

Spider Fauna of Almond Orchards in Eastern and Southeastern Anatolia

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Abstract: This research was carried out in almond orchards (*Amygdalus* sp.) in Eastern and Southeastern Anatolia in 2003 in order to determine the spider fauna. Among the 129 specimens collected, 21 species belonging to 16 genera and 9 families were recorded at 10 localities with more spiders in the almond orchards in these regions. Among the species, *Atea sturmi* (Hahn, 1831) is a new record for the araneo-fauna of Turkey. The study was the first on spider fauna in almond orchards in Turkey.

Key Words: Spider, Araneae, almond orchard, fauna, bio-control, Turkey

Doğu ve Güneydoğu Anadolu Bölgeleri'nde Badem Bahçelerinin Örümcek Faunası

Özet: Bu çalışma, 2003 yılında Doğu ve Güneydoğu Anadolu Bölgelerinde badem (*Amygdalus* sp.) bahçelerindeki örümcek faunasını belirlemek için yapılmıştır. Üstünde nispeten fazla örümcek bulunduran 10 farklı yöredeki ağaçlardan toplam 129 örümcek elde edilmiş, bunlardan 9 familya içinde 16 cinse mensup toplam 21 tür kayıt edilmiştir. Bu türlerden *Atea sturmi* (Hahn, 1831) Türkiye örümcek faunası için ilk kayıttır. Bu çalışma, Türkiye'deki badem bahçelerinde örümcek faunası üzerinde yapılan ilk çalışmadır.

Anahtar Sözcükler: Örümcek, Araneae, badem bahçesi, fauna, biyolojik mücadele, Türkiye

Introduction

Arthropoda contain approximately 70% of all known species of animals. Therefore, arthropods are the richest animal group in the world regarding species and individual numbers. Insects, which represent the largest class and species diversity in the animal world, are part of this group. Probably spiders constitute the most taxa among the arachnid orders.

Spiders can inhabit all types of the habitats and ecosystems. They have a large area of distribution, from the poles to the centers of the continents and from sea level to 5000 m elevations (Foelix, 1982). However, most spiders live in terrestrial ecosystems. Mostly, they dwell on the ground in gardens and fields or live on webs on vegetation.

Spiders that live in continental ecosystems are defined as effective predators of insects and other arthropods.

Spiders live together with insects in agricultural ecosystems. Ecological and faunistic investigations on spiders demonstrated that spiders can control insects and their larvae in terrestrial ecosystems (Riechart and Lockley, 1984; Nyffeler and Benz, 1987; Orazé and Grigarick, 1989; Laub and Luna, 1992; Maloney et al., 2003).

Many studies have been performed on spider fauna of cereal (Luczak, 1975; Jones, 1976; Kumar and Velusamy, 1997), soybean (Ferguson et al., 1984), alfalfa (Bayram et al., 1999), cotton (Bayram et al., 2000), and tobacco (Bayram et al., 1998) fields and some orchards (Ghavami, 2006) in Middle East, Western, and Far East countries. For instance, in cereals, wolf spiders (Lycosidae) and crab spiders (Thomisidae) were dominant; in tobacco fields, wolf spiders and ambushers (Gnaphosidae, Clubionidae); in cotton fields, wolf spiders

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and dwarf spiders (Linyphiidae); and in olive orchards, dwarf spiders, jumping spiders (Salticidae), and crab spiders. In addition, in Eastern Anatolia, Varol (1996) studied the systematic and ecology of ground-living spiders in the Lake Van basin and Northeastern Anatolia (2001). In addition, Allahverdi (1997) examined the spider fauna of alfalfa, trefoil, and cereal fields in Eastern Anatolia and the fauna of argiopy-formia in Southeastern Anatolia (Allahverdi, 2004).

The aim of the present study was to document the spider fauna of the almond orchards in Southeastern Anatolia, and contribute some records to the spider fauna of Turkey.

Materials and Methods

Spiders were collected in the spring and summer months of 2003 at 10 localities. The collection was performed by hand aspirator, sweeping net, and pitfall traps with ethylene glycol. Locality descriptions are as given below:

1. Eastern Anatolia, in Elazığ province [Center (38°39'N, 39°15'E at altitude of about 998 m), Gezin district (38°29'N, 39°20'E at altitude of about 1256 m), Keban district (38°43'N, 39°53'E at altitude of about 1206 m) and Sivrice district (38°28'N, 39°18'E at altitude of about 1280 m)].
2. Southeastern Anatolia, in Diyarbakır province [Çermik district (38°15'N, 39°45'E at altitude of about 710 m), Ergani, (38°17'N, 39°45'E at altitude of about 1043 m)].
3. Southeastern Anatolia, in Mardin province [Akbağ district (37°22'N, 40°39'E at altitude of about 970 m), Center (37°20'N, 40°46'E at altitude of about 853 m), Ömerli district (37°24'N, 40°56'E at altitude of about 1133 m), Yeşilli district (37°22'N, 40°51'E at altitude of about 1069 m)] (Figure).

The specimens collected were put into 70% ethanol, labeled, and taken to the laboratory for identification. The keys by Tyschenko (1971), Heimer and Nentwig (1991), and Roberts (1995) were used for identification. The specimens were identified at species level using a binocular stereomicroscope, and they were preserved in the Research Laboratory of the Plant Protection Department in Diyarbakır.

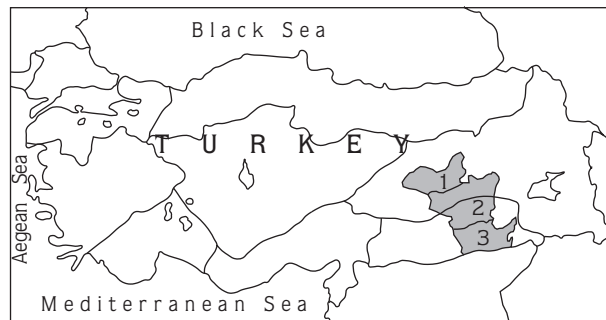


Figure. The survey areas in the Eastern (EAR) and Southeastern Anatolia (SEAR) regions; 1, Elazığ; 2, Diyarbakır; 3, Mardin.

Results

A total of 129 specimens were collected from the almond orchards in Elazığ, Diyarbakır, and Mardin, and 21 species belonging to 16 genera in 9 families were recorded. Among the specimens, 32 were male, 33 were female, and 64 were immature. The spider species determined are given in the Table.

Family: Agelenidae

Agelena gracilens CL. Koch, 1841

Material examined: Sivrice (18.05.2003) 1♂.

General Distribution: Austria, Belgium, Bulgaria, Corsica, Croatia, Czech Republic, French mainland, Germany, Greek mainland, Hungary, Italian mainland, Liechtenstein, Macedonia, Moldova, Poland, Romania, Russia, Sardinia, Sicily, Slovakia, Slovenia, Spanish mainland, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Eastern Anatolia, Eastern Mediterranean Sea, Aegean and Marmara regions (Bayram, 2002).

Recorded hosts: Apple and pear (Bogya et al., 1999).

Family: Araneidae

Araniella cucurbitina (Clerck, 1757)

Material examined: Sivrice (29.05.2003) 1♂.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Croatia, Czech Republic, Danish mainland, Estonia, Finland, French mainland, Germany, Greek mainland, Hungary, Ireland, Italian mainland, Kaliningrad region, Latvia, Liechtenstein, Lithuania, Macedonia, Moldova, Northern Ireland, Poland,

Table. List of the spider species collected from the almond orchards in Eastern and Southeastern Anatolia (MAL, male; FEM, female; TOT, total).

FAMILY	SPECIES	MAL	FEM	TOT
Agelenidae	<i>Agelena gracilens</i> CL. Koch, 1841	1	-	1
	Immature	-	-	3
Araneidae	<i>Araniella cucurbitina</i> (Clerck, 1757)	1	-	1
	<i>Araneus diadematus</i> Clerck, 1757	-	1	1
	<i>Araneus marmoreus</i> Clerck, 1757	-	2	2
	<i>Atea sturmi</i> (Hahn, 1831)	-	1	1
	Immature	-	-	7
Dictyniidae	<i>Dictyna latens</i> (Fabricius, 1775)	1	1	2
Gnaphosidae	Immature	-	-	5
Linyphiidae	<i>Linyphia hortensis</i> Sundevall, 1830	2	-	2
	Immature	-	-	5
Philodromidae	<i>Philodromus cespitum</i> (Walckenaer, 1802)	1	-	1
	<i>Philodromus collinus</i> (CL. Koch, 1835)	2	7	9
	<i>Philodromus longipalpis</i> Simon, 1870	7	4	11
	Immature	-	-	13
Salticidae	<i>Ballus chalybeius</i> (Walckenaer, 1802)	2	-	10
	<i>Evarcha arcuata</i> (Clerck, 1758)	-	1	1
	<i>Heliophanus flavipes</i> (Hahn, 1832)	-	2	2
	<i>Philaeus chrysops</i> (Poda, 1761)	1	1	2
	<i>Phlegra fasciata</i> (Hahn, 1826)	1	1	2
	<i>Synageles dalmaticus</i> (Keyserling, 1863)	3	2	5
	Immature	-	-	12
Theridiidae	<i>Kochiura aulica</i> (CL. Koch, 1838)	1	-	1
	Immature	-	-	4
Thomisidae	<i>Synaema globosum</i> (Fabricius, 1775)	3	-	3
	<i>Xysticus lineatus</i> (Westring, 1851)	3	4	7
	<i>Xysticus striatipes</i> L. Koch, 1870	-	1	1
	<i>Tmarus piochardi</i> (Simon, 1866)	3	5	8
	Immature	-	-	7
TOTAL	Total of immatures = 64	35	37	136

Portuguese mainland, Romania, Russia, Sardinia, Sicily, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Eastern Anatolia, Southeastern Anatolia, Central Anatolia, Marmara region (Bayram, 2002; Allahverdi, 2004).

Recorded hosts: Apple and pear (Bogya et al., 1999).

Araneus diadematus Clerck, 1757

Material examined: Akbağ (04.08.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Crete, Croatia, Czech

Republic, Danish mainland, Estonia, Finland, French mainland, Germany, Greek mainland, Hungary, Iceland, Ireland, Italian mainland, Kaliningrad region, Latvia, Liechtenstein, Lithuania, Macedonia, Moldova, Northern Ireland, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia, Sardinia, Slovakia, Slovenia, Sweden, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: All regions of Turkey (Bayram, 2002; Bayram et al., 2002; Bayram et al., 2005).

Recorded hosts: Fruit trees (Bayram et al., 2005).

Araneus marmoreus Clerck, 1957

Material examined: Sivrice (29.05.2003) 1♀, Elazığ, Center (25.04.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Czech Republic, Danish mainland, Estonia, Finland, French mainland, Germany, Greek mainland, Hungary, Italian mainland, Kaliningrad region, Latvia, Liechtenstein, Lithuania, Macedonia, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia, Slovakia, Slovenia, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Eastern Black Sea region (Bayram, 2002). Central Black Sea region (Topçu et al., 2005).

Recorded hosts: This spider lives in or near woods.

Atea sturmi (Hahn, 1831)

Material examined: Sivrice (09.05.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Croatia, Czech Republic, Danish mainland, Estonia, Finland, French mainland, Germany, Hungary, Iceland, Italian mainland, Kaliningrad region, Latvia, Liechtenstein, Lithuania, Moldova, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Eastern Anatolia.

Recorded hosts: This spider was recorded on almond trees in Elazığ. It is a new record for the Turkish spider fauna.

Family: Dictyniidae

Dictyna latens (Fabricius, 1775)

Material examined: Akbağ (04.08.2003) 1♂, 1♀.

General Distribution: Andorra, Austria, Belgium, Britain, Bulgaria, Croatia, Czech Republic, Estonia, Finland, French mainland, Germany, Hungary, Ireland, Italian mainland, Malta, Moldova, Northern Ireland, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Eastern Anatolia, Southeastern Anatolia, Central Anatolia, Marmara region (Bayram, 2002; Bayram et al., 2002; Bayram et al., 2005).

Recorded hosts: This spider lives on low vegetation (Roberts, 1995).

Family: Linyphiidae

Linyphia hortensis Sundevall, 1830

Material examined: Mardin, Center (22.04.2003) 1♂, Sivrice (29.05.2003) 1♂.

General Distribution: Austria, Belarus, Belgium, Britain, Bulgaria, Croatia, Czech Republic, Danish mainland, Finland, French mainland, Germany, Hungary, Ireland, Italian mainland, Latvia, Liechtenstein, Macedonia, Moldova, Northern Ireland, Norwegian mainland, Poland, Romania, Russia, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Central Anatolia (Bayram, 2002).

Recorded hosts: This spider lives on low vegetation in woods (Roberts, 1995).

Family: Philodromidae

Philodromus cespitum (Walckenaer, 1802)

Material examined: Mardin, Center (26.06.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Czech Republic, Danish mainland, Estonia, Finland, Germany, Greek mainland, Hungary, Ireland, Italian mainland, Kaliningrad region, Liechtenstein, Lithuania, Macedonia, Moldova, Northern Ireland, Norwegian mainland, Poland, Romania,

Russia, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Marmara region (Bayram, 2002). Southeast Anatolia (Topçu et al., 2005).

Recorded hosts: This spider lives on low vegetation, bushes, and lower branches of trees (Roberts, 1995).

Philodromus collinus (CL. Koch, 1835)

Material examined: Akbağ (24.06.2003) 1♀, Çermik (08.09.2003) 3♀♀, Gezin (25.04.2003) 2♀♀, 2♂♂, (10.07.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Croatia, Czech Republic, Danish mainland, Estonia, Finland, French mainland, Germany, Greek mainland, Hungary, Italian mainland, Kaliningrad region, Liechtenstein, Macedonia, Norwegian mainland, Poland, Romania, Russia, Slovakia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Eastern Mediterranean Sea region (Bayram, 2002). Mediterranean region, Marmara region (Topçu et al., 2005).

Recorded hosts: This spider lives on the lower branches of trees, particularly conifers (Roberts, 1995).

Philodromus longipalpis Simon, 1870

Material examined: Akbağ (24.06.2003) 1♀, 2♂♂, Çermik (29.04.2003) 3♂♂, (06.06.2003) 1♀, Elazığ, Center (03.08.2003) 1♀, (21.08.2003) 1♀, Ergani (06.06.2003) 2♂♂.

General Distribution: Belgium, Britain, Bulgaria, Croatia, Germany, Greek mainland, Macedonia, Romania, Slovakia, Spanish mainland, Switzerland, The Netherlands, (Platnick, 2006).

Distribution in Turkey: Eastern Anatolia, Marmara region (Topçu et al., 2005).

Recorded hosts: This spider lives on bushes and trees (Heimer and Nentwig, 1991; Roberts, 1995).

Family: Salticidae

Ballus chalybeius (Walckenaer, 1802)

Material examined: Çermik (06.06.2003) 2♂♂.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Canary Is., Croatia, Czech Republic, Danish mainland, French mainland, Germany,

Greek mainland, Hungary, Italian mainland, Liechtenstein, Macedonia, Moldova, Norwegian mainland, Poland, Romania, Russia, Sardinia, Sicily, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Eastern and Central Anatolia (Bayram, 2002). Central Anatolia (Topçu et al., 2005).

Recorded hosts: This spider lives on bushes and trees (Roberts, 1995).

Evarcha arcuata (Clerck, 1758)

Material examined: Gezin (21.07.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Croatia, Czech Republic, Danish mainland, Estonia, Finland, Germany, Greek mainland, Hungary, Italian mainland, Kaliningrad region, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Moldova, Norwegian mainland, Poland, Romania, Russia, Sicily, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Western Mediterranean Sea and Aegean regions (Bayram, 2002). Eastern Black Sea region (Topçu et al., 2005).

Recorded hosts: This spider lives on low vegetation such as heather often in damp locations (Roberts, 1995).

Heliophanus flavipes (Hahn, 1832)

Material examined: Akbağ (04.08.2003) 1♀, Sivrice (11.08.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Corsica, Czech Republic, Danish mainland, Estonia, Finland, Germany, Greek mainland, Hungary, Ireland, Italian mainland, Latvia, Liechtenstein, Lithuania, Macedonia, Moldova, Northern Ireland, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia, Sardinia, Sicily, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Central Anatolia (Bayram, 2002; Topçu et al., 2005).

Recorded hosts: This species prefers living on or at the base of low vegetation (Roberts, 1995).

Philaeus chrysops (Poda, 1761)

Material examined: Elazığ, Center (21.08.2003) 1♀, Sivrice (29.05.2003) 1♂.

General Distribution: Andorra, Austria, Bulgaria, Corsica, Czech Republic, French mainland, Germany, Greek mainland, Hungary, Italian mainland, Liechtenstein, Macedonia, Poland, Portuguese mainland, Romania, Russia, Sardinia, Sicily, Slovakia, Spanish mainland, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Central Anatolia, Eastern Mediterranean Sea, Aegean, and Marmara regions (Bayram, 2002). East Black Sea region, Mediterranean region, Central Anatolia, Eastern Anatolia (Topçu et al., 2005).

Recorded hosts: This spider lives among stones, rocks, and low vegetation (Roberts, 1995).

Phlegra fasciata (Hahn, 1826)

Material examined: Ergani (03.06.2003) 1♂, Sivrice (29.05.2003) 1♀.

General Distribution: Andorra, Austria, Belarus, Belgium, Britain, Bulgaria, Croatia, Czech Republic, Danish mainland, Estonia, Finland, French mainland, Germany, Greek mainland, Hungary, Ireland, Italian mainland, Latvia, Liechtenstein, Lithuania, Macedonia, Malta, Norwegian mainland, Poland, Portuguese mainland, Romania, Russia, Sicily, Slovakia, Slovenia, Spanish mainland, Sweden, Switzerland, The Netherlands, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Central Anatolia, Marmara region (Bayram, 2002). Mediterranean region, Central Anatolia, Aegean region (Topçu et al., 2005).

Recorded hosts: This spider lives among low vegetation on sand and shingle (Roberts, 1995).

Synageles dalmaticus (Keyserling, 1863)

Material examined: Ergani (03.06.2003) 1♀, 2♂♂, Sivrice (29.05.2003) 1♂.

General Distribution: Bulgaria, Corsica, Croatia, Greek mainland, Italian mainland, Macedonia, Spanish mainland, Ukraine (Platnick, 2006).

Distribution in Turkey: Western Mediterranean Sea region (Bayram, 2002). Marmara and Aegean regions (Topçu et al., 2005).

Recorded hosts: This species lives on trees.

Family: Theridiidae

Kochiura aulica (CL. Koch, 1838)

Material examined: Gezin (25.04.2003) 1♂.

General Distribution: Belgium, Britain, Bulgaria, Canary Is., Corsica, Croatia, Czech Republic, French mainland, Germany, Hungary, Ireland, Italian mainland, Madeira, Malta, Portuguese mainland, Romania, Russia, Sardinia, Sicily, Russia northwest, Spanish mainland, Sweden, Switzerland, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Central Anatolia (Bayram, 2002; Topçu et al., 2005).

Recorded hosts: This spider lives on low plants and bushes (Roberts, 1995).

Family: Thomisidae

Synaema globosum (Fabricius, 1775)

Material examined: Çermik (06.06.2003) 1♂, Ergani (03.06.2003) 2♂♂.

General Distribution: It is a Palearctic species and has been found in many countries in Europe and Asia (Platnick, 2006).

Distribution in Turkey: Eastern Mediterranean Sea, Western Mediterranean Sea, Aegean, and Marmara regions (Bayram, 2002). Central Anatolia (Topçu et al., 2005).

Recorded hosts: This spider lives on flowers of grass, bushes, and trees.

Xysticus lineatus (Westring, 1851)

Material examined: Sivrice (29.05.2003) 4♀♀, 3♂♂.

General Distribution: This spider is a Palearctic species and has been found in many countries in Europe and Asia (Platnick, 2006).

Distribution in Turkey: The Mediterranean Sea region, Eastern Anatolia (Topçu et al., 2005).

Recorded hosts: This spider was found on grasses and almond trees.

Xysticus striatipes L. Koch, 1870

Material examined: Çermik (06.06.2003) 1♀.

General Distribution: Belarus, Belgium, Croatia, Czech Republic, French mainland, Germany, Hungary, Italian mainland, Liechtenstein, Macedonia, Poland, Russia, Slovenia, Switzerland, Ukraine, Yugoslavia (Platnick, 2006).

Distribution in Turkey: Central Anatolia (Bayram, 2002).

Recorded hosts: This spider was recorded on grasses and almond trees.

Tmarus piochardi (Simon, 1866)

Material examined: Çermik (06.06.2003) 3♂, 5♀♀.

General Distribution: The Mediterranean countries, Yemen, India (Platnick, 2006).

Distribution in Turkey: Diyarbakır and Muğla (Bayram et al., 2007).

Recorded hosts: This spider was recorded on almond trees.

Discussion

In this research, all field studies were performed in the daytime. However, most orb-weavers are nocturnal. In addition, nocturnal species spend the daytime under shelters. Therefore, the lack of night studies was compensated for by collecting spider specimens also from this kind of habitat.

Furthermore, spider abundance in orchards depends on habitat type and collecting methods, because spiders

prefer different habitats. For example, a collecting umbrella is an effective method. However, it was not possible to use one in the present study.

On the other hand, the margin factor is important in faunistic or ecological studies. Orchards surrounded by grasslands or fields contain more spider species (Allahverdi, 1997; Bayram et al., 1999, 2000; Varol, 2001). The almond orchards examined in this research were surrounded by open areas. Because of this, purely spider fauna were determined in the orchards.

In this study, 64 specimens were immature (Table); the others were adults. Only adult individuals were identified and evaluated. Moreover, 10 specimens could not be identified because of the inadequacy of the keys. They may be new records. The proportion of immature specimens was 49.61% and of adults was 50.39%, whereas males made up 49.33% and females 50.77% of the specimens found.

This research is the first on almond orchards in Southeastern Turkey. Further studies in other regions are needed to allow a comparison of the almond spider fauna.

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