

**MAJOR TRUE SPIDERS (ARANEAE) AND THEIR  
PREDATORY EFFECTS ON DOMINANT APHID SPECIES IN  
ALFALFA AGROECOSYSTEM AT WESTERN SAUDI  
ARABIA**

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**ABSTRACT**

The weekly intensive survey showed that two major aphid species, are widely prevalent in the alfalfa agroecosystem including the black alfalfa aphid *Macrosiphum* sp. and the spotted alfalfa aphid *Therioaphis trifolii* (Monell). A rich fauna of true spiders (Araneae) was also recorded as foliage-dwelling spiders that belong to 6 major families. Three major predominant spider families arranged by their percentage presence included Philodromidae (24.09%), Thomisidae (21.09%), Salticidae (16.58%). However, other less predominant families included Zodariidae (4.68%) Gnaphosidae (4.22%), Therididae (3.80%), Lycosidae (3.01%), Araneidae (2.51%), Cithaeronidae (0.40%), Agelenidae (0.88%), Pholcidae (0.38%) and Clubionidae (0.33%). A linear correlation existed between the total numbers of spider complex and the total number of the spotted alfalfa aphid showed an appreciable synchrony with the population of the highly prevalent host (prey) throughout the year.

**Key words:** *alfalfa agroecosystem, aphid species, foliage-dwelling spiders.*

## 1. INTRODUCTION

Alfalfa forage crop *Medicago sativa* L., locally called Al-Barseem Al-Hijazi, is considered an indispensable component and a principal common denominator of most Saudi agroecosystem since it has been grown in scattered valleys and oases since hundreds of years ago. Currently the Kingdom of Saudi Arabia has been embarking on sophisticated technology of attaining ambitious goals of maintaining its own food security. Many farms are currently mushrooming in deserts, including extensive agricultural farms, huge livestock and sophisticated poultry farms were established in addition to widening and creating new high technological oases in such hostile semi-arid and desert domains. In all these enclaves and oases, alfalfa crop is being a unifying factor of these fragile agroecosystems with the objective of sustaining prodigious amounts of food and feed needed for all types of these tended crops and animals.

Alfalfa crop with its continued greenery is depicted as a retreat and a refuge for a multitude number of pests and their natural enemies (Faragalla *et al.*, 1985, Faragalla and Al-Ghamdi, 1999). Moreover, the currently intensive crop studies have generated valuable information relating its phenology with pests and their natural enemies as reported earlier by many workers. (Whitcomb *et al.*, 1963, Turnbull, 1973, Hatley and Macmahon, 1980, Dean *et al.*, 1982, Doane and Dondale, 1979, Leigh and Hunter, 1969, Lesar and Unzicker 1978, Riechert and Lockley 1984). Furthermore, indigenous and naturally occurring predators and parasitoids playing vital role in suppressing, major insects within the premises of the alfalfa agroecosystem, have been documented (Taher and Faragalla, 1990, Riechert and Bishop, 1990, Nyffeler *et al.* 1987, 1992, N'ashnosh and Salama, 1993; Riechert and Lawrence, 1997).

The potential role of true spiders as possible regulatory agents of alfalfa insect pests and as an effective imperative in their suppression has been addressed by many workers (Wheeler, 1973, Yeargan and Dondale, 1974, Culin and Rust, 1980; Plagens, 1983, 1986, Faragalla *et al.*, 1985, Fred *et al.*, 1987). Many workers have been involved in studies with the goals of evaluating their practical application concerning their use and utilization in sustaining effective environment for maximum use of these natural enemies and

subsequently in the reduction of injurious pest populations (Howell and Pienkowsli, 1971, Watson *et al.*, 1975, Culin and Rust, 1980; Ekbohm, 1994).

The objectives of this study were to determine major true spider families (Araneae) which constantly dwell in the foliage of alfalfa agroecosystem and evaluate their predatory suppressive role on major aphid population densities.

## 2. MATERIALS AND METHODS

To achieve the goals of the present study, an intensive field data collection was conducted during the years 1999/2000 within the premises of the Research Farm that belong to the College of Meterology, Environment and Arid Land Agriculture of King Abdulaziz University which is located at Hada Al-Sham 130 km north east the city of Jeddah. The field tests were conducted there because this valley represents the type of agriculture the "valley system" that prevails in western Saudi Arabia and to the scarce field investigations on major aphid populations and the predominant foliage-dwelling true spiders in the alfalfa agroecosystem.

The alfalfa crop was grown as a forage crop separately in a solid field in an area of about eight donums (one donum= 1000m<sup>2</sup>) and the central pivot system of irrigation was used as a sole system for sprinkling and delivering water to the crop. The crop schedule for irrigation was twice weekly and no insecticides were applied to control the pest species within the crop. Data collection were carried out weekly from an area of a sampling universe approximately 7.5 donums or 0.75 ha well within the crop area by using sweeping nets. Each net is made up of fine muslin having 38 cm diameter with a 100cm long handle and contains tiny holes and openings with 0.02 mm diameter. The same sweep net was used for both major aphid species and the true spiders. Data collection was performed weekly by taking 100 double sweeps (4x25) by walking diagonally across the alfalfa field. The recovered collection was secured in 100 ml glass jars each containing about 150 ml of 70% ethyl alcohol as a killing and a preserving agent. Then glass jars were taken to the lab for further investigations and categorization to their respective orders and families. The population density of dominant aphid species and their

major true spider predators were compiled to give their annual fluctuation dynamics.

The above method of sampling using the same sweepmg nets was conducted once every two weeks throughout the year to determine the population density of dominant aphid species and their true spider predators.

### Statistical Methods

A simple linear correlation and standard deviation ( $\pm$ SD) were used to show the variation in population density of major aphid species, the weekly variation and standard deviation, and linear correlation of both total number of aphids and their true spider predators.

## 3. RESULTS AND DISCUSSION

The intensive weekly survey has yielded an appreciable amount of data which showed that the major aphid species prevalent throughout the year as foliage-dwellers in alfalfa agroecosystem were *Macrosiphium* sp. and *Therioaphis trifolii* (Monell) (Table 1) Moreover, the population density of both species represented as average number  $\pm$  standard deviation per week is shown in (Table 2).

Data recovered from field surveys showed that a rich fauna of foliage-dwelling true spiders is prevalent throughout the year and the spider complex was made of twelve spider families including Zodariidae, Salticidae, Thomisidae, Philodromidae, Araneidae, Lycosidae, Theridiidae, Gnaphosidae, Clubionidae, Pholcidae, Cithoeronidae and Agelenidae. Moreover the dominant families were Philodromidae, (42.09%), Thomisidae (21.09%) and Salticidae (16.58%) of the total spider family complex (Table 3,4) and the weekly population density of the three dominant families represented as average number  $\pm$  standard deviation per week in the alfalfa agroecosystem is shown (Table 4, Fig.1). However the rest of the spider complex was represented by low percentages (Table 5) and low total population density throughout the year (Fig.2). It is evidently clear that members of the family Philodromidae was the most predominant among all other families since their activity was observed all the year round exhibiting five activity peaks, the highest occurred during May while the others were present during March, October, December and

**Table (1): Weekly variation in the population density of major aphid species in alfalfa agroecosystem Hada Al-Sham, Western Saudi Arabia, 1999-2000.**

Species	Mar.				Apr.				May				Jun.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Macrosiphum</i> sp.	200	111	551	300	139	146	515	435	700	1005	626	562	944	950	1062	1060
<i>Therioaphis trifolii</i>	220	267	414	265	260	350	77	42	97	227	186	177	409	200	341	390

Species	Jul.				Aug.				Sep.				Oct.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Macrosiphum</i> sp.	1632	222	274	274	638	640	2432	4265	800	810	97	99	415	490	133	103
<i>Therioaphis trifolii</i>	373	51	50	51	120	122	551	260	170	174	8	10	67	110	32	48

Species	Nov.				Dec.				Jan.				Feb.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Macrosiphum</i> sp.	134	152	167	392	413	308	130	145	310	329	912	760	2357	2029	2026	2060
<i>Therioaphis trifolii</i>	65	68	74	153	242	132	175	367	199	228	232	230	645	336	334	224

**Table (2): Weekly population density of major aphid species represented as average number  $\pm$  standard deviation ( $\pm$ SD) for each week in alfalfa agroecosystem, Hada Al-Sham, Western Saudi Arabia, 1999-2000.**

Species	Mar.	Apr.	May	Jun.
<i>Macrosiphum. sp</i>	290.50 $\pm$ 164.59	308.75 $\pm$ 194.75	723.25 $\pm$ 65.87	1004.00 $\pm$ 65.87
<i>Therioaphis trifolii</i>	291.50 $\pm$ 84.50	182.25 $\pm$ 147.12	171.75 $\pm$ 54.38	312.50 $\pm$ 87.43

Species	Jul.	Aug.	Sep.	Oct.
<i>Macrosiphum. sp</i>	600.50 $\pm$ 688.10	1993.75 $\pm$ 1734.10	451.50 $\pm$ 408.21	285.25 $\pm$ 195.92
<i>Therioaphis trifolii</i>	131.00 $\pm$ 161.33	263.25 $\pm$ 202.72	90.50 $\pm$ 94.12	64.25 $\pm$ 33.68

Species	Nov.	Dec.	Jan.	Feb.
<i>Macrosiphum. sp</i>	2210.25 $\pm$ 121.25	249.00 $\pm$ 135.83	577.75 $\pm$ 304.68	2118.00 $\pm$ 160.07
<i>Therioaphis trifolii</i>	90.00 $\pm$ 42.06	229.00 $\pm$ 102.53	222.25 $\pm$ 15.58	384.75 $\pm$ 181.22

Table (3) : Weekly variation in the population density of foliage-dwelling of home spiders in alfalfa agroecosystem Hada Al-Sham valley, western Saudi Arabia, 1999-2000.

Family	Mar.				Apr.				May				Jun.				Jul.				Aug.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Philodromidae</i>	40	6	30	13	8	17	16	15	55	65	40	26	25	28	29	23	6	9	9	10	6	17	18	22
<i>Thomisidae</i>	22	3	19	11	4	9	9	8	25	45	22	14	12	12	19	7	3	5	6	5	3	6	6	10
<i>Salticidae</i>	13	2	15	6	2	11	8	6	18	34	18	17	8	16	18	4	1	3	5	5	3	3	4	6
<i>Araneidae</i>	1	2	6	2	1	3	1	0	2	1	00	3	1	4	4	2	1	0	1	2	1	2	2	0
<i>Gnaphosidae</i>	8	2	3	3	2	4	2	6	2	2	4	1	2	4	6	4	1	1	2	2	1	1	1	0
<i>Clubionidae</i>	1	00	1	1	00	00	00	00	00	00	00	00	00	1	1	00	00	00	00	00	00	00	00	00
<i>Therididae</i>	1	1	5	3	2	4	1	6	3	1	2	1	1	5	5	4	2	2	1	00	2	00	00	00
<i>Zodariidae</i>	6	2	3	3	3	3	2	2	1	1	1	00	2	6	8	6	2	2	1	2	2	2	1	00
<i>Agelenidae</i>	4	00	00	1	00	1	00	1	00	00	00	00	00	2	4	00	00	00	00	00	1	1	00	00
<i>Cithaeronidae</i>	1	00	00	00	00	00	00	00	00	00	00	00	00	1	00	00	00	00	00	00	1	1	2	00
<i>Lycosidae</i>	3	1	5	3	1	4	2	1	1	1	1	00	1	4	5	00	2	00	1	00	2	2	3	1
<i>Pholcidae</i>	00	00	1	1	00	1	00	00	00	00	00	00	00	1	1	00	00	00	00	00	00	1	00	00
<b>Total</b>	<b>10</b>	<b>19</b>	<b>86</b>	<b>49</b>	<b>23</b>	<b>57</b>	<b>41</b>	<b>40</b>	<b>10</b>	<b>14</b>	<b>88</b>	<b>62</b>	<b>47</b>	<b>84</b>	<b>90</b>	<b>50</b>	<b>18</b>	<b>22</b>	<b>26</b>	<b>27</b>	<b>20</b>	<b>36</b>	<b>37</b>	<b>39</b>
	<b>0</b>								<b>7</b>	<b>5</b>														

Family	Sep.				Oct.				Nov.				Dec.				Jan.				Feb.			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Philodromidae</i>	22	27	11	11	21	44	25	15	14	15	14	18	22	17	11	28	21	22	24	8	21	19	14	33
<i>Thomisidae</i>	8	13	3	4	5	18	8	8	7	8	9	9	12	8	8	18	11	10	9	5	10	11	6	12
<i>Salticidae</i>	8	3	2	2	4	8	7	2	4	6	5	7	10	7	8	14	13	9	9	2	12	9	5	15
<i>Araneidae</i>	1	0	0	1	2	2	1	0	1	00	00	00	00	00	1	00	1	3	2	00	1	00	00	2
<i>Gnaphosidae</i>	0	0	1	1	1	2	4	1	00	00	1	2	00	3	3	3	2	2	2	00	2	00	3	4
<i>Clubionidae</i>	00	00	00	00	1	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	1	1
<i>Therididae</i>	00	1	1	1	2	6	5	1	00	1	00	1	00	1	2	1	2	4	3	00	2	2	2	1
<i>Zodariidae</i>	00	00	2	00	4	6	10	4	00	00	00	1	00	1	2	1	2	3	4	1	2	2	4	2
<i>Agelenidae</i>	00	00	00	00	1	2	1	00	00	00	00	00	00	00	1	00	00	00	00	00	00	00	1	00
<i>Cithaeronidae</i>	00	00	00	00	1	2	00	00	00	00	00	00	00	00	1	00	00	00	00	00	00	00	1	00
<i>Lycosidae</i>	1	00	00	00	1	4	3	2	00	00	00	1	00	2	1	4	0	2	3	00	1	00	2	00
<i>Pholcidae</i>	00	00	00	00	00	00	1	1	00	00	00	00	00	00	00	00	00	00	00	00	00	00	1	00
<b>Total</b>	<b>40</b>	<b>44</b>	<b>20</b>	<b>22</b>	<b>44</b>	<b>94</b>	<b>65</b>	<b>29</b>	<b>26</b>	<b>30</b>	<b>39</b>	<b>44</b>	<b>39</b>	<b>44</b>	<b>37</b>	<b>70</b>	<b>53</b>	<b>55</b>	<b>56</b>	<b>16</b>	<b>51</b>	<b>41</b>	<b>40</b>	<b>70</b>

**Table (4): Weekly population of dominant foliage-dwelling true spiders represented as average number  $\pm$  standard deviation per week in alfalfa agroecosystem Hada Al-Sham valley, western Saudi Arabia, 1999-2000.**

Family	Mar.	Apr.	May	Jun.	Jul.	Aug.
Philodromidae	22.25 $\pm$ 15.54	14.00 $\pm$ 4.8	46.50 $\pm$ 17.09	26.25 $\pm$ 2.75	8.50 $\pm$ 1.73	15.75 $\pm$ 6.84
Thomisidae	13.75 $\pm$ 8.53	7.50 $\pm$ 2.38	26.50 $\pm$ 13.17	12.50 $\pm$ 40.93	4.75 $\pm$ 1.25	6.25 $\pm$ 2.87
Salticidae	9.00 $\pm$ 6.05	6.75 $\pm$ 3.77	21.75 $\pm$ 8.18	11.50 $\pm$ 6.60	3.50 $\pm$ 1.91	4.00 $\pm$ 1.41

Family	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Philodromidae	17.75 $\pm$ 8.05	26.25 $\pm$ 12.52	15.25 $\pm$ 1.89	19.50 $\pm$ 7.23	18.75 $\pm$ 7.57	12.25 $\pm$ 8.34
Thomisidae	7.00 $\pm$ 4.54	9.75 $\pm$ 5.67	8.25 $\pm$ 0.95	11.50 $\pm$ 4.72	8.75 $\pm$ 2.63	9.75 $\pm$ 2.563
Salticidae	3.75 $\pm$ 2.87	5.25 $\pm$ 2.75	5.50 $\pm$ 1.29	9.75 $\pm$ 3.09	8.25 $\pm$ 4.57	10.25 $\pm$ 4.27

**Table (5): Total and percentage of major foliage dwellers true spiders in alfalfa agroecosystem, Hada Al-Sham, western Saudi Arabia, 1999-2000.**

Family	Clubionidae	Pholcidae	Agelenidae	Cithaeronidae	Araneidae	Lycosidae
Total/ year	8	9	21	11	60	72
%	0.33%	0.38%	0.88%	0.46%	2.51%	3.01%

Family	Therididae	Gnaphosidae	Zodariidae	Salticidae	Thomisidae	Philodromidae
Total/ year	91	101	112	397	505	1008
%	3.80%	4.22%	4.68%	16.58%	21.09%	42.09%



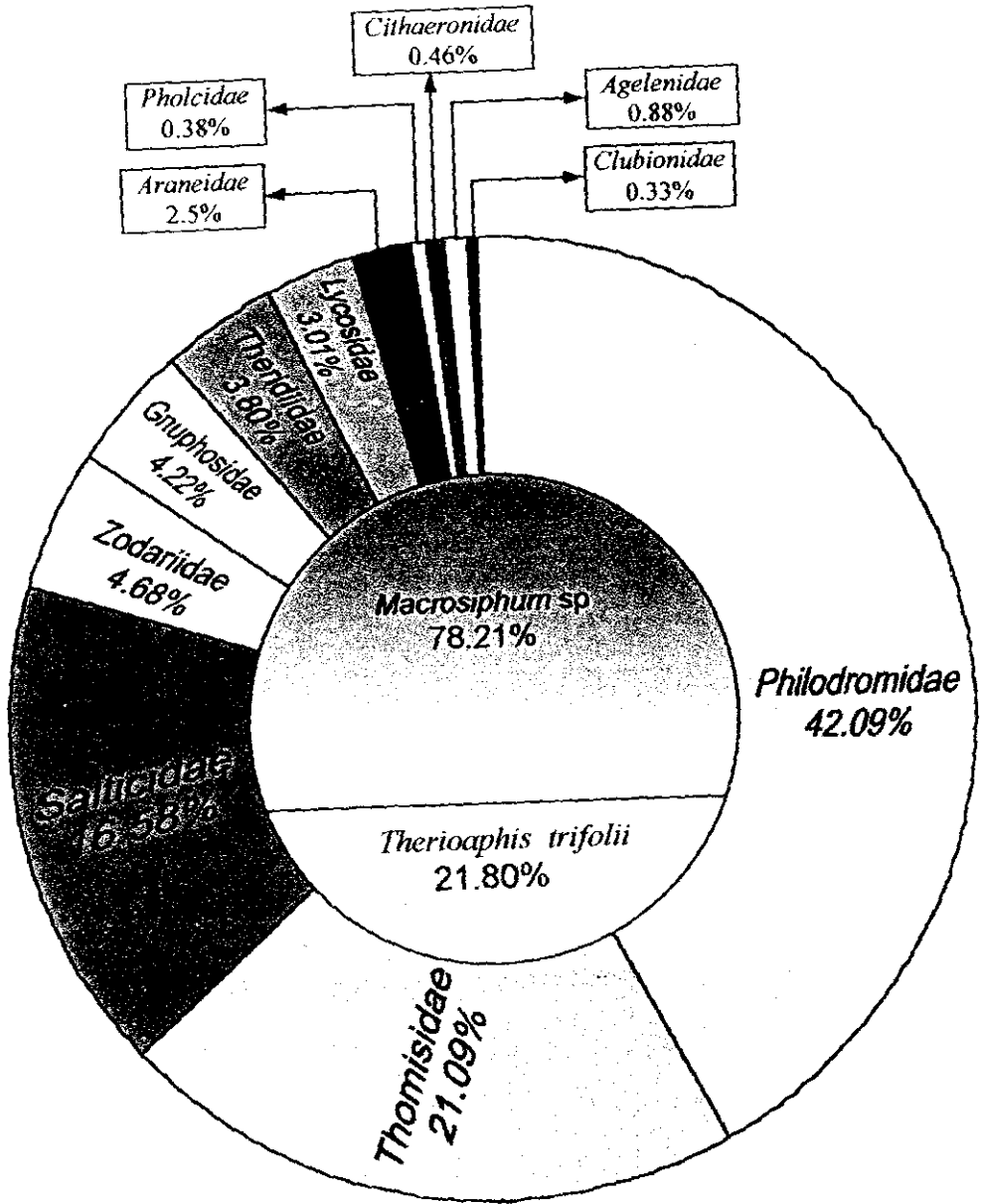
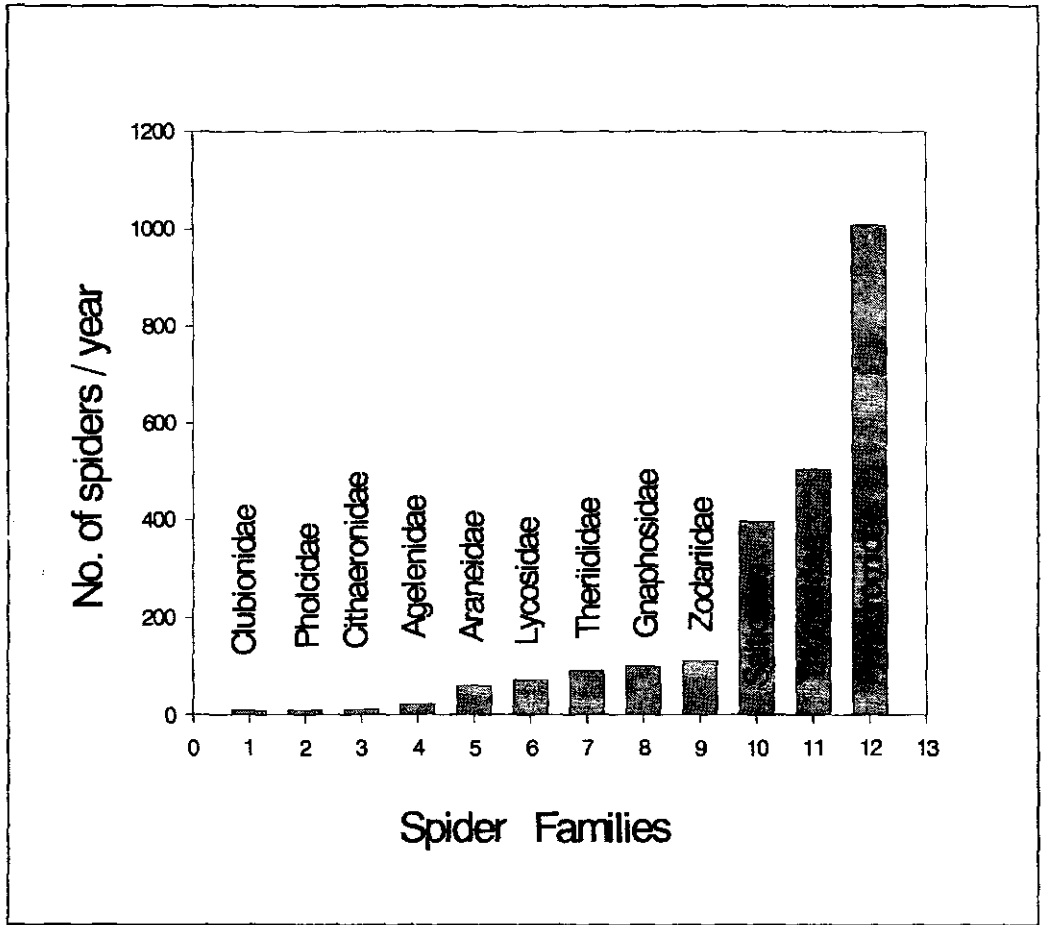


Fig. (1): Percentage variation of the foliage-dwelling true spiders complex and their major aphid preys in alfalfa agroecosystem, Hada Al-Sham valley, western Saudi Arabia, 1999-2000.



**Fig. (2): Population of foliage-dwellers true spider families in alfalfa agroecosystem, Hada Al-Sham valley, western Saudi Arabia, 1999-2000.**

February. The Thomisid family showed three activity peaks during March, May and December, whereas members of family Salticidae has only two peaks during May and December (Fig. 3). Moreover and based on recorded data and the frequent recovery of spiders from the intensive weekly field surveys, it is clear that the dominant families in the order of their frequent presence reported as (most frequent, more frequent and frequent) based on their numbers showed the following order Philodromidae, Thomisidae and Salticidae (Table 6). The linear correlation between the total numbers of the spider complex and the total number of the spotted alfalfa aphid, *T. trifolii* showed that the spider complex as a group has an appreciable synchrony with the population of its prey throughout the year where they have high population peaks with those of their prey, *T. trifolii* (Table 7).

More future in-depth and extensive studies will be needed to generate deep insights about this natural enemy complex, its speciation and nomenclature, to determine its specific role and give more information about suggested candidates to be used in the future IPM programs in the alfalfa agroecosystem.

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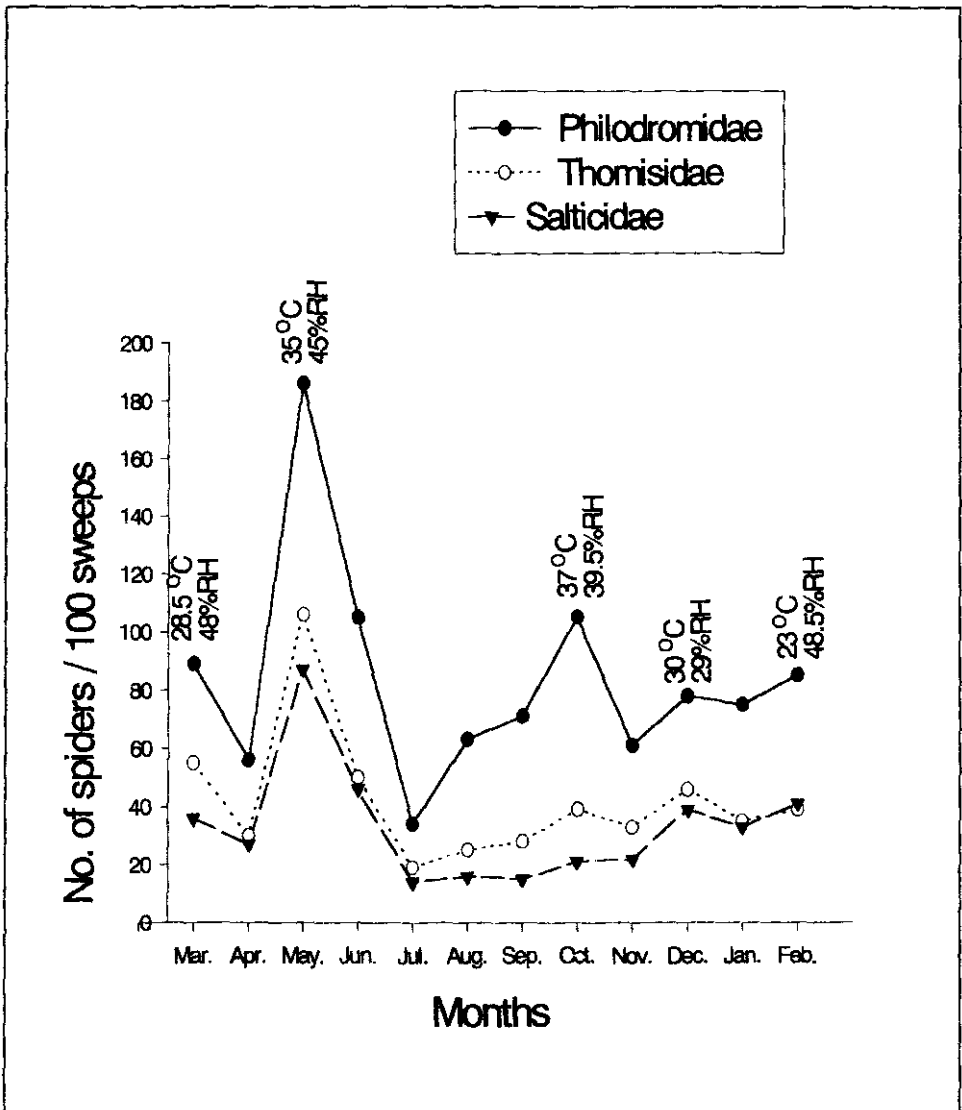


Fig. (3): Monthly fluctuation of the major foliage-dwellers true spider families in alfalfa agroecosystem, Hada Al-Sham valley, western Saudi Arabia, 1999-2000.

**Table (6): Variation in numbers of foliage-dwellers true spiders in alfalfa agroecosystem, Hada Al-Sham valley, western Saudi Arabia, 1999-2000.**

Range	Family	Status
0-200	Clubionidae	Less Frequence
	Pholcidae	
	Cithaeronidae	
	Agelenidae	
	Araneidae	
	Lycosidae	
	Therididae	
	Gnaphosidae	
	Zodariidae	
201-400	Salticidae	Frequence
401-600	Thomisidae	More Frequence
601- ....	Philodromidae	Most Frequence

**Table (7): Linear regression of the monthly numbers of the foliatedwellers true spiders complex in relation to total numbers of spotted alfalfa aphid *T. trifolii* in alfalfa agroecosystem, Hada Al-Sham valley, western Saudi Arabia, 1999-2000.**

Dependent Variable	Parameter	Estimate	Standard Error	t-vallue	P. Value
Spiders	$\beta_0$	75.815	59.936	10265	0.238
Complex	$\beta_1$	0.139	0.0635	2.182	0.057

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العناكب الحقيقية السائدة والمفترسة على حشرات المن الرئيسية في النظام البيئي الزراعي للبرسيم الحجازي بالمنطقة الغربية من المملكة العربية السعودية

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### ملخص

أوضح الحصر الأسبوعي المكثف عن وجود نوعين سائدين من حشرات المن في النظام البيئي الزراعي للبرسيم الحجازي وهما *Macrosiphum* sp. و *Therioaphis trifolii* تم من ناحية أخرى حصر أعداد عنكبوتية غزيرة مسن العناكب الحقيقية القاطنة للمجموع الخضري للبرسيم تمثلت في اثنتا عشر عائلة وهي:

*Philodromidae* (42.09%), *Thomisidae* (21.09%), *Salticidae* (16.58%), *Zodariidae* (4.68%), *Gnaphosidae* (4.22%), *Therididae* (3.80%), *Lycosidae* (3.01%), *Araneidae* (2.51%), *Cithaeronidae* (0.40%), *Agelenidae* (0.88%), *Pholcidae* (0.38%) and *Clubionidae* (0.33%).

اتضح عند استخدام التحليل الإحصائي بتطبيق معامل الارتباط فيما بين المجموع الكلي لمعقد هذه العناكب الحقيقية مع حشرات المن السائدة اتضح أن لهذه العناكب ارتباط معنوي جيد مع حشرات المن من النوع *T.trifolii* حيث يتضح أن هناك توافقية جيدة فيما بين مجتمعات معقد هذه العناكب وهذا النوع من حشرات المن السائدة.