Egyptian Academic Journal of Biological Sciences is the official English language journal of the Egyptian Society for Biological Sciences, Department of Entomology, Faculty of Sciences Ain Shams University.
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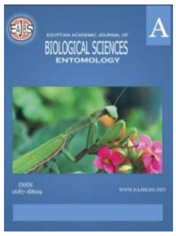
www.eajbs.eg.net

Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol. 10(4)pp: 27- 41(2017)*

Egypt. Acad. J. Biolog. Sci., 10(4): 27–41 (2017)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687- 8809
www.eajbs.eg.net



Effects of Organic and Conventional Plantation of Chamomile On the Occurrence of Some Sucking Insect Pests and Their Natural Enemies In Fayoum Governorate, Egypt

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ARTICLE INFO
Article History
Received: 1/5/2017
Accepted:3/6/2017

Keywords:
Spiders, Araneae, Sucking insect pests, Natural enemies, Chamomile, Organic plantation, Conventional plantation

ABSTRACT

Chamomile (*Matricaria chamomilla)* is one of the most important medicinal plants in Egypt. The experiment carried out at Fayoum Governorate during two successive growing seasons, 2104/2015 and 2015/2016, to compare the effects of organic and conventional plantation of chamomile on the occurrence of some sucking insect pests and their natural enemies, spiders (Araneae) were the major and most abundant predators. Aphids, *Aphis gossypii* Glov. was the major insect pest. Organic plants hosted number of aphids less than conventional plants in two seasons. Thrips, *Thrips tabaci* Lind., also were higher in number in conventional plants than in organic plants. Plant bug was observed with few numbers in both plantations. Three natural enemies; coccinellid larvae, orius and insect parasites were found in rare numbers for organic and conventional plants throughout the study period. The population density, species diversity, and relative abundance of spiders were studied. Population of spiders was higher in conventional plantation (106 & 114 individ.) than in organic plantation (89 & 97 individ.) in two seasons, respectively, which may be due to the infestation with sucking insect pests that was more in conventional plants than in organic plants.

INTRODUCTION

Much of what we known today about the relationship between crop nutrition and pest incidence comes from studies comparing the effects of organic agricultural practices and modern conventional methods on specific pest populations (Chau & Heong, 2005).

Application of compost to improve soil structure, fertility and consequently development and productivity of medicinal plants were studied in several cases (Raey & Alami-Milani, 2014).

Rizk (2015) indicated that, sustainable agriculture depends on replenishing the soil while minimizing the use or need of non-renewable resources, such as natural gas (used in converting atmospheric nitrogen into synthetic fertilizer).

Soil fertility practices can impact the physiological susceptibility of crop plants to insect pests by either affecting the resistance of individual plant to attack or by altering plant acceptability to certain herbivores (Chau & Heong, 2005).

Although studies of amendments vary widely in nature ofmaterials, application rates, and experimental conditions (Albiach *et al*., 2000), amendment with raw and composted organics generally results in increased microbial proliferation in the soil (Bünemann *et al*., 2006).

Chamomile (*Matricaria chamomilla*) is considered medically beneficial plant that has many medical benefits for humans. The active substances extracted from it are used in the pharmaceutical, food, detergent, perfume and cosmetic industries.

The present study was undertaken to compare the population level of some sucking insect pests and the natural enemies which are associated with these pestson Chamomile sown in soil provided with organic fertilizer (compost) and another with nitrogen fertilizer for better crop management strategies.

MATERIALS AND METHODS

Study area:

A field experiment of 1200 m^2 in two different regions in Fayoum Governorate was conducted. Each region was divided into two equal plots (600 m^2 each) cultivated with Chamomile (*Matricaria chamomilla*), organic and conventional, in two seasons 2014/2015 & 2015/2016.

The organic field was fertilized with compost without using any pesticide, while the conventional field was treated with inorganic fertilizers and sprayed with pesticides when appropriate.

Population abundance of some sap-sucking pests and their associated predators:

Samples of 12 leaves per field were picked every 10 days randomly from the lower, middle, and upper levels of plant. Each sample was kept in a tight closed plastic bag and transferred to the laboratory for examination. Counts of pests and predators were recorded.

The following pests were concerned; aphids (*Aphis gossypii* Glover), thrips (*Thrips tabaci* Lind.) and plant bugs, also predators: coccinellid larvae, orius and insect parasites.

Sampling method for collecting spiders from foliage:

Drop-cloth method:

Spiders live on the foliage were collected by shaking the plants on a cloth or a shake sheet (Sallam, 2002). Shaking plants on white cloth (per 20 plants) was practice twice monthly during the surveying period. Collected spiders were kept in glass vial containing 75% ethyl alcohol and some droplets of glycerin, counted and identified to species level as much as possible.

Statistical analysis:

Two-samples t-test was used to test the difference between organic and conventional cultivation of Chamomilein relation to incidence arthropods in both seasons. Assessing of significance was taken at 0.05 level probability.

The relationships between population of these arthropods and weather factors (Temp °C & R.H. %) were obtained, applying the simple correlation, (Snedecor and Cochran, 1981).

Identification of spiders

Identification and classification of spiders follows the descriptions, keys, and catalogues of Kaston (1978), Oger (2002), Ovtsharenko & Tanasevitch (2002), Prószyński (2003), Huber (2005), Platnick (2012) and numerous other consulted sources. Juvenile spiders were mostly identified to family or to genus.

Data analysis of spiders:

Frequency and abundance values of spiders:

The frequency values of the most abundant species were classified into three categories according to the system adopted by Weis Fogh (1948); “Constant species” (C) more than 50% of the samples, "Accessory species" (Ac) 25-50 % of the samples and "Accidental species"(A) less than 25%.

On the other hand, the classification of dominance abundance, values were done according to Weigmann (1973) system and El-Shahawy & El-Basheer (1992) in which the species were divided into five groups based on the values of dominance in the sample; i.e. percentage of individ. Eudominant species (Ed) (> 30% individ.), Dominant species (D) (10-30% individ.), Subdominant (Sd) (5-10% individ.), Recedent species (R) (1-5% individ.), and Subrecedent species (Sr) (<1% individ.).

Species diversity:

The biodiversity of spiders collected were estimated by using equilibrium. Diversity of collected spiders was determined for samples pooled over two seasons by two different patterns of fertilization. It was measured by diversity index that reflected the number of species (richness) in the samples.

Two common indices were computed, Shannon-Wiener index "H” and Simpson index "S”, and calculated as described by Ludwig and Reynolds (1988).

$$H' = -\sum (ni / n) \ \ln (ni/ n) \quad \text{and} \quad S = \sum (ni/n)^2$$

Where *ni* is the number of individ. belonging to the i^{th} of "S" taxa in the sample and "n" is the total number of individ. In the sample. "H" is more sensitive to changes in number of species and diversity, while "S" is a dominance index gives more weight to common or dominant species (Ludwig & Reynolds, 1988); it highly suggests that the two individ. drawn at random from the population belong to the same species. If the result is high then the probability of both individ. belonging to the same species is high, and as a result the diversity of the community samples might be low.

Sørensen quotient of similarity:

To allow a comparison of the two samplings between microhabitats of the two cultivation systems , Sørensen's quotient of similarity (Sørensen. 1948) was used to determine the similarities of spider species composition among the communities, it is: $QS = 2 C / A + B$.

Where A and B are the number of species in samples A and B, respectively, and C is the number of species shared by the two samples; QS is the quotient of similarity and ranges from 0 to 1.

RESULTS AND DISCUSSION

Effect of organic and conventional cultivation on insect pests infesting chamomile plants in 2014/2105&2015/2016 seasons:

Aphids, *Aphis gossypii* Glover

In the organic chamomile plants, the population density of aphid exhibited one activity period extended from Oct. 27^{th} until the end of Mar. 2015, with a peak of 113 individ./12 leaves which recorded on Nov. 6^{th}. The same trend was observed in the subsequent year, which started on Oct. 24^{th} until the first of Apr. 2016, with a peak of 99 individ., on Nov. 13^{th}, (Tables1 & 2).

The conventional chamomile plants, showed the greatest mean numbers of aphids (22.25 & 25.94), compared with the mean in organic chamomile which recorded (18.88&23.12) in 2014/2015 and 2015/2016 seasons, respectively.

Table 1: Number of insect pests on organic and conventional chamomile leaves by direct count during 2014/2015.

	Organic			Conventional		
Pests / Date	Aphids	Thrips	Plant bugs	Aphids	Thrips	Plant bugs
27-10-2014	72	6	0	118	11	0
06-11	113	17	0	79	14	0
16-11	14	5	1	8	3	2
26-11	8	6	0	5	10	0
06-12	1	8	0	4	11	0
16-12	5	0	0	2	0	0
26-12	2	1	1	4	2	1
05-1-2015	6	5	0	10	4	0
15-1	7	0	0	4	0	0
25-1	6	9	1	3	6	0
04-2	6	11	5	9	9	3
14-2	9	5	2	21	8	1
24-2	8	0	0	7	0	0
06-3	15	13	1	29	9	2
16-3	11	20	1	19	18	0
26-3	19	33	0	34	42	1
Total	**302**	**139**	**12**	**356**	**147**	**10**
Mean	**18.88**	**8.69**	**0.75**	**22.25**	**9.19**	**0.63**
Mean(total) **SD**	**28.3** **32.4**			**32.1** **36.6**		
T **S**	**-0.36** **0.72**					
r (temp.°C)	**0.635****	**0.367**	**-0.258**	**0.693****	**0.397**	**-0.047**
r (R.H. %)	**-0.362**	**-0.369**	**-0.351**	**-0.530***	**-0.374**	**-0.363**

Whereas (SD) Standard Deviation, (T) T- test, (S) Significance [*Significant,**High significant] (r) Correlation Coefficient (Pearson).

Table 2: Number of insect pests on organic and conventional chamomile leaves by direct count during 2015/2016.

	Organic			Conventional		
Pests / Date	Aphids	Thrips	Plant bugs	Aphids	Thrips	Plant bugs
24-10-2015	12	9	0	16	6	0
03-11	15	11	0	11	13	0
13-11	99	0	0	108	2	0
23-11	68	1	0	81	2	0
03-12	31	4	2	26	5	2
13-12	54	7	1	69	6	2
23-12	8	3	0	9	4	0
02-1-2016	4	4	0	6	5	0
12-1	7	3	0	9	4	0
22-1	1	1	0	2	3	0
01-2	23	11	0	31	9	0
11-2	4	1	0	7	1	0
21-2	16	3	0	19	5	1
02-3	28	6	0	23	7	0
12-3	9	7	1	12	9	3
22-3	11	5	2	8	3	3
01-4	3	4	1	4	4	0
Total	**393**	**79**	**7**	**441**	**88**	**11**
Mean	**23.12**	**4.65**	**0.41**	**25.94**	**5.18**	**0.65**
Mean(total) **SD**	**28.2** **26.2**			**31.8** **30.0**		
T **S**	**-0.37** **0.72**					
r (temp.°C)	**0.192**	**0.273**	**0.063**	**0.147**	**0.234**	**0.028**
r (R.H. %)	**0.171**	**0.268**	**-0.489***	**0.214**	**0.258**	**-0.407**

Whereas (SD) Standard Deviation, (T) T- test, (S) Significance [*Significant,**High significant] (r) Correlation Coefficient (Pearson).

Thrips, *Thrips tabaci* Lind.

The population density of thrips on organic chamomile plants showed two active periods; the first period extended from Nov. 6th until Dec. 6th, with a peak of 17 individ./12 leaves on Nov. 6th, while the second period extended until Mar. 26th, with a peak of33 individ./12 leaves on March 26th, 2014/2015, (Table 1).

In the subsequent season, 2015/2016, two peaks were recorded in organic cultivation on Nov. 3rd 2015 and on Feb.1st 2016 with recorded number of 11 individ., in each, and one peak was found in conventional cultivation with recorded number of 13 individ., on Nov. 3rd 2015 (Table 2). These findings are in full agreement with the results which obtained by Habashi *et al.* (2007) on cucumber plants.

The conventional chamomile plants showed the greatest mean numbers of thrips (9.19 & 5.18), while the mean numbers in organic chamomile (8.69 & 4.65) in two seasons, respectively.

In comparison with the first season, the results showed that the population of thrips in second season (79 individ./12 leaves) was less than the population in first season (139 individ./12 leaves), for organic cultivation, similar result was observed in conventional cultivation, the recorded numbers were (88&147 individ./12 leaves) in second and first season, respectively (Tables 1and 2).

However, the difference between two seasons was insignificant (0.10&0.15) for number of thrips in organic and conventional cultivation, respectively.

Brodbeck *et al.* (2001) found that population of the thrips *Frankliniella occidentalis* was significantly higher on tomatoes that received higher rate of N fertilization. On the other hand, Yoo *et al.* (2011) found that thrips, *Scirtothrips dorsalis* was highly dense in the second and third year of conventional farming, but its occurrence was lowered when the farming technique was shifted to organic farming.

Habashi *et al.* (2007) used some substances such as EM (Effective Microorganisms) and mixture of some microelements to study their effects on the population of spider mite, aphids, thrips and whitefly on cucumber plants. They found that the mean number of these pests was significantly lower than the mean number of those recorded in untreated plants. On the other hand, their results showed that no significant differences were found among predatory species in different treatments.

Plant bugs:

In both seasons of study (2014/2015&2015/2016), the population of plant bugs was recorded in rare numbers. At the first season, the recorded numbers ranged from 1 to 5 individ./12 leaves on organic chamomile throughout the season.The total population reached (12&10 individ./12 leaves) with average of (0.75&0.63) for organic and conventional cultivation, respectively (Table 1).

The same observation was recorded in the second season, plant bugs were found in rare numbers and ranged from 1 to 3 individ., and disappeared in many samples during the season. The total population reached (7&11 individ./12leaves) with average 0.41&0.65 for organic and conventional cultivation, respectively (Table 2).

The difference between the populations of plant bugs in two seasons was insignificant (0.37&0.95) in organic and conventional cultivation, respectively.

Chau & Heong (2005) found that, population of mired bugs was higher on treatment of manure compost and organic fertilizer, also they found that number of water bugs was increased on these above treatments.

Soil fertility practices can impact the physiological susceptibility of crop plants to insect pests by either affecting the resistance of individual plant to attack or by altering plant acceptability to certain herbivores. Some studies have also documented how the shift from organic soil management to chemical fertilizers has increased the potential of certain insects and diseases to cause economic losses (Chau & Heong, 2005).

Yaghoub & Morteza (2014) indicated that pests are generally not a significant problem in organic system, since healthy plants living in good soil with the balanced nutrition are better able to resist against pest and disease attacks.

Owing to positive influence of organic components medicinal plant farming system, it is therefore, be assumed that those farmers who adapted organic management practices found a way to improve the quality of their soil, or at least stemmed the deterioration. The organic system became long term productive by protecting soil and enhancing their fertility ensuring productive capacity for future generations.

Population abundances of insect common natural enemies on organic and conventional chamomile leaves:

The following natural enemies; coccinellid larvae (larvae), *Orius* spp., and insect parasites, were recorded and counted during the study. As shown in Table (3) all aforesaid species were found with rare numbers ranged between 1 to 2 individ., throughout the two seasons and disappeared in most collections.

The total number of former insects in organic and conventional cultivation at first season reached (5,3&4 individ./12 leaves) and (6,4&2 individ./12 leaves) for organic and conventional cultivation, respectively (Table 3).

Table 3: Number of insect predators and parasites on organic and conventional chamomile leaves by direct count during 2014/2015.

	Organic			Conventional		
Predators / Date	Coccinellid larvae	Orius	Insect parasites	Coccinellid larvae	Orius	Insect Parasites
27-10-2014	1	0	0	0	0	0
06-11	0	0	0	0	1	0
16-11	0	1	0	0	0	0
26-11	0	0	0	0	0	0
06-12	1	0	0	1	0	0
16-12	0	0	0	0	0	1
26-12	0	0	0	0	0	0
05-1-2015	1	0	0	0	0	0
15-1	0	0	0	0	0	0
25-1	0	0	1	2	0	0
04-2	0	1	0	0	0	0
14-2	1	0	2	1	0	0
24-2	0	0	0	0	1	1
06-3	1	1	0	1	0	0
16-3	0	0	1	0	1	0
26-3	0	0	0	1	1	0
Total	**5**	**3**	**4**	**6**	**4**	**2**
Mean	**0.31**	**1.19**	**0.25**	**0.38**	**0.25**	**0.13**
Mean(total)	**0.75**			**0.75**		
SD	**0.86**			**0.78**		
T	**0.00**					
S	**1.00**					
r (temp.°C)	**0.055**	**0.076**	**-0.261**	**-0.123**	**0.141**	**-0.257**
r (R.H. %)	**-0.483**	**-0.196**	**-0.288**	**-0.218**	**0.141**	**0.496**

Whereas (SD) Standard Deviation, (T) T- test, (S) Significance [*Significant,**High significant] (r) Correlation Coefficient (Pearson).

Table 4: Number of insect predators and parasites on organic and conventional chamomile leaves by direct count during 2015/2016.

	Organic			Conventional		
Predators / Date	Coccinellid larvae	Orius	Insect parasites	Coccinellid larvae	Orius	Insect parasites
24-10-2015	0	0	0	0	0	0
03-11	0	0	0	0	0	0
13-11	0	0	0	0	0	0
23-11	1	2	0	0	0	0
03-12	0	1	0	1	2	1
13-12	2	2	0	2	1	0
23-12	0	0	1	0	0	1
02-1-2016	0	0	1	0	0	0
12-1	1	0	0	0	0	0
22-1	0	0	0	0	0	0
01-2	0	0	2	0	0	1
11-2	0	1	0	0	0	0
21-2	1	0	0	1	1	1
02-3	1	0	1	0	1	0
12-3	0	1	0	1	0	0
22-3	0	1	0	1	0	0
01-4	0	0	0	1	0	0
Total	**6**	**8**	**5**	**7**	**5**	**4**
Mean	**0.35**	**0.47**	**0.29**	**0.41**	**0.29**	**0.24**
Mean(total) **SD**	**1.12** **1.11**			**0.94** **1.25**		
T **S**	**0.44** **0.67**					
r (temp.°C)	**-0.157**	**-0.054**	**-0.447**	**-0.035**	**-0.053**	**-0.308**
r (R.H. %)	**0.167**	**-0.060**	**0.595***	**-0.292**	**-0.089**	**0.334**

Whereas (SD) Standard Deviation, (T) T- test, (S) Significance[*Significant,**High significant] (r) Correlation Coefficient (Pearson).

Also, few numbers were observed in the second season to record (6, 8&5 individ./12 leaves) in organic plants, and (7, 5&4 individ./12 leaves) in conventional plants for aforementioned insects, respectively (Table 4).

Numbers of natural enemies in organic and conventional cultivation of chamomile in second season were more than recorded in first season.

The difference between the recorded numbers during two seasons in organic cultivation was insignificant (0.83, 0.17 and 0.83) at the population of coccinellid larvae, *Orius* and insect parasites, the same difference was found in conventional cultivation (0.87, 0.81 and 0.42) for these insects, respectively.

Chau & Heong (2005) found that application of manure and organic fertilizers was sound effect to protect natural enemies under field conditions. The same results were obtained in this study.

Aerial collected spiders on chamomile plants in two seasons 2014/2015 & 2015/2016:

Tables (5 & 6) showed the spiders species collected from plants by shaking chamomile plants in two seasons. The total numbers of spiders in conventional plants were more than that recorded in organic plants in two seasons.This result may be related to that plant infestation in conventional cultivation was more than in organic cultivation. The total population of spiders reached (89&106 individ./20 plants)in the first season, and (97&114 individ./20 plants) in the second season for organic and conventional, respectively.

Paré & Tumlinson (1999) refer this result to that the leaves normally release small quantities of volatile chemicals, but when a plant is damaged by herbivorous insects, many volatiles are released. These volatiles attract both parasitic and predatory insects that are natural enemies of the herbivores.

Table 5: Spider population/20 plants collected from organic and conventional chamomile plants during 2014/2015.

	Family \ Date	05/11	20/11	05/12	20/12	04/1	19/1	03/2	18/2	05/3	20/3	Total/season
Organic	**Dictynidae**	0	0	0	0	0	1	0	2	1	2	**6**
	Eutichuridae	0	1	0	0	1	0	2	2	3	2	**11**
	Linyphiidae	1	1	0	1	0	1	2	3	2	4	**15**
	Philodromidae	0	1	1	2	1	0	3	4	3	5	**20**
	Salticidae	1	0	2	1	1	2	1	5	3	2	**18**
	Theridiidae	0	0	1	0	2	0	1	2	2	3	**11**
	Thomisidae	1	1	0	0	1	1	0	3	1	0	**8**
	Total/sample	**3**	**4**	**4**	**4**	**6**	**5**	**9**	**21**	**15**	**18**	**89**
Conventional	**Dictynidae**	0	0	0	0	0	0	2	1	2	3	**8**
	Eutichuridae	0	0	1	1	0	2	1	2	4	2	**13**
	Linyphiidae	1	2	1	0	0	1	3	4	4	9	**25**
	Philodromidae	1	0	2	1	1	2	3	5	6	3	**24**
	Salticidae	0	0	1	0	2	2	0	2	2	5	**14**
	Theridiidae	0	2	1	1	2	0	1	3	2	3	**15**
	Thomisidae	1	0	0	1	0	1	2	0	1	1	**7**
	Total/sample	**3**	**4**	**6**	**4**	**5**	**8**	**12**	**17**	**21**	**26**	**106**

Table 6: Spider population/20 plants collected from organic and conventional chamomile plants during 2015/2016.

	Family \ Date	04/11	19/11	04/12	19/12	03/1	18/1	02/2	17/2	03/3	18/3	02/4	Total/ season
Organic	**Dictynidae**	0	0	0	0	0	0	1	0	2	1	3	**7**
	Eutichuridae	0	1	0	0	2	1	1	3	2	2	0	**12**
	Linyphiidae	0	2	1	1	0	2	1	2	3	5	4	**21**
	Philodromidae	1	0	1	0	0	1	3	4	2	0	2	**14**
	Salticidae	2	3	0	1	3	2	2	3	4	4	2	**26**
	Theridiidae	0	0	1	1	0	1	0	2	3	1	0	**9**
	Thomisidae	0	0	0	0	1	1	0	1	4	1	0	**8**
	Total/sample	**3**	**6**	**3**	**3**	**6**	**8**	**8**	**15**	**20**	**14**	**11**	**97**
Conventional	**Dictynidae**	0	0	0	1	0	0	1	2	2	3	1	**10**
	Eutichuridae	0	0	2	0	2	1	2	3	3	1	0	**14**
	Linyphiidae	1	0	0	1	0	3	3	2	2	3	5	**20**
	Philodromidae	0	2	2	1	1	0	2	4	3	4	1	**20**
	Salticidae	1	0	1	0	2	2	1	2	3	3	2	**17**
	Theridiidae	0	1	1	0	1	1	2	3	2	4	3	**18**
	Thomisidae	0	1	0	1	0	2	1	3	2	4	1	**15**
	Total/sample	**3**	**6**	**6**	**4**	**6**	**9**	**12**	**19**	**17**	**22**	**13**	**114**

Data in Tables (5&6) indicated that the members of Philodromidae, Salticidae and Linyphiidae were the most frequent taxa on organic chamomilein the first season they recorded (20, 18 & 15 individ.), respectively.While, in second season the number of these families reached (14, 26 & 21 individ.), respectively.

On the conventional chamomile, the members of Linyphiidae and Philodromidae in the first season recorded (25&24 individ.), respectively. In the second season the same families, Linyphiidae and Philodromidae recorded (20 individ. of each), followed with Theridiidae (18 individ.).

Tables (7&8) showed that the adults were more abundant than the juveniles, recording (60.67% & 71.13%) in organic chamomile in two seasons respectively, and (70.75% & 69.29%) in conventional chamomile in two seasons, respectively.

Also, the results showed that the sex ratio of total aerial collected spiders were 2.6 ♂: 1♀ in organic chamomile and this ratio was 2.3 ♂: 1♀ in conventional chamomile.

Table 7: Population of spider families and species inhabiting organic and conventional chamomile plants during 2014/2015 season.

	2014/2015									
	Organic					Conventional				
Family, Species	♂	♀	J	Σ	**Total**	♂	♀	J	Σ	**Total**
Dictynidae					**6**					**8**
Dictynidsp.	2	1	3	**6**		3	1	4	**8**	
Eutichuridae					**11**					**13**
Cheiracanthium sp.	5	2	4	**11**		6	4	3	**13**	
Linyphiidae					**15**					**25**
Linyphiid sp.	3	1	1	**5**		5	1	3	**9**	
Mermessus denticulatus	3	0	0	**3**		3	1	1	**5**	
Sengletus extricatus	2	1	4	**7**		6	4	1	**11**	
Philodromidae					**20**					**24**
Philodromus sp.	3	0	3	**6**		3	1	3	**7**	
Thanatus albini	6	3	5	**14**		9	5	3	**17**	
Salticidae					**18**					**14**
Ballus sp.	2	1	3	**6**		1	0	2	**3**	
Phlegra flavipes	5	2	3	**10**		4	1	2	**7**	
Salticid sp.	1	0	1	**2**		1	0	3	**4**	
Theridiidae					**11**					**15**
Enoplognatha gemina	2	0	1	**3**		2	1	1	**4**	
Steatoda erigoniformis	3	1	3	**7**		4	2	2	**8**	
Theridion sp.	1	0	0	**1**		1	0	2	**3**	
Thomisidae					**8**					**7**
Xysticus sp.	3	1	4	**8**		4	2	1	**7**	
Σ	**41**	**13**	**35**			**52**	**23**	**31**		
Total	**89**					**106**				

Table 8: Population of spider families and species inhabiting organic and conventional chamomile plants during 2015/2016 season.

	2015/2016									
	Organic					Conventional				
Family, Species	♂	♀	J	Σ	**Total**	♂	♀	J	Σ	**Total**
Dictynidae					**7**					**10**
Dictynidsp.	3	2	2	**7**		5	2	3	**10**	
Eutichuridae				**12**	**12**					**14**
Cheiracanthium sp.	5	4	3			6	3	5	**14**	
Linyphiidae					**21**					**20**
Linyphiid sp.	5	2	4	**11**		3	0	4	**7**	
Mermessus denticulatus	2	0	1	**3**		1	0	2	**3**	
Sengletus extricatus	3	1	3	**7**		5	2	3	**10**	
Philodromidae					**14**					**20**
Philodromus sp.	2	1	1	**4**		4	2	1	**7**	
Thanatus albini	5	2	3	**10**		7	4	2	**13**	
Salticidae					**26**					**17**
Ballus sp.	3	1	1	**5**		1	1	0	**2**	
Phlegra flavipes	7	3	4	**14**		5	2	1	**8**	
Salticid sp.	5	2	0	**7**		3	1	3	**7**	
Theridiidae					**9**					**18**
Enoplognatha gemina	0	0	2	**2**		1	1	3	**5**	
Steatoda erigoniformis	4	2	1	**7**		5	2	2	**9**	
Theridion sp.	0	0	0	**0**		2	1	1	**4**	
Thomisidae					**8**					**15**
Xysticus sp.	4	1	3	**8**		7	3	5	**15**	
Σ	**48**	**21**	**28**			**55**	**24**	**35**		
Total	**97**					**114**				

Population and relative abundance of spiders collected from chamomile plants in two seasons, 2014/2015&2015/2016:

2014/2015 season:

The total number of collected spiders from chamomile plants during this season was 195 individ. (89 individ. for organic and 106 individ. for conventional). The collected spiders were classified to 14 species in 7 families (Table 9).

As revealed in Table (9) in organic cultivation, Philodromidae was the most dominant family of spiders which represented (22.47%), followed by Salticidae, Linyphiidae, Theridiidae and Eutichuridae with ratios of (20.22, 16.85, 12.36, 12.36%), respectively. Thomisidae and Dictynidae were the subdominant families with ratios of (8.99 and 6.74%), respectively. Rizk *et al*. (2012) found that family Philodromidae represented 23.6 % of the total spiders collected from red pepper plants. Ghallab (2013) considered that family Miturgidae was the most abundant family (20.1 %) followed by Philodromidae (19.75%), Salticidae (18.3%), and Theridiidae (14.6%), of the total spiders collected from foliage of two ornamental plants (Lantana shrubs and Croton trees).

Table 9: Relative abundance-frequency relationship of spider communities in organic andconventional chamomile plants during 2014/2015 season.

	2014/2015									
	Organic					Conventional				
Family, Species	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.
Dictynidae				6.74	A				7.55	A
Dictynid sp.	6	6.74	Sd			8	7.55	Sd		
Eutichuridae				12.36	A				12.26	A
Cheiracanthium sp.	11	12.36	D			13	12.26	D		
Lyniphiidae				16.85	A				23.58	A
Linyphiid sp.	5	5.62	Sd			9	8.49	Sd		
Mermessus denticulatus	3	3.37	R			5	4.72	R		
Sengletus extricatus	7	7.87	Sd			11	10.38	D		
Philodromidae				22.47	A				22.64	A
Philodromus sp.	6	6.74	Sd			7	6.60	Sd		
Thanatus albini	14	15.73	D			17	16.04	D		
Salticidae				20.22	A				13.21	A
Ballus sp.	6	6.74	Sd			3	2.83	R		
Phlegra flavipes	10	13.48	D			7	6.60	Sd		
Salticid sp.	2	2.25	R			4	3.77	R		
Theridiidae				12.36	A				14.15	A
Enoplognatha gemina	3	3.37	R			4	3.77	R		
Steatoda erigoniformis	7	7.87	Sd			8	7.55	Sd		
Theridion sp.	1	1.12	R			3	2.83	R		
Thomisidae				8.99	A				6.60	A
Xysticus sp.	8	8.99	Sd			7	6.60	Sd		
Total	89					106				

Abundance: Sr=Subrecedent (< 1%), R= Recedent (1-5%), Sd=Subdominant (>5-10%), D=Dominant (>10-30%) Ed = Eudominant (>30%), **Frequency:** C=Constant (>50%), Ac=Accessory (25-50%), A=Accidental (<25%)

Thanatus albini (Philodromidae), *Phlegra flavipes* (Salticidae) and *Cheiracanthium* sp. (Eutichuridae) were the dominant species with ratios of (15.73, 13.48 and 12.36%) of the collected population.

The subdominant species were *Xysticus* sp. (8.99%), *Sengletus extricatus* (7.87%), *Steatoda erigoniformis* (7.87), *Ballus* sp. (6.74%), Dictynid sp. (6.74%), *Philodromus* sp. (6.74%), and Linyphiid sp. (5.62%).

Enoplognatha gemina, Mermessus denticulatus, Salticid sp. and *Theridion* sp., were found resident with ratios of (3.37, 3.37, 2.25 and 1.12%), respectively.

In conventional cultivation, Linyphiidae was the most dominant family of spiders which represented (23.58%), followed by Philodromidae, Theridiidae, Salticidaeand Eutichuridae with ratios of (22.64, 14.15, 13.21, 12.26%), respectively. Dictynidae and Thomisidae were the subdominant families with ratios of (7.55 and 6.60%), respectively.

Thanatus albini (Philodromidae), *Cheiracanthium* sp. (Eutichuridae) *and Sengletus extricates* (Linyphiidae) were the dominant species with ratios of (16.04, 12.26 and 10.38%) of the collected population, respectively.

The subdominant species wereLinyphiid sp.(8.49%), Dictynid sp., *Steatoda erigoniformis* (7.55 of each), *Philodromus* sp., *Phlegra flavipes* and *Xysticus* sp. with ratio of (6.60 of each).

Mermessus denticulatus, Enoplognatha gemina, Salticid sp. *Ballus* sp. and *Theridion* sp., were found resident with ratios of (4.72, 3.77, 3.77, 2.83 and 2.83%), respectively (Table 9).

2015/2016 season:

The total number of the collected spiders was 211 individ. (97 individ., for organic and 114 individ. for conventional) which were classified to 14 species in 7 families (Table 10).

Table 10: Relative abundance-frequency relationship of spider communities in organic and conventional chamomile plants during 2015/2016 season.

	2015/2016									
	Organic					Conventional				
Family, Species	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.
Dictynidae				7.22	A				8.77	A
Dictynid sp.	7	7.22	Sd			10	8.77	Sd		
Eutichuridae				12.37	A				12.28	A
Cheiracanthium sp.	12	12.37	D			14	12.28	D		
Lyniphiidae				21.65	A				17.54	A
Linyphiid sp.	11	11.34	D			7	6.14	Sd		
Mermessus denticulatus	3	3.09	R			3	2.63	R		
Sengletus extricatus	7	7.22	Sd			10	8.77	Sd		
Philodromidae				14.43	A				17.54	A
Philodromus sp.	4	4.12	R			7	6.14	Sd		
Thanatus albini	10	10.31	D			13	11.40	D		
Salticidae				26.80	Ac				14.91	A
Ballus sp.	5	5.15	Sd			2	1.75	R		
Phlegra flavipes	14	14.43	D			8	7.02	Sd		
Salticid sp.	7	7.22	Sd			7	6.14	Sd		
Theridiidae				9.28	A				15.79	A
Enoplognatha gemina	2	2.06	R			5	4.39	R		
Steatoda erigoniformis	7	7.22	Sd			9	7.89	Sd		
Theridion sp.	0	0.00	Sr			4	3.51	R		
Thomisidae				8.25	A				13.16	A
Xysticus sp.	8	8.25	Sd			15	13.16	D		
Total	97					114				

Abundance: Sr=Subrecedent (< 1%), R= Recedent (1-5%), Sd=Subdominant (>5-10%), D=Dominant (>10-30%) Ed = Eudominant (>30%), **Frequency:** C=Constant (>50%), Ac=Accessory (25-50%), A=Accidental (<25%).

Data in Table (10) explained that in organic cultivation, the most dominant family was Salticidae (26.80%) followed by Linyphiidae (21.65%), Philodromidae (14.43%) and Eutichuridae (12.37%). Theridiidae, Thomisidae and Dictynidae were subdominant families with ratios of (9.28, 8.25 and 7.22%), respectively.

Phlegra flavipes (Salticidae) was the most dominant species representing (14.43%) of the total population, followed by *Cheiracanthium* sp. (12.37%), Linyphiid sp. (11.34%) and *Thanatus albini* (10.31%).

The subdominant species were *Xysticus* sp. (8.25%), followed by Dictynid sp., Salticid sp., *Sengletus extricatus*, *Steatoda erigoniformis* (7.22% of each) and *Ballus* sp. (5.15%). However, *Philodromus* sp., *Mermessus denticulatus*, and *Enoplognatha gemina* were considered resident species with the ratios of (4.12, 3.09 and 2.06%), respectively.

In conventional cultivation, Linyphiidae and Philodromidae were the most dominant families with (17.54% of each), followed by Theridiidae, Salticidae, Thomisidae and Eutichuridae with the ratios of (15.79, 14.91, 13.16 and 12.28%), respectively. While, family Dictynidae was considered subdominant with the ratio (8.77%).

The dominant species were *Xysticus* sp. (13.16%), *Cheiracanthium* sp. (12.28%) and *Thanatus albini* (11.40%). However, subdominant species were Dictynid sp., *Sengletus extricatus* (8.77% of each), *Steatoda erigoniformis* (7.89%), *Phlegra flavipes* (7.02%), Linyphiid sp., *Philodromus* sp. and Salticid sp. (6.14% of each). While, *Enoplognatha gemina*, *Theridion* sp., *Mermessus denticulatus*, and *Ballus* sp., were considered resident species with ratios of (4.39, 3.51, 2.63 and 1.75%), respectively (Table 10).

Rizk *et al*. (2012) found that Philodromidae was "dominant" in Castor bean and Red pepper as shown in the classification of dominance, while the families Theridiidae, Dyctinidae, and Thomisidae were "dominant" in Spearmint and all were "accidental" according to Weis Fog system.

According to Shannon-Wiener "H" index the chamomile conventional cultivation recorded high value (2.52) than organic cultivation (2.48) in the first season. Similarly, in the second season, "H" value was (2.52) for conventional cultivation, while this value was (2.46) for organic cultivation (Table 11).

Consequently, these values indicated that conventional chamomile harbored more of spider numbers than the organic chamomile in both seasons.

According to Simpson "S" index, which reflect the measure of dominance, it was found that the highest value recorded was in the organic chamomile (0.093) in the second season, while the lowest value recorded was in the conventional chamomile (0.087) in the second season, as well. However, in the first season both chamomile cultivations obtained the same value (0.090) (Table 11).

Table 11: Estimation of Shannon-Wiener [H'] and Simpson [S] Indices of spider diversity inorganic and conventional farming systems.

Season		2014 / 2015		2015 / 2016	
Type of agric. \ Type of index		H'	S	H'	S
Chamomile	Organic	2.48	0.094	2.46	0.093
	Conventional	2.52	0.090	2.52	0.087

Similarity of species:

The number of collected spiders throughout study period from organic farming was less than those collected from conventional farming (186 and 220 individ.), respectively. However, the same number of spider species was obtained in the organic and conventional chamomile (14 species of each) in first season, while the number of species was (13species for organic and 14 species for conventional) in second season.

So, according to Sørensen's quotient of similarity (QS) no difference was observed between spider communities for both organic and conventional chamomile in first season (QS=1). While, the inconsiderable difference was found between spider communities for organic and conventional chamomile in second season (QS=0.96).

CONCLUSION

Whether chamomile farmed organically or conventionally, it is essential to know the incidence, abundance and diversity of pests and how to monitor them, as well as to identify beneficial arthropods, especially spiders, to effectively manage pests in these plants. Also it is essential to indicate that organic agricultural methods are more environmentally sound than conventional ones, which is dependent on the used chemical nutrient applications in the production of crops, but organic agriculture results in less leaching of nutritious.

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ARABIC SUMMARY

تأثير الزراعة العضوية والتقليدية على تواجد بعض الآفات الحشرية الثاقبة الماصة وأعدائها الحيوية فى الشيح فى محافظة الفيوم

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يعتبر الشيح من أهم النباتات الطبية فى مصر، وأجريت الدراسة فى محافظة الفيوم والتى تعتبر من أهم المناطق فى زراعة هذا المحصول وأعلاها انتاجا. وتمت الدراسة خلال موسمين متتاليين ٢٠١٥/٢٠١٤ و٢٠١٦/٢٠١٥، وتهدف إلى توضيح الإختلاف بين الزراعة التقليدية والزراعة العضوية على الإصابة ببعض الحشرات الثاقبة الماصة وأعدائها الحيوية، خاصة العناكب والتى تعتبر من أهم المجموعات المفترسة. أوضحت النتائج أن المن أكثر الآفات الحشرية التى تصيب نباتات الشيح، وكانت درجة الإصابة على الشيح التقليدى أعلى من العضوى حيث بلغ التعداد الكلى ٣٥٦ فرداً على الشيح التقليدى و٣٠٢ فرداً على الشيح العضوى فى الموسم الأول ٢٠١٥/٢٠١٤ وازداد هذا العدد فى الموسم الثانى إلى ٣٩٣ فرداً للعضوى و٤٤١ فرداً للتقليدى. الإصابة بالتربس أيضا كانت أعلى فى الشيح التقليدى عن العضوى حيث بلغ التعداد الكلى ١٤٧ فرداً للتقليدى و١٣٩ فرداً للعضوى فى الموسم الأول، وقل التعداد كثيراً فى الموسم الثانى ليسجل ٧٩ فرداً للعضوى و٨٨ فرداً للتقليدى. بق النبات لوحظ بأعداد قليلة بلغت ١٢ فرداً للعضوى و١٠ أفراد للتقليدى فى الموسم الأول و٧ أفراد للعضوى و١١ فرداً للتقليدى فى الموسم الثانى. أما الأعداء الحيوية والتى تمثلت فى يرقات أبى العيد وبق الأوريس والطفيليات الحشرية فقد سجلت جميعها بأعداد قليلة جداً على كلتا الزراعتين خلال الموسمين. على الجانب الآخر أظهرت الدراسة أن تعداد العناكب على نباتات الشيح التقليدى كان أعلى من التعداد الذى سجل على نباتات الشيح العضوى فى كلا الموسمين، حيث بلغ التعداد الكلى للعناكب ١٠٦ فرداً للتقليدى ٨٩ فرداً للعضوى فى الموسم الأول، وازداد التعداد قليلاً فى الموسم الثانى إلى ١١٤ فرداً للتقليدى و٩٧ فرداً للعضوى. وعلى ذلك يمكن استنتاج أن تعداد العناكب يمكن أن يكون له علاقة بتعداد الآفات الحشرية، حيث كان تعدادها أقل على نباتات الشيح المنزرعة عضوياً والتى احتوت أيضاً على تعداد أقل من الآفات الحشرية من التعداد الذى سجل على نباتات الشيح المنزرعة تقليديا.