

SURVEY OF SPIDER POPULATIONS (ARANEAE) IN TOMATO FIELDS AT FAYOUM GOVERNORATE

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ABSTRACT

Survey of spiders in tomato plantations was carried out in Al-Mandara region Fayoum Governorate, from Nov. 2012 till Sep. 2014. Collection of spiders started two weeks after planting and continued weekly to the end of season. Results revealed the existence of 42 species that belong to 34 genera in 14 families. Population densities and seasonal fluctuations in relation to weather conditions were estimated. The most dominant families were Theridiidae, Lycosidae and Dictynidae, represented by 36.02%, 21.01% and 20.62%, respectively. In moderate numbers were families Miturgidae and Philodromidae, represented by 8.01% and 5.75%, respectively. The rest of families were found in low or rare numbers as follow; Thomisidae 2.4%, Araneidae 2.3%, Salticidae 1.6%, Pisauridae 0.8%, Gnaphosidae 0.6%, Linyphiidae 0.4%, Pholcidae 0.2%, Clubionidae 0.1% and Mimetidae 0.1%. In general two species *Anelosimus aulicus* (Theridiidae) and *Dictyna segregate* (Dictynidae) were most dominant being 32.01% and 20.62% of the population of spiders community inhabiting tomato fields.

Statistics indicated insignificant correlation between spider populations and temperature, with negative significant correlation for relative humidity and population during nili plantation 2012/2013, whereas in nili plantation 2013/2014 the positive correlation between populations was only for temperature, with no significant correlation with relative humidity. In summer plantation 2013, a positive significant correlation was found for both temperature and relative humidity, but in summer plantation 2014, high positive correlation was found between population and temperature only, with no significant correlation with relative humidity.

Key words: Spiders- Survey- Araneae- Population densities- Population fluctuation.

INTRODUCTION

Tomato (*Lycopersicon esculentum* L.) is a main vegetable crop in Egypt that represents 35% of the total vegetable production (Zaki, 1992). Arthropods comprise the most diverse organisms in any terrestrial environment. However, enough information's on diverse groups, such as spiders (Araneae) are lacking (Longino, 1994). Currently, Spiders, as important predators, are one of the most diverse and abundant groups that prevail under different environments with almost 42.473 species described in Phylum Arthropoda (Platnick, 2011). Due to their presence in large numbers and capabilities to capture the prey, spiders in some crops can be considered as potentially important bio-control agent. For instances, predators surveyed in rice fields in Kafr El-Sheikh, Egypt, included 13 species of orb web spiders (Sherif *et al.*, 2002) of which *Argiope* spp. captured 33 species of phytophagous insects and the

others captured 14 to 21 prey species.. In El- Fayoum Governorate (**Rahil, 2006**) collected eighteen spider species in six families from tomato fields. Many species belonging to comb-footed spiders (Araneae: Theridiidae) described by (**Levy and Amitai, 1982**) of which the main species was *Anelosimus aulicus* (Koch). Nevertheless, the present study was designed to reveal some ecological aspects of some field spiders and population fluctuations as related to weather conditions in Fayoum Governorate.

MATERIALS AND METHODS

1. Population densities of spiders in tomato fields.

Al-Mandara region, Fayoum, was chosen where seedling of tomato, *Lycopersicon esculentum* Mill, Marwa and Basha. Varieties were transplanted during the period from Nov. 2012 to Sept. 2014, in an area of 1/8 feddan and cultivated in two plantations (nili and summer). Sampling started two weeks after planting and continued weekly till the end of each season. All usual agricultural practices were followed, without the use of pesticides. To collect aerial and ground species of spiders, direct count and pitfall traps were used to estimate populations.

For direct count of spiders, fifteen leaves were weekly examined. Spiders collected were immediately preserved in glass vials (15 mm³) containing 70% ethyl alcohol and 30% glycerin, identified using a binocular microscope.

For traps, ten pitfall traps were used. The trap was prepared by imbedding a wide-mouth, ½ liter glass jar in the soil, so that the top of which was even with soil surface. The fallen spiders were weekly collected and immediately preserved in the preservative for Lab. counting and classification.

Identification of the collected species was carried out according to **Denis (1947)**, **Bristowe (1941 and 1958)**, **Kaston B. and Kaston E. (1953)**, **Levy and Amitai (1982)** and **Breene et al., (1993)**.

RESULTS AND DISCUSSIONS

1. Families and species of spiders collected from tomato plants.

Survey revealed the existences of 42 species of spiders that belong to 34 genera in 14 families as shown in table (1). The collected spiders could be classified as: **a) web-building spiders**; Araneidae (5 genera), Theridiidae (4 genera), Linyphiidae (2 genera) Dictynidae and Pholcidae (one genus each), of the 1st group, Genus *Argiope* and *Theridion* only included 2 species and **b) Hunter spiders**; Lycosidae (6 genera), Salticidae (5 genera), Gnaphosidae, Pisauridae, and Thomisidae (2 genera).

Clubionidae, Mimetidae, Miturgidae and Philodromidae, (one genus each), of the 2nd group, genus *Allocosa* and *Pardosa*, included 2 species each and genus *Lycosa* & *Pirata* included 3 species each.

Table: (1) Spiders families and species collected from tomato fields at Fayoum Governorate during 2012-2013 and 2013-2014 seasons.

No.	Families	Species
1	Araneidae Simon	<i>Araneus nordamanni</i> (Thorell) <i>A. trifasciata</i> (Forskall,1775) <i>A. argentata</i> (Fabricius) <i>Eustala cepina</i> (Walckenaer) <i>Metazygia wittfeldae</i> (Mc Cook) <i>Zygiella x-notata</i> (Clerck,1757)
2	Clubionidae Wagner	<i>Clubiona stagnatilis</i> Kulczynski
3	Dictynidae Cambridge	<i>Dictynasegregata</i> Gertsch&Mulaik
4	Gnaphosidae Pocock	<i>Drassyllus depressus</i> (Emerton) <i>Zelotes subterraneus</i> (C.L. Koch,1833)
5	Linyphiidae Blackwall	<i>Meioneta fabra</i> Keyserling <i>Microneta viaria</i> Blackwall
6	Lycosidae Sundeval	<i>Allocosa funereal</i> (Hentz) <i>A. absoluta</i> Gertsch <i>Hogna antelucana</i> (Montgomery) <i>Lycosa avida</i> Walckenaer <i>L. carolinensis</i> Walckenaer <i>L. gulosa</i> Walckenaer <i>Pardosa distincta</i> (Blackwell) <i>P. milvina</i> (Hentz) <i>Pirata montanus</i> Emerton <i>P. minutes</i> Emerton <i>P. piratical</i> (Clerck) <i>Schizocosa bilineata</i> Emerton
7	Mimetidae Simon	<i>Mimetus puritanus</i> Chamberlin
8	Miturgidae Simon	<i>Chieracanthium jovium</i> (Denis)
9	Philodromidae Thorell	<i>Thanatus formicinus</i> (Clerck,1757)
10	Pholcidae C.L. Koch	<i>Pholcus phalangioides</i> Fuesslin, 1755
11	Pisauridae Semone	<i>Dolomedes triton</i> Hentz <i>Pelopatis undulate</i> (Keyserling)
12	Salticidae Blackwall	<i>Eris aurantia</i> (Lucas) <i>Onondaga lineate</i> Peckham et Peck. <i>Paraphidippus aurantia</i> (Lucas) <i>Sassacus cyanea</i> (Hentz) <i>Zygoballus bettini</i> Peckham
13	Theridiidae Sundevall	<i>Anelosimus aulicus</i> (Koch) <i>Dipoena nigra</i> (Emerton) <i>Theridion murarium</i> Emerton <i>T. simile</i> C. L. Koch <i>Parasteatoda tepidariorum</i> Koch
14	Thomisidae Sundevall	<i>Misumena vatia</i> (Clerck,1757) <i>Thomisus onustus</i> (Walckenaer)

1.2. Population density and relative abundance of spiders collected.

Nili 2012- 2013: As shown in table (2), 29 species in 25 genera in 10 families were found. The largest numbers belong to Theridiidae (166.0 individuals), Dictynidae (90.0 individuals) and Lycosidae (83.0 individuals), represented 38.52%, 20.88% and 19.26% of the total population, respectively. Miturgids spiders were found in moderate numbers; 31.0 individuals (7.19%). Philodromids, thomisids and araneids spiders were in low numbers; (23.0, 14.0 and 13.0 individuals), represented 5.34%, 3.25% and 3.02%, respectively. Salticids, pisauridis and linyphiidis spiders only represented 1.16%, 0.92% and 0.46%, respectively.

The numbers of *A. aulicus* (Theridiidae) 152.0 and *D. segregate* (Dictynidae) 90.0, these dominant species, represented 35.27% and 20.88%, respectively of the spider community in the field. The populations of the lycosid, *P. montanus* and the miturgid, *C. jovium* were moderate being 36.0 and 31.0 individuals, represented 8.35% and 7.19%, respectively. Two species; *T. formicines* (Philodromidae) and *L. avida* (Lycosidae) were in low population, represented 5.34% and 3.71%, respectively. On the other hand, 23 species were rarely found (< 10 individuals/season).

Table: (2) Population density and relative abundance of spider families and species collected from tomato fields during (Nov.2012 to Feb. 2013) in nili plantation in Fayoum Governorate.

Families	Species	Collection method		Season Total	% Relative abundance	
		D. C.	Pf. t.		(Species)	(Families)
Araneidae	<i>A. trifasciata</i>	04	-	04	0.93	3.02
	<i>A. argentata</i>	01	-	01	0.23	
	<i>A. nordamanni</i>	04	-	04	0.93	
	<i>E. cepina</i>	02	-	02	0.46	
	<i>M. wittfeldae</i>	02	-	02	0.46	
	Sub total		13	-	13	
Dictynidae	<i>D. segregate</i>	87	03	90	20.88	20.88
Linyphiidae	<i>M. viaria</i>	-	02	02	0.46	0.46
Lycosidae	<i>A. funereal</i>	-	09	09	2.09	19.26
	<i>L. avida</i>	-	16	16	3.71	
	<i>H. antelucana</i>	-	04	04	0.93	
	<i>L. gulosa</i>	-	02	02	0.46	
	<i>P. montanus</i>	-	36	36	8.35	
	<i>P. distinct</i>	-	08	08	1.86	
	<i>P. milvina</i>	-	06	06	1.39	
	<i>S. bilineata</i>	-	02	02	0.46	
	Sub total		-	83	83	
Miturgidae	<i>C. jovium</i>	31	-	31	7.19	7.19
Philodromidae	<i>T. formicinus</i>	02	21	23	5.34	5.34
Pisauridae	<i>P. andulata</i>	-	02	02	0.46	0.92
	<i>D. triton</i>	-	02	02	0.46	
	Sub total		-	04	04	
Salticidae	<i>E. aurantia</i>	-	02	02	0.46	1.16
	<i>S. cyanea</i>	-	02	02	0.46	
	<i>Z. bettini</i>	-	01	01	0.23	
	Sub total		-	05	05	
Theridiidae	<i>A. aulicus</i>	150	02	152	35.27	38.52
	<i>T. simile</i>	04	-	04	0.93	
	<i>T. murarium</i>	03	-	03	0.70	
	<i>D. nigra</i>	05	-	05	1.16	
	<i>P. tepidariorum</i>	02	-	02	0.46	
	Sub total		164	02	166	
Thomisidae	<i>M. vatia</i>	08	-	08	1.86	3.25
	<i>T. onustus</i>	06	-	06	1.39	
	Sub total		14	-	14	
Total / Season		311	120	431		
%		72.16	27.84			

D.C. = Direct counts (15 plants) Categories:
Pf. T. = Pitfall traps (10)

R = < 10 spiders for season
L = 11-30
M = 31-60
H = > 60

Summer 2013:

Results in table (3) revealed that the existence of 24 species in 21 genera in 13 families. The largest numbers belong to Theridiidae (189.0 individuals), Lycosidae (128.0 individuals) and Dictynidae (121.0 individuals), represented 34.17%, 23.14% and 21.88% of the total population, respectively. Miturgids and philodromids spiders were in moderate numbers; 42.0 and 35.0 individuals, represented 7.59% and 6.33%, respectively. Eight families were rare as follows; Thomisidae, Araneidae, Salticidae, Gnaphosidae, Clubionidae, Linyphiidae, Pisauridae and Mimetidae, represented 1.63%, 1.44%, 1.44%, 0.90%, 0.54%, 0.36%, 0.36% and 0.18%, respectively of the populations.

The numbers of *A. aulicus* (Theridiidae) 171.0, *D. segregate* (Dictynidae) 121.0 and *L. carolinensis* (Lycosidae) 65.0 individuals these dominant, represented 30.92%, 21.88 and 11.75%, respectively of the populations. The populations of the miturgid *C. jovium* and the philodromid *T. formicinus* were in moderate being 42.0 and 35.0 individuals, represented 7.59% and 6.33%, respectively. Three species; *P. minutus* (Lycosidae), *L. avida* (Lycosidae) and *D. nigra* (Theridiidae) were in low population, represented 4.88%, 3.62% and 1.99%, respectively. On the other hand, 16 species were rarely found (< 10 individuals/season).

Table: (3) Population density and relative abundance of spider families and species collected from tomato fields during (May. 2013 to Sep. 2013) in summer plantation in Fayoum Governorate.

Families	Species	Collection method		Season Total	% Relative abundance	
		D. C.	Pf. t.		(Species)	(Families)
Araneidae	<i>M. wittfeldae</i>	04	-	04	0.72	1.44
	<i>Z. x-notata</i>	04	-	04	0.72	
	Sub total	08	-	08		
Clubionidae	<i>C. stagnatilis</i>	-	03	03	0.54	0.54
Dictynidae	<i>D. segregate</i>	118	03	121	21.88	21.88
Gnaphosidae	<i>D. depressus</i>	-	03	03	0.54	0.90
	<i>Z. subterraneus</i>	-	02	02	0.36	
	Sub total	-	05	05		
Linyphiidae	<i>M. fabra</i>	-	02	02	0.36	0.36
Lycosidae	<i>A. absoluta</i>	-	03	03	0.54	23.14
	<i>L. avida</i>	-	20	20	3.62	
	<i>L. carolinensis</i>	-	65	65	11.75	
	<i>L. gulosa</i>	-	07	07	1.26	
	<i>P. minutes</i>	-	27	27	4.88	
	<i>P. piratical</i>	-	03	03	0.54	
	<i>P. milvina</i>	-	03	03	0.54	
Sub total	-	128	128			
Mimetidae	<i>M. puritanus</i>	-	01	01	0.18	0.18
Miturgidae	<i>C. jovium</i>	39	03	42	7.59	7.59
Philodromidae	<i>T. formicinus</i>	02	33	35	6.33	6.33
Pisauridae	<i>D. triton</i>	-	02	02	0.36	0.36
Salticidae	<i>O. lineate</i>	-	06	06	1.08	1.44
	<i>Z. bettini</i>	-	02	02	0.63	
	Sub total	-	08	08		
Theridiidae	<i>A. aulicus</i>	167	04	171	30.92	34.17
	<i>D. nigra</i>	11	-	11	1.99	
	<i>P. tepidariorum</i>	07	-	07	1.26	
	Sub total	185	04	189		
Thomisidae	<i>M. vatia</i>	09	-	09	1.63	1.63
Total / Season		361	192	553		
%		65.28	34.72			

Categories: R = < 10 spiders for season

L = 11-30

M = 31-60

H = > 60

D.C. = Direct counts (15 plants)

Pf. T. = Pitfall traps (10)

Nili 2013- 2014

As shown in table (4), 28 species in 24 genera in 11 families were found. The largest numbers belong to Theridiidae (159.0 individuals), Lycosidae (88.0 individuals) and Dictynidae (66.0 individuals), represented 35.65%, 19.73% and 14.79% of the total population, respectively. Miturgids spiders were in moderate numbers 44.0 individuals, represented (9.86%). Philodromids, thomisids, araneids and salticids spiders were in low numbers; 24.0, 19.0, 18.0 and 14.0 individuals, represented 5.38%, 4.26%, 4.03 and 3.14%, respectively. Pisaurids, pholcids and linyphiids spiders only, represented 1.79%, 0.89% and 0.45%, respectively.

The numbers of *A. aulicus* (Theridiidae) 133.0 individuals and *D. segregata* (Dictynidae) 66.0 individuals these dominant, represented 29.82% and 14.79%, respectively of the spider populations. The populations of the miturgidis *C. jovium* and the lycosidis *P. montanus* were in moderate numbers, represented 9.86% and 8.07%.

Four species; *T. formicines* (Philodromidae), *L. carolinensis* (Lycosidae), *M. vatia* (Thomisidae) and *P. tepidariorum* (Theridiidae) were in low population, represented 5.38%, 4.93%, 2.91% and 2.69%, respectively. On the other hand, 20 species were rarely found (< 10 individuals/season).

Table: (4) Population density and relative abundance of spider families and species collected from tomato fields during (Nov.2013 to Feb. 2014) in nili plantation in Fayoum Governorate.

Families	Species	Collection method		Season Total	% Relative abundance	
		D. C.	Pf. t.		(Species)	(Families)
Araneidae	<i>A. trifasciata</i>	08	-	08	1.79	4.03
	<i>A. nordamanni</i>	02	-	02	0.45	
	<i>E. cepina</i>	04	-	04	0.89	
	<i>M. wittfeldae</i>	02	-	02	0.45	
	<i>Z. x-notata</i>	02	-	02	0.45	
	Sub total		18	-	18	
Dictynidae	<i>D. segregata</i>	62	04	66	14.79	14.79
Linyphiidae	<i>M. viaria</i>	-	02	02	0.45	0.45
Lycosidae	<i>S. bilineta</i>	-	01	01	0.22	19.73
	<i>L. carolinensis</i>	-	22	22	4.93	
	<i>L. avida</i>	-	03	03	0.67	
	<i>H. antelucana</i>	-	08	08	1.79	
	<i>P. milvina</i>	-	03	03	0.67	
	<i>P. montanus</i>	-	36	36	8.07	
	<i>P. minutus</i>	-	07	07	1.57	
	<i>P. piratical</i>	-	08	08	1.79	
	Sub total		-	88	88	
Miturgidae	<i>C. jovium</i>	41	03	44	9.86	9.86
Philodromidae	<i>T. formicinus</i>	-	24	24	5.38	5.38
Pholcidae	<i>P. phalangioides</i>	04	-	04	0.89	0.89
Pisauridae	<i>D. triton</i>	-	08	08	1.79	1.79
Salticidae	<i>E. aurantia</i>	-	08	08	1.79	3.14
	<i>P. aurantia</i>	-	05	05	1.12	
	<i>Z. bettini</i>	-	01	01	0.22	
	Sub total		-	14	14	
Theridiidae	<i>A. aulicus</i>	129	04	133	29.82	35.65
	<i>P. tepidariorum</i>	12	-	12	2.69	
	<i>T. simile</i>	04	-	04	0.89	
	<i>T. murarium</i>	10	-	10	2.24	
	Sub total		155	04	159	
Thomisidae	<i>M. vatia</i>	12	01	13	2.91	4.26
	<i>T. onustus</i>	06	-	06	1.35	
	Sub total		18	01	19	
Total / Season		298	148	446		
%		66.82	33.18			

Categories: R = < 10 spiders for season

D.C. = Direct counts (15 plants)

L = 11-30

Pf. T. = Pitfall traps (10)

M = 31-60

H = > 60

Summer 2014

Results in table (5) revealed that the existence of 26 species in 22 genera in 12 families. The largest numbers belong to Theridiidae (232.0 individuals), Dictynidae (150.0 individuals) and Lycosidae (136.0 individuals), represented 36.19%, 23.40% and 21.22%, respectively of the total population. miturgids and philodromids spiders were in moderate numbers; (49.0 and 37.0 individuals), represented 7.64% and 5.77%, respectively. Seven families were rare as follows; Araneidae, Gnaphosidae, Thomisidae, Salticidae, Mimetidae, Pisauridae and Linyphiidae, represented 1.40%, 1.25%, 1.25%, 1.10%, 0.31%, 0.31% and 0.16% of the populations, respectively.

The numbers of *A. aulicus* (Theridiidae, 207.0 individuals) and *D. segregata* (Dictynidae, 150.0 individuals) were dominant, represented 32.29%, and 23.40%, respectively of the spider populations. Five species namely; *C. jovium* (Miturgidae), *L. carolinensis* (Lycosidae), *P. minutes* (Lycosidae), *T. formicinus* (Philodromidae) and *L. avida* (Lycosidae) were in moderate numbers, represented 7.64%, 7.49%, 6.08%, 5.77% and 5.46% of the populations, respectively. One species namely; *D. nigra* were in low numbers, represented 2.65%. On the other hand, 18 species were rarely found (< 10 individuals/season).

Table: (5) Population density and relative abundance of spider families and species collected from tomato fields during (May 2014 to Sep.2014) in summer plantation in El-Fayoum Governorate.

Families	Species	Collection method		Season Totals	% Relative abundance	
		D. C.	Pf. t.		(Species)	(Families)
Araneidae	<i>A. trifasciata</i>	04	-	04	0.62	1.40
	<i>M. wittfeldae</i>	05	-	05	0.78	
	Sub total	09	-	09		
Dictynidae	<i>D. segregata</i>	146	04	150	23.40	23.40
Gnaphosidae	<i>D. depressus</i>	-	02	02	0.31	1.25
	<i>Z. subterraneus</i>	-	06	06	0.94	
	Sub total	-	08	08		
Linyphiidae	<i>M. fabra</i>	-	01	01	0.16	0.16
Lycosidae	<i>A. absoluta</i>	-	05	05	0.78	21.22
	<i>L. avida</i>	-	35	35	5.46	
	<i>L. gulosa</i>	-	02	02	0.31	
	<i>L. piratical</i>	-	02	02	0.31	
	<i>L. carolinensis</i>	-	48	48	7.49	
	<i>P. minutes</i>	-	39	39	6.08	
	<i>P. milvina</i>	-	04	04	0.62	
	<i>S. bilineata</i>	-	01	01	0.16	
Sub total	-	136	136			
Mimetidae	<i>M. puritanus</i>	-	02	02	0.31	0.31
Miturgidae	<i>C. jovium</i>	47	02	49	7.64	7.64
Philodromidae	<i>T. formicinus</i>	-	37	37	5.77	5.77
Pisauridae	<i>P. andulata</i>	-	02	02	0.31	0.31
Salticidae	<i>E. aurantia</i>	-	03	03	0.47	1.10
	<i>O. lineate</i>	-	03	03	0.47	
	<i>Z. bettini</i>	-	01	01	0.16	
	Sub total	-	07	07		
Theridiidae	<i>A. aulicus</i>	198	09	207	32.29	36.19
	<i>D. nigra</i>	17	-	17	2.65	
	<i>P. tepidariorum</i>	08	-	08	1.25	
	Sub total	223	09	232		
Thomisidae	<i>M. vatia</i>	03	-	03	0.47	1.25
	<i>T. onustus</i>	05	-	05	0.78	
	Sub total	08	-	08		
Total / Season		433	208	641		
%		67.55	32.45			

Categories R = < 10 spiders for season

D.C. = Direct counts (15 plants) L = 11-30

Pf. T. = Pitfall traps (10)

M = 31-60

H = > 60

1.3. Population fluctuations of spider populations in tomato plantations as related to weather conditions in Fayoum.

- Fluctuation in nili season (Nov. 2012 to Feb. 2013):

As shown in table (6) and fig (1), the density of spiders community in nili plantation 2012-2013, gradually increased from the beginning of plantation till the 1st week of Dec. to record, 24.0, 27.0, 27.0, 29.0, 30.0 and 36.0 individuals, respectively then decreased gradually until the end of population to record 27.0, 25.0, 24.0, 24.0 and 24.0 individuals respectively, from the 2nd week of Dec. till the 4th week of Feb.

Statistical analysis of data indicated that the correlation between the population density and temperature was insignificant positive ($r=0.291$; $P \leq 0.05:0.242$), while the correlation with relative humidity were significant negative ($r= -0.573$; $P \leq 0.05: 0.013$).

-Fluctuation in summer season (May to Sep. 2013):

As shown in table (7) and fig (2), population density of spiders community in summer plantation 2013, gradually increased for three weeks in the beginning of the plantation, to record 19.0 and 22.0 indiv., then decreased for five weeks to record 10.0, 11.0, 16.0, 17.0 and 20.0 indiv., followed with the highly numbers during plantation with recorded numbers of 22.0, 22.0, 28.0, 32.0, 33.0, 41.0 and 43.0 indiv., respectively. The population decreased sharply for about three weeks to record 22.0, 25.0 and 27.0 indiv., then increased gradually towards the end of the plantation.

Statistical analysis of data indicated that the correlation between the population density and temperature were significant positive ($r=0.458^*$; $P \leq 0.05:0.032$), also the correlation between the population density and relative humidity were significant positive ($r=0.431^*$; $P \leq 0.05: 0.045$).

Table: (6) Population fluctuation of species spider in tomato plants nili plantation during Nov. 2012 to Feb. 2013.

Sampling date	Collection Method		Total Count	Weekly average	
	D.C	Pf. T.		Temp. °C	RH. %
01/11/2012	19	05	24	28.2	46
08/11/2012	25	02	27	27.1	47
15/11/2012	24	03	27	22.9	47
22/11/2012	25	04	29	20.5	45
29/11/2012	17	13	30	19.3	45
06/12/2012	31	05	36	19.4	45
13/12/2012	20	07	27	17.8	49
20/12/2012	15	10	25	13.8	49
27/12/2012	20	04	24	14.1	50
03/01/2013	13	11	24	17.1	54
10/01/2013	21	03	24	16.8	53
17/01/2013	17	05	22	15.9	51
24/01/2013	14	07	21	16.6	49
31/01/2013	14	06	20	17.2	54
07/02/2013	16	03	19	17.6	52
14/02/2013	03	16	19	15.7	49
21/02/2013	08	10	18	16.4	49
28/02/2013	09	06	15	19.3	49
Total / Season	311	120	431		
r-value(Person Correlation)				0.291	-0.573*
P≤ 0.05				0.242	0.013

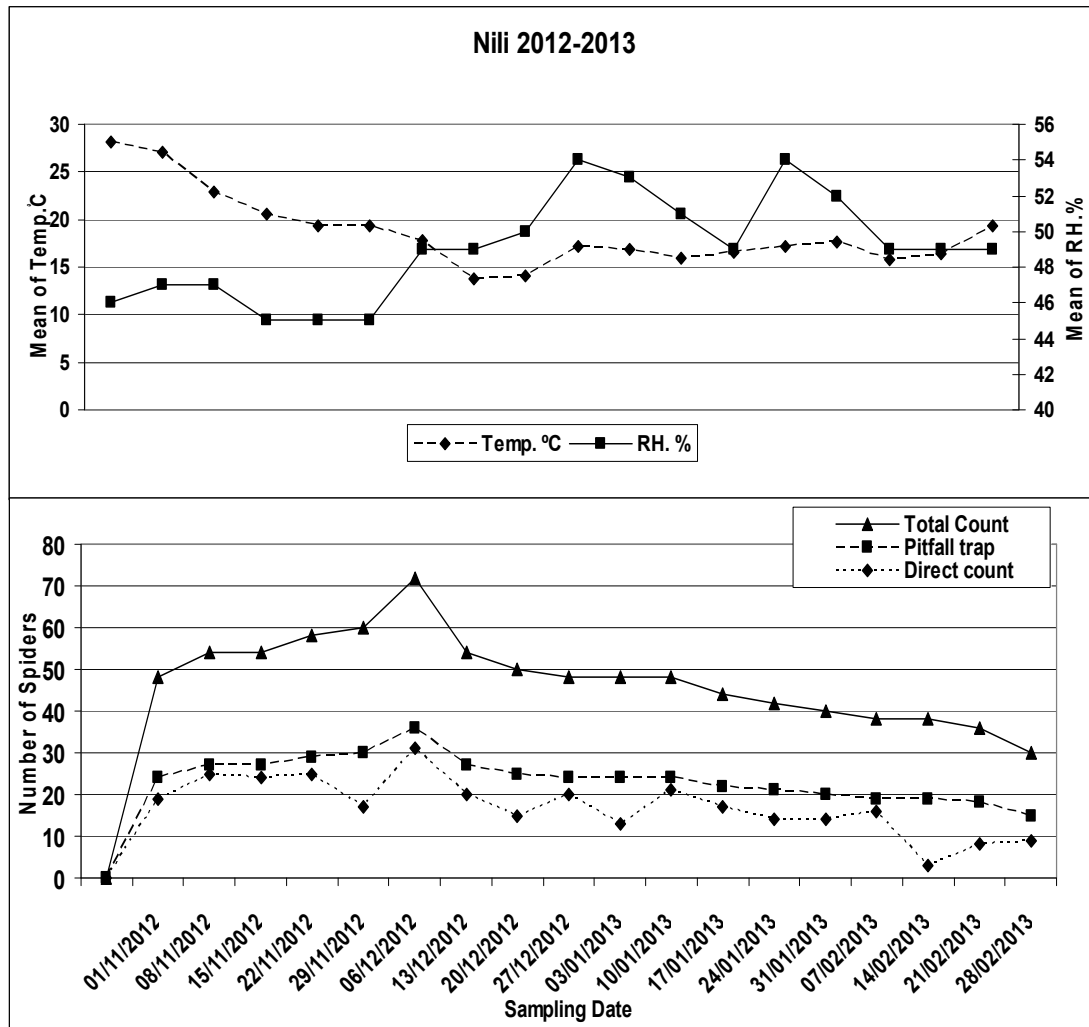


Fig (1) Fluctuation in nili season (Nov. 2012 to Feb. 2013)

Table: (7) Population fluctuation of species spider in tomato plants summer plantation during May. 2013 to Sep. 2013.

Sampling date	Collection Method		Total Count	Weekly average	
	D.C	Pf. T.		Temp. °C	RH. %
01/05/2013	07	10	17	30.2	39
08/05/2013	16	03	19	29.3	43
15/05/2013	11	11	22	28.9	42
22/05/2013	07	03	10	29.1	41
29/05/2013	06	05	11	29.7	43
05/06/2013	12	04	16	32.5	40
12/06/2013	04	13	17	30.8	44
19/06/2013	15	05	20	29.3	45
26/06/2013	17	05	22	32.4	45
03/07/2013	12	10	22	30.1	44
10/07/2013	16	12	28	31.1	47
17/07/2013	24	08	32	29.8	47
24/07/2013	23	10	33	29.6	47
31/07/2013	19	22	41	33.2	44
07/08/2013	33	10	43	32.7	43
14/08/2013	10	12	22	32.2	43
21/08/2013	17	08	25	30.9	44
28/08/2013	24	03	27	31.2	45
04/09/2013	17	12	29	31.4	46
11/09/2013	21	09	30	30.1	43
18/09/2013	27	06	33	30.7	43
25/09/2013	23	11	34	31.4	43
Total / Season	361	192	553		
r value ((Person Correlation)				0.458*	0.431*
P≤ 0.05				0.032	0.045

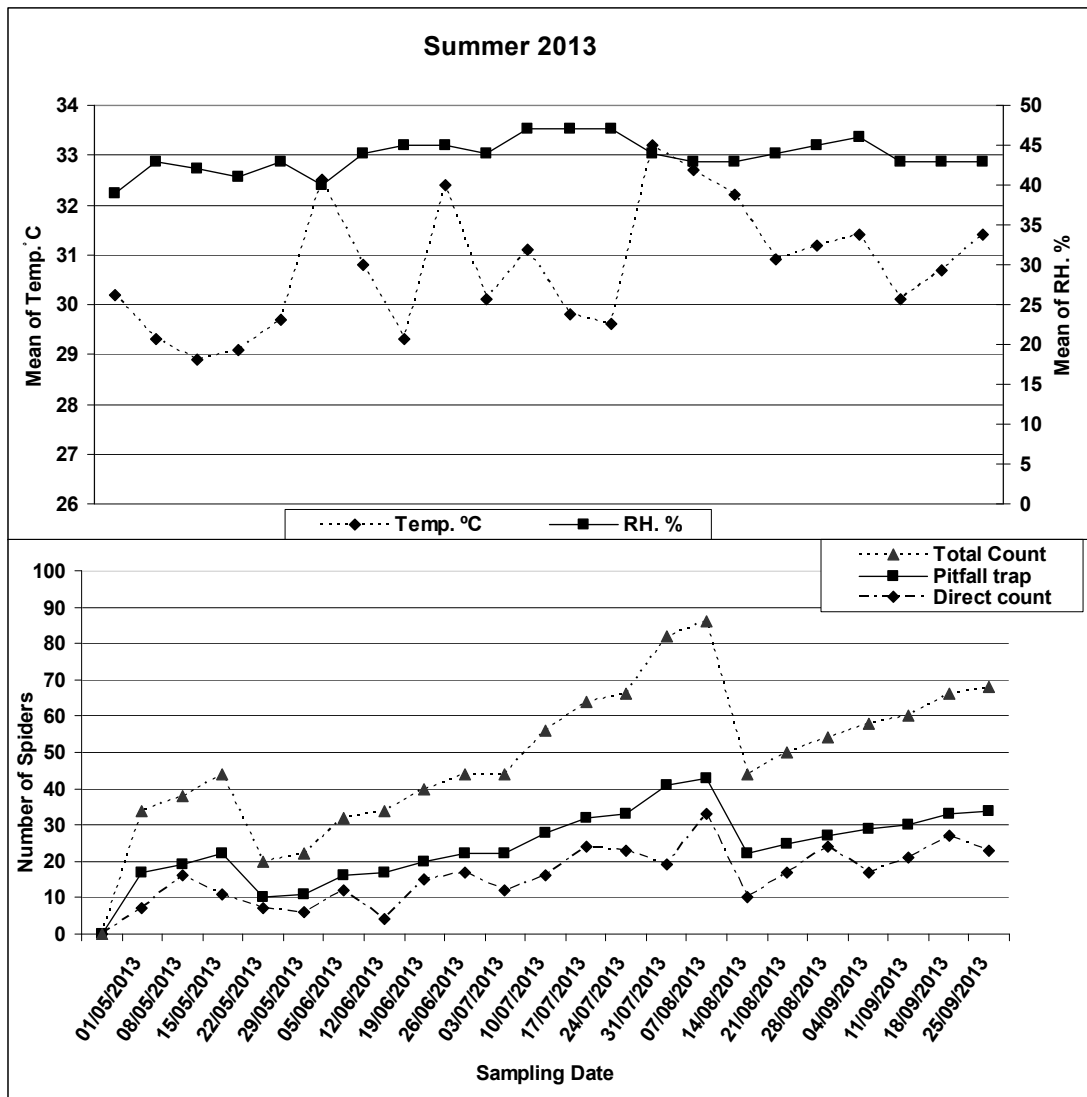


Fig (2) Fluctuation in summer season (May to Sep. 2013)

1.3.3. Fluctuation in nili season (Nov. 2013 to Feb. 2014).

As shown in table (8) and fig.(3), the population density of spider populations, gradually increased from the beginning of plantation to record 28.0, 31.0, 40.0 and 43.0 individuals, respectively during the first four samples and then decreased towards the end of plantation. The least numbers were collected during Feb.

Statistical analysis of data indicated that the correlation between the population density and temperature were significant positive ($r=0.529^*$; $P \leq 0.05: 0.024$), while the correlation between the population density and relative humidity were insignificant negative ($r= - 0.444$; $P \leq 0.05: 0.065$).

1.3.4. Fluctuation in summer season (May to Sep. 2014.)

As shown in table (9) and fig. (4), the population density of spider populations in summer plantation 2014, gradually increased from the beginning of plantation and continued throughout the season. The high numbers were collected during July to Aug., while the least numbers were recorded in May and Sep.; On the other hand moderate numbers were collected during June.

Statistical analysis of data indicated that the correlation between the population density and temperature were high significant positive ($r=0.588^{**}$; $P \leq 0.05:0.004$), whereas the correlation between the population density and relative humidity were insignificant positive ($r= 0.225$; $P \leq 0.05: 0.314$).

Table: (8) Population fluctuation of species spider in tomato plants nili plantation during (Nov. 2013 to Feb. 2014).

Sampling date	Collection Method		Total Count	Weekly average	
	D.C	Pf. T.		Temp. °C	RH. %
01/11/2013	20	08	28	26.4	36
08/11/2013	27	04	31	24.6	39
15/11/2013	24	16	40	23.8	40
22/11/2013	23	20	43	22.6	43
29/11/2013	29	04	33	22.8	39
06/12/2013	16	16	32	23.4	46
13/12/2013	12	19	31	16.6	43
20/12/2013	16	09	25	13.8	48
27/12/2013	16	10	26	18.1	43
03/01/2014	15	10	25	17.7	47
10/01/2014	15	07	22	16.9	46
17/01/2014	19	01	20	15.8	44
24/01/2014	13	08	21	16.8	43
31/01/2014	16	05	21	16.9	41
07/02/2014	12	03	15	18.2	44
14/02/2014	10	04	14	17.5	41
21/02/2014	06	08	14	18.4	48
28/02/2014	06	03	09	20.1	49
Total / Season	298	148	446		
r value ((Person Correlation)				0.529*	-0.444
P≤ 0.05				0.024	0.065

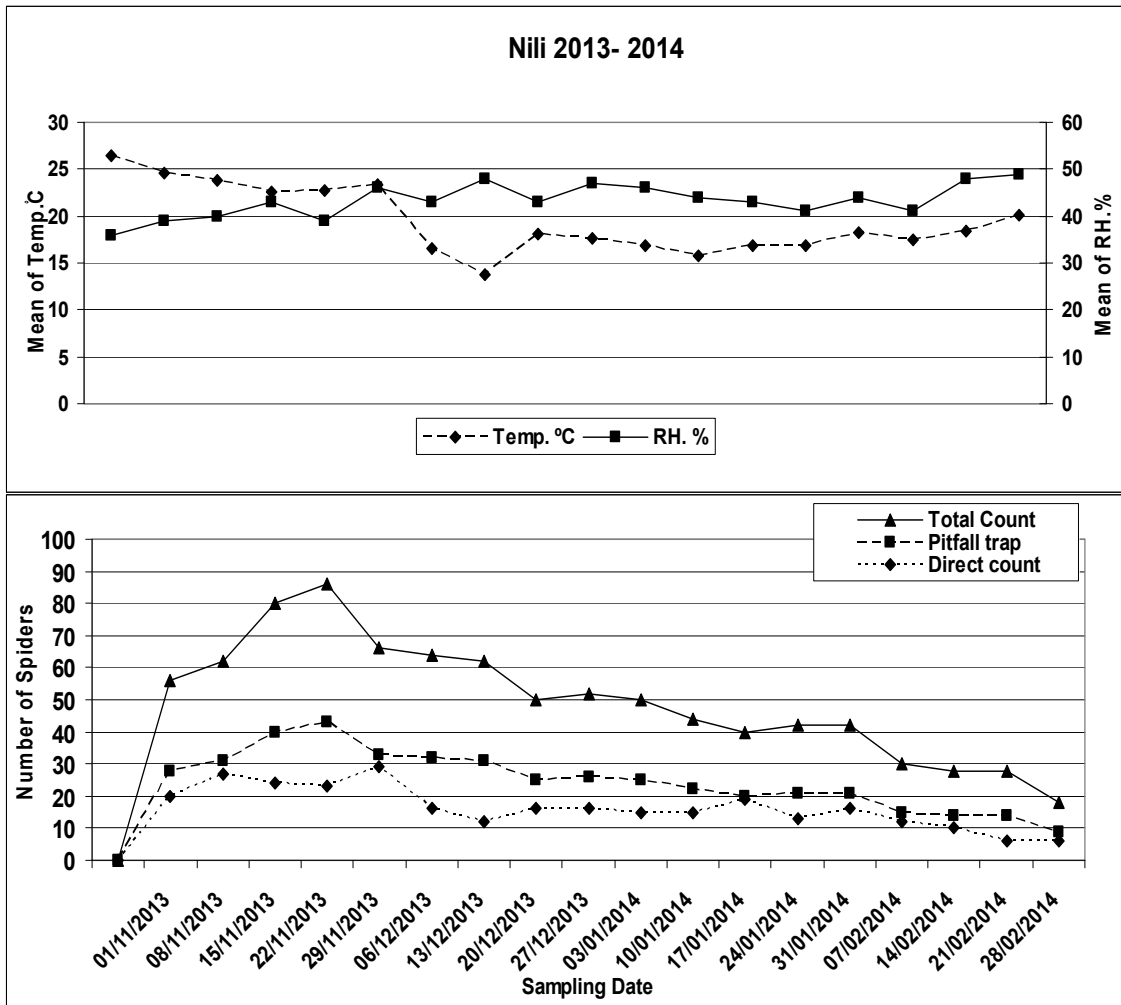


Fig (3) Fluctuation in nili season (Nov. 2013 to Feb.2014)

Table: (9) Population Fluctuation of species spider in tomato plants summer plantation during (May. 2014 to Sep. 2014).

Sampling date	Collection Method		Total Count	Weekly average	
	D.C	Pf. T.		Temp. °C	RH. %
01/05/2014	17	03	20	30.3	38
08/05/2014	16	06	22	30.6	43
15/05/2014	08	15	23	25.1	42
22/05/2014	20	04	24	30.2	42
29/05/2014	16	10	26	30.3	41
05/06/2014	22	05	27	31.3	39
12/06/2014	16	12	28	30.6	44
19/06/2014	21	09	30	32.1	42
26/06/2014	24	06	30	30.8	45
03/07/2014	26	07	33	33.3	42
10/07/2014	28	07	35	33.2	44
17/07/2014	26	11	37	33.7	44
24/07/2014	24	13	37	32.0	44
31/07/2014	29	12	41	33.2	44
07/08/2014	33	12	45	33.7	44
14/08/2014	20	13	33	32.9	45
21/08/2014	14	16	30	34.1	44
28/08/2014	18	09	27	33.5	44
04/09/2014	08	17	25	32.7	45
11/09/2014	21	03	24	31.2	44
18/09/2014	14	09	23	31.4	45
25/09/2014	12	09	21	31.5	47
Total / Season	433	208	641		
r value (Person Correlation)				0.588**	0.225
P≤ 0.05				0.004	0.314

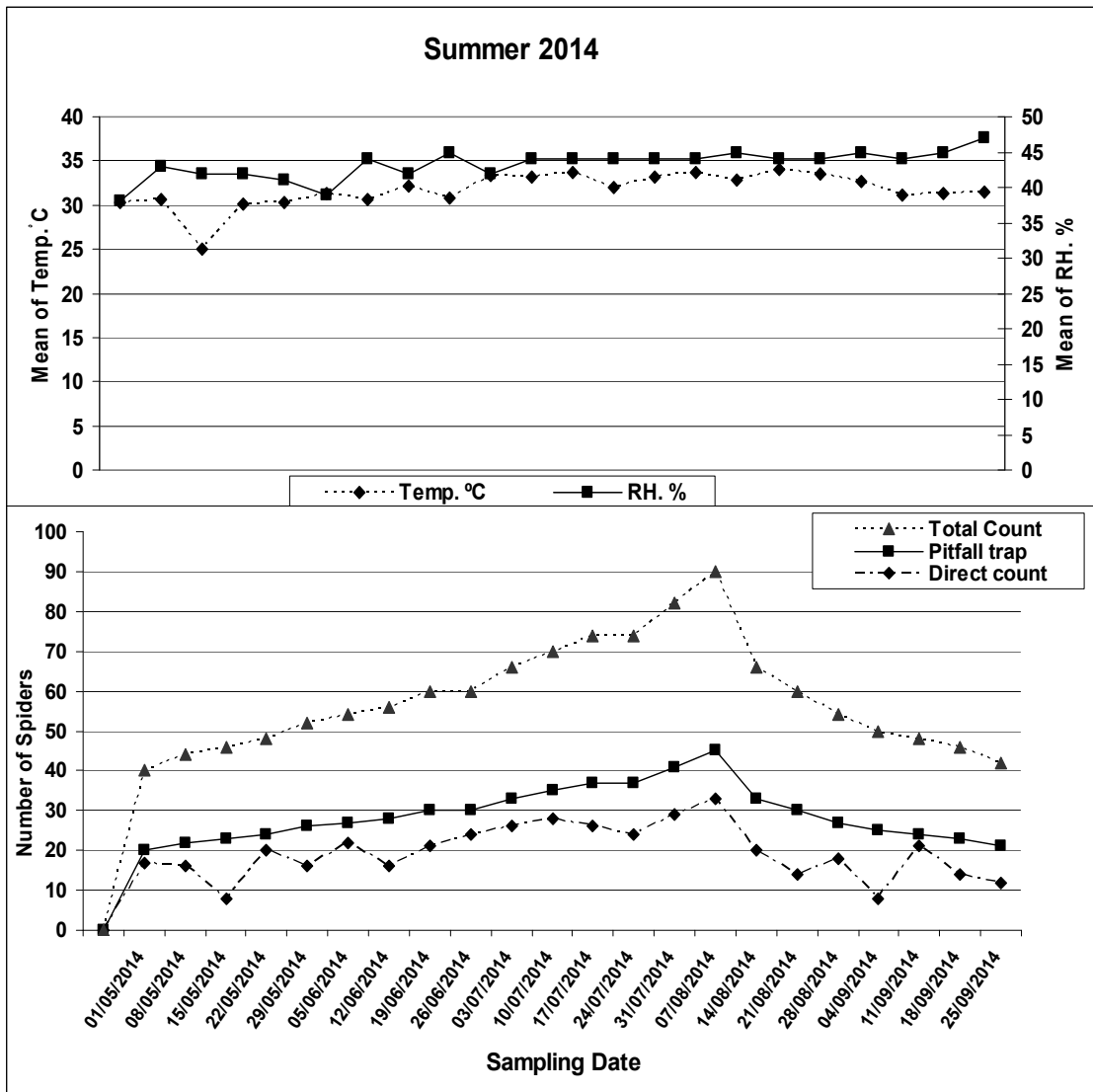


Fig (4) Fluctuation in summer season (May to Sep. 2014)

Discussions:

Population density of spiders in tomato fields cultivated at Al-Mandara region, Fayoum Governorate, Egypt during two successive years (2012/2013- 2013/2014), revealed that spiders are found all over the plantation season as indicated by periodic regular collection using two different methods, (direct count and pitfall traps). Population of spiders during two successive years included 42 species in 34 genera in 14 families.

In nili plantation (2012-2013), the numbers of spiders collected (total count) were 431.0 individuals/season; 72.16% by direct count & 27.84% by pitfall traps and in nili plantation, (2013-2014) the numbers were 446.0 individuals/ season; 66.82% by direct count and 33.18% by pitfall traps.

In summer plantation (2013), the numbers of collected spiders were 553.0 individuals/ season; 65.28% by direct count and 34.72% by pitfall traps. Much more spiders 641.00 individuals/ season were collected during summer plantation (2014) by the above two methods being 433.0 (67.55%) and 208.0 (32.45%), respectively.

In 2012/2013 seasons, a total of 984.0 individuals was collected from tomato plants during nili and summer plantations compared with 1087 individuals in 2013/2014 season (nili and summer plantations).

Rahil, 1988: studied the spider fauna associated with fields of cucurbits (squash-melon) in Fayoum, five families namely; Clubionidae, Linyphiidae, Lycosidae, Theridiidae and Thomisidae were dominant. Spiders of low population densities were those of families; Amaurobiidae and Uloboridae. Spiders found in moderate densities were those of families; Araneidae, Dictynidae, Gnaphosidae and Salticidae.

Ghabbour et al., 1999: surveyed spiders in 18 different agricultural crops in Nile delta in 1996 using pitfall traps. High densities in summer crops were recorded in tomatoes, aborigines and cucurbits and in winter crops observed in caraway, cabbage and onion. Sweet potatoes had the lowest density. In spring, densities varied from 0.4 spiders/trap in taro (*Colocasia esculenta*) to 6.55 spider/trap in caraway. Ten families were recorded in winter crops compared with 12 in summer. Lycosidae was the dominant in both plantations (80%), followed by Linyphiidae, Philodromidae, Gnaphosidae and Tetragnathidae. Males were trapped in higher numbers than females.

Rahil, 2006 collected eighteen spider species in six families from tomato fields in El-Fayoum Governorate. These species were; *Araneus miniatus* (Walckenaer), *Eustala anastera* (Walckenaer), *Mangora placida* (Hentz), *Metazygia wittfeldae* (McCook), *Singa pratensis* Emerton

(Araneidae), *Dictyna segregate* (Gertsch and Mulaik) (Dictynidae), *Chieracanthium jovium* (Denis) (Miturgidae), *Thanatus fabricii* Audouin, *T. formicinus* (Clerck) (Philodromidae), *Anelosimus aulicus* (Koch), *Steatoda triangulosa* (Walckenaer), *Theridion murarium* Emerton, *T. tepidariorum* (Koch) (Theridiidae), *Misumena asperatus* (Hentz), *M. vatia* (Clerck), *Misumen opsoblongus* (Keyserling), *Xysticus elegans* Keyserling and *X. funestus* Keyserling (Thomisidae). Population of these spiders reached up to 25 indiv. /10 plants at the end of the season (Nov.).

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