

MAIN INSECT PESTS OF MINT AND THEIR  
ASSOCIATED NATURAL ENEMIES  
AT HEHIA DISTRICT, SHARKIA  
GOVERNORATE

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**ABSTRACT :** Studies on the insect pests attacking mint plants and their natural enemies were carried out at Hehia district, Sharkia Governorate during two successive seasons of 2000-2001 and 2001-2002. The obtained results are summarized as follow :

1. Twenty insect species belonging to ten families and six orders were recorded as pests. The most dominant species were *Bemisia tabaci* (Genn.), *Empoasca lybica* (de Berg), *Empoasca decipiens* (Paoli), *Nysius cymoides* Spin., *Cicadulina chinai* (Ghauri), *Creontiades pallidus* Rb. *Aphis gossypii* Glover, *Thrips tabaci* Lind. and *Myzus persicae* (Sülzer), showing general relative densities of 19.55, 19.35, 18.13, 17.16, 6.51, 6.41, 4.60, 1.93 and 1.24 of the total number of recorded insects, respectively.
2. The main period of *B. tabaci* activity was recorded from August till January in both seasons, with the highest means of infestation, 90.40 and 68.60% during October in the first and second seasons, respectively. *E. lybica* had two peaks in the season, with the highest one during May. *E. decipiens* showed two peaks in the season, with the highest one during October.
3. The highest record of *C. chinai* was observed during June and July in the first and second seasons, respectively. The population of *N. cymoides* indicated the highest value during June in the first season and during July in the second one. The highest mean number of *C. pallidus* sample was noticed during July in both seasons. *A. gossypii* showed three peaks in the season, with the highest one on 13<sup>th</sup> March and 20<sup>th</sup> March in the two respective

seasons. *M. persicae* population indicated the highest counts on 20<sup>th</sup> March and 25<sup>th</sup> March in the first and second seasons, respectively.

4. Eleven predaceous species belonging to six families and five orders were surveyed. Hemipterous species, *Orius albidipennis* (Reut.) and *Orius laevigatus* Fieb. ranked the first category, represented 98.78% of the total number of predators. They followed by coleopterous and neuropterous ones, which comprised 0.66 and 0.29%, respectively.
5. The highest populations of *Orius* spp. occurred during June in both seasons, with means of 17166.50 and 5099.50 individuals/sample in the first and second seasons, respectively. *Orius* spp. showed general means of 1787.63 and 594.61 individuals/sample in the two successive seasons.
6. The primary parasitoid, *Diaeretiella rapae* (M'Intosh) parasitized *A. gossypii* and *M. persicae* individuals. The main period of *D. rapae* activity was found from late February till the first week of April. Parasitism showed highest values of 22.54% on 27<sup>th</sup> March in the first season and 19.21% on 25<sup>th</sup> March in the second one. The mean percentage of parasitism was 11.09% in the first season and 9.37% in the second one.

**Key words :** Mint, insect pests, predators, parasitoids.

## INTRODUCTION

During the last few years, cultivation of the medicinal and aromatic plants in Egypt has noticeably increased due to their relative economic value as compared with other field and horticultural crops. The mass cultivation of these plants made them a target of several pests, which may cause damage and

yield loss. Mint, *Mentha viridis* L. is a perennial crop grown primarily for its oil, which is used as a flavoring in dental products and other confectionery and pharmaceutical products. Because mint stay all round the year in the field, that makes it a target for many insect pests, especially the sap sucking insects belonging to order Homoptera, which may reduce its yield.

In Egypt, the available literature revealed that there is a little known about the insect pests infesting mint plants (Mesbah *et al.*, 1983; Ali, 1988; Ramadan, 1988; El-Nabi *et al.*, 1996 and Afsah, 2005).

The present work was conducted to contribute a better knowledge about the following objectives :

1. Surveying the insect pests infesting mint plants and their associated predators, as well as estimating their relative densities.
2. Seasonal abundance of the main insect pests in relation with prevailing temperatures and relative humidities.
3. Seasonal abundance of the predominant natural enemies in relation with prevailing temperatures and relative humidities.

## MATERIALS AND METHODS

Field experiment was conducted at Hehia district, Sharkia Governorate. An area of about 800 m<sup>2</sup> was prepared and divided into suitable plots for growing mint. Mint, *Mentha viridis* L. rhizomes was transplanted on 17<sup>th</sup> June 2000. The area received normal agricultural practices and was not

subjected to any chemical control application during the period of investigation.

Two sampling techniques were used, namely plant samples and sweeping net. The experimental area was divided into four replicates (each about 200 m<sup>2</sup>). Samples of 25 leaves were weekly collected at random from each replicate, starting from the beginning of August 2000 till the end of July 2002. The samples were placed in polyethylene bags and transferred to the laboratory, where they were carefully examined using a binocular microscope. The stages of insect species associated with samples were counted and recorded. Unknown immature stages of the predators were reared individually till adult emergence.

The sweeping net used was 30cm in diameter and 60 cm in depth. Each weekly consisted of 100 double strokes. Every 50 double strokes were taken by walking diagonally across the experimental area from one corner to the opposite one. The catches were killed using a jar containing calcium cyanide. Samples were examined in the laboratory by the aid of binocular microscope and the number of each insect species were recorded.

In the present work, the parasitism of the aphids, *Aphis gossypii* Glover and *Myzus persicae* (Sülzer) was considered. Mummified individuals of the aphids were transferred gently from the plant leaves, using a fine brush, to test tubes (15 x 1 cm), covered with pieces of cotton wool and were kept till emergence of the parasitoids. Adults and nymphs of the aphids were reared on the plant leaves in glass jars until mummification of the parasitized individuals. Emerged adults of parasitoids and predators, were collected, counted and identified.

Prevailing temperatures and relative humidities were obtained from the Meteorological station in Zagazig.

## RESULTS AND DISCUSSION

### Survey and Relative Densities of Insect Pests

Twenty insect species belonging to ten families and six orders were recorded (Table 1). The most dominant species were *Bemisia tabaci* (Genn.), *Empoasca lybica* (de Berg), *Empoasca decipiens* (Paoli), *Nysius cymoides* Spin., *Cicadulina chinai* (Ghauri), *Creontiades pallidus* Rb., *Aphis gossypii* Glover, *Thrips tabaci*

Lind. and *Myzus persicae* (Sülzer), constituting 24.51, 23.25, 20.24, 8.81, 7.71, 4.10, 3.40, 2.03 and 1.39%, respectively of the total number of pests in the first season (2000-2001). The relative densities of the previously mentioned pests in the second season (2001-2002) were 11.88, 13.31, 14.90, 30.08, 4.66, 9.97, 6.45, 1.77 and 1.00%, successively. The general relative densities of *B. tabaci*, *E. lybica*, *E. decipiens*, *N. cymoides*, *C. chinai*, *C. pallidus*, *A. gossypii*, *T. tabaci* and *M. persicae* during the two seasons of study were 19.55, 19.35, 18.13, 17.16, 6.51, 6.41, 4.60, 1.93 and 1.24%, respectively.

Moreover, plant samples proved to be the effective method for estimation of *B. tabaci* and aphid species, while sweeping net was effective for collecting cicadellids, hemipterous species and *T. tabaci*.

The obtained results are in agreement with the findings of the following investigators: El-Nahal *et al.* (1977) who used sweeping net for estimating the population density of leafhoppers, planthoppers and froghoppers on field and vegetable crops, Mesbah *et. al* (1983) in Alexandria, Egypt, who recorded *B. tabaci* and *A. gossypii* as pests of peppermint, Ali (1988) who mentioned that *Nysius graminicola* (Kolenati), *E.*

*decipiens*, *Cicadulina bipunctella* Zeae China and *S. littoralis* infest *Mentha viridis* in Assiut and the New Valley Governorates. Ramadan (1988) in Egypt, who reported that *Nezara viridula* L., *T. tabaci* and *S. littoralis* as pests of *M. viridis*. El-Nabi *et al.* (1996) in Egypt, who indicated that *M. avividis* (= ? *M. viridis*) and *M. piperita* were attacked by *B. tabaci*, cicadellids, *S. littoralis* and *A. gossypii*. *B. tabaci* and cicadellids were the most dominant pests on each of the two mint species. Gocemen and Dervan (2002) in Turkey, who mentioned that *Bemisia tabaci* infests peppermint. Afsah (2005) who recorded *A. gossypii*, *M. persicae*, *B. tabaci*, *E. lybica* and *T. tabaci* as pests of peppermint and spearmint plants in Gharbia Governorate, Egypt. Hammad and Mohsen (2000) and Hammad (2006) mentioned that the plant samples proved to be the best technique for estimating the density of aphid species and *B. tabaci*, while sweeping net was effective for collecting cicadellids, hemipterous species and *T. tabaci*.

Different species were recorded in other countries as follow: Sagar and Reddy (1987) indicated that *Syngamia abruptalis* Walker infests Japanese mint, *M. arvensis* in India. Sagar (1988) reported that *H. armigera* and *Thysanoplusia*

*orichalcea* (Fab.) infest *M. arvensis* in India. Sagar (1989a and b) recorded *Aphis affinis* del Guercio and *Diacrisia obliqua* Walker as pests of Japanese mint in India. Ramji and Sagar (1990) mentioned that *T. orichalcea* infests different species/ cultivars of mint in India. Sagar and Ramji (1991) in India, concluded that *T. arichalcea* is a pest of 25 host plants including mint. Singh and Bali (1993) in India, reported that *A. affinis* and *M. persicae* infest Japanese mint. Mareggian and Bachur (1998) mentioned that the wooly aphid, *Kaltenbachiella pallida* (Pemphiginae: Eriosomatini) infests mint, *Mentha* spp., in Argentina. Khamraev (1999) recorded *Lygus* spp. as pests of mint, *Mentha* sp., in Uzbekistan. Kattimani and Patil (2000) reported that *Spodoptera litura* is a pest of mint, *M. arvensis* in India. Boll and Geria (2002) in France, showed that the major pests of mint are aphids, mites and leafminers.

### Seasonal Abundance of the Main Insect Pests

#### *Bemisia tabaci* (Genn.)

The seasonal abundance of *B. tabaci* on mint leaves was estimated considering the percentages of infestation and numbers of insect stages (nymphs and pupae)/ sample (Table 2).

Table 1. Total numbers of insect pests recorded on mint plants, using plant samples and sweeping net, during 2000-2001 and 2001 – 2002 growing seasons.

Insect species	2000 – 2001				2001 – 2002				General	
	P.S.	S.N.	Total number	%	P.S.	S.N.	Total number	%	Total number	%
<b>Homoptera</b>										
<b>Cicadellidae</b>										
<i>Empoasca lybica</i> (de Berg.)	448	19386	19834	23.25	377	6966	7343	13.31	27177	19.35
<i>Empoasca decipiens</i> (Paoli)	473	16786	17259	20.24	256	7951	8207	14.90	25466	18.13
<i>Cicadulina chinai</i> (Ghauri)	147	6430	6577	7.71	85	2487	2572	4.66	9149	6.51
<i>Empoasca decedens</i> (Paoli)	77	1100	1177	1.38	49	519	568	1.03	1745	1.24
<i>Balclutha hortensis</i> Lindb.	56	916	972	1.14	23	393	416	0.75	1388	0.99
<i>Neolimnus aegyptiacus</i> (Mast.)	21	315	336	0.39	7	26	33	0.06	369	0.26
<i>Nephotettix apicalis</i> (Mast.)	8	151	159	0.19	5	13	18	0.03	177	0.13
<b>Aleyrodidae</b>										
<i>Bemisia tabaci</i> (Genn.)	14566	6340	20906	24.51	3324	3231	6555	11.88	27461	19.55
<b>Aphididae</b>										
<i>Aphis gossypii</i> Glover	1896	1005	2901	3.40	2279	1280	3559	6.45	6460	4.60
<i>Myzus persicae</i> (Sülzer)	728	456	1184	1.39	378	173	551	1.00	1735	1.24
<b>Hemiptera</b>										
<b>Lygaeidae</b>										
<i>Nysius cymoides</i> Spin.	192	7321	7513	8.81	357	16236	16593	30.08	24106	17.16

Table 1. Contd.

Insect species	2000 – 2001				2001 – 2002				General	
	P.S.	S.N.	Total number	%	P.S.	S.N.	Total number	%	Total number	%
<b>Miridae</b>										
<i>Creontiades pallidus</i> Rb.	105	3388	3493	4.10	118	5384	5502	9.97	8995	6.41
<b>Pentatomidae</b>										
<i>Nezara viridula</i> L.	17	614	631	0.74	24	641	665	1.20	1296	0.92
<b>Thysanoptera</b>										
<b>Thripidae</b>										
<i>Thrips tabaci</i> Lind.	73	1663	1736	2.03	63	913	976	1.77	2712	1.93
<b>Lepidoptera</b>										
<b>Noctuidae</b>										
<i>Spodoptera littoralis</i> Boisd.	51	113	164	0.19	229	965	1194	2.16	1358	0.97
<i>Heliothis armigera</i> (Hb.)	17	22	39	0.05	14	28	42	0.08	81	0.06
<b>Orthoptera</b>										
<b>Acrididae</b>										
<i>Anacridium aegyptium</i> L.	0	8	8	0.01	0	11	11	0.02	19	0.01
<i>Locusta migratoria danica</i> L.	0	16	16	0.02	0	53	53	0.10	69	0.05
<i>Euprepocnemis plorans</i> Charp.	0	17	17	0.02	0	12	12	0.02	29	0.02
<b>Collembola</b>										
<b>Entomobryidae</b>										
<i>Lepidocertinus incertus</i> Hand.	85	279	364	0.43	72	218	290	0.53	654	0.47
<b>General total</b>	<b>18960</b>	<b>66326</b>	<b>85286</b>	<b>100.00</b>	<b>7660</b>	<b>47500</b>	<b>55160</b>	<b>100.00</b>	<b>140446</b>	<b>100.00</b>

P.S. = Plant samples

S.N. = Sweeping net

### Infestation percentages

Data in Table 2 reveal that the main period of *B. tabaci* activity was recorded from August till January during the two successive seasons, 2000-2001 and 2001-2002. October was the preferable month, whereas the mean of infestations were 90.40 and 68.60% in the two years of investigation.

Also, the mean infestation during February, March and from May till July were relatively low. The general mean percentage of infestation in the first season (29.82%) was relatively higher as compared with that in the second one (22.48%).

These results disagree with those of Mesbah *et al.* (1983) who mentioned that the highest infestation of peppermint with *B. tabaci* was recorded on June, then distinctly decreased during July, August and September. The obtained results, however agree with the findings of the following workers : Ahmed (1990) who reported that *B. tabaci* population on Roselle plants gave its highest level in the first half of September and the second half of October. Hammad and Mohsen (2000) who reported that the infestation of roselle plants by *B. tabaci* attained

its highest peak during October. On the other hand, El-Dash (2001) indicated that the infestation of vegetable crops by immature stages of *B. tabaci* varied according to the season and plant species, and it reached 85.3, 88.1, 80.2, 21.6 and 12.5% on potato, tomato, cabbage, bean and pea plants, respectively.

### Number of insect stages per sample

As shown in Table 2 in the first season, the mean numbers of *B. tabaci* / sample was obviously high during the period from August till December 2000, with the highest value, 1391.20 insects / sample, during October at means of 28.7°C and 63.6% RH.

Similar observations were recorded in the second season (Table 2), whereas there was a coincidence between the high percentages of infestation and high mean numbers of insects/sample. The highest mean numbers of the pest / sample (294 individuals) was obtained during October at means of 25.4°C and 59.6% RH. The general mean numbers of the insect / sample in the first season (271.80) was obviously higher as compared with that in the second one (60.71).



Table 2. Seasonal abundance of *Bemisia tabaci* (Genn.), larvae and pupae, on mint plants during 2000-2001 and 2001 – 2002 growing seasons

Months	2000-2001				Months	2001-2002			
	Mean of % infestation	Mean number of insect /sample	Corresponding means of			Mean of % infestation	Mean number of insect / sample	Corresponding means of	
			Temp.°C	RH%				Temp.°C	RH%
Aug. , 2000	36.60	84.00	32.4	66.0	Aug., 2001	18.00	29.50	35.9	63.0
Sep.	80.00	1035.00	31.3	63.0	Sep.	67.50	219.25	28.9	62.2
Oct.	90.40	1391.20	28.7	63.6	Oct.	68.60	294.00	25.4	59.6
Nov.	69.25	558.50	24.6	60.0	Nov.	42.00	93.50	20.4	59.3
Dec.	45.75	140.50	20.8	63.0	Dec.	20.40	26.00	17.0	58.6
Jan., 2001	21.20	31.40	19.3	63.6	Jan., 2002	12.25	14.75	16.8	64.0
Feb.	8.50	13.25	20.1	60.8	Feb.	1.50	0.75	16.2	60.9
Mar.	0.00	0.00	24.1	60.1	Mar.	1.00	1.00	18.0	59.1
Apr.	2.20	2.80	19.2	55.0	Apr.	15.00	18.80	24.3	54.2
May	1.75	2.00	30.7	52.5	May	8.75	11.50	25.5	52.8
Jun.	0.25	0.50	29.3	55.2	Jun.	8.50	12.25	28.6	55.8
Jul.	2.20	2.40	27.8	63.7	Jul.	6.25	7.20	29.2	59.9
General mean	29.82	271.80			General mean	22.48	60.71		

These findings agree in a great part with those of the following authors: Hammad and Mohsen (2000) who indicated that the number of *B. tabaci* stages/sample of roselle plants reached its highest values in October and September during the two respective seasons. Afsah (2005) who mentioned that the highest peak of *B. tabaci* on peppermint in the first season, 561.0 immature stages / 20 leaves, was found on 20<sup>th</sup> September at means of 28.4°C and 59.2% RH. The lowest one, 2.7 immatures / 20 leaves, Occurred on 3<sup>rd</sup> April at means of 19.7°C and 50.5% RH. The highest peak in the second season, 2863.7 individuals / 20 leaves, was observed on 27<sup>th</sup> June at means of 25.3°C and 41.9% RH. On the other hand, the present results disagree with those of Salman *et al.* (2002) who indicated that the abundance of *B. tabaci* on soybean plants reached its peak during August and the population decreased to the lowest level in September. Sourial *et al.* (2002) reported that *B. tabaci* had one peak in the end of July, two peaks in late July and mid August, and one peak in the end of August on the first, second and third sowing dates of soybean, respectively.

#### **Cicadellids and hemipterous species**

As sweeping net was effective for collecting cicadellids and

hemipterous species, the seasonal abundance of these species are based on the records of the sweeping net technique.

#### ***Empoasca lybica* (de Berg)**

In the first season, data represented in Fig. 1 reveal that *E. lybica* infests mint plants all-round the season. Its population was fluctuated, showing two peaks. The first one, 817.00 insects/sample, was observed during December at means of 20.8°C and 63.0% RH. The second peak was higher than that in the first one and it was represented by 1118.80 individuals / sample, occurred during May at means of 30.7°C and 52.5% RH.

Data of the second season (Fig. 2) indicate similar trend, whereas two peaks were recorded. They were during December and May, with mean numbers of 379.75 and 410.50 insects at the mean temperature of 17.0 and 25.5°C, and 58.6 and 52.8% RH, respectively.

In this respect, different findings were mentioned by several workers owing to the host plant and location as follow: Hegab *et al.* (1989) indicated that *E. lybica* had two peaks, in mid July and mid September, on

eggplants summer plantation at Salhia district, Sharkia Governorate. Afsah (2005) stated that the peak of *E. lybica* on peppermint took place in November.

#### ***Empoasca decipiens* (Paoli)**

Data illustrated in Fig. 1 indicate that in the first season, this species was recorded all-round the season except during February 2001. *E. decipiens* population showing two peaks. The first one was the highest, with a mean of 1277.00 individuals / sample, occurred during October at means of 28.7°C and 63.6% RH. The second peak, 357 insects/sample, was obviously lower as compared with the first one, and it was observed during May 2001 at means of 30.7°C and 52.5% RH.

In the second season (Fig. 2), the pest population show similar trend, whereas two peaks were recorded. The first and highest one was during October, with a mean of 558.20 insects/sample at means of 25.4°C and 59.6% RH. The second peak, 474.75 individuals/sample, occurred during May at means of 25.5°C and 52.8% RH.

Ammar *et al.* (1977) mentioned that the two main peaks of *E. decipiens* on vegetable crops were

in May and October. Mesbah *et al.* (1983b) reported that 58% of the total counts of leafhoppers including *E. decipiens* on roselle plants were recorded in October. Hegab *et al.* (1989) stated that this species had two peaks, in mid July and the beginning of October, on summer plantations of tomato, eggplant and pepper. El-Sharkawy (2002) indicated that *E. decipiens* had three peaks on cabbage and cauliflower plants in the end of October, mid December and mid March.

#### ***Cicadulina chinai* (Ghauri)**

As shown from obtained data (Fig. 1), in the first season *C. chinai* infests mint plants all-round the season with the exception of January, February and March 2001. June, July and September were characterized by high populations, with the highest one, 533.50 insects / sample, during June at means of 29.3°C and 55.2% RH.

Data of the second season (Fig. 2), reveal that approximately no infestation was recorded during the period from December 2001 till May 2002. The highest record, 255 insects / sample, was obtained during July at means of 29.2°C and 59.9% RH.

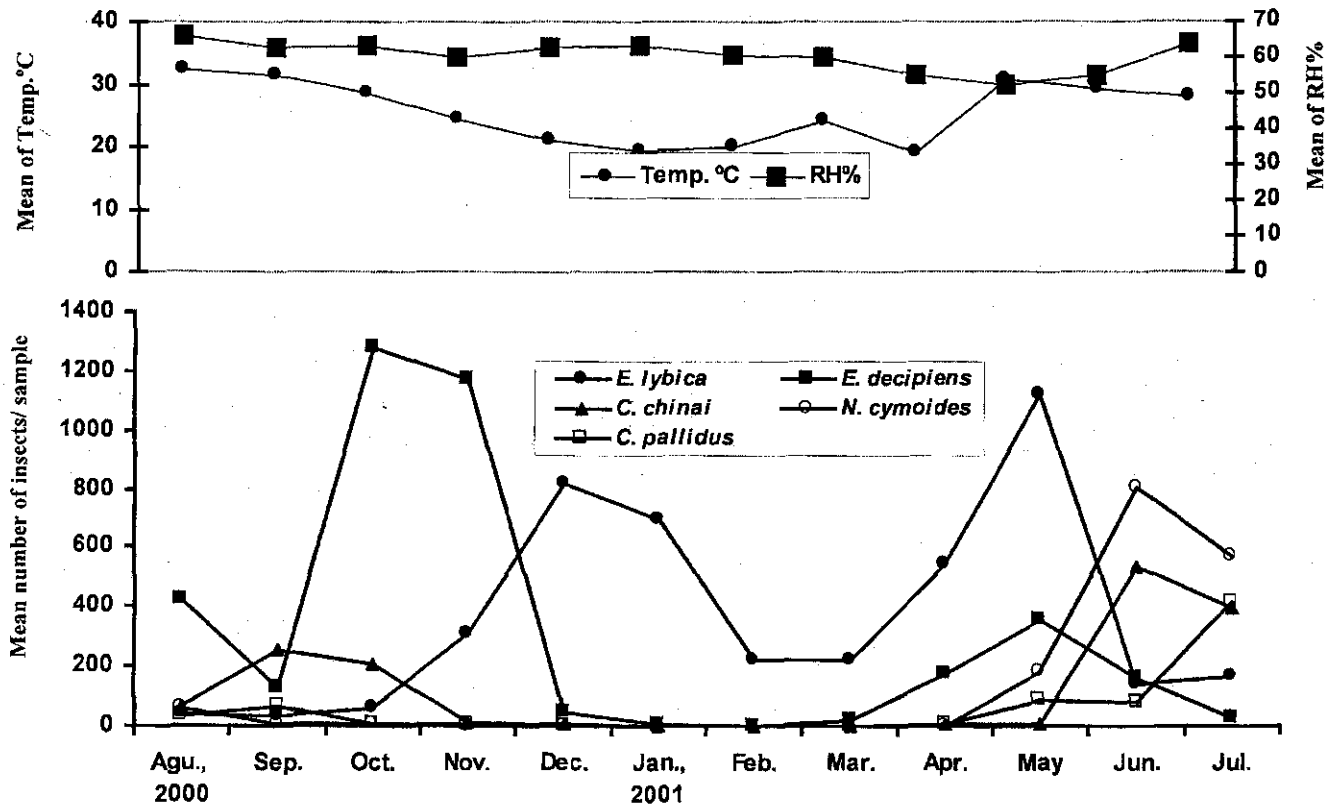


Fig. 1. Seasonal abundance of *Empoasca lybica* (de Berg), *Empoasca decipiens* (Paoli), *Cicadulina chinai* (Ghauri), *Nysius cymoides* Spin. and *Creontiades pallidus* Rb. on mint plants using sweeping net during 2000-2001 growing season

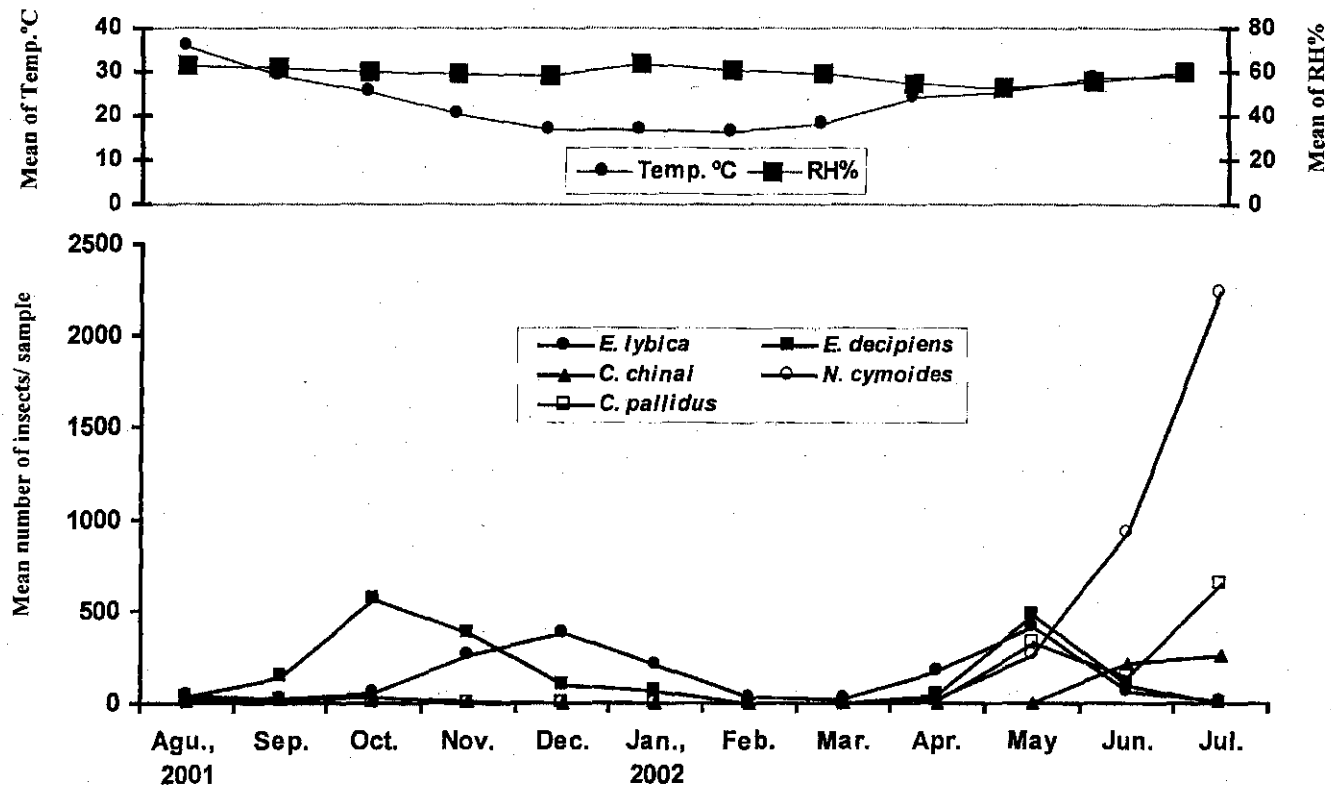


Fig. 2. Seasonal abundance of *Empoasca lybica* (de Berg), *Empoasca decipiens* (Paoli), *Cicadulina chinai* (Ghauri), *Nysius cymoides* Spin. and *Creontiades pallidus* Rb. on mint plants using sweeping net during 2001-2002 growing season

Different results were obtained on several host plants as follow. Hegab *et al.* (1987) mentioned that the adults of *C. chinai* had three main peaks in mid June, mid August and in the beginning of October. According to Hegab *et al.* (1988), the adults of this species showed four main peaks in stone fruit orchards, in May, July, September and late October to the beginning of November.

#### *Nysius cymoides* Spin.

Data illustrated in Fig. 1 show that the main period of *N. cymoides* activity in the first season was during August 2000, May, June and July 2001. The highest population was recorded during June, with a mean of 803.00 insects/sample at means of 29.3°C and 55.2% RH.

Similar observations nearly were recorded in the second season (Fig. 2), whereas August 2001, April, May, June and July were characterized by high population. The highest mean number of this species, 2240.80 insects/sample, was obtained during July at means of 29.2°C and 59.9% RH.

#### *Creontiades pallidus* Rb.

In the first season, data given in Fig. 1 indicate that *C. pallidus* population was high during August, September 2000, May, June and July 2001. The highest

mean number, 413.60 individuals / sample, was recorded during July at means of 27.8°C and 63.7% RH.

Similar trend was observed in the second season (Fig. 2), whereas this species was active during August, September 2001 April, May, June and July 2002. The highest record, 651.60 insects/sample, was found during July at means of 29.2°C and 59.9% RH.

#### *Aphis gossypii* Glover

As evidently shown in Table 3 indicate that in the first season, *A. gossypii* infests mint plants from 1<sup>st</sup> August till 28<sup>th</sup> November 2000 and from 13<sup>th</sup> February till 24<sup>th</sup> April 2001. During these periods, the aphid population was fluctuated, showing three peaks. The first one, 167 aphids/sample, occurred on 29<sup>th</sup> August 2000 at means of 33.0°C and 64.8% RH. The second peak, 74 individuals /sample, took place on 28<sup>th</sup> November 2000 at means of 22.7°C and 59.4% RH. The third and highest one, 304 insects/sample, was recorded on 13<sup>th</sup> March 2001 at means of 22.5°C and 66.0% RH.

In the second season, data obtained in Table 3 show similar trend as in the first one. The infestation was recorded during the periods from 6<sup>th</sup> August till 12<sup>th</sup> November 2001, and from 25<sup>th</sup> February till 29<sup>th</sup> April 2002,

Table 3. Seasonal abundance of *Aphis gossypii* Glover and *Myzus persicae* (Sülzer) on mint plants during 2000-2001 and 2001 – 2002 growing seasons

2000-2001					2001-2002				
Date	Number of .../ sample (100 leaves)		Corresponding means of		Date	Number of .../ sample (100 leaves)		Corresponding means of	
	<i>Aphis gossypii</i> Glover	<i>Myzus persicae</i> (Sülzer)	Temp.°C	RH%		<i>Aphis gossypii</i> Glover	<i>Myzus persicae</i> (Sülzer)	Temp.°C	RH%
Aug., 1, 2000	7	0	34.1	61.5	Aug., 6, 2001	16	0	29.3	66.6
8	13	0	32.2	65.8	13	448	0	31.9	66.0
15	18	0	31.8	67.5	20	145	0	30.6	64.9
22	58	0	32.9	68.1	27	39	0	30.5	64.6
29	167	0	33.0	64.8	Sep., 3	22	0	30.2	64.4
Sep., 5	119	0	32.1	63.6	10	13	0	29.7	62.8
12	93	0	31.9	64.4	17	9	0	27.3	62.5
19	37	0	31.4	63.5	24	6	0	29.0	62.9
26	15	0	31.9	61.4	Oct., 1	0	0	28.8	62.3
Oct., 3	5	0	29.3	62.0	8	0	0	26.0	60.4
10	2	0	31.2	61.1	15	5	0	26.9	59.5
17	2	0	30.1	64.8	22	7	0	26.0	59.6
24	8	0	27.3	65.0	29	4	0	24.1	59.8
31	14	0	26.4	64.8	Nov., 5	8	0	20.7	56.6
Nov., 7	20	0	25.2	61.6	12	36	0	21.6	58.8
14	23	0	25.5	60.3	19	0	0	20.7	60.4
21	33	0	25.1	63.1	26	0	0	18.4	60.0
28	74	0	22.7	59.4	Feb., 25, 2002	11	36	16.6	53.6
Feb., 13, 2001	8	0	20.7	59.8	Mar., 4	129	50	15.8	61.3
20	76	16	18.9	60.6	11	154	61	21.7	64.4
27	111	36	20.0	57.1	18	652	50	17.0	59.4
Mar., 6	177	70	21.9	60.6	25	233	74	18.1	56.5
13	304	97	22.5	66.0	Apr., 1	212	57	16.1	54.6
20	176	347	22.6	65.5	8	86	35	26.0	60.4
27	131	113	24.7	55.5	15	22	10	26.9	49.8
Apr., 3	121	29	27.8	55.4	22	16	5	25.3	51.8
10	64	14	24.0	57.4	29	6	0	21.2	53.3
17	18	6	25.9	55.3					
24	2	0	29.1	52.5					
Total	1896	728			Total	2279	378		
Mean	65.38	80.89			Mean	99.9	42.00		

except the first eight days of October 2001. The aphid population showed three peaks. The first one, 448 individuals / sample, was recorded on 13<sup>th</sup> August 2001 at means of 31.9°C and 66.0% RH. The second and lowest peak, 36 aphids/ sample, took place on 12<sup>th</sup> November 2001 at means of 21.6°C and 58.8% RH. The third and highest one, 652 individuals/ sample, was obtained on 18<sup>th</sup> March 2002 at means of 17.0°C and 59.4% RH. Generally, the mean number of aphids/sample in the second season, 99.09, was higher comparatively with that in the first one (65.38).

These results are in disagreement with those of Mesbah *et al.* (1983) who mentioned that the population fluctuations of *A. gossypii* on peppermint followed a curve with one or two peaks, mostly occurring in June, July and August. The present results agree in a great part with the findings of the following workers. Aboul-Nasr *et al.* (1975) who stated that *A. gossypii* had two peaks of abundance on chrysanthemum during spring and autumn in Giza and Zohria gardens. Abou-Elhagag (1998) who mentioned that the maximum level of *A. gossypii* abundance on cotton was recorded during August. Hammad and Mohsen (2000) who reported that this aphid

attained its highest peaks on roselle in July and August during the two respective seasons. Sourial *et al.* (2002) who indicated that the highest peak of *A. gossypii* on three sowing dates of soybean was in mid August. Afsah (2005) who recorded two peaks for *A. gossypii* on peppermint, with the highest one on 2<sup>nd</sup> August.

#### *Myzus persicae* (Sülzer)

As obviously shown in Table 3, *M. persicae* in the first season infests mint plants from 20<sup>th</sup> February till 17<sup>th</sup> April 2001, with the highest count, 347 aphids/sample, on 20<sup>th</sup> March at means of 22.6°C and 65.5% RH.

In the second season (Table 3), the infestation started on 25<sup>th</sup> February and continued till 22<sup>nd</sup> April 2002. The highest population, 74 aphids / sample, was recorded on 25<sup>th</sup> March at means of 18.1°C and 56.5% RH. In general, the mean number of *M. persicae* / sample in the first season, 80.89, was clearly higher as compared with that in the second season (42.00).

Different findings were reported by several investigators owing to the host plant and location as follow. El-Zohairy *et al.* (1989) mentioned that *M. persicae* during winter plantation had two peaks on tomato plants, in mid November



and at the beginning of March, while only one peak was recorded in mid November on potato plants. Hammad (1998) indicated that this aphid had two peaks, during the first ten days of April and the second week of May, on peach trees. El-Kordy *et al.* (1999) reported that *M. persicae* on valerian (*Valerina officinalis*) plants reached its maximum number in the first week of January. El-Sharkawy (2002) recorded two peaks of abundance of *M. persicae* on cabbage plants, in mid November and at the end of February. Hammad (2006) stated that this aphids had 2-3 peaks on chamomile, with the highest ones on 8<sup>th</sup> March and 24<sup>th</sup> February during the two respective seasons.

#### Survey and Relative Densities of Predatory Insects

Data presented in Table 4, show that eleven predaceous species belonging to 6 families and five orders were recorded. The orders could be arranged descendingly according to general relative densities as follow : Hemiptera (98.78%), Coleoptera (0.66%), Neuroptera (0.29%), Diptera (0.22%) and Dictyoptera (0.05%). Hemipterous species were *Orius* spp., *Orius albidipennis* (Reut.) and *Orius laevigatus* Fieb. (Anthocoridae). Coleopterous ones included *Scymnus interruptus*

Goeze, *Coccinella undecimpunctata* L., *Cydonia vicina isis* Cr., *Cydonia vicina nilotica* Muls. (Coccinellidae) and *Paederus alfieri* (Koch.) (Staphylinidae). Dipterous species were *Metasyrphus* (= *Syrphus*) *corollae* (Fabr.) and *Xanthogramma aegyptium* Wied. (Syrphidae). Both of Neuroptera and Dictyoptera was represented only by one species, viz. *Chrysoperla carnea* (Steph.) (Chrysopidae) and *Mantis religiosa* L. (Mantidae), respectively.

Moreover, sweeping net technique proved to be effective method for collecting adults of all previously mentioned predators.

These results agreed with the findings of the following investigators. Ali (1988) who recorded *O. albidipennis*, *C. undecimpunctata* and *Scymnus syriacus* Mars. as predators associated with insects pests on *M. viridis* plants in Assiut and the New Valley Governorates. Ramadan (1988) mentioned that *P. alfieri* and *C. undecimpunctata* were predatory insects on *M. viridis* plants. Hammad and Mohsen (2000) who recorded *C. undecimpunctata*, *S. interruptus*, *O. albidipennis*, *O. laevigatus*, *C. vicina nilotica*, *P. alfieri*, *M. corollae*, *X. aegyptium*, *C. carnea*

Table 4. Survey and relative densities of insect predators on mint plants during 2000-2001 and 2001- 2002 growing seasons.

Order	Family	Species	Recorded stage	Number of insect stages								General	
				2000-2001				2001-2002				Total number	%
				P.S.	S.N.	Total number	%	P.S.	S.N.	Total number	%	Total number	%
Hemiptera	Anthoridae	<i>Orius</i> spp. ( <i>Orius albidipennis</i> (Reut.) & <i>Orius laevigatus</i> Fieb.)	A. & N.	427	90087	90514	98.90	148	29599	29747	98.41	120261	98.78
	Total											120261	
	%											98.78	
Coleoptera	Coccinellidae	<i>Scymnus interruptus</i> Goeze <i>Coccinella undecimpunctata</i> L. <i>Cydonia vicina isis</i> Cr. <i>Cydonia vicina nilotica</i> Muls.	A. & L. A.,P.& L. A. A.	11 5 0 0	284 20 7 4	295 25 7 4	0.32 0.03 0.01 0.01	5 4 0 0	68 19 11 6	73 23 11 6	0.24 0.08 0.04 0.02	368 48 18 10	0.30 0.04 0.01 0.01
	Staphylinidae	<i>Paederus alferii</i> (Koch.)	A.	5	224	229	0.25	3	130	133	0.44	362	0.30
	Total											806	
	%											0.66	
Diptera	Syrphidae	<i>Metasyrphus</i> (=Syrphus) <i>corollae</i> (Fabr.) <i>Xanthogramma aegyptium</i> Wied.	A.,P.& L. A.,P.& L.	15 9	96 37	111 46	0.12 0.05	13 5	65 22	78 27	0.26 0.09	189 73	0.16 0.06
	Total											262	
	%											0.22	
Neuroptera	Chrysopidae	<i>Chrysoperla carnea</i> (Steph.)	A.,L.& E	46	220	266	0.29	21	66	87	0.29	353	0.29
	Total											353	
	%											0.29	
Dictyoptera	Mantidae	<i>Mantis religiosa</i> L.	A.	0	18	18	0.02	0	41	41	0.13	59	0.05
	Total											59	
	%											0.05	
General	Total											121741	100.00
				518	90997	91515	100.00	199	30027	30226	100.00	121741	100.00
		P.S. = Plant samples	S. N. Sweeping net	A. = Adults	P. = Pupae	L.= Larvae	E.=Eggs					N. = Nymphs	

as predatory insects on roselle plants, whereas the main insect pests are the same as on mint plants. Also, Hammad (2006) recorded *M. corollae*, *X. aegyptium*, *O. laevigatus*, *O. albidipennis*, *C. undecimpunctata*, *S. interruptus*, *C. vicina nilotica*, *C. vicina isis* and *C. carnea* as predatory insects on chamomile plants, whereas the main insect pests were *M. persicae*, *A. gossypii* and *Thrips tabaci*.

#### Seasonal abundance of *Orius* spp.

As shown from the obtained data in Table 5, *Orius* spp. were recorded all round the first season, with the exception of February 2001. The main period of the activity was from May till July 2001. The highest counts, 17166.50 individuals / sample, was observed during June at means of 29.3°C and 55.2% RH.

Similar trend was observed in the second season (Table 5), whereas these species occurred all round the season, except during January and February 2002. Also, as in the first season May, June and July 2002 were characterized by high populations.

The highest population, 5099.50 individuals, was appeared during June 2002 at means of 28.6°C and 55.8% RH. The general mean

number of *Orius* spp. was obviously higher in the first season, 1787.63, as compared with that in the second one, 594.61.

The present results are in agreement with the findings of the following workers. El-Heneidy *et al.* (1978-79) who mentioned that nymphs and adults of *Orius* spp. in clover and cotton field peaked on 9<sup>th</sup> June and 30<sup>th</sup> June, respectively. Ahmed (1990) recorded two marked peaks, during the second half of August and October, on roselle plants. Salem *et al.* (1999) who reported that water mint, *Mentha microphylla* was the most favourable host plant for oviposition of *Orius* spp. Both water mint and clover fields could be considered as the main save store of *Orius* spp., especially those adjacent to cotton and vegetable fields.

#### Parasitism percentages of *Aphis gossypii* Glover and *Myzus persicae* (Sülzer)

During the course of this study, it was found that *A. gossypii* and *M. persicae* individuals were parasitized by the primary parasitoid, *Diaeretiella rapae* (M'Intosh) (Hymenoptera : Aphidiidae). The data concerning parasitism percentages of the two aphid species together during the two seasons of study are given in Table 6.

Table 5. Seasonal abundance of *Orius* spp. , *Orius albidipennis* (Reut.) and *Orius laevigatus* Fieb. on mint plants, using sweeping net, during 2000-2001 and 2001 – 2002 growing seasons

Months	2000-2001			Months	2001-2002		
	Mean number of insects / sample*	Corresponding means of			Mean number of insects / sample*	Corresponding means of	
		Temp. °C	RH%			Temp. °C	RH%
Aug., 2000	14.25	32.4	66.0	Aug., 2001	167.00	35.9	63.0
Sep.	4.25	31.3	63.0	Sep.	78.25	28.9	62.2
Oct.,	37.00	28.7	63.6	Oct.	15.00	25.4	59.6
Nov.	6.75	24.6	60.0	Nov.	6.00	20.4	59.3
Dec.	2.75	20.8	63.0	Dec.	1.50	17.0	58.6
Jan. , 2001	2.50	19.3	63.6	Jan. , 2002	0.00	16.8	64.0
Feb.	0.00	20.1	60.8	Feb.	0.00	16.2	60.9
Mar.	34.00	24.1	60.1	Mar.	4.25	18.0	59.1
Apr.	125.75	19.2	55.0	Apr.	146.20	24.3	54.2
May	3305.80	30.7	52.5	May	660.00	25.5	52.8
Jun.	17166.50	29.3	55.2	Jun.	5099.50	28.6	55.8
Jul.	752.00	27.8	63.7	Jul.	957.60	29.2	59.9
General mean	1787.63			General mean	594.61		

\* Data based on 100 double strokes

Table 6. Parasitism percentages of aphids, *Aphis gossypii* Glover and *Myzus persicae* (Sülzer), by *Diaeretiella rapae* (M'Intosh) on mint plants during 2000-2001 and 2001- 2002 growing seasons

2000-2001						2001-2002					
Date	Number of...		Parasitism %	Corresponding means of		Date	Number of...		Parasitism %	Corresponding means of	
	collected aphids	parasitized aphids		Temp. °C	RH %		collected aphids	parasitized aphids		Temp. °C	RH %
Aug., 1, 2000	7	0	0.00	34.1	61.5	Aug., 6, 2001	16	0	0.00	29.3	66.6
8	13	0	0.00	32.2	65.8	13	448	0	0.00	31.9	66.0
15	18	0	0.00	31.8	67.5	20	145	0	0.00	30.6	64.9
22	58	0	0.00	32.9	68.1	27	39	0	0.00	30.5	64.6
29	167	0	0.00	33.0	64.8	Sep., 3	22	0	0.00	30.2	64.4
Sep., 5	119	0	0.00	32.1	63.6	10	13	0	0.00	29.7	62.8
12	93	0	0.00	31.9	64.4	17	9	0	0.00	27.3	62.5
19	37	0	0.00	31.4	63.5	24	6	0	0.00	29.0	62.9
26	15	0	0.00	31.9	61.4	Oct., 1	0	0	0.00	28.8	62.3
Oct., 7	5	0	0.00	29.3	62.0	8	0	0	0.00	26.0	60.4
10	2	0	0.00	31.2	61.1	15	5	0	0.00	26.9	59.5
17	2	0	0.00	30.1	64.8	22	7	0	0.00	26.0	59.6
24	8	0	0.00	27.3	65.0	29	4	0	0.00	24.1	59.8
31	14	0	0.00	26.4	64.8	Nov., 5	8	0	0.00	20.7	56.6
Nov., 7	20	0	0.00	25.2	61.6	12	36	0	0.00	21.6	58.8
14	23	0	0.00	25.5	60.3	19	0	0	0.00	20.7	60.4
21	33	0	0.00	25.1	63.1	26	0	0	0.00	18.4	60.0
28	74	0	0.00	22.7	59.4	Feb., 25, 2002	47	2	4.26	16.6	53.6
Feb., 13, 2001	8	0	0.00	20.7	59.8	Mar., 4	179	12	6.70	15.8	61.3
20	92	4	4.35	18.9	60.6	11	215	29	13.36	21.7	64.4
27	147	15	10.20	20.0	57.1	18	702	102	14.53	17.0	59.4
Mar., 6	247	24	9.72	21.9	60.6	25	307	59	19.21	18.1	56.5
13	401	58	14.46	22.5	66.0	Apr., 1	269	34	12.64	16.1	54.6
20	523	101	19.31	22.6	65.5	8	121	9	7.44	26.0	60.4
27	244	55	22.54	24.7	55.5	15	32	2	5.56	26.9	49.8
Apr., 3	150	26	17.33	27.8	55.4	22	21	0	0.00	25.3	51.8
10	78	7	8.97	24.0	57.4	29	6	0	0.00	21.2	53.3
17	24	1	4.17	25.9	55.3						
24	2	0	0.00	29.1	52.5						
Total	2624	291				Total	2657	249			
Mean			11.09			Mean			9.37		

In the first season, the parasitism occurred only during the period from 20<sup>th</sup> February till 17<sup>th</sup> April 2001, in spite of aphid infestation which took place from the beginning of August 2000 till the end of April 2001, with the exception of December 2000. Parasitism percentages fluctuated and reached the highest value, 22.54%, on 27<sup>th</sup> March at means of 24.7°C and 55.5% RH. The mean percentage of parasitism during the season was 11.09%.

As shown in the second season, although aphids were recorded during the whole season, with the exception of first week of October, second half of November and December 2002, the parasitism was observed only during the period from 25<sup>th</sup> February till 15<sup>th</sup> April. During this period, the parasitism percentages were increased gradually and reached the highest value, 19.21%, on 25<sup>th</sup> March 2002 at means of 18.1°C and 56.5% RH. The parasitoid showed a mean of 9.37% parasitism during the season.

On basis of the previously discussed results, it could be concluded that the main period of parasitoid activity was the second half of February, March and first half of April, which may be attributed to the favorable climatic factors, especially temperature.

Confirmed results were reported by some investigators such as Halima – Kamel and Hamouda (1993), Hammad and Mohsen (2000) and Megahed (2000) who mentioned that *D. rapae* is a primary parasitoid of *A. gossypii*. Also, the present results are in agreement with those of Stary (1966), Thakur *et al.* (1989), Souza and Bueno, Reed *et al.* (1995), Kavalleratos *et al.* (1997), Hammad (1998), Kavallieratos (2001) and Hammad (2006) who mentioned that *D. rapae* is a primary parasitoid of *M. persicae*. Concerning parasitism percentages, Hammad and Mohsen (2000) indicated that the parasitism of *A. gossypii* on roselle plants peaked on 7<sup>th</sup> June and 31<sup>st</sup> May during the first and second seasons, respectively. Kasseem *et al.* (2005) reported that the total parasitism of *M. persicae* on nili squash plantation was 8.53% in the first season and 8.40% in the second season. The total parasitism on winter squash plantation was 12.18 and 3.30% in the first and second seasons, respectively. Hammad (2006) found that the highest percentage of parasitism of *M. persicae* on chamomile plants, 15.9 and 20.3%, occurred on 15<sup>th</sup> March and 9<sup>th</sup> March during the two respective seasons.

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## الآفات الحشرية الرئيسية للنعناع وأعداؤها الحيوية بمنطقة ههيا - محافظة الشرقية

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أجريت دراسات على الآفات الحشرية التي تصيب نباتات النعناع وأعدائها الحيوية بمنطقة ههيا - محافظة الشرقية خلال موسمي ٢٠٠٠-٢٠٠١ و ٢٠٠١-٢٠٠٢. يمكن تلخيص النتائج المتحصل عليها على الوجه التالي :

١- سجل ٢٠ نوعاً تتبع ١٠ عائلات و ٦ رتب كآفات حشرية . كان أكثر هذه الأنواع سيادة *Empoasca* ، *Empoasca lybica* (de Berg) ، *Bemisia tabaci* (Genn.) ، *Cicadulina chinai* ، *Nysius cymoides* Spin. ، *decipiens* (Paoli) ، *Thrips* ، *Aphis gossypii* Glover ، *Creontiades pallidus* Rb. ، (Ghauri) ، *Myzus persicae* (Sülzer) ، *tabaci* Lind. ، ١٩,٣٥ ، ١٩,٥٥ والتي مثلت ١,٢٤ ، ١,٩٣ ، ٤,٦٠ ، ٦,٤١ ، ٦,٥١ ، ١٧,١٦ ، ١٨,١٣ من المجموع العام للآفات خلال الموسمين على التوالي .

٢- كانت الفترة الرئيسية لنشاط *B. tabaci* من أغسطس حتى يناير مسجلة أعلى متوسط لنسبة الإصابة (٩٠,٤٠% ، ٦٨,٦٠%) خلال أكتوبر في الموسمي الأول و الثاني على التوالي . سجل أعلى متوسط لتعداد الآفة / عينة خلال أكتوبر . وجد أن *E. lybica* له

ذروتين في الموسم وكانت أعلاهما خلال مايو . أوضح تعداد *E. decipiens* ذروتين في الموسم وكانت أعلاهما خلال أكتوبر .

٣- أوضح نشاط *C. chinai* أعلى تعداد خلال يونيو ويوليو في الموسمين الأول والثاني على التوالي . سجل أعلى تعداد للنوع *N. cymoides* خلال يونيو في الموسم الأول ويوليو في الموسم الثاني . وجد أعلى متوسط لتعداد *C. pallidus* خلال يوليو في موسمي الدراسة . أظهر تعداد *A. gossypii* ثلاثة ذروات في الموسم وكانت أعلى هذه الذروات في ١٣ ، ٢٠ مارس في الموسمين الأول والثاني على التوالي . أوضح نشاط *M. persicae* أعلى تعداد في ٢٠ مارس خلال الموسم الأول ، ٢٥ مارس خلال الموسم الثاني .

٤- تم حصر ١١ نوع مفترس يتبع ٦ عائلات و٥ رتب . احتل النوعان التابعان لرتبة نصفية الأجنحة (*Orius laevigatus* Fieb., *Orius albidipennis* (Reut.)) المرتبة الأولى ممثلان ٩٨,٧٨ % من الأعداد الكلية للمفترسات خلال موسمي الدراسة . جاءت الأنواع التابعة لرتبتي غمدية الأجنحة وشبكية الأجنحة في المرتبتين الثانية والثالثة ممثلة ٠,٢٩,٠٠,٦٦ % على التوالي .

٥- سجلت أعلى أعداد من *Orius* spp. خلال يوليو في موسمي الدراسة وبمتوسطات ١٧١٦٦,٥٠ ، ٥٠٩٩,٥٠ فرد / عينة في الموسمين الأول والثاني على التوالي . كان المتوسط العام لأعداد *Orius* spp. ١٧٨٧,٦٣ ، ٥٩٤,٦١ فرد / عينة في الموسمين الأول والثاني على التوالي .

٦- وجد أن الطفيل *Diaeretiella rapae* (M' Intosh) يتطفل على أفراد *A. gossypii* ، *M. persicae* . كانت الفترة الرئيسية لنشاط الطفيل من نهاية فبراير حتى الأسبوع الأول من أبريل . أظهرت نسب التطفل أعلى قيمة (٢٢,٥٤%) في ٢٧ مارس خلال الموسم الأول ، ١٩,٢١% في ٢٥ مارس خلال الموسم الثاني . كان متوسط نسب التطفل ٩,٣٧,١١,٠٩% في الموسمين الأول والثاني على التوالي .