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MAIN INSECT PESTS OF CHAMOMILE AND THEIR ENTOMOPHAGUS INSECTS AT ZAGAZIG REGION, SHARKIA GOVERNORATE

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ABSTRACT: **Studies on insect pests infesting chamomile plants and their entomophagous insects were carried out at Zagazig region, Sharkia Governorate during 2000 – 2001 and 2001 – 2002 successive seasons. The obtained results are summarized as follow:**

1. **Ten insect species belonging to seven families and four orders, were recorded as pests. The most dominant species were *Myzus persicae* (Sülzer), *Thrips tabaci* Lind. and *Aphis gossypii* Glover, accounting 61.22, 13.85 and 14.53% of the whole insect pests in the first season, and 61.97, 17.99 and 7.51% in the second one, respectively.**
2. ***M. persicae* infests chamomile plants from the second half of December till the beginning of May, showing two and three peaks in the first and second seasons, successively. The highest peaks were registered on 8th March and 24th February, recording 13.81 and 11.80 aphids per leaf in the first and second seasons, consecutively.**
3. **The main period of *A. gossypii* infestation occurred from early February to the 3rd week of March, with one peak at the beginning of March in the first season, and two peaks at 4th week of February and mid March in the second one.**
4. ***T. tabaci* infests chamomile plants from 8th February in the first season and 17th February in the second one, and continued till the end of both seasons. The insect populations appeared two peaks during infestation's season, with the highest ones, 1.73 and 1.52 insects per leaf, occurring on 27th and 26th April during the two respective seasons.**
5. **Nine predaceous species belonging to four families and four orders were surveyed. *Metasyrphus corollae* Fabr., *Xanthogramma aegyptium* Wied., *Coccinella undecimpunctata* L. and *Orius***

laevigatus **Fieb. were the most dominant ones, representing 31.14, 22.23, 13.82 and 12.74% of the total numbers of predators, respectively.**

6. **Three hymenopterous parasitoids were emerged from mummified individuals of *M. persicae*. They were *Diaeretilla rapae* (M'Intosh), *Pachyneuron aphidis* Bouche and *Charips sp.* The first species is a primary, while the latter ones are hyperparasitoids. *D. rapae* comprised 93.31% of all emerged parasitoids during the whole period of study.**
7. **The main period of *D. rapae* activity was from the second half of January to late March in the first season and from late January till late March in the second one. Parasitism percentages showed three and two peaks in the first and second seasons, successively. The highest ones were represented by 15.9 and 20.3% parasitism, occurring on 15th and 8th March in the two respective seasons. The mean percentage of parasitism was 9.72% in the first season and 8.61% in the second one.**
8. **The correlations between *M. persicae* populations and percentages of parasitism in both seasons were positive, being high significant and significant in the first and second seasons, respectively.**

Key words: Chamomile, insect pests, predators, *Myzus persicae*, 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. Nowadays, the government encourages the cultivation of aromatic and medicinal plants because they are potentially exportable crops, and therefore become a source of national income, beside their importance in pharmaceutical industries, which grow enormously in Egypt.

Chamomile (*Matricaria chamomilla* L.) is one of the most important medicinal and aromatic plants. The local production of flowers during winter and early months of spring gives the crop a great worldwide advantage. The total cultivated area of chamomile in Egypt according to 1999–2000 statistics was estimated as 7198 feddans; about 18% of the total cultivated area with medicinal and aromatic plants (Yousef, 2002).

Chamomile has many medicinal uses. Mild infusion of the chamomile flowers is used as a remedy against fever, intestinal pain and as mild tonic and antispasmodic, healing agent, stimulant, carminative and sedative. The flowers are applied externally against inflammation or irritation. The oil is also used as a flavouring agent in fine liquors and is also used in cosmetics (Yousef, 2002).

In general, Sharkia Governorate is a suitable location for the chamomile cultivation. Insect pests attacking chamomile is one of the most important obstacles facing massive increase of its production. However, scattered records of insect species associated with chamomile plants in Egypt were reviewed by Hussein, 1982; Hammoda, 1987; Ali, 1988 and Ramadan, 1988. Therefore, the present investigation was planned with the aim of studying the following objectives:

1. Surveying the insect pests infesting chamomile plants and their associated predators as well as estimating their relative densities.
2. The seasonal abundance of the main insect pests.
3. The parasitism of the major insect pest.
4. Effect of prevailing temperatures and relative humidities on the main insect pests and parasitism.

MATERIALS AND METHODS

Field experiment was conducted in the Experimental Farm, Faculty of Agriculture, Zagazig University at Zagazig region.

An area of 1000 m^2 was prepared and divided into suitable plots for growing chamomile. Chamomile (*Matricaria chamomilla* L.) was sown on 22nd and 30th October during 2000 and 2001 years, respectively. The area received normal agricultural practices and was not subjected to any chemical control application.

Two sampling techniques were used, namely plant samples and sweeping net. The experimental area was divided into four replicates (each about 250 m^2). Samples of 25 leaves were weekly collected at random from each replicate, starting from 14th and 16th December during the two respective seasons and continued till harvest. 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. Unkown immature stages of the predators were reared individually till adult emergence.

The sweeping net used was 30cm in diameter and 60 cm in deep. Each weekly sample 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 *Myzus persicae* (Sülzer) was considered. Mummified individuals of the aphid 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 aphid were reared in glass jars on pieces of plant leaves until mummification of the parasitized individuals. Emerged adults of aphidophagous (parsitoids and predators) were collected, counted and identified.

Prevailing temperatures and relative humidities were obtained from the Meterological Station in Zagazig. Simple correlation, partial regression values and explained variance were calculated according to Snedecor and Cochran (1987).

RESULTS AND DISCUSSION

Survey and Relative Densities of Insect Pests

Ten insect species belonging to seven families and four orders were recorded (Table 1). They were arranged descendingly according to their relative densities as follow: *Myzus persicae* (Sülzer), *Thrips tabaci* Lind., *Aphis gossypii* Glover, *Nysius cymoides* (Spin.), *Creontiades pallidus* Rb., *Empoasca decipiens* (Paoli), *Cicadulina chinai* (Ghauri), *Nezara viridula* L., *Heliothis armigera* (Hb.) and *Nephotettix apicalis* (Mast.).

M. persicae was the most dominant species, constituting 61.22 and 61.97% of the total number of pests in the first (2000-2001) and second (2001–2002) seasons, respectively. *T. tabaci* ranked the second category, representing 13.85 and 17.99% in the first and second seasons, successively. It was followed by *A. gossypii* which comprised 14.53 and 7.51% in the first and second seasons, respectively. The general relative densities of *N. cymoides, C. pallidus, E. decipiens, C.*

Table 1: Total number of insect pests recorded on chamomile 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	%
Myzus persicae (Sülzer) (Homopera: Aphididae)	7103	2407	9510	61.22	4940	1806	6746	61.97	16256	61.53
Thrips tabaci Lind. (Thysanoptera: Thripidae)	666	1486	2152	13.85	548	1410	1958	17.99	4110	15.55
Aphis gossypii Glover (Homoptera: Aphididae)	1934	323	2257	14.53	707	111	818	7.51	3057	11.64
Nysius cymoides Spin. (Hemiptera: Lygaeidae)	15	606	621	4.00	13	580	593	5.45	1214	4.59
Creontiades pallidus Rb. (Hemiptera: Miridae)	13	618	631	4.06	11	543	554	5.09	1185	4.48
Empoasca decipiens (Paoli) (Homoptera: Cicadellidae)	7	218	225	1.45	4	116	120	1.10	345	1.33
Cicadulina chinai (Ghauri) (Homoptera: Cicadellidae)	4	107	111	0.71	2	74	76	0.70	187	0.71
Nezara viridula L. (Hemiptera: Pentatomidae)	2	9	11	0.07	2	7	9	0.08	20	0.08
Heliothis armigera (Hb.) (Lepidoptera: Noctuidae)	3	8	11	0.07	2	6	8	0.07	19	0.07
Nephotettix apicalis (Mast.) (Homoptera: Cicadellidae)	1	5	6	0.04	0	4	4	0.04	10	0.04
General total	9748	5787	15535	100.00	5259	4657	10886	100.00	26421	100.00

P.S. = Plant samples S.N. = Sweeping net

chinai, N. viridula, H. armigera and *N. apicalis* during the two seasons of study were 4.59, 4.48, 1.33, 0.71, 0.08, 0.07 and 0.04%, consecutively.

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

Hammoda (1987), in Egypt, reported that chamomile proved to be the most preferred host for sheltering *A. gossypii.* The polyphagous insect pest *N. cymoides* was recorded by Eubanks *et al.* (2003) in UK. The present results, however agree with the findings of the following investigators. Ali(1988) mentioned that chamomile plants were infested by *T. tabaci, Aphis craccivora* Koch., *Nysius graminicola* (Kolenati), *E. decipiens* and *Cicadulina bipunctella* Zeae China. Ramadan (1988) recorded *N. viridula, Empoasca lybica* de Berg, *E. decipiens, H. armigera, Spodoptera littoralis* (Boisd.) and *Agrotis ipsilon* (Hufn.) as pests of the chamomile plants. Different species were recorded in other countries as follow: Freese (1995), in Germany, stated that the main phytophagous insects associated with the flower heads of two chamomile species (*Chamomilla recutita* and *Matricaria perforata)* were *Apion hookeri, Ceutorhynchus rugulosus, Olibrus aeneus, Napomyza lateralis* and *Ozirhincus chrysanthemi (O. longicollis).* Easterbrook and Tooley (1999), in UK, indicated that various species of plants belonging to family Asteraceae including chamomile *(Matricaria recutita)* were shown to be hosts for *Lygus rugulipennis.*

Seasonal Abundance of the Main Insect Pests

Myzus persicae (Sülzer)

In the first season, data represented in Fig. (1) reveal that the aphid infestation occurred during the period from 14th December 2000 till 3rd May 2001. During this period, the aphid population was fluctuated with a tendency to increase, showing two peaks. The first one (1.53 aphids/ leaf) was observed on 25th January at means of 20.1°C and 63.4% RH. The second peak was distinctly higher than that of the first one and it was represented by 13.81 aphids/ leaf, occurred on 8th March at means of 22.2°C and 62.1% RH. The mean numbers of the aphid during the period of its occurrence was 3.35 individuals / leaf (Table 2).

In the second season (2001-2002), data in Fig. (2) indicate similar trend as in the first season. The initial aphid infestation was recorded on 16th December 2001 at means of 15.3°C and 59.1% RH, with a mean of 0.15 insect/leaf. Then, the aphid population was fluctuated with a tendency to increase, recording three peaks. The first one (3.76 aphids /leaf) was noticed on 27th January 2002 at means of 14.4°C and 63.4% RH. The second peak (11.80 individuals/leaf) was the highest one, occurred on 24th February at means of 16.5°C and 54.5% RH. The third one (1.68 aphids/leaf) was smaller than the preceding ones and it was attained on 13th April at means of 25.8°C and 55.1% RH. *M. persicae* population appeared a mean of 2.35 individuals/leaf during the period of infestation (Table 2).

From the aforementioned results, it was clear that *M. persicae* infests chamomile plants from the second half of December till the beginning of May. The pest population was relatively high during the period from the fourth week of January to early April. Moreover, the aphid population in the first seasons was relatively higher than that in the second one which may be due to the differences in climatic factors, especially temperature, where its means during periods of aphid infestation were 22.72 and 18.09°C in the first and second seasons, respectively.

El-Kordy *et al.* (1999) reported that *M. persicae* infests valerian (*Valeriana officinalis)* plants from the 1st week of January till the 2nd week of April, and it reached its maximum number in the 1st week of January. Azab *et al.* (1965) found that *M. persicae* had three peaks of high abundance on *Brussels sprouts* during the years, occurred in spring (March), at the beginning of summer (May) and in July. Tawfik *et al.*(1976) noticed that *M. persicae* infests peach trees during spring and summer. 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. El-Sharkawy (2002) recorded two peaks of abundance of *M. persicae* on cabbage plants, in mid November and at the end of February.

Statistical analysis (Table 3) indicated that there were insignificant negative correlations between mean temperatures and weekly mean number of *M. persicae* in both seasons. Relative humidity had insignificant positive

correlations in the two seasons. Temperature and relative humidity influenced weekly mean number of *M. persicae/* leaf by 72.79 and 73.58% in the first and second seasons, respectively. These findings are in agreement with those of El-Kordy *et al.* (1999) who revealed that temperature was negatively correlated with the population density of *M. persicae* on valerian plants, while relative humidity had a positive effect.

***Aphis gossypii* Glover**

Data illustrated in Fig. (1) indicate that in the first season (2000–2001), *A. gossypii* infests chamomile plants from 28th December 2000 till 12th April 2001. During this period, the aphid population increased gradually with a peak 6.28 individuals/leaf on 1st March at means of 21.5°C and 55.8% RH. Thereafter, the aphid density sharply decreased through the successive samples. The mean numbers of aphid /leaf during the period of aphid appearance was 1.21 (Table 2).

In the second season (2001–2002), the aphid infestation took similar trend as in the first one (Fig. 2). The infestation occurred during the period extended from 6th January till 13th April, but the main period of the pest activity was from the 1st week of February to the 3rd week of March. During this period, the aphid population showed two peaks. The first one (1.30 aphids/leaf) occurred on 24th February at means of 16.5°C and 54.5% RH, in coincidence with the highest peak of *M. persicae*. The second peak (0.95 aphid/leaf) was recorded on 16th March at means of 18.6°C and 59.5% RH. The mean numbers of aphid during the period of infestation was 0.47 insect /leaf (Table 2).

From the above mentioned results, it could be concluded that the main period of chamomile infestation with *A. gossypii* occurred during the period from early February to the 3rd week of March, with one peak at the beginning of March in the first season and two peaks at the 4th week of February and mid March in the second one. In general, the insect population was higher in the first season than that in the second one.

Different results were detected by several workers owing to the location, plant species and vegetation period of the plant. Abul-Nasar *et al.* (1975) stated that *A. gossypii* had two peaks of

abundance on chrysan -themum during spring and autumn in Giza and Zohria gardens. In Antoniadis garden, the infestation covered the whole season, from January to October. Abou- Elhagag (1998) revealed that the maximum level of *A. gossypii* abundance on cotton was on 14th August. Metwally-Samia (1998) mentioned that the population density of *A. gossypii* on cucumber plants reached a maximum on 10th and 7th May during the two seasons of study, respectively. According to El-Kordy *et al.* (1999) *A. gossypii* infests roselle leaves from the first week of May till the second week of November, and reached its peak during the last week of October. El-Shabrawy *et al.*(2001-2002) revealed that *A. gossypii* had four peaks on roselle plants at Beni- Sweif Governorate, while at Sharkia Governorate four and three peaks were recorded during the two respective seasons of study. Sourial *et al.* (2002) indicated that *A. gossypii* appeared on soybean plants in relatively low numbers in the beginning of the season and increased, giving the highest peak on 14th August in the three sowing dates. Ismail *et al.* (2005) reported that aphid reached its maximum numbers on the cotton plants at the end of June and beginning of July.

Statistical analysis (Table 4) revealed that there were negative insignificant correlations between mean number of *A. gossypii* and means of each temperature and relative humidity in both seasons. Temperature and relative humidity affected aphid population by 75.57 and 88.39% in the first and second seasons, successively. These results, however, agree with the findings of El-Kordy *et al.* (1999) who reported that the population density of *A. gossypii* was negatively correlated with temperature, while was positively with relative humidity.

***Thrips tabaci* Lind.**

In the first season (2000 – 2001), data in Fig. (1) reveal that *T. tabaci* started to appear on chamomile plants on 8th February at means of 20.0°C and 65.4% RH. Then, the insect population was fluctuated, recording two peaks. The first one (0.16 insect/leaf) was observed on 22nd February at means of 18.7°C and 61.1% RH. The second peak was relatively higher (1.73 insects/leaf) and took place on 26th April at means of 27.4°C and 55.9% RH. The population of thrips during the period of occurrence, showed a mean of 0.48 insect /leaf (Table 2).

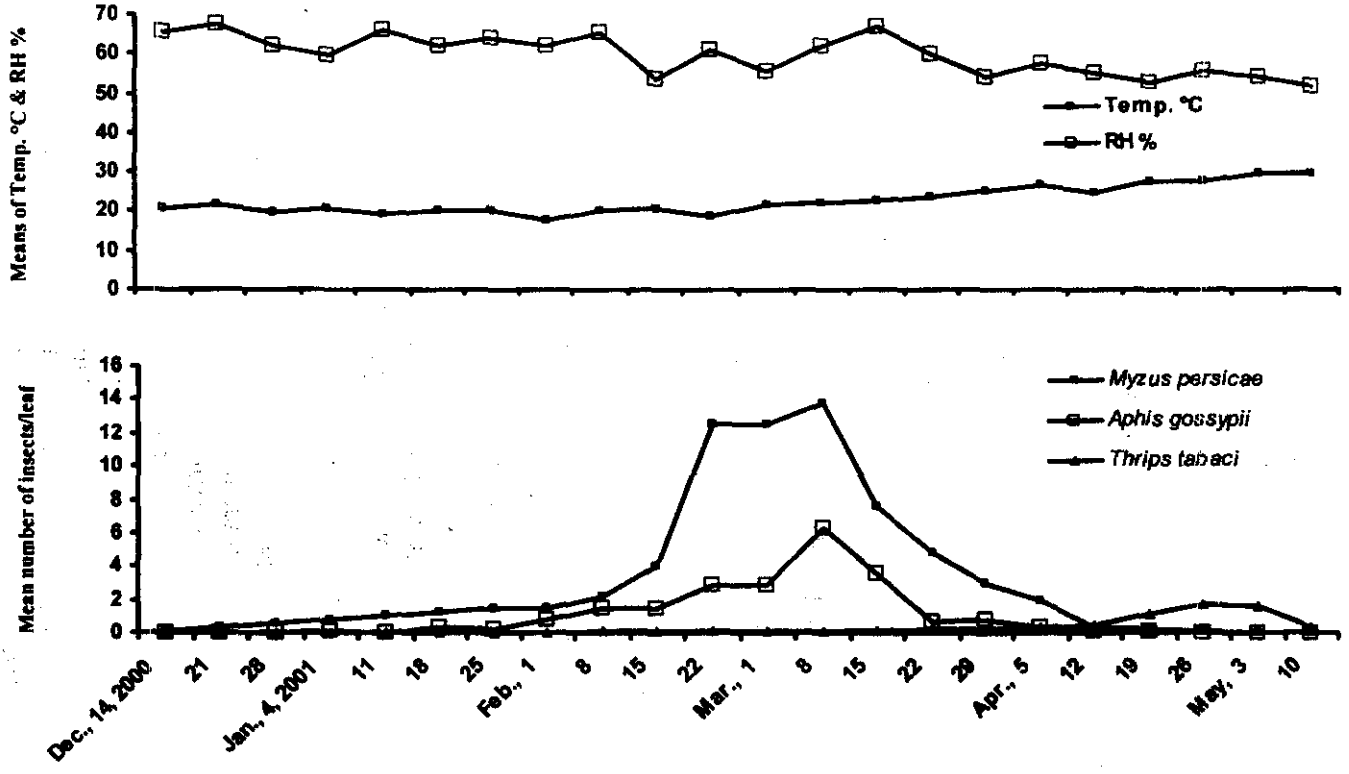

Fig. 1: Seasonal abundance of *Myzus persicae* (Sülzer), *Aphis gossypii* Glover and *Thrips tabaci* Lind. on chamomile plants during 2000 -2001 growing season.

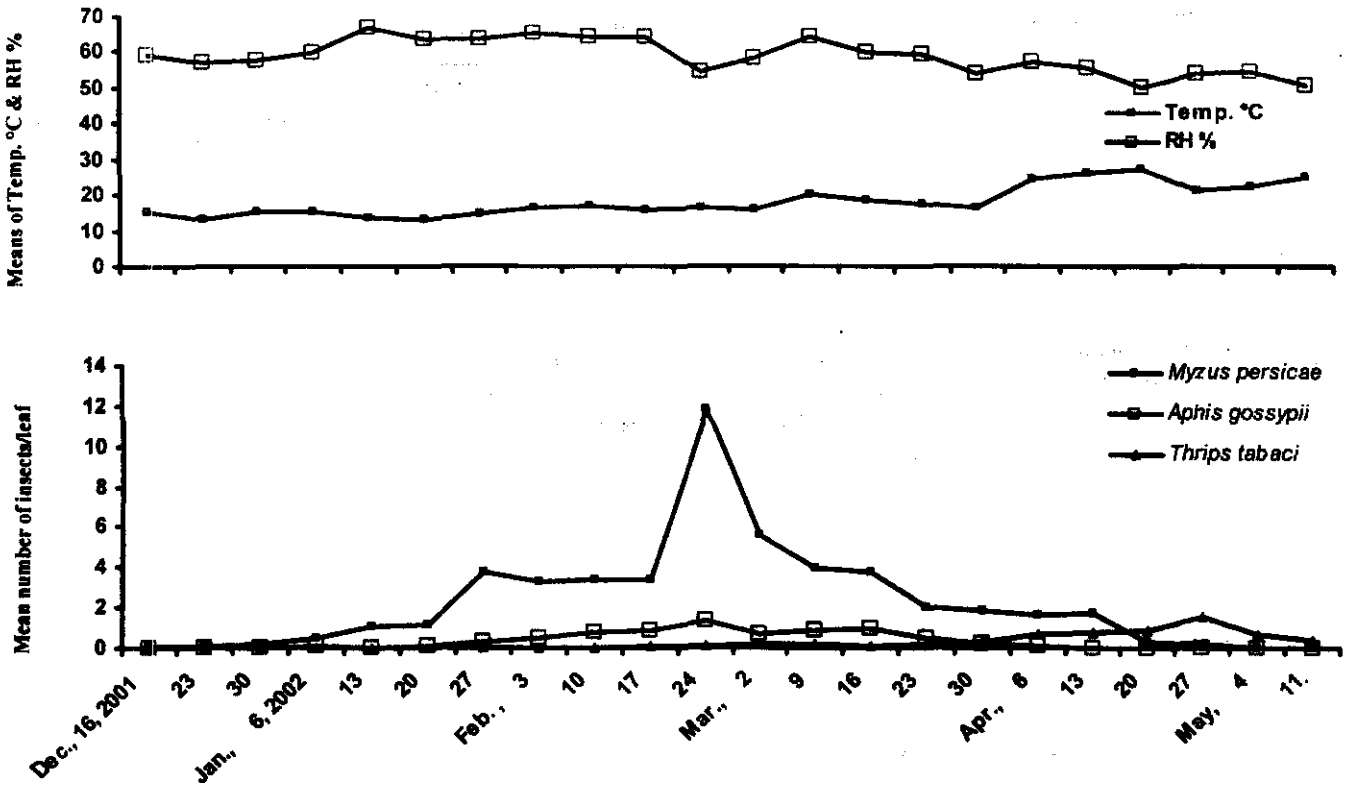

Fig. 2: Seasonal abundance of *Myzus persicae* (Sülzer), *Aphis gossypii* Glover and *Thrips tabaci* Lind. on chamomile plants during 2001 -2002 growing season.

Table 2: Seasonal mean numbers of *Myzus persicae* (Sülzer), *Aphis gossypii* Glover and *Thrips tabaci* Lind. per chamomile leaf during 2000-2001 and 2001-2002 growing seasons.

Season	Mean number of insect /leaf		
	M. persicae	*A. gossypii*	*T. tabaci*
2000-2001	3.35	1.21	0.48
2001-2002	2.35	0.47	0.45

Table 3: Simple correlation (r), partial regression (b) and explained variance (E.V.) for the weekly mean numbers *of M. Persicae* / chamomile leaf under the periodic mean temperature and relative humidity during 2000-2001 and 2001-2002 growing seasons.

Season	Considered climatic factors	r	b	E.V.%
2000 – 2001	Periodic mean Temp.	- 0.220	- 0.533	30.72
	Periodic mean RH	+ 0.023	+ 0.256	14.87
	Interaction Temp. X RH			27.20
	Total E.V.			72.79
2001 – 2002	Periodic mean Temp.	- 0.118	- 0.215	20.74
	Periodic mean RH	+ 0.183	+ 0.215	26.42
	Interaction Temp. X RH			26.42
	Total E.V.			73.58

Table 4: Simple correlation (r), partial regression (b) and explained variance (E.V.) for the weekly mean numbers of *A. gossypii*/chamomile leaf under the periodic mean temperature and relative humidity during 2000-2001 and 2001- 2002 growing seasons.

Season	Considered climatic factors	r	b	E.V.%
2000 – 2001	Periodic mean Temp.	- 0.213	- 0.101	28.13
	Periodic mean RH	- 0.206	- 0.055	23.08
	Interaction Temp. X RH			24.36
	Total E.V.			75.57
2001 – 2002	Periodic mean Temp.	- 0.062	- 0.008	44.64
	Periodic mean RH	- 0.015	- 0.002	32.14
	Interaction Temp. X RH			11.61
	Total E.V.			88.39

Similar observation was noticed in the second season (2001-2002); the infestation occurred during the period extended from 17th February to 11th May (Fig. 2). During this period, two peaks were recorded. The first one (0.15 insect/leaf) was observed on 2nd March at means of 15.7°C and 58.3% RH. The second peak (1.52 insects /leaf) occurred on 27th April at means of 21.0°C and 53.6% RH. *T. tabaci* during the above mentioned period indicated a mean of 0.45 individual / leaf (Table 2).

The present findings agree in a great part with those of the following investigators. Salman (1999) reported that *T. tabaci* reached a maximal level on onion plants sown on 20th October on 18th March and 1st April during the two respective seasons, while the highest level of thrips population was recorded during March on the plants sowed on 10th November. Salman and Abou- Elhagag (2001) mentioned that the number of *T. tabaci* differed on faba bean plants according to the sowing dates. Megahed- Metwally *et al.* (2005) revealed that the numbers of *T. tabaci* on guar plants were highly significantly influenced with the five tested sowing dates, showing average numbers ranged between 0.06-0.98 and 0.00–0.29 individual

/ sample during the first and second seasons, respectively. It was found that the highest numbers of thrips occurred during March and May in the two successive seasons.

Data in Table (5) indicate that there were positive correlations between the weekly mean numbers of *T. tabaci*/ leaf and mean of temperature in both seasons, being highly significant (r = + 0.688**) and significant (r = 0.608*) in the first and second seasons, respectively. Relative humidity showed negative correlations, insignificant (r =-0.435) in the first season and significant (r=- 0.450*) in the second one. Temperature and relative humidity influenced *T. tabaci* population by 56.95 and 55.88% in the first and second seasons, consecutively.

Table. 5: Simple correlation (r), partial regression (b) and explained variance (E.V.) for the weekly mean numbers of *T. Tabaci* / chamomile leaf under the periodic mean temperature and relative humidity during 2000-2001 and 2001- 2002 growing seasons.

Season	Considered climatic factors	r	b	E.V.%
2000 – 2001	Periodic mean Temp.	+ 0.688**	+ 0.204	22.72
	Periodic mean RH	- 0.435	- 0.215	12.99
	Interaction Temp. X RH			21.24
	Total E.V.			56.95
2001 – 2002	Periodic mean Temp.	+ 0.608*	+ 0.132	18.81
	Periodic mean RH	- 0.540*	- 0.114	17.53
	Interaction Temp. X RH			19.54
	Total E.V.			55.88

* = Significant ** = Highly significant

Survey and Relative Densities of Predatory Insects

Data presented in Table (6) show that nine predaceous species belonging to four families and four orders were recorded. The orders could be arranged descendingly according to their relative densities as follow: Diptera (53.37%), Hemiptera (20.90%), Coleoptera

Table 6: Survey and relative densities of insect predators on chamomile 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	%		
Diptera	Syrphidae	*Metasyrphuys (=Syrphus) corollae* Fabr.	Larvae, pupae & adults	18	173	191	30.81	11	172	183	31.50	374	31.14
		Xanthogramma aegyptium Wied.	Larvae, pupae & adults	11	103	114	18.39	9	144	153	26.33	267	22.23
Total												641	
%												53.37	
Hemiptera	Anthocoridae	*Orius laevigatus* Fieb.	Adults	9	76	85	13.71	6	62	68	11.70	153	12.74
		Orius albidipennis (Reut.)	Adults	5	52	57	9.19	7	34	41	7.06	98	8.16
Total												2.51	
%												20.90	
Coleoptera	Coccinellidae	*Coccinella undecimpunctata* L.	Larvae, pupae & adults	7	81	88	14.19	6	72	78	13.43	166	13.82
		Scymnus interruptus Goeze	Larvae adults	5	27	32	5.16	2	20	22	3.79	54	4.50
		Cydonia vicina nilotica Muls.	Adults	0	7	7	1.13	0	3	3	0.51	10	0.83
		Cydonia vicina isis Cr.	Adults	0	3	3	0.48	0	2	2	0.34	5	0.42
Total												235	
%												19.57	
Neuroptera	Chrysopidae	*Chrysoperla carnea* (Steph.)	Eggs, larvae & adults	12	31	43	6.94	9	22	31	5.34	74	6.16
Total												74	
%												6.16	
General total				67	553	620	100.00	50	531	581	100.00	1201	100.00

P.S. = Plant samples S. N. Sweeping net

(19.57%) and Neuroptera (6.16%). Dipterous species were *Metasyrphus (= Syrphus) corollae* Fabr. and *Xanthogramma aegyptium* Wied. (Syrphidae). Hemipterous species included *Orius laevigatus* Fieb. and *Orius albidipennis* (Reut.) (Anthocoridae). Coleopterous ones were *Coccinella undecimpunctata* L., *Scymnus interruptus* Goeze, *Cydonia vicina nilotica* Muls. and *Cydonia vicina isis* Cr. (Coccinellidae). Neuroptera was represented only by *Chrysoperla carnea* (Steph.) (Chrysopidae).

M. corollae was the most dominant predator, accounting 31.14% of the whole species. It was followed by *X. aegyptium, C. undecimpunctata, O. laevigatus, O. albidipennis, C. carnea* and *S. interruptus,* constituting 22.23, 13.82, 12.74, 8.16, 6.16 and 4.50% of all predators, respectively. Moreover, sweeping net technique proved to be effective method for collecting adults of all previously mentioned predators.

These results are in accordance with those of the following workers. Hussein (1982) who collected syrphids from certain plant species including chamomile. Ali (1988) who mentioned that the predaceous species inhabited chamomile plants including *Chilomenes vicina nilotica* Muls., *Coccinella undecimpunctata* L., *Scymnus syriacus* Mars., and *Syrphus corollae.* Ramadan (1988) who recorded *O. albidipennis, Chrysopa vulgaris* Schn., *C. undecimpunctata, Rodolia cardinalis* (Mulsant) and *S. syriacus* as predaceous species associated with chamomile plants. Hammad (1998) who found 15 species of predatory insects associated with *M. persicae* on peach trees, including *M. corollae, X. aegyptium, O. laevigatus, O. albidipennis, C. undecimpunctata, S. interruptus, C. vicina nilotica, C. vicina isis and C. carnea.*

On the other hand, different species of *M. persicae* predators, on different host plants, were mentioned by other investigators. El-Shafie (2001), in Sudan, reported that the main predaceous species of insect pests of potato plants, including *M. persicae,* were *Adalia biupnctella* L. *Adonia variegata* (Goeze), *Coccinella quinquepun-ctata* L., *C. undecimpunctata, Cydonia* sp., *Scymnus* sp., *Xanthogramma* sp. and *C. carnea.* Kavallieratos *et al.* (2004) revealed that the aphidophagous coccinellids of *M. persicae* infesting tobacco in an insecticide–free field, in Greece, were *Hippodamia* (= *Semiadalia) undecimpunctata* Schn., *Adalia bipunctata* (L.), *A. variegata, Propylaea quaturodecimpunctata*

L. and *Coccinella septempunctata* L. Trabdafirescu *et al.* (2004), in Romania, stated that *C. septempunctata, C. quinqueunctata, A. bipunctata, Chrysopa perla* L., *C. carnea, C. vulgaris, Scaeva pyrastri* L., *Syrphus ribesii* L., *Episyrphus balteatus* de Geer and *Leucopis caucozia* Tanas. are predators of *Myzodes persicae* Sulz. in apple and peach orchards.

Parasitoids of *Myzus persicae* (Sülzer)

Survey and relative densities

The survey studies of the emerged parasitoids from the collected mummified aphids infesting chamomile plants during 2000–2001 and 2001–2002 growing seasons (Table 7) revealed the presence of the following hymenopterous species: *Diaeretiella rapae* (M'Intosh) (Aphidiidae), *Pachyneuron aphidis* Bouche (Pteromaliae) and *Charips* sp. (Charipidae). The first species is a primary parasitoid while the other two species are hyperparasitoids.

Stary (1966), Shean & Cranshaw (1991), Souza & Bueno (1992), Reed *et al.* (1995), Kavallieratos *et al.* (1997) and Kavallieratos *et al.* (2001) mentioned that *D. rapae* is a primary parasitoid.

On the other hand, several primary parasitoids species of *M. persicae* were reported by other workers. Shean and Cranshaw (1991) recorded *Aphelinus sermiflavus* Howard. *Aphidius matricariae* Haliday was detected by Bezemer *et al.*(1998). *Aphidiuis colemani* Viereck, *Aphidius ervi* Haliday, *A. matricariae, Praon volucre* (Haliday) and *Praon staryi* (Kavallieratos & Lykouresis) were mentioned by Kavallieratos *et al.* (2004).

P. aphidis was reported as a hyperparasitoid by Stary (1966), Thakur *et al.* (1989), Souza & Bueno (1992) and Hammad (1995 and 1998). Kavallieratos *et al.* (2004) stated that *Asaphes* spp. and *Pachyneuron* spp. are hyperparasitoids of the primary parasitoids of *M. persicae.*

Stary (1966) and Hammad (1998) mentioned that *Charips* sp. is a hyperparasitoid on *D. rapae.* Trandafirescu *et al.* (2004) recorded 3 species belonging to *Charips* as secondary parasitoids.

The primary parasitoid, *D. rapae* represented 95.75 and 92.00% of all collected parasitoids in the first and second seasons, respectively. *P. aphidis* constituted 3.22% in the first season and 5.65% in the second one. *Charips* sp. showed a relative densities of

1.03 and 2.35% in the first and second seasons, successively.

Generally, the primary parasitoid, *D. rapae* comprised 93.31 of all parasitoids during the whole experimental period, followed by *P. aphidis* and *Charips* sp., which represented 4.15 and 1.54%, respectively. These results disagree with the findings of Souza and Bueno (1992) who mentioned that a proportion of hyperparasitoids was 6 times greater than that of the primary parasitoid, *D. rapae*.

Table 7: Survey and relative densities of *Myzus persicae* (Sülzer) parasitoids on chamomile plants during 2000-2001 and 2001-2002 growing seasons.

Family	Specie	2000-2001		2001-2002		General	
		Total number	%	Total number	%	Total number	%
Aphidiidae	*Diaeretiella rapae* (M'Intosh)	654	95.75	391	92.00	1045	93.31
Pteromalidae	*Pachyneuron aphidis* Bouche	22	3.22	24	5.65	46	4.15
Charipidae	*Charips* sp.	7	1.03	10	2.35	17	1.54
Total		683	100.00	425	100.00	1108	100.00

Parasitism percentages

As mentioned before, *M. persicae* individuals were parasitized by the primary parasitoid *D. rapae*. The data concerning parasitism percentages during the two seasons of study are given in Table (8).

In the first season (2000- 2001) the parasitism occurred only during the period from 28th December to 12th April, in spite of aphid infestation which took place from 14th December till 5th May (Table 8). Parasitism percentages showed three peaks. The first one (7.4%) was recorded on 1st February at means of 17.7°C and 62.0% RH. The second one (12.5%) was observed on 22nd February at means of 18.7°C and 61.1% RH. The third peak was the highest one (15.9%), occurred on 15th March, one week after the onset of the highest aphid population; the means of climatic factors were 22.9°C and 66.8% RH. The mean percentage of parasitism during the seasons was 9.72%.

Table 8: Parasitism percentages of *Myzus persicae* (Sülzer) by *Diaeretiella rapae* (M'Intosh) on chamomile 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 %
Dec.,14, 2000	15	0	0.0	20.8	65.6	Dec., 16, 2001	5	0	0.0	15.3	59.1
21	31	0	0.0	21.6	67.4	23	11	0	0.0	12.8	57.0
28	61	1	1.6	19.5	62.3	30	18	0	0.0	15.3	57.3
Jan., 4, 2001	82	2	2.4	20.5	59.7	Jan., 6, 2002	48	1	2.1	15.0	59.9
11	101	4	4.0	19.3	66.0	13	104	3	2.9	13.7	66.5
18	132	7	5.3	20.2	62.1	20	111	4	3.6	12.9	63.6
25	153	11	7.2	20.1	64.3	27	376	20	5.3	14.4	63.4
Feb., 1	149	11	7.4	17.7	62.0	Feb., 3	330	15	4.6	16.2	65.2
8	214	14	6.5	20.0	65.4	10	336	7	2.1	17.0	63.8
15	408	22	5.4	20.7	53.9	17	340	11	3.2	15.7	64.3
22	1251	156	12.5	18.7	61.1	24	1180	91	7.7	16.5	54.5
Mar., 1	1253	141	11.3	21.5	55.8	Mar., 2	555	82	14.8	15.7	58.3
8	1381	123	8.9	22.2	62.1	9	395	80	20.3	20.3	64.2
15	755	120	15.9	22.9	66.8	16	370	66	17.8	18.6	59.5
22	478	41	8.6	23.6	59.9	23	203	27	13.3	17.1	59.1
29	295	22	7.5	25.1	54.4	30	178	10	5.6	16.4	53.8
Apr., 5	197	7	3.6	26.6	57.8	Apr., 6	161	5	3.1	24.2	56.9
12	34	1	2.9	24.7	55.2	13	168	3	1.8	25.8	55.1
19	20	0	0.0	27.7	52.9	20	25	0	0.0	27.0	49.8
26	12	0	0.0	27.4	55.9	27	20	0	0.0	21.0	53.6
May, 3	5	0	0.0	29.5	54.1	May, 4	4	0	0.0	22.0	54.2
Total	7027	683			60.24	Total	4938	425			
Mean			9.72	22.40		Mean			8.61	17.76	59.01

As shown in the second seasons (2001-2002), although aphid was recorded during the period from 16th December till 4th May, the parasitism was observed only during the period from 6th January to 13th April (Table 8). Parasitism percentages showed two peaks during this period. The first one (5.3%) was noticed on 27th January at means of 14.4°C and 63.4% RH. The second peak was noticeably higher (20.3%) and occurred on 9th March, two weeks later than the highest aphid infestation, at means of 20.3°C and 64.2% RH. The parasitoid showed a mean of 8.61% parasitism during the season.

On basis of the obtained results, it could be concluded that the main period of parasitoid activity was from the second half of January to late March in the first season and from late January till late March in the second one.

The present results are in agreement with the findings of Kassem *et al.* (2005) who mentioned that the total parasitism of *M. persicae* on nili squash plantation was 8.53% in the first season and 8.40% in the second one. The total parasitism on winter squash plantation was 12.18% in the first season and 3.30% in the second one. On the other hand, the obtained results disagree with those of Liu *et al.* (1990) who reported that the rates of parasitism of *M. persicae* and *Lipaphis erysimi* on cruciferous vegetables were usually 0–3% and rarely exceeded 10%. According to Ibraheem (1993), percentage of parasitized *M. persicae* on potato plants was 16.66% during April. In case of pepper, the highest percent parasitism (38.46%) was recorded at early July.

Statistical analysis (Table 9) indicated that there were insignificant correlations between parasitism percentages and means of each temperature and relative humidity in both seasons. The correlation coefficient values between mean temperature and parasitism percentage were negative, whereas r = - 0.358 and -0.047 in the first and second seasons, respectively. Relative humidity coefficient values were positive in both seasons, whereas r = + 0.208 in the first season and +0.258 in the second one. Temperature and relative humidity affected parasitism percentage by 66.60 and 73.99% in the first and second seasons, consecutively.

Moreover, the correlations between the aphid populations and parasitism percentages in both seasons were positive, being high significant (r=+0.780**) in the first season and significant (r =+ 0.511*) in the second one.

Table 9: Simple correlation (r), partial regression (b) and explained variance for the parasitism percentage of *M. persicae* on chamomile plants by *D. rapae* under the periodic mean temperature and relative humidity during 2000- 2001 and 2001 – 2002 growing seasons.

Season	Considered climatic factors	r	b	E.V.%
2000 – 2001	Periodic mean Temp.	- 0.358	- 1.143	22.78
	Periodic mean RH	+ 0.208	+ 0.703	17.99
	Interaction Temp. X RH			25.83
	Total E.V.			66.60
2001 – 2002	Periodic mean Temp.	- 0.047	- 0.447	15.53
	Periodic mean RH	+ 0.258	+ 0.576	32.46
	Interaction Temp. X RH			26.00
	Total E.V.			73.99

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الآفات الحشرية الرئيسية للبابونج ومفتاتاتها الحشرية بمنطقة الزقازيق- محافظة الشرقية

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أجريت دراسات على الآفات الحشرية التى تصيب نباتات البابونج ومفتاتاتها الحشرية بمنطقة الزقازيق – محافظة الشرقية، خلال موسمى ٢٠٠٠ – ٢٠٠١ و ٢٠٠١ – ٢٠٠٢ . يمكن تلخيص النتائج المتحصل عليها على الوجه التالى :

١- سجلت ١٠ أنواع تتبع ٧ عائلات و٤ رتب كآفات حشرية. كان أكثر هذه الأنواع سيادة من الخوخ الأخضر وتربس البصل ومن القطن والتى مثلت ٦١,٢٢ ، ١٣,٨٥ ، ١٤,٥٣% من مجموع الآفات فى الموسم الأول ، ٦١,٩٧ ، ١٧,٩٩ ، ٧,٥١% فى الموسم الثانى ، على التوالى.

٢- من الخوخ الأخضر يصيب نباتات البابونج خلال الفترة من النصف الثانى من ديسمبر حتى بداية مايو موضحاً ذروتين وثلاثة ذروات خلال الموسمين الأول والثانى على التوالى . كانت أعلى هذه الذروات فى ٨ مارس ، ٢٤ فبراير مسجلة ١٣,٨١، ١١,٨٠ فرد لكل ورقة فى الموسمين الأول والثانى على التوالى.

٣- كانت الفترة الرئيسية للإصابة بمن القطن من بداية فبراير إلى الأسبوع الثالث من مارس مسجلة ذروة واحدة فى بداية مارس خلال الموسم الأول، وذروتين فى الأسبوع الرابع من فبراير ومنتصف مارس خلال الموسم الثانى.

٤- يصيب تربس البصل النباتات إبتداءاً من ٨ فبراير فى الموسم الأول ،١٧ فبراير فى الموسم الثانى وقد أستمرت الإصابة حتى نهاية الموسمين. أظهر تعداد الأفة ذروتين

فى الموسم، كانتا أعلاهما ١,٧٣، ١,٥٢ حشرة لكل ورقة فى ٢٧ ، ٢٦ أبريل خلال الموسمين المتتاليين.

٥- سجلت ٩ أنواع مفترسة تتبع ٤ عائلات و ٤ رتب. كانت الأنواع *Metasyrphus corollae* Fabr.، *Xanthogramma aegyptium* Wied.، *Coccinella undecimpunctata* L. و *Orius laevigatus* Fieb. هى الأكثر سيادة حيث مثلت ٣١,١٤ ، ٢٢,٢٣ ، ١٣,٨٢ ، ١٢,٧٤% من الأعداد الكلية للمفترسات فى موسمى الدراسة على التوالى.

٦- تم حصر ٣ أنواع من الطفيليات الغشائية الأجنحة تتبع ٣ عائلات كطفيليات مرتبطة بمن الخوخ الأخضر. النوع *Diaeretiella rapae* (M'Intosh) طفيل أولى بينما النوعين *Pachyneuron aphidis* Bouche و *Charips* sp. طفيليان مفرطان على النوع السابق.

٧- كانت الفترة الرئيسية لنشاط الطفيل *D. rapae* من النصف الثانى من ديسمبر فى الموسم الأول ومن نهاية يناير فى الموسم الثانى وحتى نهاية مارس فى الموسمين. أظهرت نسب التطفل ٣ ذروات وذروتين خلال موسمى الدراسة على التوالى. سجلت أعلى ذروات للتطفل فى ١٥، ٨ مارس ممثلة بنسبتى تطفل ١٥,٩، ٢٠,٣% فى الموسمين الأول والثانى على التوالى. كان متوسط نسبة التطفل ٩,٧٢% فى الموسم الأول، ٨,٦١% فى الموسم الثانى.

٨- وجد أن الإرتباط بين تعداد المن ونسب التطفل كان موجباً خلال موسمى الدراسة وعالى المعنوية فى الموسم الأول ومعنوياً فى الموسم الثانى.