

**SEASONAL ABUNDANCE AND POPULATION
FLUCTUATION OF CERTAIN MIDICINAL PLANT
PESTS AND THEIR ASSOCIATED NATURAL
ENEMES IN ASSIUT GOVERNORATE, EGYPT**

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ABSTRACT

Field trails were undertaken to determine the seasonal abundance and population fluctuations of key insect pests infesting caraway, cumin and chamomile plants. The most pests associated with these plants were *Myzus persicae* (Sulzer), *Aphis craccivora* Koch and *Thrips tabae* Lindeman. The most numerous pests on caraway plants were *T. tabae*. It constituted about 45.47% and 62.85% out of the grand total of pests in 2013 and 2014 seasons, respectively. Whereas *M. persicae* was the most dominant insect pest on cumin plants, constituting about 60.97% and 58.92% out of grand total of pests in first and second seasons, respectively. On chamomile crop *M. persicae* was the numerous pest as compared with the other insect pests (54.17% and 71.70%). The highest level of abundance was recorded during March and April. Temperature and relative humidity significantly affected the population densities of these pests. The dominant predators were *Coccinella undecimpunctata* Reiche, *Scymnus interruptus* Gaeze, *Orius spp.*, *Chrysoperla carnea* [Stephens] *Paedrus alfirri* Kock, *Syrphus corolla* F. and true spiders. These predators attained their maximum population densities during February and March.

INTRODUCTION

The aromatic plants have a great demand both in Egypt and abroad, for its multiple uses. The demand for these plants is increasing continuously in many important fields e.g. medicinal cure, perfume production, soap cosmetics, refreshing beverages and nutritious such as hibiscus, mint, anise, caraway and others. Also, some are used as spices such as, cumin, coriander, fennel fruits and in natural flavor and aroma additives in food industries that in addition of it's using as insecticides (Abou Zaid, 1988 and Rayadh, 2002). Medicinal and aromatic plants cultivated areas reached the average of 62.5 thousand feddans during the period from 1990 to 2011, representing 0.43% of the total cultivated areas at the Arab Republic of Egypt. Whereas, their total production value reached 396.715 million L.E. as an annual average from 1990 to 2011. Exporting value reached 94.71 million L.E. representing approximately 6.08% from the total export value (Shabbara and Taha, 2007 and Mosallam, 2014). However, many destructive insect species may feed on these plants until physiological maturation is reached. This inevitably leads to eventual loss in the quantity and quality of pharmaceutical products. Also, beneficial insects such as, predators, parasitoids, pollinators and visitors could play an important role which affecting productivity of the crops. Many investigators surveyed the insects infesting different medicinal plants (Propov, 1972 and 1973; Tiwari and Joshi,

1974; Giry, 1980; Mesbah *et al.*, 1983; Ali, 1988; El-Gendi, 1988; Abou Elhagag, 1989; Abdel-Hafez *et al.*, 1997; Abdel-Hafez and Abou El-Hagag 1999; Abdel-Moniem and Abdel-Wahab, 2006 and Abd El-Wahab *et al.*, 2011).

The objective of this investigation was aimed to determine the following aims: (1) the seasonal abundance and population fluctuation of certain insect pests and their predatory on caraway, cumin and chamomile plants; (2) Simultaneous effects of the three tested weather factors and the associated predators on population density of main insect pests infesting three medicinal plants species.

MATERIALS AND METHODS

I-Survey and population density of insect pests associated with caraway, cumin and chamomile plants:

The experiment of this investigation was conducted at Abnoub district located 25 Km northeast of Assiut city during two consecutive seasons of 2012/2013 and 2013/2014. The medicinal plants (i.e., caraway, cumin and chamomile) were planted in the end of November. An area about 0.5 Feddan was chosen and divided into 12 plots. The three species of these medicinal plants were distributed in a complete randomized blocks with four replicates each. Normal agricultural practices were performed while no insecticides were applied during the course of this study. Sampling for seasonal fluctuations and population densities of main pests and associated predators were taken weekly, after three weeks of planting date and continued for about 15 weeks. The number of individuals (nymphs and adults) presented on 20 plants (5 plants/replicate/each species) were recorded directly in the field.

II-Simultaneous effects of the three weather factors and the associated predators on population density of main pests infesting three medicinal crops:

Records of maximum and minimum temperature and average relative humidity were obtained from the meteorological station located at the Assiut Agricultural Research Station. Partial correlation was calculated to obtain information about the relationship between the average number of individuals for each major pest and each of the three tested weather factors (maximum minimum temperature and daily mean relative humidity) considered in the present study, as well as the number of the associated predators (Mannaa, 1988; Abdel-Lateef, 1993; Abdel-Hafez *et al.*, 1997 and Abdel-Hafez and Abou El-Hagag, 1999).

RESULTS AND DISCUSSION

I-Survey and population density of insect pests associated with caraway, cumin and chamomile plants:

Survey study of pests on the three medicinal plants, caraway, cumin and chamomile revealed the presence of two species of aphids, the green peach

aphid, *Myzus persica* Sulzer and the cowpea aphid, *Aphis craccivora* Koch as well as the onion thrip *Thrips tabae* Lindeman.

a-Seasonal abundance of insect pests associated with caraway plants:

1-*M. persicae*:

The population of *M. persicae* fluctuated in a similar pattern during both years of study showing different levels of infestation.

Field observations during the first growing season indicated that the average monthly population of *M. persicae* 46.50 individuals during January, increased gradually during February (84.75 individuals), thereafter, it dropped in March (53.75 individuals). However, population increased rapidly to reach of the highest peak of abundance in April (154 individuals) constituting about 45.43% of the grand total (Table 1). Similar trend was observed at the second season (Table 2).

2-*A. craccivora*:

In 2013 season, *A. craccivora* was encountered in small numbers in the second week of January, then it increase a gradually to reach its maximum density in April (Table 1). However, average monthly population of *A. craccivora* was 13.75 and 20.50 individuals during January and February, respectively, reached its highest peak in April (49.5 individuals), constituting about 51.03% of the grand total. The same trend was observation in the second season (Table 2).

3-*T. tabae*:

Data presented in Table (1) showed that the infestation by *T. tabae* appeared on caraway plants during the second week of January, on 2013 season. The pest has two peaks of abundance one in March (369 individuals) and the other in April (568 individuals). During the plantation of 2014, thrips was recorded on leaves during the period from 13 January to 28 Aril. The least population density recorded (258 individuals) during February, then increased gradually to reach its peak (568 individual) in April.

b- Seasonal abundance of pests and predators associated with cumin plants:

The seasonal abundance of insect pests infesting cumin plants and associated predators during 2013 and 2014 seasons of investigation (2013 and 2014) are presented in (Tables 3 and 4).

1-*M. persicae*:

Field observations indicated that the average monthly population of *M. persicae* was 37.75 and 127.50 individuals during January and February. The population increased rapidly to reach its highest peak of abundance on March (814.50 individuals constituting about 83.13% from the total population of 2013, Table 3). In 2014 season, population of *M. persicae* was nearly doubled and followed a similar pattern of 2013 growing season. The initial infestation was recorded during the first week of January. The population increased to reach its maximal level in the third week of March and disappeared during the first week of April. The average monthly total of *M. persicae* was 93.75 and 287.5 individuals during January and February, and then it increased rapidly to attain its peak (1188.25 individuals) in March, constituting about 75.71% out of the grand total (Table 4).

2-A. craccivora:

In 2013 season, the average monthly population of *A. craccivora* ranged between 13.50 to 290.25 individuals, (Table 3). The aphid started to appear on the first week of January (9 individuals were recorded), then the population density increased gradually reaching its peak (36 individuals) in March.

In 2014 season, the results indicated that the population density of aphids was markedly higher than in 2013 season. The monthly average ranged between 35.50 and 445.25 individuals, (Table 4). The aphids recorded in small numbers during the first week of January and the numbers increased gradually to reach its maximum in the third week of March.

3-T. tabace:

Data presented in (Tables 3 and 4) showed the population of *T. tabace* in the two season (2013 and 2014). It appears that the trend of thrips population follow a similar pattern in each of the growing seasons. The initial infestation with the *T. tabace* was recorded during the first week of January when the plants were 5 weeks old. The population increased to reach its the maximum level in February. The monthly average of the population's density was 187.00 and 258.50 individuals constituting about 65.16% and 51.12% out of the grand total in 2013 and 2014, respectively.

c-Population density of insect pests and predators associated with chamomile plants:

1-M. persicae:

In 2013 season, the population density of *M. persicae* (as shown in Table 5) started to appear on the chamomile plants during January. It increased gradually through February, in which the monthly sum was 233 individuals, constituting 20.62% of the grand total. The population reached a peak of abundance during March. The monthly total was 422 individuals representing 37.35% out of the grand total. The population of the pest then decreased in April, where the monthly total was 328 individuals representing 29.03% of grand total.

2-A. craccivora:

As shown in Table (5), the population of the pest in 2013 began to appear on the plants during the second week of January with a low level of abundance. The monthly total in January was 50 individuals representing 12.50% Of the grand total. The population of the pest increased gradually during the following two months. Since the monthly total during February and March were 71 and 100 individuals constituting 17.75% and 25.00% of the grand total, respectively. The pest attained its highest level during April. The monthly total of the pest in this month was 251 aphids, constituting about 53.18% out of the grand total. The population of the pest in 2014 followed approximately the same pattern as in 2013 except the peak of (in March) and the population was more than five time as much as in 2013 (Table 6).

3-T. tabaci:

The obtained results arranged in Table (5) cleared that the insect pest in 2013 had two peak of abundance. The first peak of 147 individuals was recorded in February. The second peak was attained in April resulting in 219 individuals. In 2014, the data in Table 6 also revealed the occurrence of two peaks (the first of 281 individuals and the second of 304 individuals) were recorded in February and April, respectively. It is clear that the population of the thrips in 2014 was higher than that in 2013.

I- Associated predators:

In the present investigation, *Coccinella undecimpunctata* Reiche, *Scymnus interruptus* Gaeze, *Orius spp.*, *Chrysoperla carnea* [Stephens] *Paedrus affirri* Kock, *Syrphus corolla* F. and true spiders were the most common predators recorded on caraway, cumin and chamomile plants. The population density of the predators began to appear in the field in 2013 during January. Then it increased gradually to attain a peak of abundance in March. In 2014, the population pattern of the predators was nearly similar to that of 2013. It is obvious that the number of predators was high at the time when aphids population reached their peak. It could be concluded that the population of predators seem to be synchronized with the population of the common pests infesting caraway, cumin and chamomile plants and they might be able to affects the buildup aphid numbers. It's clear that the number of predators found to be in a high level at time when aphid population reached their peak, (Abdel-Hafez *et al.*, 1997 and Abdel-Hafez and Abou El-Hagag 1999, Abdel-Moniem and Abdel-Wahab, 2006, Ali *et al.*, 2009 and Abd El-Kareim *et al.*,2011).

II- Effect of certain weather and biotical factors on population density of main insect pests infesting three medicinal plants:

The partial correlation values (Table 7) indicate that the maximum temperature has significant positive effect on the population of *M. persicae* during two seasons of investigation, whereas, the average relative humidity and predators have significant negative effect on the population of pests on caraway at the seasons. On cumin plants the partial correlation values showed that the maximum and minimum temperature were highly significantly positive on *M. persicae* and *A. craccivora* during 2013 season, whereas it was insignificantly on these pests in 2014 season (Table 8). The partial correlation values (Table 9) indicated that, the effect of maximum temperature was insignificantly positive effect on the population activity of *M. persicae*, *A. craccivora* and *T. tabace* on chamomile corp. Relative humidity has significant negative effect on *A. craccivora* *M. persicae* and *T. tabace*. Predators affected significantly the population of *T. stellate* in the two seasons. These results indicated that the minimum temperature and average relative humidity were the most important abiotic factors that affected the activity of the pests of chamomile plants. It is found also that the predators affected the activity of the pests in this investigation.

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In general, the results indicated that the biotic and abiotic factors under this study have influence on the activity of pests infesting caraway, cumin and chamomile crops. The forgoing results indicate that the population levels were markedly higher in 2013 than those in 2014. However, it is clear that *T. tabace* was the most dominant pest on caraway plants representing, 48.79% out of the total numbers, followed by *M. persicae* which constituted 39.82% out of the grand total. The highest level of the population was recorded in April. The green peach aphid *M. persicae* was the most numerous pest on cumin plants, representing 59.69% out of the total numbers of pests recorded during both seasons, followed by *A. craccivora* which constituted 21.75% out of the grand total. Whereas *T. tabace* constituted 18.56% out of the grand total. The highest level of population of *M. persicae* and *A. craccivora* were recorded in March, whereas it was recorded in February for *T. tabace* in both seasons. The foregoing results indicated that the population levels of these pests were markedly higher in 2014 than those in 2013. However, it is clear that the green peach aphid was the abundance pest on chamomile plants. This pest represented 68.99% out of the total numbers of pests recorded during both seasons followed by *A. craccivora* which constituted 22.41% out of the grand total. In addition, it is clear that March and April were the most favorable period for the growth and multiplication of these pests. The highest levels of population for *M. persicae* were recorded in March, whereas for *A. craccivora* and *T. tabace* were recorded in April.

These results are in general agreement with (Soliman, 1987; Ali *et al.*, 1990; Abdel-Hafez *et al.*, 1997 and Abdel-Hafez and Abou El-Hagag 1999), who mentioned that *M. persicae* and *A. craccivora* attained its maximum abundance during March and disappeared during the first week of April. Pozarwska (1987) stated that the occurrence of *M. persicae* was found to be affected by temperature. Mesbah *et al.*, (1983); Harrington and Cheng (1984); Abdel-Hafez *et al.*, (1997) and Abdel-Hafez and Abou El-Hagag (1999) reported that the numbers of *M. persicae* and *T. tabace* were correlated significantly with temperature and R.H.

REFERENCES

- Abd El-Kareim, A. I.; M. E. El-Naggar and E. M. Amal (2011). Survey of predaceous insects associated with four medicinal plants. J. Plant Prot. and Pathology, Mansoura Univ., Vol. 2 (6): 623 – 636.
- Abd El-Wahab, T.E., I.M.A. Ebadah and Y.A. Mahmoud (2011). Population fluctuation of destructive and beneficial insects inhabiting some medicinal plants at assiut governorate, Egypt. J. Basic. Appl. Sci. Res., 1(7)554-558.
- Abdel-Hafez, N. A. and G. H. Abou-Elhagag (1999). Seasonal occurrence and relative abundance of the main pests infesting caraway and cumin plants in Upper Egypt. Assiut J. Agric. Sci. 30 (4) 149-166.

- Abdel-Hafez, N. A.; Abou-Elhagag, G. H. and M. M. Khela (1997). Incidence of common pests infesting chamomile plants in southern Egypt. Scientific Conference of Agric. Sci. Fac. Agric. Assiut Univ., Assiut, 11: 579-689.
- Abdel-Lateef, N, A. (1993). Studies on some insect pests of apricot trees and associated natural enemies. M.Sc. Thesis, El-Fayoum Fac. Of Agric., Cairo Univ. 176 pp.
- Abdel-Moniem, A. S. H. and T. E. Abdel-Wahab (2006). Insect pests and predators inhabiting roselle plants, *Hibiscus sabdariffa* L., a medicinal plant in Egypt. Archives of Phytopathology and Plant Protection, 39 (1): 25-32.
- Abou Zaid, E. N. (1988). Aromatic and medicinal plants—their agricultural and medicinal products, El-Dar El-Arabia for Publishing, Cairo.
- Abou-Elhagag, G. H. (1989). Field and laboratory studies on certain pests of medicinal and aromatic plants. M. Sc. Thesis, Fac. Agric., Assiut Univ.
- Ali, A. G. (1988) Ecological and control studies on certain pests infesting medicinal and aromatic plants. Ph. D. Thesis, Fac. Agric., Assiut Univ. 297 pp.
- Ali, A. G.; M. Z. Embarak and A. E. A. Ahmed (2009). Composition and population fluctuation of destructive and beneficial insect species inhabiting three medicinal plants in Assiut governorate. Ass. Univ. Bull. Environ. Res. 12 (2) 77-86.
- Ali, A. M.; S. A. Ahmed; F. M. Khalil and A. M. Soliman (1990). *M. persicae* (Sulzer) and its natural enemies in potato fields. Acta phytopathologica et Entomologica Hungarica. 25: 375-382
- El- Gendi, S. S. M. (1988). Ecological and biological studies on some insect pests of ornamental and medicinal plants. Ph. D. Thesis, Fac. Agric., El-Fayoum, Cairo Univ.
- Giry, H., (1980). A list of insects injurious of anise, *Pimpinella anisum* in the Aegean region: Turkiye Bitki Koruma Dergisi, 4: 49-57.
- Harrington, R. and X. N. Cheng (1984). Winter mortality, development and reproduction in field population of *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) in England. Bull. of Entomol. Res., 44 (4): 633-640.
- Mannaa, S. H . (1988). Biological and ecological studies on certain pests of fig with special reference to their integrated pest management. Ph. D. Thesis, Fac. Agric., Assiut Univ.
- Mesbah, H. A.; K. S. Moursi and I. A. Abou El-Fadl (1983). Survey of the pests infesting medicinal and ornamental plants in Egypt. I- The common harmful pests and beneficial ones found on chillies, *Capsicum minimum* at Alexandria district. Proc. 5th Arab. Pesticide Conf. Tanta Univ., II: 320-329.
- Mosallam, S. S. A. (2014). Study the effects of the local aspects on the foreign trade of some medicinal and aromatic plants. J. Agric. Econom. and Social Sci., Mansoura Univ., Vol.5 (1): 47 – 62.

- Pozarwska, P. J. (1987). Studies on low temperature survival, reproduction and development in Scottish clone of *M. persicae* (Sulzer) and *Aulacorthum solani* (Kaltenbach) (Hemiptera: Aphididae) Susceptible and resistant to organophosphates. Bull. Entomol. Res. 77:123-134.
- Propov, P. (1972). Insect pests of medicinal plants in Bulgaria. III-Coleoptera. Rastenievdni Nauki, 9: 167-175.
- Propov, P. (1973). Insect pests of medicinal plants in Bulgaria. I-Hemiptera. Rastenievdni Nauki, 10: 167-175.
- Rayadh, L. (2002). Producing and manufacturing aromatic and medicinal plants in Egypt, National planning Institute Diploma.
- Shabbara, H. M. and A. E. Taha (2007). An economical study of the most important Egyptian aromatic plants. Journal of Applied Sciences Research, 3 (8):747-756.
- Soliman, M. M. (1987). Biological and ecological studies on certain potato pests. M. Sc. Thesis, Fac. Agric. Assiut Univ.
- Tiwari, K. C. and P. Joshi (1974). A record of some insect pests attacking medicinal plants at Ranikhet. Indian J. of Pharmacy, 36: 111-112.

**الوفرة الموسمية وتقلبات تعداد بعض الآفات الحشرية لثلاثة نباتات طبية وأعدائها
الحيوية المصاحبة في محافظة أسيوط - مصر
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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - مصر**

أجرى هذا البحث خلال موسمي ٢٠١٣ و ٢٠١٤ في محافظة أسيوط بهدف حصر ودراسة الكثافة الموسمية للآفات الرئيسية التي تصيب الكراوية والكمون والبابونج . وأوضحت الدراسة أن أهم الآفات الحشرية التي تصيب كلا من المحاصيل الطبية الثلاث محل الدراسة هي من الخوخ و من البقوليات وتربس البصل . وأظهرت النتائج أن تربس البصل يتواجد على الكراوية بدرجة عالية خلال موسمي الدراسة حيث كان تعداد هذه الحشرة يمثل أعلى كثافة عددية يليه من الخوخ ثم من البقوليات. وكانت النسبة المئوية للتربس ٤٥.٤٧ % و ٦٢.٨٥ % من المجموع الكلي للآفات خلال موسم ٢٠١٣ و ٢٠١٤ على التوالي. كما وجد أن من الخوخ كان أكثر الآفات سيادة على محصول الكمون حيث مثل ٦٠.٩٧ % و ٥٨.٩٢ % من المجموع الكلي للآفات على الكمون خلال موسمي ٢٠١٣ و ٢٠١٤ على التوالي. كما أوضحت النتائج أيضا أن من الخوخ يتواجد على شيح البابونج بدرجة عالية خلال موسمي الدراسة حيث مثل تعداد هذه الحشرة أعلى كثافة عددية بالمقارنة بالآفات الأخرى. وأثبتت الدراسة أيضا أن هذه الآفات تصل الى أقصى تعداد لها خلال شهري مارس وأبريل ووجد أن بعض العوامل الجوية وخاصة درجات الحرارة والرطوبة تلعب دورا هاما في إحداث التغيير في الكثافة العددية للآفات. ومن ناحية أخرى أوضحت النتائج أن أهم المفترسات التي تم تسجيلها أثناء الدراسة هي حشرة أبو العيد ذو الأحدى عشرة نقطة والإسكمنس والرواغة وبقعة الأوريس وأسد المن وذبابة السيرفس والعناكب الحقيقية. وبصفة عامة أوضحت النتائج أن هذه المفترسات تصل الى أقصى تعداد لها خلال شهري فبراير ومارس وذلك في خلال موسمي الدراسة وأن الزيادة في تعداد هذه المفترسات متلازم مع الزيادة في أعداد الآفات.

Table (1): The incidence of main insect pests and associated natural enemies on caraway from January to April 2013, at Abnoub, Assiut Governorate.

Inspected Month	insect pests												Natural enemies		
	<i>M. persicae</i>			<i>A. craccivora</i>			<i>T. fabace</i>			Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total
	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total						
Jan.	186	46.5	13.71	53	13.25	13.66	368	92.00	23.54	23	5.75	6.91			
Feb.	339	84.75	25.00	82	20.50	21.13	258	64.50	16.51	92	23.00	27.63			
Mar.	215	53.75	15.86	55	13.75	14.18	369	92.25	23.61	167	41.75	50.15			
Apr.	616	154	45.43	198	49.50	51.03	568	142.00	36.34	51	12.75	15.31			
Total	1356	-	100	388	-	100	1563	-	100	333	-	100			

Table (2): The incidence of main insect pests and associated natural enemies on caraway from January to April 2014, at Abnoub, Assiut, Governorate.

Inspected Month	insect pests												Natural enemies		
	<i>M. persicae</i>			<i>A. craccivora</i>			<i>T. fabace</i>			Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total
	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total						
Jan.	377	94.25	24.59	97	24.25	24.25	572	143.00	27.85	3	0.75	4.17			

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Feb.	321	80.25	20.94	67	16.75	16.75	87.00	16.94	11	2.75	15.28
Mar.	133	33.25	8.68	38	9.50	9.50	121.50	23.66	17	4.25	23.61
Apr.	702	175.50	45.79	198	49.50	49.50	162.00	31.55	41	10.25	56.94
Total	1533	-	100	400	-	100	-	100	72	-	100

Table (3): The incidence of main insect pests and associated natural enemies on cumin from January to April 2013, at Abnoub, Assiut Governorate.

Inspected Month	insect pests											
	<i>M. persicae</i>			<i>A. craccivora</i>			<i>T. tabace</i>			Natural enemies		
	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total
Jan.	151	37.75	3.85	54	13.50	3.97	279	69.75	24.30	9	2.25	12.68
Feb.	510	127.50	13.02	146	36.50	10.73	748	187.00	65.16	26	6.50	3.62
Mar.	3258	814.50	83.13	1161	290.25	85.30	121	30.25	10.54	36	9.00	50.70
Total	3919	-	100	1361	-	100	1148	-	100	71	-	100

Table (4): The incidence of main pests and associated natural enemies on cumin from January to April 2014, at Abnoub, Assiut Governorate.

Inspected Month	insect pests											
	<i>M. persicae</i>			<i>A. craccivora</i>			<i>T. tabace</i>			Natural enemies		
	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total
Jan.	375	93.75	5.97	142	35.50	6.03	784	196.00	38.75	5	1.25	7.58
Feb.	1150	287.5	18.32	431	107.75	18.31	1034	258.50	51.12	10	2.50	15.15
Mar.	4753	1188.25	75.71	1781	445.25	75.66	205	51.25	10.13	51	12.75	77.27

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Total	6278	-	100	2354	-	100	2023	-	100	66	-	100
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Table (5): The incidence of main insect pests and associated natural enemies on chamomile from January to April 2013, at Abnoub, Assiut Governorate.

Inspected Month	insect pests											
	<i>M. persicae</i>			<i>A. craccivora</i>			<i>T. tabace</i>			Natural enemies		
	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total
Jan.	147	36.75	13.00	50	12.50	10.59	16	4.00	3.31	3	0.75	0.98
Feb.	233	58.25	20.62	71	17.75	15.04	147	36.75	30.37	43	10.75	14.10
Mar.	422	105.25	37.35	100	25.00	21.19	102	25.50	21.07	178	44.50	58.36
Apr.	328	82.00	29.03	251	62.75	53.18	219	54.75	45.25	81	20.25	26.56
Total	1130	-	100	472	-	100	484	-	100	305	-	100

Table (6): The incidence of main insect pests and associated natural enemies on chamomile from January to April 2014, at Abnoub, Assiut Governorate.

Inspected Month	insect pests											
	<i>M. persicae</i>			<i>A. craccivora</i>			<i>T. tabace</i>			Natural enemies		
	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total	Monthly sum	Monthly average	% from all year total
Jan.	204	51	2.50	65	16.25	2.55	17	4.25	2.51	11	2.75	2.48
Feb.	476	119	5.83	182	45.5	7.14	281	70.25	41.57	23	5.75	5.19
Mar.	6601	1650.25	80.82	1898	474.5	74.49	74	18.50	10.95	178	44.50	40.18
Apr.	887	221.75	10.85	403	100.75	15.82	304	76.00	44.97	231	57.75	52.15
Total	8168	-	100	2548	-	100	676	-	100	443	-	100

Table (7): Correlation coefficient of the relations between population density of major insect pests, natural enemies and certain weather factors (Max., Min. temp. and R.H. %) on caraway crop throughout 2013 and 2014 seasons.

Independent factors	Correlation coefficient					
	2013			2014		
	<i>M. persicae</i>	<i>A. craccivora</i>	<i>T. tabaci</i>	<i>M. persicae</i>	<i>A. craccivora</i>	<i>T. tabaci</i>
Max. temp.	0.5334	0.3709	0.3352	0.5652	0.6398	0.1367
Min. temp.	0.7623**	0.7486*	0.2775	0.5322	0.6230**	0.2044
Avg. R.H.%	-0.5926	-0.64***	-0.2788	-0.5303	-0.5011	-0.1834
Predators	-0.2895	-0.3432	-0.3481	0.4902	0.5092	-0.0729

Table(8): Correlation coefficient of the relations between population density of major insect pests, natural enemies and certain weather factors (Max., Min. temp. and R.H. %) on cummin crop throughout 2013 and 2014 seasons.

Independent factors	2013			2014		
	<i>M. persicae</i>	<i>A. craccivora</i>	<i>T. tabaci</i>	<i>M. persicae</i>	<i>A. craccivora</i>	<i>T. tabaci</i>
	Max. temp.	0.6958	0.7038	-0.3101	0.2552	0.2503

1560

Min. temp.	0.7479**	0.7535**	-0.0837	0.4139	0.3822	-0.3557
Avg. R.H.%	-0.5435	-0.5087	0.4367	-0.4976	-0.4512	0.2651
Predators	-0.0142	-0.0449	-0.0355	0.4905	0.4791	-0.5714*

Table (9): Correlation coefficient of the relations between populations of major pests, natural enemies and certain weather factors (Max., Min. temp. and R.H. %) on anise crop throughout 2013 and 2014 seasons.

Independent factors	Correlation coefficient					
	2013			2014		
	<i>M. persicae</i>	<i>A. craccivora</i>	<i>T. tabaci</i>	<i>M. persicae</i>	<i>A. craccivora</i>	<i>T. tabaci</i>
Max. temp.	0.2438	0.4349	0.2631	0.0113	0.0657	0.4238*
Min. temp.	0.3876*	0.5878*	0.6359	0.0825	0.0728	0.3067
Avg. R.H.%	-0.3651	-0.5480*	-0.5541*	-0.3630	-0.4031*	-0.2752
Predators	0.5702	0.4976	0.3422	0.2158	0.1541	0.2044

** = highly significant * = significant

