

**NATURAL ENEMIES ASSOCIATED WITH MEALY PLUM
APHID *HYALOPTERUS PRUNI* (Geoff.), (HOMOPTERA:
APHIDIDAE) INFESTED APRICOT TREES, AT QALUBIA
GOVERNORATE**

[34]

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ABSTRACT

The present work was carried out to study the population dynamics of the mealy plum aphid *Hyalopterus pruni* (Geoff.) and related parasitoids and predators on apricot trees, during the two successive seasons, 2003 and 2004, at Qalubia Governorate. The obtained data revealed that, the occurrence of *H. pruni* on apricot trees covered 5 months (from February to June). The mean total numbers of this aphid species per season were 1.78 (0.01-6.37) and 2.83 (0.00-10.01) individuals./leaf. The maximum numbers of *H. pruni* were recorded during the 2nd weeks of April, 2003 and 2004. No aphid individuals were observed during the period extended from July to September, in the two studied seasons. Four species of parasitoids; namely *Aphidius matricariae* Hal., *Lysiphylbus* sp. (1st parasitoids) and 2 species of *Alloxysta* spp. (2nd parasitoids) were recorded during this study, attacking *H. pruni*. These parasitoid species were found during nearly three months of each season, in connection with the population density of the previous aphid species. The first parasitoid was the highest in its numbers. The total numbers of predatory species per season were 407 and 1082 individuals, in the two studied seasons, 2003 and 2004, respectively. The maximum monthly occurrence of these predatory species was during April, 2003 (146 individuals) and April, 2004 (581 individuals), respectively. The predator *Chrysoperla septempunctata* L. had the highest percentages of occurrence among other recorded predatory species (52.83 and 73.01%, respectively). In general, the parasitoid *A. matricariae* and the predator *C. septempunctata*, could be mass reared and released for controlling *H. pruni* on apricot trees with other available safe control methods developed in Integrated Pest Management (IPM) programs against this pest.

Key words: Apricot, *Hyalopterus pruni*, Parasitoids, Predators, Population dynamics

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INTRODUCTION

Owing to the increasing importance of aphids as pests of ornamental and other agricultural plants in greenhouses and outdoors, they have become a subject to intensive investigations. Aphids are by all means among the most important insect pests of different crops all over the world (**Ibrahim, 1994**) and in addition, are considered as the most injurious pest attacking fruit trees (**Ismail et al 1991**).

Apricot trees are by far one of the most important fruit crop in Egypt. They are widely cultivated in Qalubia Governorate, where their fruit represent one of the most important sources of farmers income. This fruit possesses highly nutritional quality, because of its contents of sugars, proteins and vitamins, especially vitamin "A". Besides, it represents one of the best sources of mineral salts including, Phosphorous, Potassium and Calcium. The apricot fruit trees are liable to attack by the mealy plum aphid *Hyalopterus pruni* (Geoff.) (**El-Kady et al 1970**). In Egypt, this aphid species has been recognized as a pest of stone fruit trees (*Prunus* spp.), causing considerable damage by sucking the juice and resulting in loss of the yield (**Ibrahim and Afifi, 1994**). Besides, this aphid species acts sometimes as a vector of plum pox virus (**Minoiu, 1973**).

Recently, the attention has been focused upon the integrated pest control approach that, appears as an essential aim for sound future of agriculture. The first goal of this approach depends extensively on minimizing the use of chemical pesticides, for avoiding their indiscriminate usage (**Abd El-Salam, 2000 and El-Khawas et al 2003**). Consequently, it has dictated the urgent need for encouraging

the field of biological control, as representing one of the main components of these recent control strategies. Biological control depends mainly on studying the natural role of biological agents and knowing the most efficient natural enemies for their future uses continuously against insect pests. For instance, **Hagley (1989)** stated that, in biological control programs of *Myzus pome*, an additional release of an effective natural enemy, is used to regulate pest populations in many countries.

Little information are known on the natural relationship between *H. pruni* infestation and its natural enemies (especially, parasitoids and predators), on apricot trees. For this reason, this work was conducted to shed light on the population dynamics of this aphid species. Also, the present study aimed at surveying the most common natural enemies found associated with the previous aphid species, during the period of aphid existence. Such ecological information will undoubtedly help in planning integrated control programs against *H. pruni* on apricot trees.

MATERIAL AND METHODS

This study was carried out for the two successive years 2002/2003 and 2003 / 2004 at Alamar locality, which is an area of widely cultivated apricot trees. The survey period lasted from October, 2002 until September, 2004. An area of 5 feddans was chosen and twenty apricot trees of the relatively same size and age were selected, where the normal agricultural practices were followed regularly without any insecticidal treatments throughout the period of investigation. From each tree, 25 leaves (representing the four principle directions and the heart of the tree) were

randomly weekly picked up early in the morning and the number of nymphs and adults of *H. pruni* were counted on both surfaces of 500 leaves (20 trees x 25 leaves/tree). Sampling began in 10/2/2003 and ended in 30/6/2003 in the 1st season, while in the 2nd season, sampling began in 9/2/2004 and ended in 28/6/2004. The total numbers of aphid individuals were calculated and the percentages of wingless individuals were also recorded. At the same time, the total numbers of the commonly observed predatory species, found associated with aphid on the tested leaves of apricot trees were identified and counted. Infested leaves with aphids, were weekly picked up from the working site, kept in paper bags and transferred to the laboratory, for the determination of the percentages of aphid parasitism, according to the technique of **Hafez, (1994)**. The infested leaf samples were also used for identifying the parasitoid species, that emerged from parasitized aphid species.

Data obtained were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 levels (**Snedecor, 1970**). Moreover, the weather factors including the means of temperature and relative humidity, were obtained from the Meteorological station at A.R.C.

RESULTS AND DISCUSSION

As no apricot leaves were found during October, November and December, the survey period extended from February to September, during the two seasons of 2002/2003 and 2003/2004.

I- Seasonal population of *H. pruni*

Data recorded in Tables (1 and 2) and graphically illustrated in Fig. (1) revealed

that, *H. pruni* started to appear during the 2nd week of February, in both experimental seasons, at Qalubia Governorate. The winged adults (alate viviparous) of *H. pruni* appeared firstly on apricot trees with low numbers (at 14.7°C and 49.0% R.H.), with a density of 3 and 5 aphids/500 leaves, in the two seasons, respectively. The population of alate and apterous forms increased gradually to reach the monthly maximum mean number of 6.37 individuals / leaf (at 18.9°C and 64.50% R.H.) and 10.01 individuals / leaf, during April of the two successive seasons, 2003 and 2004, respectively. After that, the population decreased gradually in May, and sharply afterwards till vanishing completely in the experimental site in June, for both of the two studied seasons. Accordingly, the occurrence of the mealy plum aphid *H. pruni* on apricot trees covered 5 months (i.e., from February to June). The mean total numbers of *H. pruni* individuals per season, were 1.78 (0.01-6.37) and 2.83 (0.00-10.01) individuals/leaf. No aphid individuals were observed during the period extended from July to September.

From the aforementioned results, it could be concluded that, the *H. pruni* was observed with its highest population during April and it appears that, the active period of this aphid species under investigation occurred during the period from March until May. Therefore, this period represents a critical period, for Integrated Pest Management (I.P.M.) programs to protect apricot trees from aphid attacks. **El-Kady et al (1970)** showed that, *H. pruni* is the most injurious aphid species on peach and apricot as well as on reed weed. **Ibrahim and Afifi, (1994)** reported two peaks of infestation of *H. pruni* occurred on both peach and reed

Table 1. Total monthly numbers of aphids in directly and mean panders of plaids/leaf, mean percentages of alate form and percentages of parasitism, during the two successive seasons of 2003 and 2004, on apricot trees, at Qalubia Governances

Season 2003						
Month	Mean no of aphids/leaf	Forms %		% of parasitism	Wata or factors	
		Alate form	Apterous form		Mean °C	Mean R.H%
February	0.01	50.00	50.00	0.00	17.4	40.3
March	1.34	9.72	90.28	2.13	16.6	59.8
April	6.37	1.87	98.13	16.16	18.9	64.5
May	1.15	1.16	98.84	54.57	25.4	57.3
June	0.01	0.00	100.00	3.33	27.2	56.2
Mean total no./ season	1.78 (0.01-6.37)				21.1 (16.6-27.2)	55.6 (40.3-64.5)
Season 2004						
Month	Mean no. of aphids/leaf	Forms %		% of parasitism	Wata or factors	
		Alate form	Apterous form		Mean °C	Mean R.H%
February	0.01	54.55	45.45	0.00	15.4	63.7
March	2.83	10.41	89.59	0.86	18.1	69.0
April	10.01	0.61	99.39	10.72	22.1	59.0
May	1.31	0.66	99.34	31.15	25.2	60.8
June	0.00	0.00	100.00	0.00	28.6	58.5
Mean total no./ season	2.83 (0.00-10.01)				21.9 (15.4-28.6)	62.2 (58.5-69.0)

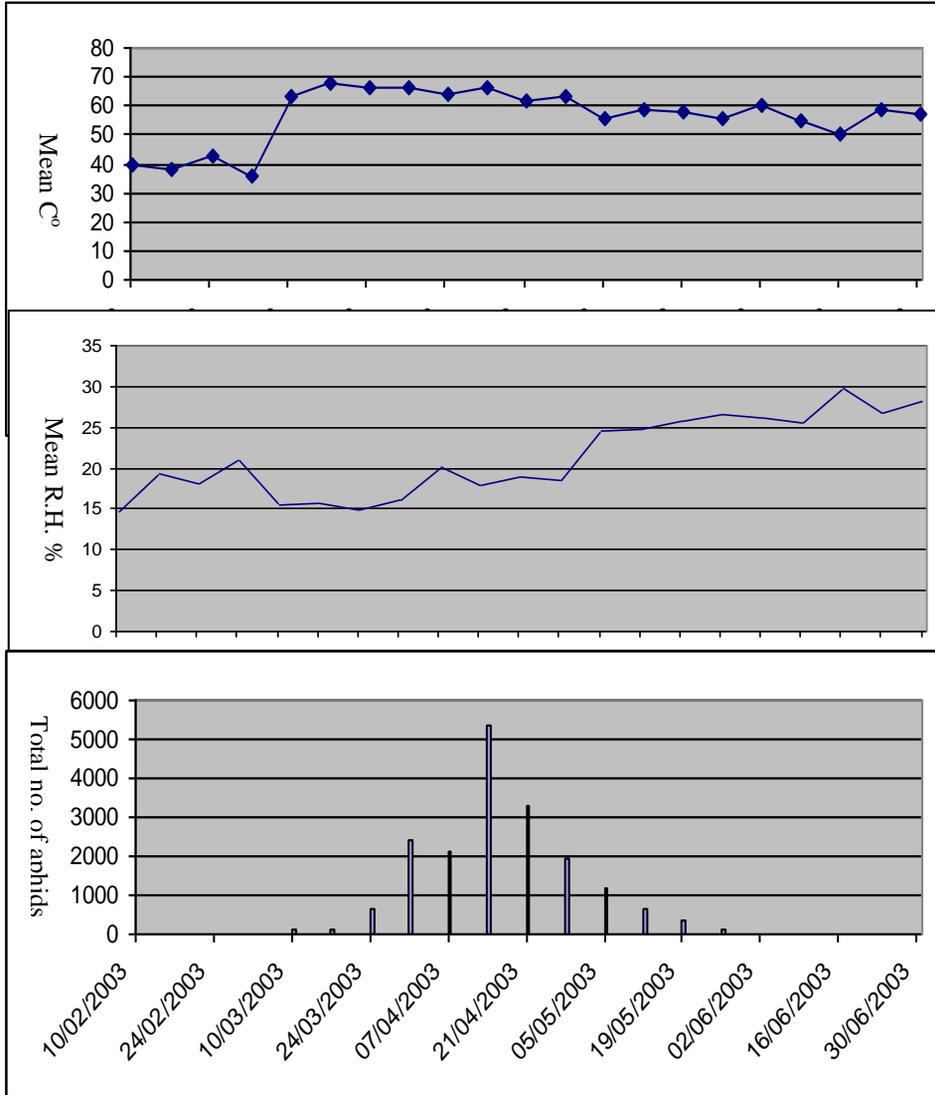


Fig. 1. Weekly total numbers of aphids recorded on apricot trees during season, 2003, at Qalubia Governorate

plants, the first was during March and the second one was during July on peach trees and August on reed plants. They added that, this aphid species existed all over the year on reed plants and only during the nine months from February to October on peach trees.

II- Common natural enemies of *H. pruni*

A- Parasitoids

In the present work, four species of parasitoids; namely *Aphidius matricariae* Hal., *Lysiphylbus* sp. (1st parasitoids) and *Alloxysta* spp. (2^{ty} parasitoids, 2 species), were found associated with *H. pruni* on apricot trees. **Achvlediani, (1964)** revealed that, *Lysiphylbus fabarum* Marshall were recorded associating with *H. pruni*. While, **Stary (1968 and 1970)** showed that, *Aphidius colemani* Vier. attacks *H. pruni* in the Mediterranean area and Central Asia. However, **Ibrahim and Afifi (1994)** recorded *A. colemani* and *A. picipes* Nees, attacking *H. pruni* on peach trees and reed plants.

The percentages of parasitism of *H. pruni* are shown in Tables (1) and Fig. (3), for the two successive seasons of 2002/2003 and 2003/2004. In the 1st season, the parasitoids of *H. pruni* existed during the period from the 2nd week of March until the 1st week of June, 2003. These parasitoid species were found during nearly 3 months within the season, in connection with the population density of the previous aphid species. The maximum monthly percentage of parasitism (54.57%), was recorded during May, 2003 (at 25.4°C and 57.3% R.H.). In the 2nd season, the parasitoids of *H. pruni* existed during the period from the 3rd

week of March until the last week of May, 2004. These parasitoid species were also found during nearly 3 months of the season, in connection with the surveyed aphid species. The maximum monthly percentage of parasitism (31.15%), was found during May, 2004 (at 25.2°C and 60.8% R.H.). Similar to the present observations, **Ibrahim and Afifi (1994)** found that, the maximum percentages of *H. pruni* parasitism (64.50 %) occurred in May on peach trees.

However, the parasitism of *H. pruni* individuals at the beginning of each experimental season was not affected the population density of the aphid species. But, parasitism was increased as the population density of this aphid species increased. parasitism, indicating the important natural role of common aphid parasitoids against the tested aphid species. **Ibrahim and Afifi (1994)** demonstrated that, parasitism of, *H. pruni* did not cause an immediate reduction in the aphid population, it caused a slight rapid increase.

In general, the active periods of *H. pruni* parasitoids (last week of April-May), should be considered in an Integrated Pest Management program against the aphid *H. pruni*, on apricot trees.

B- Predatory species

Data summarized in Table (2) represented the field observations of the most common predators recorded associated with *H. pruni* on apricot trees. Several predaceous species belonging to 4 orders and 5 families were recorded during the period from the last week of February to the third week of June, 2003 and from the last week of February to the last week of June, 2004. From the available literature,

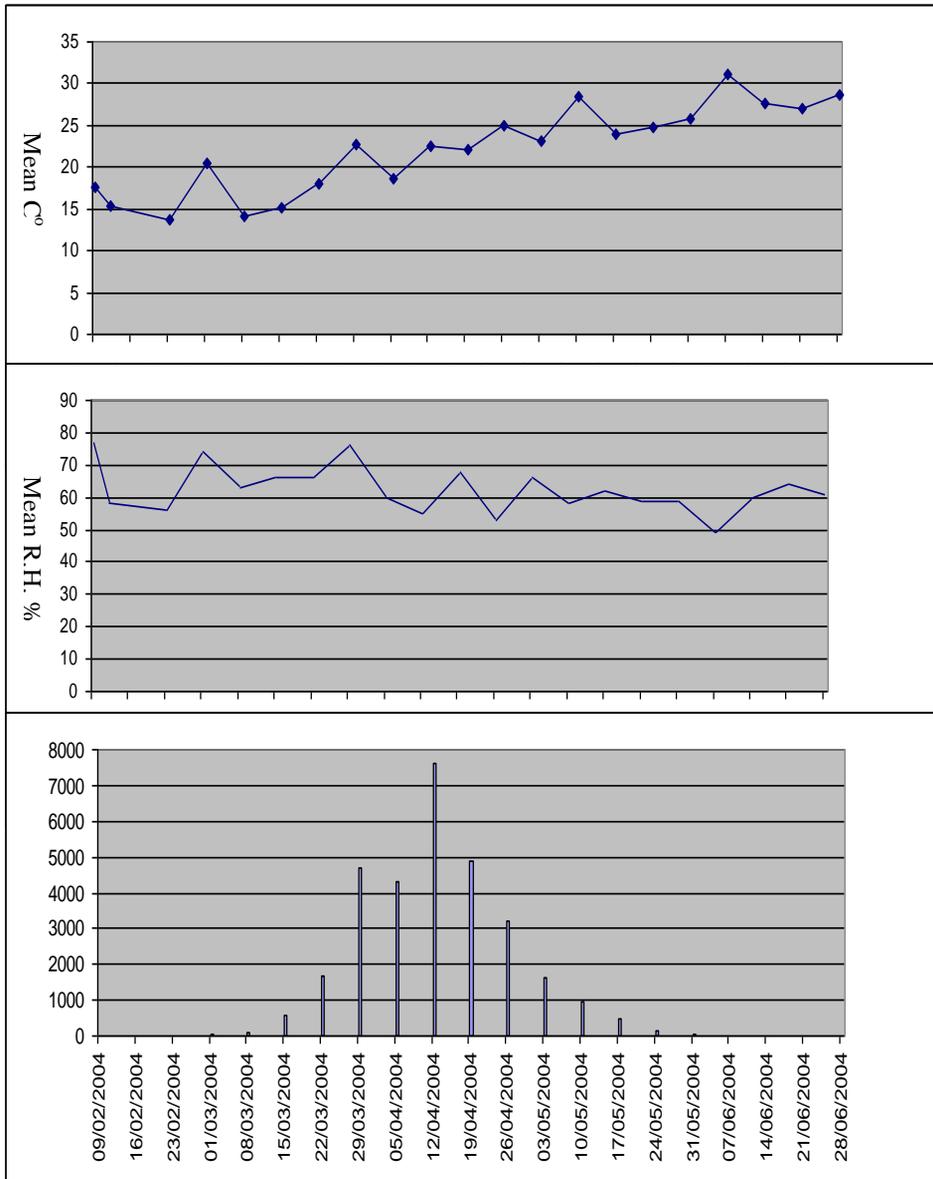


Fig. 2. Weekly total numbers of aphids recorded on apricot trees during season, 2004, at Qalubia Governorate

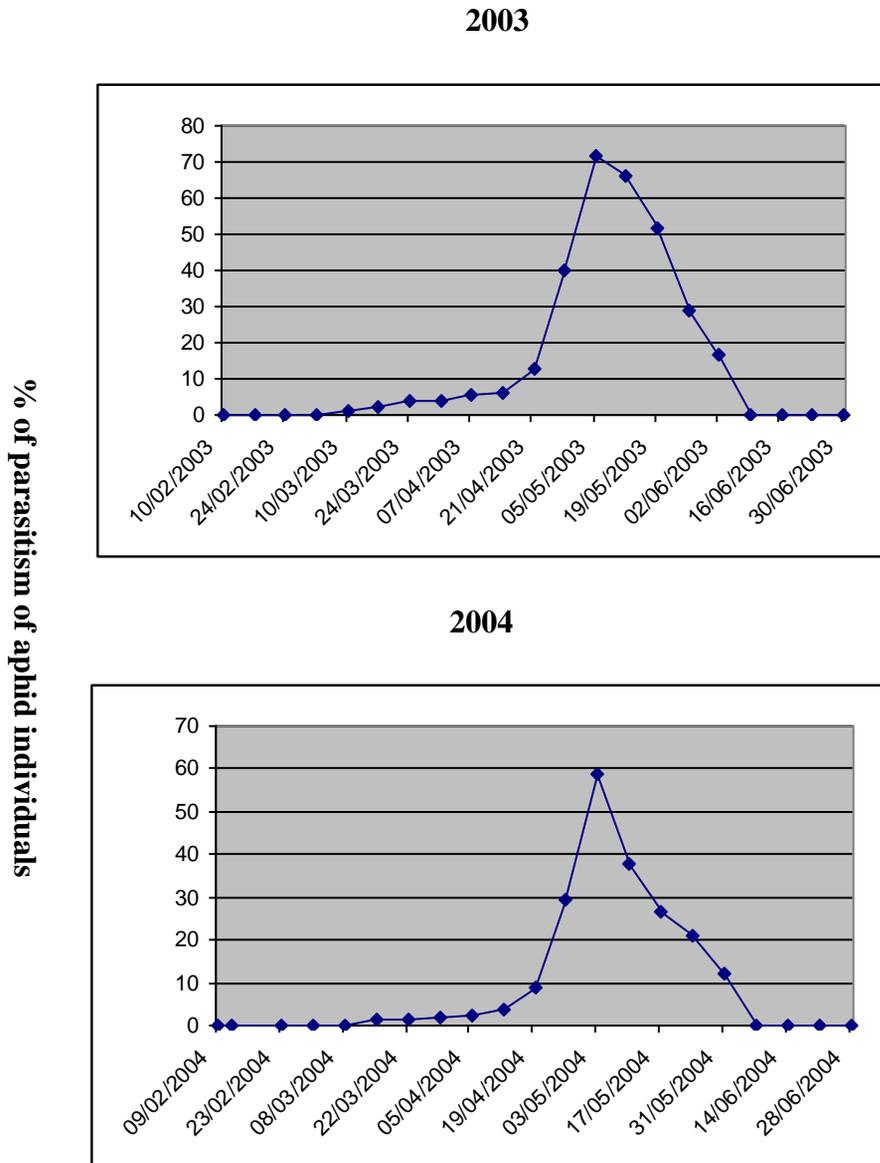


Fig. 3. Weekly percentages of parasitism of *H. pruni*, attacking apricot trees, during the two successive seasons, 2003 and 2004, at Qalubia Governorate

these predators were firstly recorded associated with *H. pruni* in the present study on apricot trees in Egypt. True spiders (unidentified species) were also found during this study. The recorded predatory species were: *Chrysoperla septempunctata* L. (Neuroptera: Chrysopidae), ladybird beetles (Coleoptera: Coccinellidae), *Scymnus* spp. (Coleoptera: Coccinellidae), *Orius* sp. (Hemiptera: Anthocoridae), *Syrphus* spp. (Diptera: Syrphidae) and *Phaenobremia* sp. (Diptera: Cecidomyiidae).

Numbers of these predatory species increased gradually to reach their peaks during April, 2003 and 2004, (146 and 581 individuals in both seasons, respectively). Then, their numbers declined towards the end of the two successive seasons.

However, eggs of the predator *Chrysoperla septempunctata* were the highest in their numbers on apricot trees (as the percentages of their occurrence were 52.83 and 73.01%, among all other recorded predatory species), in both seasons, respectively. This predator was detected during the period existed from March, 2003 to June, 2003 and from February to June, 2004, respectively. Also, the highest monthly total numbers were recorded during April, 2003 (97 individuals) and April, 2004 (422 individuals), respectively (Table, 2 and Fig., 4).

The egg stage as well as the larval and adult stages of the ladybird beetles (*Coccinella undecimpunctata* L. and *Cydonia vicina* (Mulsant)), appeared from April and continued up to June. Their percentages of occurrence to other predatory species were 5.90 and 5.18%, during, 2003 and 2004 seasons, respectively. The highest abundance occurred on May,

2003 (11 individuals) and April, 2004 (46 individuals).

Very few numbers of the predator *Orius* sp., (2 individuals) were recorded on apricot trees, during May of either 2003 or 2004 (2 individuals, respectively). While, the percentages of its occurrence among other predatory species were 0.23 and 0.18%, in both seasons, respectively (Table, 2 and Fig., 4).

However, the predator *Phaenobremia* sp. (adults), was recorded associated with *H. pruni* on apricot trees, during the periods; February-June in 2003 season and March- June, in 2004 season. Its percentages of occurrence among other predatory species were 14.25 and 2.68%, respectively. The highest monthly total numbers of this predator were found during March, 2003 (35 individuals) and March, 2004 (13 individuals), respectively.

Adults and larvae of the predators *Syrphus* spp. were found from April-May, 2003 and April-May, 2004. Their percentages of occurrence among other predatory species were 12.29 and 16.36, respectively. The maximum monthly abundance of these predators was recorded during April, 2003 (28 individuals) and April, 2004 (95 individuals) respectively.

Adults and larvae of *Scymnus* spp. were observed during the periods from April- June, 2003 and April-June, 2004. Their percentages of occurrence among other recorded species were 9.34 and 1.48%, in both seasons, respectively. The maximum monthly abundance of these species was found during June, 2003 (15 individuals) and April, 2004 (8 individuals) respectively.

The occurrence of unidentified species of true spiders were recorded during

Table 2. Monthly total numbers of predatory species recorded on apricot trees during the two successive seasons of 2003 and 2004, at Qalubia Governorate

Season 2003								
Month	predatory species							Total no,
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
February	0	0	0	0	0	1	0	1
March	0	0	12	2	0	35	0	49
April	4	12	97	2	0	3	28	146
May	11	11	75	6	1	13	22	139
June	9	15	31	11	0	6	0	72
Total/no. season	24	38	215	21	1	58	50	704
Mean / season	4.80 (0-11)	7.60 (0-15)	43.00 (0-97)	4.20 (0-11)	0.02 (0-1)	11.60 (0-35)	10.00 (0-28)	81.40 (0-28)
Season 2004								
Month	predatory species							Total no,
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
February	0	0	1	1	0	0	0	2
March	0	0	68	2	0	13	0	83
April	46	8	422	1	0	9	95	581
May	8	1	261	4	2	5	82	363
June	2	7	38	4	0	2	0	53
Total/no. season	56	16	790	12	2	29	177	1082
Mean / season	11.20 (0-46)	3.20 (0-8)	158.00 (1-422)	2.40 (1-4)	0.40 (0-2)	5.80 (0-13)	35.40 (0-45)	261.40 (2-581)

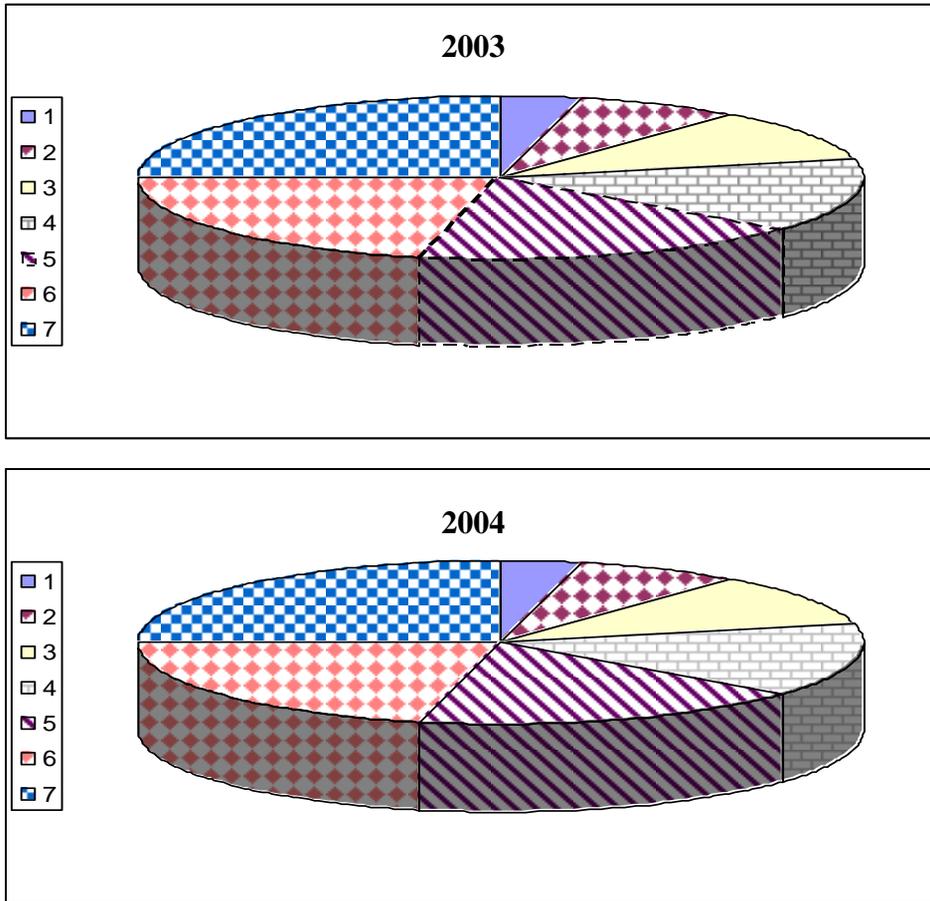


Fig. 4. Percentages of occurrence of predatory species to each others on apricot trees during the two successive seasons, 2003 and 2004, at Qalubia Governorate

- (1) Ladybird beetles
- (2) *Scymnus* spp.
- (3) *Chrysoperla septempunctata*
- (4) True spiders
- (5) *Orius* sp.
- (6) *Phaenobremia* sp.
- (7) *Syrphus* sp.

March-June, 2003 and February-June, 2004. Their percentages of occurrence among other predatory species were 5.16 and 1.11%, in both seasons, respectively. The maximum monthly abundance was recorded during June, 2003 (11 individuals) and May & June, 2004 (4 individuals), respectively.

From Tables (1 and 2), it could be mentioned that, occurrence of the predatory species was synchronized with that of the mealy plum aphid *H. pruni* recorded during this study. Also, the time and weather factors of the two successive seasons may affect the occurrence of these different predatory species. However, ladybird beetles, *Chrysoperla carnea*, syrphids, *Scymnus* spp. were found to attack aphids on wheat plants by many authors (**El-Heneidy et al**

1991; El-Heneidy, 1994; Hafez, 1994 and El-Heneidy and Abdel-Samad, 2001).

Moreover, the correlations recorded between aphid populations, percentages of aphid parasitism and predatory species and means of temperature and relative humidity were shown in Table (3).

Generally, it could be concluded from the results obtained in the two successive years of study that, the parasitoid *A. matricariae* and the predator *C. septempunctata* play an active natural role against *H. pruni* on apricot trees. Therefore, they could be mass reared and released against this mealy plum aphid during the critical period of pest infestation. Also, their natural role must be extensively encouraged when planning IPM programs against the pest.

Table 3. Correlation between aphid, predatory species and percentages of *H. pruni* parasitism in relation to means of temperature and relative humidity, during the two successive seasons, 2003 and 2004, at Qalubia Governorate

Tested factors	2003		2004	
	r-value	Equation of correlation	r-value	Equation of correlation
Aphid x mean temperature	0.3908	$Y = 13188 - 444.7918X$	0.0658	$Y = 8332.30 - 103.1678X$
Aphid x mean relative humidity	0.6813	$Y = -18381 + 396.3372X$	0.1428	$Y = 23208 - 275.4477X$
Predators x mean temperature	0.3986	$Y = -26.85 + 5.3718X$	0.1508	$Y = 100.06 + 6.4323X$
Predators x mean relative humidity	0.8058	$Y = -220.9 + 5.5500X$	0.4532	$Y = 1719.5 - 23.7725X$
% aphid parasitism X mean temperature	0.4587	$Y = -32.84 + 2.2568X$	0.3600	$Y = -11.39 + 0.9113X$
% aphid parasitism X mean relative humidity	0.2951	$Y = -25.89 + 0.7419X$	0.3112	$Y = 68.811 - 0.9689X$

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الأعداء الطبيعية المصاحبة لمن البرقوق الدقيقي، على أشجار المشمش في محافظة القليوبية

[34]

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Lysiphylbus و *Aphidius matricariae* Hal. sp. (وهي طفيليات أولية). وكذلك النوعين من الطفيليات *Alloxysta* spp. (وهي طفيليات ثانوية) . وقد ارتبطت بتواجدها بتواجد المن السابق، حيث تواجدت هذه الطفيليات خلال ثلاثة أشهر تقريباً لكل موسم، وسجل أعلى تعداد بالنسبة للطفيل الأول بالمقارنة بباقي أنواع الطفيليات الأخرى.

بلغ التعداد الكلي لمجاميع المفترسات المصاحبة للمن 407 و 1082 فرداً، في حالة موسمي الدراسة ، على التوالي ، وقد بلغ أعلى تعداد شهري لتلك المفترسات 146 فرداً خلال شهر ابريل 2003 و 581 فرداً خلال شهر أبريل 2004 للموسمين على التوالي. وقد ر أعلى تعداد للمفترسات في حالة المفترس *Chrysoperla septempunctata* (حيث بلغت نسبة التواجد للمفترس بالمقارنة بباقي أنواع المفترسات الأخرى المسجلة 52.83 و 73.01 % للموسمين على التوالي).

وعموماً فإنه يمكن تربية الطفيل A. *matricariae* والمفترس *C. septempunctata*

أجرى هذا العمل بغرض دراسة التعداد الموسمي لمن البرقوق الدقيقي (*Hyalopterus pruni* Geoff.) على أشجار المشمش خلال الموسمين المتتاليين 2003 و 2004 في محافظة القليوبية . كذلك اشتمل الحصر على تسجيل الطفيليات والمفترسات المصاحبة للأفة المذكورة.

أظهرت النتائج أن تواجد المن على أشجار المشمش استمر لمدة خمسة أشهر من العام وذلك في الفترة الممتدة من فبراير حتى يونيو خلال كلا من موسمي الدراسة. كما كان أعلى متوسط شهري لتعداد للمن خلال الأسبوع الثاني من أبريل لكلا الموسمين 2003 و 2004 (حيث بلغ 1.78 و 2.83 فرداً / ورقة ، على التوالي) . ولم يسجل تواجد للمن خلال الفترة الممتدة من يولية حتى سبتمبر خلال كلا من موسمي الدراسة. سجلت خلال الدراسة أربعة أنواع من الطفيليات لأول مرة في مصر حسب المراجع المتاحة وهي كالآتي:

المشمش، مع استخدام الوسائل الأخرى
المتاحة والأمنه للمكافحة في إطار منظومة
برامج المكافحة المتكاملة للأفات، حفاظاً
للبيئة من التلوث.

معملياً والاطلاق الحقلى لمكافحة هذا النوع
من المن على أشجار

تحكيم: أ.د أحمد على جمعه

أ.د مصطفى سيد الدرورى