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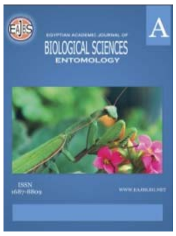

The Difference Between Organic and Conventional Cultivation on Biodiversity Activity of Spiders (Araneae) in Chamomile and Chrysanthemum in Fayoum Governorate, Egypt

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ABSTRACT

Spiders were sampled from organically and conventionally farmed Chamomile, *Matricaria chamomilla* and Chrysanthemum, *Calendula officinalis* in two successive growing seasons 2014/2015 and 2015/2016 in Fayoum region. Spiders were collected by ground pitfall traps. Seventeen species of spiders were recorded. Most of collected species belong to the family Lycosidae, with especially high captures of *Honga* sp., *Pardosa* sp., and *Wadicosa fidelis*. The Gnaphosidae was represented by *Micaria dives* and *Zelotes laetus*, although the samples were largely dominated by the presence of *Steatoda erigoniformis*, Theridiidae. Results showed that more spider population, and a greater number of spider species, were captured from organic than from conventional fields.

INTRODUCTION

The organic farming systems are the extreme expression of low-input agriculture in the UK (Feber *et al*., 1998). Such systems could potentially sustain longer or more diverse spider communities than more intensive farming systems because of the absence of agrochemical use and the typically more complex crop rotations within the system. For example, Gluck & Ingrish (1990) showed that intensively farmed fields had fewer spider species, and lower activity of Lycosidae, than bio-dynamic fields.

Chamomile [*Matricaria chamomilla*] and Chrysanthemum [*Calendula officinalis*] are considered medically beneficial plants, and they have many medical benefits for humans. The active substances extracted from them are used in the pharmaceutical, food, detergent, perfume and cosmetic industries. These plants are considered the most dominant medicinal and aromatic plants cultivated in Fayoum Governorate, the first producer of these crops in Egypt. According to the latest registered data of 2015, the "feddan" area cultivated in Fayoum yields (ton/fed.) 0.830 & 15.373 and production (ton) 7308 & 7256 for Chamomile and Calendula, respectively.

Our study aimed to characterize the spider communities of organic and conventional Chamomile and Calendula in Fayoum (Egypt) and quantify the differences which might exist between the spider assemblages of the two systems.

We discuss the implications of any differences for spider conservation in contrasting arable systems.

MATERIALS AND METHODS

Study area:

A field experiment of 2400m^2 in two different regions in Fayoum Governorate for organic and conventional management was conducted. Each region was divided into two equal plots (600m^2 each) cultivated with two medicinal plants, Chamomile, *Matricaria chamomilla*, and Chrysanthemum, *Calendula officinalis*.

The organic plots were fertilized with compost and no sprays were used, while the conventional plots were treated with inorganic fertilizers and sprayed with pesticides when appropriate.

Sampling method:

Spiders were sampled in organic and conventional fields at each site after two weeks of transplantation, using pitfall trap method as described by Slingsby & Cook (1986) and Southwood and Henderson (2000). Although experiments have shown that pitfall trap catches can be affected by a number of factors such as differing activity rates and habitat structure (Topping, 1993; Topping & Sunderland, 1992), pitfall trapping is nonetheless a valuable and widely used method of investigating the activity of surface-dwelling invertebrates (e.g., Luff & Eyre, 1988; Merrett & Snazell, 1983), as long as the results are interpreted in terms of catch size and composition rather than mean densities.

Pitfall trapping was conducted at the end of October in two seasons and continues to the last week of March .Ten pitfall traps (plastic cups of 7 cm diameter, 8 cm deep) were placed in each of the fields under study, these traps were left for 24 hours. Samples were taken every ten days, stored in a 70% ethanol solution with some droplets of glycerin during sorting and identification to species level as much as possible.

Identification of spiders:

Spiders were identified according to Kaston (1978), Roberts (1987), Levi (2002), Oger (2002), Ovtsharenko & Tanasevitch (2002), Prószyński (2003), Huber (2005), El-Hennawy (2006), and Platnick (2012). Voucher specimens were preserved in 70% alcohol and deposited in a reference collection lodged in the plant protection Research institute, Cairo.

Frequency and abundance values:

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 individuals Eudominant species (Ed) (> 30% individuals), Dominant species (D) (10-30% individuals), Subdominant (Sd) (5-10% individuals), Recedent species (R) (1-5% individuals), and Subrecedent species (Sr) (<1% individuals).

Species diversity:

The biodiversity of ground spiders fauna 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 *i* calculated as described by Ludwig & Reynolds (1988).

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

Where *ni* is the number of individuals belonging to the i^{th} of "S" taxa in the sample and "n" is the total number of individuals 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 individuals drawn at random from the population belong to the same species. If the result is high then the probability of both individuals 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: $QS = 2C / A + B$.

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

Spider assemblages:

Seventeen species of spiders belong to 10 families were collected during this study (Tables1-2). Most of individuals belong to family Lycosidae and are commonly recorded on agricultural land in Egypt (Feber *et al*., 1998; Tahir & Butt, 2009; Rizk *et al*., 2012 & 2015). Members of Lycosidae were represented with high captures of *Hong*a sp., *Pardosa* sp., and *Wadicosa fidelis*. The most abundant species were, *Wadicosa fidelis* (291 individ.), *Pardosa* sp. (207 individ.), and *Hogna* sp. (133 individ.). Nyffeler & Benz (1988) showed that, family Lycosidae were well represented by *Pardosa* and *Trochosa* spp., although the samples were largely dominant by the presence of *Pardosa palustris*.

The Gnaphosidae were well represented by *Micaria dives* and *Zelotes laetus*. The recorded numbers were 92 and 50 individuals during the study, respectively.

The remaining species were recorded as follows: *Steatoda erigoniformis*, Theridiidae (79 individ.), *Sengletus extricatus*, Linyphiidae (39 individ.), *Thanatus albini*, Philodromidae (67 individ.), and *Cheiracanthium* sp., Eutichuridae (29 individ.). Also, uncommon spider species were captured during the study, the numbers of these species were: *Nurscia albomaculata*, Titanoecidae (14 individ.), Dictynid sp. 2, Dictynidae (17 individ.), Dictynid sp.1, Dictynidae (7 individ.), and *Oecobius* sp., Oecobiidae (3 individ.).

Tahir & Butt (2009) indicated this result, which the group of dominant spider species was seen in all fields under investigation. However, abundance and spatial distribution of a particular species significantly depend on the type of management practices in the field.

Table 1: 1 Population of spider families and species collected by pitfall traps in organic Chamomile and Calendula during two seasons 2014/2015 & 2015/2016.

	2014/2015										2015/2016									
	Chamomile					Calendula					Chamomile					Calendula				
Family, Species	?	?	J	Σ	Total	?	?	J	Σ	Total	?	?	J	Σ	Total	?	?	J	Σ	Total
Dictynidae																				
Dictynid sp.1	0	0	0	0	3	1	1	1	3	6	1	0	0	1	4	0	0	0	0	3
Dictynid sp.2	1	1	1	3		2	1	0	3		1	1	1	3		0	1	2	3	
Euticharidae					7					0					3					5
Cheiracanthium sp.	3	2	2	7		0	0	0	0		2	1	0	3		2	1	2	5	
Gnaphosidae																				
Micaria dives	7	5	1	13	22	9	4	5	18	27	2	1	1	4	8	6	4	4	14	20
Zelotes laetus	6	2	1	9		4	3	2	9		3	1	0	4		4	2	0	6	
Lycosidae																				
Hogna sp.	7	3	3	13	57	8	4	4	16	79	9	4	5	18	102	12	5	8	25	117
Pardosa sp.	10	4	4	18		13	7	6	26		16	10	5	31		20	13	8	41	
Wadicosa fidelis	13	10	3	26		9	11	7	37		28	17	8	53		22	9	10	51	
Linyphiidae																				
Mermessus denticulatus	2	0	0	2	8	1	0	0	1	7	1	0	1	2	4	2	1	0	3	9
Sengletus extricatus	4	1	1	6		4	2	0	6		2	0	0	2		3	2	1	6	
Oecobiidae					0					2					0					1
Oecobius sp.	0	0	0	0		1	0	1	2		0	0	0	0		0	0	1	1	
Philodromidae					6					12					9					11
Thanatus albini	4	2	0	6		5	3	4	12		5	2	2	9		6	3	2	11	
Salticidae																				
Ballus sp.	2	1	1	4	9	1	1	1	3	9	0	1	1	2	8	1	0	1	2	6
Phlegra flavipes	3	2	0	5		4	2	0	6		3	2	1	6		2	1	1	4	
Theridiidae																				
Enoplognatha gemina	3	1	0	4	10	5	2	0	7	11	0	1	0	1	6	2	0	0	2	23
Steatoda erigoniformis	4	2	0	6		3	1	0	4		3	2	0	5		13	8	0	21	
Titanoecidae					0					4					3					2
Nurscia albomaculata	0	0	0	0		2	1	1	4		2	0	1	3		1	0	1	2	
Σ	69	36	17			82	43	32			78	43	26			96	60	41		
Total	122					157					147					197				

Species restriction:

Spiders inhabiting land of organic management:

A total of 122 & 147 spider individuals were caught in the Chamomile organic cultivation in two seasons 2014/2015 and 2015/2016, respectively. The species were classified in 8 & 9 families and 14 & 16 species respectively. Juveniles comprised 13.9%, 17.7%, while adults averaged 86.1%, 82.3% respectively in two seasons. The sex ratio was 1.9: 1 and 1.8 : 1 males (M) : females (F) in two seasons, Table (1).

When both sampling data were combined, one species, Dictynid sp.1 (Dictynidae), was not recorded in first season.

Also in Table (2) results show that a total of 97 & 118 spider individuals were caught in the Chamomile conventional cultivation in two seasons, respectively. These species were classified in 9 & 8 families and 15 & 15 species in two seasons, respectively. Juveniles comprised 6.2% & 18.6%, while adults averaged 93.8% & 81.4% in two seasons, respectively.

The sex ratio was 1.9: 1 and 2: 1 (M: F) in 2014/2015 and 2015/2016, respectively.

When both sampling data were combined, one species, Dictynid sp.1, disappeared in first Chamomile conventionally farmed field, also in second season in the same field, one species, *Nurscia albomaculata*, was not recorded.

Table (1) also shows, a total of 157 & 197 spider individuals were collected from Calendula organic cultivation in two seasons respectively, and classified into 9 & 10 families and 16 & 16 species in two seasons, respectively. Juveniles comprised 20.4% & 20.8%, while adults averaged 79.6% & 79.2% in two seasons, respectively. The sex ratio was 1.9: 1 and 1.6: 1 (M: F) in 2014/2015 and 2015/2016, respectively.

When both sampling data were combined, one species, *Cheiracanthium* sp., disappeared in first season, also one species, Dictynid sp.1, was not recorded in second season.

Results in Table (2) shows that a total of 126 & 171 spider individuals were caught in the Calendula conventional cultivation in two seasons respectively, and classified into 8 & 9 families and 15 & 14 species in two seasons, respectively. Juveniles comprised 17.5% & 19.3%, while adults averaged 82.5% & 80.7% in two seasons, respectively. The sex ratio was 1.8: 1 and 1.7: 1 (M: F) in 2014/2015 and 2015/2016, respectively.

Table 2: Population of spider families and species collected by pitfall traps in conventional Chamomile and Calendula during two seasons 2014/2015 & 2015/2016.

	2014/2015										2015/2016									
	Chamomile					Calendula					Chamomile					Calendula				
Family, Species	?	?	J	Σ	Total	?	?	J	Σ	Total	?	?	J	Σ	Total	?	?	J	Σ	Total
Dictynidae					2					3					3					1
Dictynid sp.1	0	0	0	0		1	1	0	2		0	0	1	1		0	0	0	0	
Dictynid sp.2	1	0	0	1		0	0	1	1		1	0	1	2		1	0	0	1	
Eutichuridae					5					1					2					6
Cheiracanthium sp.	3	1	1	5		1	0	0	1		1	0	1	2		3	2	1	6	
Gnaphosidae					13					28					12					13
Micaria dives	5	3	0	8		12	4	4	20		5	2	0	7		5	2	1	8	
Zelotes laetus	2	2	0	4		4	3	1	8		2	0	3	5		3	2	0	5	
Lycosidae					42					55					74					105
Hogna sp.	3	2	2	7		6	5	3	14		9	5	2	16		6	7	11	24	
Pardosa sp.	12	8	1	21		11	4	4	19		13	6	3	22		16	9	4	29	
Wadicosa fidelis	7	7	0	14		10	9	3	22		19	13	4	36		31	16	5	52	
Linyphiidae					7					12					6					6
Mermessus denticulatus	1	0	0	1		3	1	0	4		1	0	1	2		1	0	0	1	
Sengletus extricatus	5	1	0	6		4	1	3	8		1	2	1	4		3	1	1	5	
Oecobiidae					0					0					0					0
Oecobius sp.	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0	
Philodromidae					8					7					7					7
Thanatus albini	4	3	1	8		3	2	2	7		4	2	1	7		3	1	3	7	
Salticidae					7					5					6					3
Ballus sp.	2	0	0	2		1	0	0	1		1	0	0	1		0	0	0	0	
Phlegra flavipes	3	1	0	4		3	1	0	4		1	1	3	5		2	0	1	3	
Theridiidae					12					15					8					26
Enoplognatha gemina	4	1	0	5		3	1	1	5		2	0	0	2		2	1	3	6	
Steatoda erigoniformis	5	2	0	7		6	4	0	10		4	1	1	6		10	9	1	20	
Titanoecidae					1					0					0					4
Nurscia albomaculata	1	0	0	1		0	0	0	0		0	0	0	0		1	1	2	4	
Σ	60	31	6			68	36	22			64	32	22			87	51	33		
Total	97					126					118					171				

When both sampling data were combined, one species, *Nurscia albomaculata*, was not collected in first season, also one species, *Ballus* sp., disappeared in second season.

Monthly fluctuation of spider population "Catch size":

In March, more spiders were caught in each of organic and conventional Chamomile, 35 & 26 individ., and 34 & 23 individ. in two seasons respectively, Tables (5-6).

In April, more spiders were caught in each of organic and conventional Calendula, 32 & 43 individ. and 24 & 32 individ. in two seasons respectively, Tables (5-6).

The total number of spiders collected from organic Calendula were 157 & 197 individ. in two seasons respectively, while 126 & 171 individ. were collected in Calendula conventional respectively, in the period between October and May in first season and last week of April in second season.

Feber *et al*. (1998) indicated this result, they mentioned that in late May more spiders were caught in all three organic farms than in all three conventional farms. Also, they indicated that significantly more spiders were caught in the organic fields than the conventional fields.

Unlike, spiders caught in winter were lower in both organic and conventional cultivations (Tables 5-6). Several researchers reported that the winter was the lowest abundance for spiders while in summer the population density of spiders increased (Rizk *et al*., 2012).

Table 5: Number of spiders collected from Chamomile and Calendula fields by pitfall traps during 2014/2015.

Date	Chamomile		Calendula	
	Organic	Conventional	Organic	Conventional
	Spider population		Spider population	
27-Oct.2014	3	4	6	3
06-Nov.	6	2	4	5
16-Nov.	4	3	5	7
26-Nov.	7	8	8	4
06-Dec.	11	7	5	3
16-Dec.	9	11	6	4
26-Dec.	8	9	4	2
05-Jan.2015	6	3	8	5
15-Jan.	5	4	5	6
25-Jan.	10	7	7	9
04-Feb.	8	4	9	6
14-Feb.	6	6	6	4
24-Feb.	4	3	5	8
06-Mar.	9	6	7	5
16-Mar.	12	9	4	4
26-Mar.	14	11	7	5
05-Apr.			10	8
15-Apr.			12	7
25-Apr.			10	9
05-May.			13	12
15-May.			16	10
Total	**122**	**97**	**157**	**126**
Mean	**7.63**	**6.06**	**7.48**	**6**

Table 6: Number of spiders collected from Chamomile and Calendula fields by pitfall traps during 2015/2016.

Date	Chamomile		Calendula	
	Organic	Conventional	Organic	Conventional
	Spider population		Spider population	
24-Oct.2015	15	11	17	14
03-Nov.	10	8	9	11
13-Nov.	8	6	12	9
23-Nov.	5	3	9	10
03-Dec.	7	6	14	13
13-Dec.	8	4	11	7
23-Dec.	6	7	7	9
02-Jan.2016	8	9	9	5
12-Jan.	9	6	7	7
22-Jan.	4	3	6	3
01-Feb.	5	7	4	5
11-Feb.	10	8	6	3
21-Feb.	7	5	10	8
02-Mar.	12	8	13	13
12-Mar.	9	6	11	10
22-Mar.	13	9	9	12
01-Apr.	11	12	12	11
11-Apr.			17	9
21-Apr.			14	12
Total	**147**	**118**	**197**	**171**
Mean	**8.65**	**6.94**	**10.37**	**9**

Furthermore, Rizk *et al*. (2015) indicated this result and reported that monthly counts of spiders collected from the organic and conventional cultivations in the period between Octobr and first week of May occurred in high abundance in March and recorded 109 individuals with 3 egg sacs for the organic while respective numbers in conventional cultivation was 88 individuals and one egg sac.

Similar results were reported by Mushtaq *et al*. (2000); they recorded that maximum number of foliage spider species were recorded in monthly sample of May.

These results agree with Ghallab (2013) who indicated that total monthly counts of spiders collected from Croton trees occurred in high abundance in early summer during May and the lowest numbers were recorded during February, also she found that the highest number of spiders on Lantana plants were collected in May & June while the lowest numbers of spiders were recorded during December, January, and February.

Frequency and abundance values:

Table (3) showed the frequency and abundance values of the most abundant spiders in organic Chamomile and Calendula during two seasons 2014/2015 & 2015/2016. According to"Weis Fogh system" family Lycosidae was considered "accessory" 46.72% in organic Chamomile in first season and "constant" 69.39% in second season. Also this family was considered "constant" in the organic Calendula with 50.32 & 59.39% in two seasons, respectively.

Table 3: Relative abundance -frequency relationship of spider communities in organic Chamomile and Calendula during two seasons 2014/2015 & 2015/2016.

	2014/2015										2015/2016									
	Chamomile					Calendula					Chamomile					Calendula				
Family, Species	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.
Dictynidae				2.46	A				3.82	A				2.72	A				1.52	A
Dictynid sp.1	0	0	Sr			3	1.91	R			1	0.68	Sr			0	0	Sr		
Dictynid sp.2	3	2.46	R			3	1.91	R			3	2.04	R			3	1.52	R		
Eutichuridae				5.74	A				0	A				2.04	A				2.54	A
Cheiracanthium sp.	7	5.74	Sd			0	0	Sr			3	2.04	R			5	2.54	R		
Gnaphosidae				18.03	A				17.2	A				5.44	A				10.15	A
Micaria dives	13	10.66	D			18	11.46	D			4	2.72	R			14	7.11	Sd		
Zelotes laetus	9	7.38	Sd			9	5.73	Sd			4	2.72	R			6	3.05	R		
Lycosidae				46.72	Ac				50.32	C				69.39	C				59.39	C
Hogna sp.	13	10.66	D			16	10.19	D			18	12.24	D			25	12.69	D		
Pardosa sp.	18	14.75	D			26	16.56	D			31	21.09	D			41	20.81	D		
Wadicosa fidelis	26	21.31	D			37	23.57	D			53	36.05	Ed			51	25.88	D		
Linyphiidae				6.56	A				4.46	A				2.72	A				4.57	A
Mermessus denticulatus	2	1.64	R			1	0.64	Sr			2	1.36	R			3	1.52	R		
Sengletus extricates	6	4.92	R			6	3.82	R			2	1.36	R			6	3.05	R		
Oecobiidae				0	A				1.27	A				0	A				0.51	A
Oecobius sp.	0	0	Sr			2	1.27	R			0	0	Sr			1	0.51	Sr		
Philodromidae				4.92	A				7.64	A				6.12	A				5.58	A
Thanatus albini	6	4.92	R			12	7.64	Sd			9	6.12	Sd			11	5.58	Sd		
Salticidae				7.38	A				5.73	A				5.44	A				3.05	A
Ballus sp.	4	3.28	R			3	1.91	R			2	1.36	R			2	1.02	R		
Phlegra flavipes	5	4.1	R			6	3.82	R			6	4.08	R			4	2.03	R		
Theridiidae				8.2	A				7.01	A				4.08	A				11.68	A
Enoplognatha gemina	4	3.28	R			7	4.46	R			1	0.68	Sr			2	1.02	R		
Steatoda erigoniformis	6	4.92	R			4	2.55	R			5	3.4	R			21	10.66	D		
Titanoecidae				0	A				2.55	A				2.04	A				1.02	A
Nurscia albomaculata	0	0	Sr			4	2.55	R			3	2.04	R			2	1.02	R		
Total	122					157					147					197				

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

Table (4) showed that the Lycosidae was considered "accessory" (43.30 & 43.65%) in conventional Chamomile and Calendula in first season, respectively. But, Lycosidae was considered "constant" (62.71 & 61.40%) in the conventional Chamomile and Calendula, respectively, in the second season.

Members of family Lycosidae: *Hogna* sp., *Pardosa* sp., and *Wadicosa fidelis* ranged between "dominant" and "eudominant" (according to Weigmann classification of dominance) (Table 4). Our results agreed with the results which were obtained by Shuang-Lin and Bo-Ping (2006) who indicated that Lycosidae was the dominant family and occupied more than 60% of individual's community.

Table 4: Relative abundance-frequency relationship of spider communities in conventional Chamomile and Calendula during two seasons 2014/2015 & 2015/2016.

	2014/2015										2015/2016									
	Chamomile					Calendula					Chamomile					Calendula				
Family, Species	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.	Σ	Sp.%	Dom.	Fam.%	Freq.
Dictynidae																				
Dictynid sp.1	0	0	Sr	2.06	A	2	1.59	R	2.38	A	1	0.85	Sr	2.54	A	0	0	Sr	0.58	A
Dictynid sp.2	2	2.06	R			1	0.79	Sr			2	1.69				1	0.58	Sr		
Eutichuridae																				
Cheiracanthium sp.	5	5.15	Sd	5.15	A	1	0.79	Sr	0.79	A	2	1.69	R	1.69	A	6	3.51	R	3.51	A
Gnaphosidae																				
Micaria dives	9	9.28	Sd	13.4	A	20	15.87	D	22.22	A	7	5.93	Sd	10.17	A	8	4.68	R	7.6	A
Zelotes laetus	4	4.12	R			8	6.35	Sd			5	4.24	R			5	2.92	R		
Lycosidae																				
Hogna sp.	7	7.22	Sd	43.3	Ac	14	11.11	D	43.65	Ac	16	13.56	D	62.71	C	24	14.04	D	61.4	C
Pardosa sp.	21	21.65	D			19	15.08	D			22	18.64	D			29	16.96	D		
Wadicosa fidelis	14	14.43	D			22	17.46	D			36	30.51	Ed			52	30.41	Ed		
Lyniphiidae																				
Mermessus denticulatus	1	1.03	R	7.22	A	4	3.17	R	9.52	A	2	1.69	R	5.08	A	1	0.58	Sr	3.51	A
Sengletus extricates	6	6.19	Sd			8	6.35	Sd			4	3.39	R			5	2.92	R		
Oecobiidae																				
Oecobius sp.	0	0	Sr	0	A	0	0	Sr	0	A	0	0	R Sr	0	A	0	0	Sr	0	A
Philodromidae																				
Thanatus albini	8	8.25	Sd	8.25	A	7	5.55	Sd	5.55	A	7	5.93	Sd	5.93	A	7	4.09	R	4.09	A
Salticidae																				
Ballus sp.	2	2.06	R	7.22	A	1	0.79	Sr	3.97	A	1	0.85	Sr	5.08	A	0	0	Sr	1.75	A
Phlegra flavipes	5	5.15	Sd			4	3.17	R			5	4.24	R			3	1.75	R		
Theridiidae																				
Enoplognatha gemina	5	5.15	Sd	12.37	A	5	3.97	R	11.9	A	2	1.69	R	6.78	A	6	3.51	R	15.2	A
Steatoda erigoniformis	7	7.22	Sd			10	7.94	Sd			6	5.08	Sd			20	11.7	D		
Titanoecidae																				
Nurscia albomaculata	1	1.03	R	1.03	A	0	0	Sr	0	A	0	0	Sr	0	A	4	2.34	R	2.34	A
Total	97					126					118					171				

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

Moreover, Rizk *et al*. (2012) indicated that members of Lycosidae were represented by three common species: *Wadicosa fidelis*, *Pardosa injucunda* and *Pardosa* sp. and all their developmental structures were collected by pitfall traps below the four plants: Spearmint, Castorbean, Roselle (Karkadi) and Red pepper. Similar results were reported by Rizk *et al*. (2015) who found that members of Lycosidae in the three cultivated plants: Wormwood, Daisy and Spearmint were *Wadicosa fidelis*, and *Pardosa* sp. ranged between "eudominant" and "dominant" according to Weigmann classification of dominance.

Also, Tables (3-4) showed that all the remaining families were "accidental" while their members ranged between "recedent" and "subrecedent" except of *Micaria dives* (Gnaphosidae) for Chamomile and Calendula organic in 2014/2015 and Calendula conventional cultivation in 2014/2015 werre "dominant". Also, *Steatdoa erigoniformis* (Theridiidae) was "dominant" for Calendula organic and conventional cultivations in 2015/2016, and "subdominant" in Chamomile and Calendula conventional cultivation.

Thanatus albini (Philodromidae), was "subdominant" in all cultivations, except for organic Chamomile in first season and conventional Calendula in second season being "recedent". Whereas, *Sengletus extricatus* (Linyphiidae) in the conventional Chamomile and Calendula cultivation was "subdominant" in the first season and "recedent" in the second season, while in organic Chamomile and Calendula it was "recedent" in the two seasons. This result was in accordance with that of Eyre *et al*. (2008) who stated that linyphiid species preferred plants in conventional cultivation, while larger lycosid, philodromid and gnaphosid species favoured the organic cultivation.

Species diversity:

Table (7) compared the biodiversity of collected spiders in different vegetation between organic and conventional cultivations in two seasons by using Shannon-Wiener "H" and Simpson "S" indices of diversity.

Table 7: Estimation of Shannon-Wiener [H'] and Simpson [S] Indices of spider diversity in organic and conventional farming systems.

Season		2014 / 2015		2015 / 2016	
Type of index / Type of agric.		H'	S	H'	S
Chamomile	Organic	2.40	0.108	2.05	0.199
	Conventional	2.43	0.113	2.16	0.163
Calendula	Organic	2.36	0.121	2.23	0.149
	Conventional	2.47	0.111	2.12	0.164

High numbers of spiders were collected on organic plants, the recorded numbers were 122 & 147 individ. in chamomile and 157 & 197 individ. in Calendula in two seasons respectively. Less numbers were recorded on conventional plants, the numbers were 97 & 118 individ. in Chamomile plants and 126 & 171 individ. in Calendula in two seasons, respectively.

According to Shannon-Wiener "H" index the Calendula conventional cultivation recorded the highest value (2.47) in first season in contrast to that the Calendula organic cultivation recorded the lowest value (2.36) in the same season. In the second season, the Calendula organic cultivation, in contrary to the first season, recorded the highest value (2.23) while the Chamomile organic cultivation recorded the lowest value (2.05). Also, this result revealed that the highest "H" value recorded in conventional Calendula in the first season while the lowest "H" value recorded in organic Chamomile in the second season (Table 7).

Consequently, these values demonstrated that in first season the organic Chamomile harbored more of spider number but less diverse and occur than the conventional Chamomile while the organic Calendula harbored more spider number and diverse but less occur than the conventional Calendula.

In the second season, the organic Chamomile harbored more spider number and diverse but less occur than the conventional Chamomile while organic Calendula harbored more spider number, diverse and occur than the conventional Calendula (Table 7).

According to Simpson "S" index, which reflect the measure of dominance, it was found the highest value recorded in the organic Calendula (0.121), however the lowest value recorded in the organic Chamomile (0.108) in the first season. In contrast to that, the organic Chamomile recorded the highest value (0.199), however the organic Calendula recorded the lowest value (0.149) (Table 7).

Similarity of species:

The number of collected spiders throughout study period from organic farming was more than the members collected from conventional farming (623 and 512 individ.), respectively. However, the same number of spider species was obtained in the organic and conventional Chamomile (16 species of each), whereas the disparity obtained between organic and conventional Calendula (17 & 16 species, respectively). Therefore, according to Sørensen's quotient of similarity (QS) no difference was observed between spider communities for both organic and conventional Chamomile (QS=1) while inconsiderable difference was observed between spider communities for both organic and conventional Calendula (QS=0.97) with percentage of similarity reached 98.5 %, so it can be concluded that insignificant difference was found between both communities.

Relation between type of vegetation, spider abundance and spider species richness:

Tables (1-2) showed that Calendula plants harbored a higher abundance of spiders (354 & 297 individ.) in organic and conventional vegetation respectively while Chamomile had (269 & 215 individ.) in organic and conventional vegetation, respectively. This result indicated that vegetation type may influence spider abundance.

Tahir & Butt (2009) indicated that the spider densities vary with phenology of crops. In general, the density of the spiders in the fields increase with the increase in plant size and complexity, thus smaller plant host fewer spiders than tall ones (Liu *et al*., 2003). The higher spider densities in the present study in organic field suggested it favorable habitat for spiders (Schmidt *et al*., 2005). It is argued that organic systems are more diverse and therefore more stable, resulting in lower incidences of pest and disease problems and increased biodiversity (Lampkin, 1990).

Also, Tahir & Butt (2009) found that high abundance of spiders in the organic field might be due to rapid increase in the population of detritivores and plankton feeders after the addition of organic manure. These organisms serve as alternate prey for ground spiders in the absence of potential prey items in the fields (Settle *et al*., 1996). Organic field also provide more diverse and complex habitat for spiders (especially Lycosidae) than conventionally farmed fields (Wisniewska & Prokopy, 1997; Feber *et al*., 1998; Yardim & Edward, 1998; Schmidt *et al*., 2005).

Habashy *et al*. (2005) indicated that, indirectly, the surface vegetation affects spider population density and biodiversity which is influenced by microclimate of the plant. Where growth dependent on a mosaic of microclimatic conditions is produced with shaded areas interspersed with more open exposed area. These variations in sun and shade have a marked effect on the horizontal distribution patterns of many pests affected directly on the growth rate of spiders.

Also, this result agreed with the results which obtained by Ghabbour *et al*. (1999), who found that the shade of plants and the available humidity expressed as water requirements for each crop in addition to density of plants/acre directly affected abundance of activity density of soil fauna.

CONCLUSION

This study concluded reason is that an increased soil microbe community in the organic fields provides a healthier one more than conventional soil system.

More studies are needed to determine relationship between patterns in the distribution of spider species and management practices. Differences in the community compositions among different management practices should continue to be studied so that we may gain a better understanding of the agricultural practice and habitats are important in determining the spider inhabitants.

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ARABIC SUMMARY

أثر الاختلاف بين الزراعة العضوية والزراعة التقليدية على التنوع الحيوى للعناكب فى الشيح والأقحوان فى محافظة الفيوم

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تم حصر العناكب على نباتين من النباتات الطبية والعطرية هما الشيح Chamomile والأقحوان Chrysanthemum فى الزراعة العضوية والتقليدية لكل منهما لمدة موسمين متتاليين ٢٠١٥/٢٠١٤ و ٢٠١٥/ ٢٠١٦ فى محافظة الفيوم ، وذلك باستخدام المصايد الأرضية Pitfall traps لجمع العينات. تم حصر ١٧ نوعاً من العناكب من ١٠ فصائل. اشتملت فصيلة Lycosidae على أعلى تعداد للأفراد التى تم حصرها خلال فترة الدراسة حيث بلغ ٦٣١ فرداً تمثل ٣ أنواع هى *Wadicosa fideles*, *Pardosa* sp., *Hogna* sp. ويمثل هذا العدد نسبة ٥٥,٥٩٪ من التعداد الكلى والذى بلغ ١١٣٥ فرداً. كما وجدت فصائل أخرى تم تمثيلها بأعداد أقل طوال فترة الدراسة وهى على الترتيب فصيلة Gnaphosidae ويمثلها النوعان *Micaria dives* و *Zelotes laetus* ، وفصيلة Theridiidae وتشمل النوعين *Steatoda erigoniformis* و *Enoplognatha gemina* وفصيلة Philodromidae ويمثلها النوع *Thanatus albini*. بعض الأنواع وجدت بأعداد قليلة للغاية ومنها النوع *Oecobius* sp. من فصيلة Oecobiidae والنوع Dictynid sp.1 من فصيلة Dictynidae. أوضحت النتائج أن الزراعة العضوية فى كلا المحصولين أعطت تعداداً أعلى للعناكب وكذلك تنوعاً أكثر مقارنة بالزراعة التقليدية.