) individuals in seasons, 2018 and 2019, respectively (Table, 2). The total numbers of the predatory species were; (6&7), (9&14), (5&4) and (10&6) adults, in case of *C. undecimpunctata*, *H. convergens*, *C. vicina nilotica* and *C. vicina isis*, for 2018 and 2019 seasons, respectively (Table, 3). The sequence of the predators' occurrence was arranged as follows: *H. convergens* (11.0) > *C. vicina isis* (8.0) > *C. undecimpunctata* (6.5) > *C. vicina nilotica* (4.5), in case of the mean of the two seasons, 2018 and 2019 together on the guava trees (Table, 3). The ratio between (the cotton aphid *A. gossypii*: observed predators) was; 97.41:1 & 86.45:1, for 2018 and 2019 seasons, respectively, while the general ratio for the two seasons together was 93.71:1 (Table, 4). As for the relationship between the pest species & predatory coccinellids with the means of temperature, the r-values were; (0.135&0.930, in season, 2018) and (0.120&0.692, in season, 2019), while, the corresponding r-values for the relative humidity were; (0.670&0.167, in season, 2018) and (0.492&0.943, in season, 2019), (Table, 5).

It could be stated that the total numbers of all predatory coccinellids were higher on the new leaves found on the guava tree in comparing with the old ones. The occurrence of the predators was directly related to the existence of the suitable food contents of the fresh new leaves for aphid species feeding and their continuous reproduction process. As the highest population density of the cotton aphid *A. gossypii* will be directly led to the occurrence of the highest total numbers of the predatory coccinellids in the guava orchard during the two seasons of the study.

Finally, it could be concluded from the present study the importance of the following points concerning the seven compared ecological parameters in the guava orchard:

1- The occurrence of the coccinellid ladybird predator *H. convergens* was the highest, in comparing with the other recorded three predators. Magnifying this natural role of the predator *H. convergens* become necessary in order to encourage this beneficial agent to do its role and decrease the degree of infestation of the cotton aphid to an acceptable level. So, this predator is a useful biocontrol agent against the cotton aphid *A. gossypii* and could be laboratory mass-reared and released against the pest on the guava trees or other fruit trees that are subjected to attack by the pest. This situation will help to increase the efficiency of control against the cotton aphid *A. gossypii* in many of the fruit orchards. The predatory coccinellids have widely been known as useful predators of different species of aphids (Kacar, 2015) and they were often considered as the most abundant and common predators on many field agriculture plants attacking aphids (Hafez, 1994).

2- No aphid individuals or predatory coccinellids were observed during the period extended from December until the mid. February in the two studied seasons, 2018 and 2019. The occurrence of the predators was mainly related to the degree of infestation of their prey (the cotton aphid *A. gossypii*). Similarly, El-Heneidy *et al.* (2004) cleared that, the trend of the population density of predators on wheat plants mainly depends on the density of aphids. This result was also agreed with that of Abdel-Samad *et al.* (2005) who showed that no pests or predators were recorded during the period extended from July to December on the guava trees in Qalubia Governorate. They revealed the reason to be due

to the migration of the pests' species and predators from the guava trees to attack other fruit orchards or other crops (representing the period of fall of the guava leaves in the year). However, Verghese and Tandon (1987) stated that there was a positive association between the cotton aphid *A. gossypii* and the coccinellid predator *Menochilus sexmaculatus* in an unsprayed guava ecosystem. Therefore, it is very important to recognize both the positive and the negative interactions that occur between the two primary components of a management system, plant cultivars, and natural enemies when planning Integrated Pest Management (I.P.M.) programs (El-Heneidy & Abdel-Samad, 2001).

3- The period of the control of the cotton aphid *A. gossypii* must be extended during the three successive months; April, May, and June, especially in May. As a result, this period of the extensive aphid infestation representing a suitable time for applying I.P.M. programs against the pest on the guava trees (including the use of the biological control techniques).

4- The obtained results cleared that, four predatory coccinellids including; *C. undecimpunctata*, *H. convergens*, *C. vicina nilotica* and *C. vicina isis* were recorded in the guava orchard associated with the cotton aphid *A. gossypii*. In similar results, El-Serafi *et al.* (2004) recorded the two predatory coccinellids; *C. undecimpunctata* and *C. vicina isis* among the common predators observed in the guava orchard. While, Abdel-Samad *et al.* (2005) showed that, the predator *Coccinella* sp. was the highest in its number (associated with the cotton aphid *A. gossypii*), on the guava trees in comparing with the other recorded predators. They added that the highest total numbers of this predator on the guava trees were recorded during the second week of May, in the two seasons of their study.

5- It could be mentioned from the obtained data that, the predators' occurrence was greatly appeared with the highest numbers towards the end of the season to synchronize with the extensive occurrence of the cotton aphid *A. gossypii*. Many authors such as; El-Serafi *et al.*, (2004) and El-Khawas & Abul-Fadl (2009) demonstrated that the numbers of predators gradually increased towards the end of the season and always found following the presence of the cotton aphid *A. gossypii*.

6- As shown in this study, the general ratios obtained between (the cotton aphid *A. gossypii* and the common recorded predatory coccinellids), clearly indicated these predators play an effective obvious natural role against the pest in the guava orchard. Similarly, Ghanim and El-Adl (1983) declared that, when the predator-prey ratio was under 1:40, the predators play an effective role in controlling the injurious insects in different field crops and could keep their abundance in low levels. But, when this ratio was higher than 1:40, the role of the predator is considered not effective against the insects' pests.

7- It was found from the field observations that; the second, the third & the fourth instars predatory larvae and also the predatory adults (males & females) of the coccinellids were found together in the same periods of the coccinellids activity. So, both these predatory larvae and/or the predatory adults can be laboratory mass-reared and released against the cotton aphid *A. gossypii* on the guava trees or other fruit or crops that are subjected to attack by the pest species.

8- Detecting the statistical analysis relationships that were recorded between the cotton aphid *A. gossypii* & the common predatory coccinellids with the means of the temperature and the relative humidity, is very important and necessary and can share as a part of I.P.M. programs against the aphid species. However, Mohamed & Ghanim (2008) stated that it is necessary before introducing any predator in a biological control program to indicate its efficacy under different environmental factors where among these factors;

the prey type, the temperature, and the relative humidity are considered the most important ones.

The Biological Control of the Cotton Aphid *A. gossypii* on the Guava Trees by Releasing the Ladybird Coccinellid Predatory Adults of *H. convergens*:

It was found from the ecological survey that, the predator *H. convergens* had the highest percentages of occurrence among the other recorded three predators. So, a biological control experiment was performed by laboratory mass rearing of the predator *H. convergens* on the cowpea aphid *A. craccivora*. Then, it was released against the cotton aphid *A. gossypii* in a guava orchard in Qalubia Governorate (Table, 6 & Fig., 4); the following points were concerning the biological control experiment:

1-The predatory *H. convergens* adults were released during the period of the highest aphid infestation (which was applied according to the results concerning the survey studies of the recorded aphid species).

2- The means of the following were compared between the released area with the control area, during season, 2019: the mean of infested total trees/10 trees, the mean of total infested leaves/500 leaves, the mean number of cotton aphid *A. gossypii*/one guava leaf, the mean total number individuals of winged adults, the mean total number of wingless individuals and the total number of wingless individuals and the total number of the cotton aphid *A. gossypii* individuals (winged adults & wingless individual). The previous features in case of the control area (without any release of the coccinellid ladybird predator *H. convergens*) were: (8.96±0.62 (8.52- 10.00), with a percentage of infestation of 89.60%), (64.57±22.97 (26.75-125.92), with a percentage of infestation of 12.91%), (3.48±2.26 (0.54-10.17)), (99.00±55.99 (12-258)), (8233.50±5428.48 (1025-24159)) and (8628.75±5767.41 (1055- 25599)). The corresponding values recorded in case of the release area (where the coccinellid ladybird predator *H. convergens* was released) were: ((7.42±0.75 (5.59-9.25), with a percentage of infestation of 74.20%), (29.71±7.06 (13.50-44.50), with percentages of infestation of 5.94%), (0.91±0.27 (0.43-1.67)), (23.50±9.85 (12-53)), (2252.25±880.38 (838-4660)) and (2275.25±875.06 (852-4670)) individuals, respectively.

3- The percentages of reduction occurred in the experimental area in case of: the mean of total infested trees/10 trees, the mean of total infested leaves/500 leaves, the mean number of cotton aphid *A. gossypii*/one guava leaf, the total number individuals of winged adults, the total number of wingless individuals and the total number of the cotton aphid *A. gossypii* individuals (winged adults & wingless individual) for the previous recorded ecological features (in comparing with the control area) were; 17.19%, 53.98%, 73.85%, 76.26%, 72.65% and 55.16%, respectively. However, the recorded mean total numbers of eggs, larvae, pupae, adults for the recorded predatory coccinellids stages were; 130.50±64.10, 74.25±37.50, 5.50±3.10, 21.50±15.18 and 236.75±115.18 individuals, in case of the control area, respectively, while the corresponding values for the releasing area were: 20.25±15.09, 7.25±4.27, 5.25±3.20, 16.50±13.52 and 48.75±35.54 individuals, respectively.

Table (6): The biological control experiment conducted against the cotton aphid *A. gossypii* on the guava trees by the field releasing of the ladybird coccinellid predatory adults of *H. convergens* during season, 2019 in Qalubia Governorate

Months	1- The cotton aphid <i>A. gossypii</i>									
	a- The control area (without any release at all of the coccinellid ladybird predator <i>H. convergens</i>)									
	The infestation of the guava trees by the cotton aphid <i>A. gossypii</i>									
	Mean no. of total infested trees/10 trees	Mean no. of total infested leaves/ 500 leaves	Mean no. of the cotton aphid <i>A. gossypii</i> /one leaf	Total no. of winged adults	Total no. of wingless individuals	Total no. of winged adults & wingless individuals				
March	10.00	73.50	0.96	96	1634	1733				
April	8.25	26.75	0.54	30	1025	1055				
May	7.59	32.09	2.23	12	6116	6128				
June	10.00	125.92	10.17	258	24159	25599				
Mean / season, 2019	8.96 ± 0.62 (8.25-10.00)	64.57 ± 22.97 (26.75-125.92)	3.48 ± 2.26 (0.54-10.17)	99.00 ± 55.99 (12-258)	8233.50 ± 5428.48 (1025-24159)	8628.75 ± 5767.41 (1055-25599)				
	89.60% *	12.91%								
Months	b- The release area (where the coccinellid ladybird predator <i>H. convergens</i> was released)									
	Mean no. of infested trees/10 trees	Mean no. of infested leaves/ 500 leaves	Mean no. of the cotton aphid <i>A. gossypii</i> /one leaf	Total no. of winged adults	Total no. of wingless individuals	Total no. of winged adults & wingless individuals				
March	9.25	44.50	0.64	53	1045	1098				
April	7.50	13.50	0.43	14	838	852				
May	7.34	22.84	1.67	12	4660	4670				
June	5.59	38.00	0.91	15	2466	2481				
Mean / season, 2019	7.42 ± 0.75 (5.59-9.25)	29.71 ± 7.06 (13.50-44.50)	0.91 ± 0.27 (0.43-1.67)	23.50 ± 9.85 (12-53)	2252.25 ± 880.38 (838-4660)	2275.25 ± 875.06 (852-4670)				
	74.20%	5.94%								
% reduction	17.19%	53.98%	75.85%	76.26%	72.65%	55.16%				
Months	2- The ladybird predatory coccinellids recorded in the guava orchard									
	a- The control area (without any release of the coccinellid ladybird predator <i>H. convergens</i>)					b- The released area (where the coccinellid ladybird predator <i>H. convergens</i> was released)				
	Eggs	Larvae	Pupae	Adults	Total no.	Eggs	Larvae	Pupae	Adults	Total no.
March	0	0	0	2	21	0	0	0	2	2
April	64	30	2	8	104	5	2	1	2	10
May	164	99	6	10	279	11	8	6	5	29
June	294	168	14	67	543	65	19	14	57	154
Total / months	522 (0-294)	297 (0-168)	22 (0-14)	86 (0-67)	947 (2-543)	81 (0-65)	29 (0-19)	21 (0-13)	66 (0-57)	195 (0-154)
Mean / season, 2019	130.50 ± 64.10	74.25 ± 37.50	5.30 ± 3.10	21.50 ± 15.18	236.75 ± 115.18	20.25 ± 15.09	7.25 ± 4.27	5.25 ± 3.20	16.50 ± 13.52	48.75 ± 35.54

In conclusion, it could be shown from the obtained data that, the release of the ladybird beetle* = % of infestation by the cotton aphid *A. gossypii*.

4- The *H. convergens* adults (pairs of males & females) was made only one time in 25/9/2019. These released adults of the predator *H. convergens* continued to feed on the cotton aphid *A. gossypii* and complete their life cycle, therefore the control of the pest species will continue all over the season. Besides, the emergence of the new predatory larvae in the guava orchard also supported the feeding capacity role of the predator on the aphid species. The low total numbers of the cotton aphid after the predator release revealed that the control results after the release were at an acceptable level that there was any need for another release of the predator *H. convergens*. The predatory coccinellids (adults and/or larvae) need high population density of the cotton aphid *A. gossypii* to feed on and reproduce in the guava orchard; so the occurrence of the different stages of the predator were lower in the releasing area in comparing with the control one. As a result, a

migration of the predatory adults and/or larvae was happened from the releasing area to the control one, searching for the occurrence of higher population density of the pest in the control area located in the guava orchard. The released adults (pairs of males & females) of the coccinellid predator *H. convergens* were effective against the cotton aphid *A. gossypii* on the guava trees. This predator can be laboratory mass-reared and released in the guava orchards and/or other fruit orchards that are subjected to attack by the cotton aphid *A. gossypii*, side by side with the other safe control techniques in the frame of I.P.M. However, Mondor and Warren (2000) stated that, as aphids are one of the serious groups of insect pests that attack green plants, their natural enemies have received high attention through studying, mass rearing and releasing.

5- Many successful biological control experiments against the cotton aphid *A. gossypii* were made by releasing the coccinellid predator *H. convergens* in many agricultural crops. For example; Vinson and Scarborough (1989) demonstrated that releasing the adults and the third instars larvae of the coccinellid predator *H. convergens* was effective in reducing the population density of the cotton aphid *A. gossypii* in the cotton fields. In addition, Dreistadt and Flint (1996) concluded that, releasing the coccinellid ladybird predator *H. convergens* adults for controlling the cotton aphid *A. gossypii*, infesting outdoor potted Chrysanthemum, could provide augmentative control of the relatively high aphid densities in small potted plants. In addition, Al-Arnaouty *et al.* (2000) indicated that releasing the larvae and adults of the coccinellid ladybird *Harmonia axyridis* Pallas was able to control the cowpea aphid *A. craccivora*, with the best rate of release at one predator/30 aphids/plants of faba bean. Similarly, Zibai and Hatani (2001) found that the predator: prey ratios of 1:30 and 1:90 of the predatory coccinellid larval instars of *Hippodamia variegata* (Goeze) significantly reduced the population density of the cotton aphid *A. gossypii* on cucumber plants under the greenhouse condition. Moreover, Abdel-Samad *et al.* (2005) concluded that the predator *Coccinella* sp. could be mass-reared and release against the cotton aphid *A. gossypii* in the guava orchards during the critical periods of the pest infestation, with the other safe control methods in the frame of I.P.M. strategies. Finally, Bahy El-Din *et al.* (2013) and Bahy El-Din (2014) reared the ladybird beetle *H. convergens* in the laboratory on many artificial diets and carried out a semi-field biological control experiment by releasing this predator against the cotton aphid *A. gossypii* on squash plants. They found that the predator *H. convergens* was able to decrease the numbers of the pest individuals and the predatory adults were more efficient than larvae, in addition the best releasing rate of predatory adults was one predator: 72 aphid individuals. They concluded that this predator can share with the other control safe control methods to control the cotton aphid *A. gossypii* on many crops that are subjected to attack by the aphid species.

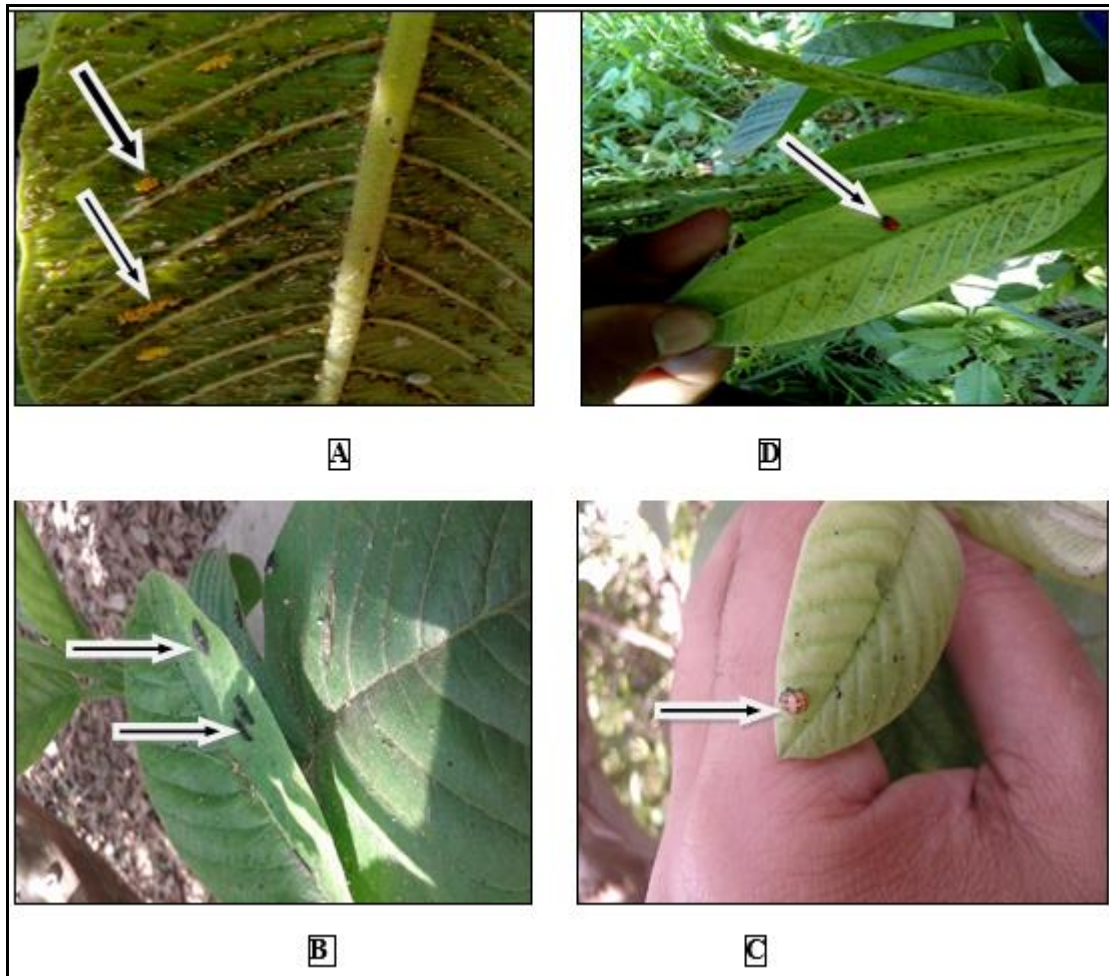


Fig. (4): The new predatory coccinellids stages (eggs, larvae, pupae & adults) that resulted from the biological control experiment conducted by releasing the adults of the predator *H. convergens* against the cotton aphid *A. gossypii* on the guava trees during season, 2019 in Qalubia Governorate.

A = The newly deposited eggs by the ladybird coccinellid females' predators of *H. convergens* that were recorded in the releasing area of the experiment

B = The newly predatory larvae of the ladybird coccinellid predator *H. convergens* that were extensively fed on the cotton aphid *A. gossypii* individuals that were recorded in the releasing area of the experiment

C = The newly formed pupa of the predator *H. convergens* that was recorded in the releasing area experiment

D = The newly emerged adult predator *H. convergens* that was started feeding on the cotton aphid *A. gossypii* individuals in the releasing area of the experiment.

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ARABIC SUMMARY

مقارنة تأثير عدة عوامل بيئية مختلفة على تواجد من القطن (*Aphis gossypii* (Glov.) والمفترسات الشائعة من عائلة *Coccinellidae* على أشجار الجوافة في محافظة القليوبية، مع إجراء تجربة مكافحة حيوية تطبيقية للآفة.

إسماعيل عبد الحليم بهي الدين و مصطفى أحمد محمد الخواص
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أجريت هذه الدراسة في حديقة جوافة (صنف بلدى)، خلال الموسمين المتتاليين 2018 & 2019 في منطقة سرياقوس (محافظة القليوبية)، بغرض دراسة تأثير سبعة مقارنات بيئية مختلفة على كثافة التعداد لمن القطن (*Aphis gossypii* (Glov.) Homoptera: aphididae) المهاجم لأشجار الجوافة. كما اختص أيضاً بتسجيل أنواع المفترسات الشائعة التواجد من عائلة *Coccinellidae* (Order: Coleoptera) وجود المقارنات السابقة. وقد اشتملت المقارنات السبعة على الآتى : 1- مكان تواجد أشجار الجوافة في الحديقة (أ- الأشجار المتواجدة على حواف الحديقة ، ب- الأشجار المتواجدة داخل الحديقة) ، 2- مستوى تواجد الأوراق في حديقة الجوافة (أ- الأوراق المتواجدة في قمة الشجرة ، ب- الأوراق المتواجدة في وسط الشجرة ، ج- الأوراق المتواجدة في منطقة جذع الشجرة). وأخيراً، 3- حالة الأوراق المتواجدة في حديقة الجوافة (أ- الأوراق القديمة على الأشجار ، ب- الأوراق الحديثة النمو على الأشجار).

أظهرت النتائج المتحصل عليها ، أن أعلى فترات الإصابة بمن القطن *A. gossypii* the cotton aphid لأشجار الجوافة ، كانت في شهر أبريل 2018 ، 2019 (في حالة الأشجار المتواجدة في حواف الحديقة) ، بينما كانت خلال شهر مايو 2018 ، 2019 (في حالة الأشجار المتواجدة في داخل الحديقة) في موسمي الدراسة 2018 و 2019 ، على التوالي. ووجد أن متوسط تعداد أفراد المن (المجنح ، الغير مجنح) لموسمي الدراسة هو الأقل على الأشجار المتواجدة في حواف الحديقة (695,25 (0-4666)) بالمقارنة بالأشجار المتواجدة داخل الحديقة (912,60 (0-5071)). كما تبين أن الآفة ذات فترات إصابة مرتفعة للأشجار في خلال شهر مايو 2018 ، 2019 للأوراق التي تقع في قمة الشجرة وكذلك الأوراق التي توجد في وسط الشجرة ، بينما كانت خلال شهرى مايو 2018 ، يونيو 2019 بالنسبة للأوراق المتواجدة حول جذع الشجرة. ووجد أن متوسط تعداد أفراد المن (المجنح ، الغير مجنح) لموسمي الدراسة هو الأعلى على الأوراق المتواجدة في وسط الشجرة (1014,85 (0-7814)) ، بالمقارنة بالأوراق المتواجدة في قمة الشجرة (656,60 (0-4654)) أو تلك المتواجدة في جذع الشجرة (559,30 (0-3134)) ، على التوالي. وعلاوة على ذلك، فقد سجلت فترات النشاط للآفة بنسبة ضعيفة جداً في حالة الأوراق القديمة المتواجدة على الأشجار، بينما كانت مرتفعة خلال شهرى أبريل 2018 ، مايو 2019 في حالة الأوراق حديثة النمو للأشجار. وجد

ايضا أن متوسط تعداد أفراد المن (المجنح ، الغير مجنح) لموسمى الدراسة هو الأقل على الأوراق القديمة المتواجدة على الأشجار (19,90(0-95)) بالمقارنة بالأوراق حديثة النمو المتواجدة على الأشجار (15,1796(0-12301)). وعموماً، يمكن القول إجمالاً أن الشهور الثلاثة المتتالية: أبريل ، مايو ويونيه هي الشهور الأعلى المسجلة في الإصابة بالمن على أشجار الجوافة خلال الدراسة الحالية.

A. تم تسجيل أربعة أنواع من المفترسات من عائلة Coccinellidae مرتبطة بفترات تواجد من القطن *the cotton aphid gossypii* على أشجار الجوافة خلال موسمى الدراسة ، وقد اشتملت على الآتى:
Cydonia vicina ، *Coccinella undecimpunctata* L. ، *Hippodamia convergens* (Geur.)
nilotica و *Cydonia vicina isis*. كان ترتيب التواجد للمفترسات المسجلة تنازلياً على أشجار الجوافة للموسمين معاً كالآتى : *H. convergens* (بلغ المتوسط للموسمين 49%) < *C. vicina isis* (22%) < *C. vicina nilotica* (19%) < *C. vicina nilotica* (10%). وبذلك يتبين من النتائج المتحصل عليها أن المفترس *H. convergens* هو أكثر المفترسات تواجداً بالمقارنة مع باقى الأنواع الثلاثة الأخرى المسجلة. ومن هذا المنطلق ، فقد أجريت تجربة مكافحة حيوية تطبيقية عن طريق الإكثار الكمي للمفترس *H. convergens* فى المعمل ، ثم الإطلاق بعد ذلك للحشرات الكاملة (أزواج متساوية من الذكور والإناث) في حديقة للجوافة فى موسم 2019 (فى حديقة مجاورة للحديقة التى أجريت فيها دراسة المقارنات). ووضح من النتائج أن نسبة الخفض فى منطقة الإطلاق (المنطقة التى تم فيها الإطلاق للمفترس) بالمقارنة بمنطقة الكنترول (المنطقة التى لم يتم فيها عمل أى إطلاق للمفترس) بلغت: 17,19 ، 53,98 ، 73,85 ، 76,26 ، 72,65 و 55,16 % ، وذلك فى حالة حساب الآتى: متوسط عدد الأشجار الكلية المصابة بمن القطن/10 شجرة ، متوسط عدد الأوراق الكلية المصابة/500 ورقة ، متوسط عدد أفراد من القطن الكلى/ورقة جوافة واحدة ، العدد الكلى لأفراد المن المجنح ، العدد الكلى لأفراد المن الغير مجنح والعدد الكلى للمن/الموسم 2019 ، على التوالى. وبالتالي، يتضح مدى أهمية الدور الذى يؤديه المفترس *H. convergens* فى مجال مكافحة الحيوية لمن القطن *A. gossypii* على أشجار الجوافة. ويمكن العمل على استخدامه على نطاق واسع لمكافحة الآفة فى حدائق الجوافة أو الحدائق الأخرى لأشجار الفاكهة، ويكون هذا الاستخدام جنباً الى جنب مع باقى الوسائل الأخرى الأمانة ضمن برامج مكافحة المتكاملة للأفات *Integrated Pest Management (I.P.M.)* ، حفاظاً على صحة الانسان والبيئة المحيطة خالية من التلوث.