



Coccinellidae (Insecta: Coleoptera) Species of Bartın Province

Azize TOPER KAYGIN¹, Umut SOBUTAY KAPTAN¹

¹Bartın University, Faculty of Forestry, Forest Entomology and Protection Department, Bartın, TURKEY

Abstract

One of the important insectivore groups used in biological control of aphids is predatory insects from Coccinellidae family known as the lady beetles. There is no comprehensive study carried out in Bartın province on identifying the species belonging to Coccinellidae family. Therefore, this study was conducted during 2014-2015. The samples were collected by atrap and hand-picking; their preparation and identification were made.

Bartın is a city in Western Blacksea Region of Turkey. 14 Coccinellidae species was found in Bartın province. The species with the highest density and the largest distribution area were *Coccinella septempunctata* (L.) and *Harmonia axyridis* (Pallas). The rarest found species were *Scymnus quadriguttatus* (Capra), *Halyzia sedecimguttata* (Linnaeus), *Oenopia conglobata* (Linnaeus), *Propylea quatuordecimpunctata* (Linnaeus), and *Adalia decempunctata* (Linnaeus). In addition, *Dinocampus coccinellae* (Schrank, 1802) (Hymenoptera; Braconidae: Euphorinae), a parasitoid of *Coccinella septempunctata* (L.) was determined at Kumluca.

References were showing that, *Scymnus quadriguttatus* was found only in Kastamonu in Western Black Sea Region. But there are no records that *Adalia fasciatopunctata revelieri* (Mulsant, 1866) and *Adalia decempunctata* (Linnaeus, 1758) are found in Western Black Sea.

Keywords: Bartın, Coccinellidae, species, distribution.

Bartın İli Coccinellidae (Insecta: Coleoptera) Türleri

Öz

Biyolojik mücadelede yararlı olan önemli insektivör gruplarından biri uğur böcekleri olarak bilinen Coccinellidae familyasından yırtıcı böceklerdir. Bartın ilinde daha önce Coccinellidae familyasına ait türlerin belirlenmesine yönelik kapsamlı bir araştırma bulunmamaktadır. Bu nedenle Coccinellidae türlerini tespit ve teşhis etmek amacıyla 2014-2015 yılları arasında bu çalışma yapılmıştır. Örnekler atrap kullanma ve elle toplama yöntemleriyle toplanmış; preparasyonu ve teşhisleri yapılmıştır.

Batı Karadeniz Bölgesi'nde bir şehir olan Bartın'da Coccinellidae familyasına ait 14 tür saptanmıştır. En yüksek yoğunluk ve en geniş dağılım alanına sahip olan türler; *Coccinella septempunctata* (L.), *Harmonia axyridis* (Pallas)'dır. En nadir bulunan türler *Scymnus quadriguttatus* (Capra), *Halyzia sedecimguttata* (Linnaeus), *Oenopia conglobata* (Linnaeus), *Propylea quatuordecimpunctata* (Linnaeus) ve *Adalia decempunctata* (Linnaeus) idi. Buna ek olarak, Kumluca'da *Coccinella septempunctata* (L.) parazitoidi olan *Dinocampus coccinellae* (Schrank, 1802) (Hymenoptera; Braconidae: Euphorinae) tespit edilmiştir. Kaynaklar, *Scymnus quadriguttatus*'ların yalnızca Batı Karadeniz Bölgesi'ndeki Kastamonu'da bulunduğunu göstermektedir. Ancak, *Adalia fasciatopunctata revelieri*'nin (Mulsant, 1866) ve *Adalia decempunctata*'nın (Linnaeus, 1758) Batı Karadeniz'de bulunduğuna dair kayıt bulunmamaktadır.

Anahtar Kelimeler: Bartın, Coccinellidae, tür, yayılış

*Sorumlu Yazar (Corresponding Author):

Azize TOPER KAYGIN (Dr.); Bartın University, Faculty of Forestry, Forest Entomology and Protection Department, Bartın, TURKEY. E- mail: azize_toper@yahoo.com

Geliş (Received) : 21.11.2017
Kabul (Accepted) : 24.11.2017
Basım (Published) : 01.12.2017

1. Introduction

Coccinellidae is a family of order Coleoptera. This order with 350.000 known species, represents 40% of all insect species (Grimaldi and Engel, 2006)). It is known that family Coccinellidae has around 6000 species around the world (Canepari, 2011). They are essential both for agriculture and forestry because they are the predators of many bugs such as aphids whose imago and larva feeds on plants, white flies and scale insects. Therefore, they are used in biological control since the end of the 1800s. However, the ones in Epilachninae sub-family feed on plants (Solonaceae, Curcubitaceae, and Fabaceae), and the ones in Halyziini (tribe) group feed on fungus (Ascomycetes: Ersiphales) (Vandenberg, 2002).

Lady beetle has complete metamorphosis in its lifecycle (holometabolous metamorphosis) and go through 4 stages (Figure 1); egg, larva, pupa, adult (Nedvěd and Honěk, 2012). Adult is of tiny, small (0.8mm) to medium size (18mm) and has three pairs of short, well-developed and running legs. body is generally oval. It has two pairs of wings. The forewings are called elytra. The second pair of wings (hind wings) are folded and hidden under the elytra (Kovar, 1973).

A lot of Coccinellid species synthesise alkaloids internally as defensive substances. Defence fluid is exuded by an active ladybird once it is attacked by a predator. This is a behaviour called reflex bleeding (Holloway et al., 1991).

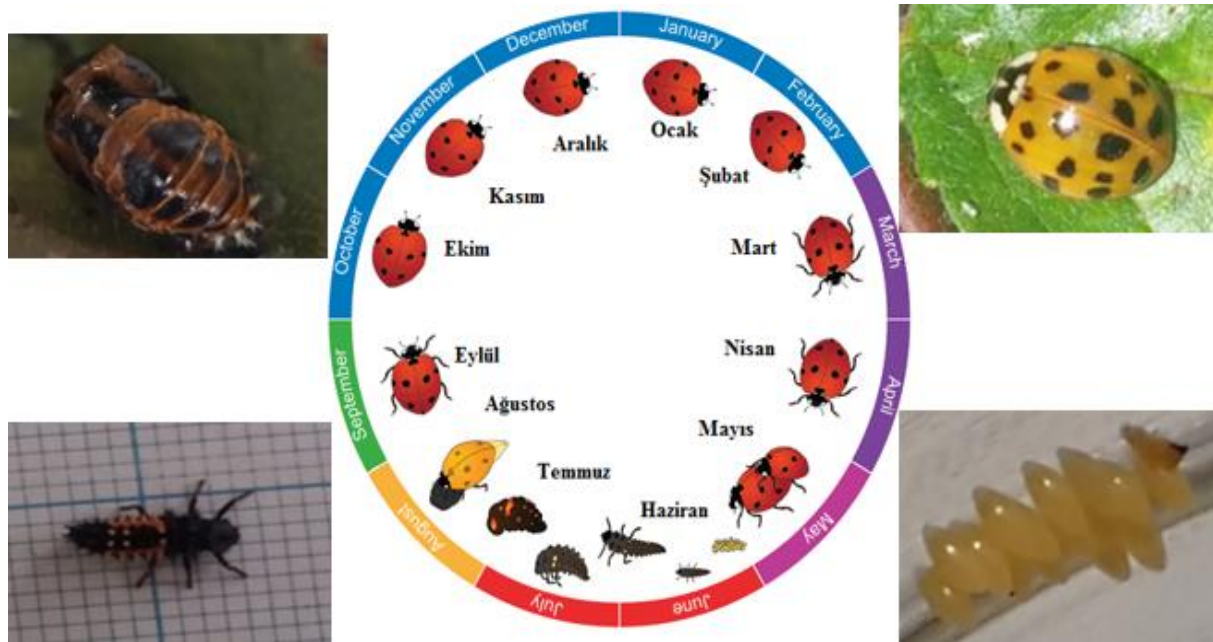


Figure 1. Life cycle of a lady beetle (It has been modified from Ware, 2005).

There are a lot of regional faunistic research about Coccinellidae in Turkey. Some published researches on Turkish Coccinellidae fauna are Giray 1970; Kansu and Uygun, 1973; Öncüer, 1977; Kreissl and Uygun, 1980; Uygun, 1981; Yiğit and Uygun, 1982; Düzgüneş et al., 1982; Erkin, 1983; Özkan, 1986; Alaoğlu and Özbek, 1987; Zeren, 1989; Öncüer, 1991; Özbek and Çetin, 1991; Yaşar et al., 1999; Ölmez, 2000; Yurtsever, 2001; Bolu and Uygun, 2003; Tezcan et al., 2003; Aslan, 2004; Çınar et al. 2004; Demirözer, 2004; Öztürk et al., 2004; Özgen and Karsavuran, 2005; Işıkber and Karcı, 2006; Bolu et al. 2007; Hepdurgun et al., 2007; Bayram, 2008; Bayram, 2009; Buğday, 2010; Portakaldalı and Satar, 2010; Narmanlıoğlu and Güçlü, 2011; Keskin, 2012; Baştuğ and Kasap, 2015; Unal et al., 2017.

Bartın is a small city in Western Black Sea Region. The source of income for the people here is agriculture, forestry and coal mine. In the city which is rich in flora and fauna, the existence of species belonging to the family Coccinellidae (Figure 2) stands out but there is no comprehensive research towards this family. The purpose of this study is to determine and identify the species of Coccinellidae family. Therefore, this study was carried out during 2014 and 2015 in Bartın.



Figure 2. Larvae and pupae of Coccinellidae were photographed in May.

2. Material and Method

2.1. Material

The main materials of this study are the species of Coccinellidae and tools used to determine and identify these species (insect collection boxes, GPS, high resolution mobile phone camera use for taking photos, magnifying glass, insect pins, microscope etc.). These tools are grouped based on whether they are used in field studies or in laboratory studies and are presented below (Figure 3).



Figure 3. Materials used in field study and lab study.

2.2. Method

Field studies were carried out in forest and agricultural lands of Bartın. Samples on herbaceous plants and bushes were collected; while others on long trees were photographed; caught with a trap and collected from branches by hitting. Samples were brought to the labs in storage boxes and prepared. Field study was carried out in sunny days. In nights, lady beetles coming towards the light were collected and were put into bug storage boxes for preparation in Bartın University Entomology Laboratory.

During the field study, GPS was used to determine the coordinates of the location where the samples were collected. The data collected from the field work are put into table (Table 1).

Table 1. Data collected in field study.

Name of the sample (species)	Date, Location (Coordinates)
<i>Harmonia axyridis</i>	02.06.2015 Ağdacı Village (41°36'08.62"N / 32°20'43.26"E); 10.06.2014 Bartın Centrum (41°37'38.74"N / 32°20'22.65"E); 04.07.2014 Çağlayan (41°38'21.59"N / 32°21'4.15"E); 26.07.2014 Amasra (41°45'09.87"N / 32°23'03.62"E); 03.08.2014 İnkum (41°39'30.58"N/ 32°12'53.11"E); 12, 15, 16, 20.08.2014 İnkum (41°39'30.58"N/32°12'53.11"E); 14.04.2015 Bartın Centrum, Bahçeşehir College (41°34'32.18"N/32°19'28.85"E); 26.04.2015 İnkum (41°40'08.92"N/32°13'37.87"E); 26.05.2015 Bartın Centrum, Bahçeşehir College (41°34'32.18"N/32°19'28.85"E); 26.05.2015 Ağdacı Village (41°36'06.92"N/32°20'46.34"E); 02.06.2015 Ağdacı Village (41°36'10.05"N/32°20'49.07"E); 41°36'08.62"N/32°20'43.26"E); 04.06.2015 Kutlubey demirci (41°34'57.22"N/ 32°20'14.52"E); 08.06.2015 Bartın Centrum (41°37'39.28"N/ 32°20'23.36"E); 09.06.2015 Ağdacı Village (41°36'07.87"N/ 32°20'42.53"E); 41°36'08.62"N/ 32°20'43.26"E); 24,25,26.06.2015 Ağdacı Village (41°36'08.62"N/ 32°20'43.26"E); 19.07.2015 Bartın Centrum (41°37'39.28"N/ 32°20'23.36"E); 20.07.2015 İnkum (41°39'30.58"N/ 32°12'53.11"E); 13, 14, 19, 22, 27, 31.08.2015; 02,04.09.2015 İnkum (41°39'30.58"N/ 32°12'53.11"E); 15.08.2015 İnkum (41°39'30.58"N/32°12'53.11"E); 21, 22, 23.08.2015 Amasra (41°44'26.35"N/ 32°23'28.66"E); 16.06.2015 Bartın Centrum (41°37'39.28"N /32°20'23.36"E); 17.08.2015 İnkum (41°39'30.58"N/32°12'53.11"E); 18.06.2015 Bartın Centrum (41°37'39.28"N/ 32°20'23.36"E); 18.06.2015 Ağdacı Village (41°36'07.87"N/ 32°20'42.53"E); 20.08.2015 Bartın Centrum (41°37'39.28"N/ 32°20'23.36"E); 10.08.2015 İnkum (41°39'30.58"N/32°12'53.11"E)
<i>Harmonia quadripunctata</i>	02.06.2015 Ağdacı Village (41°36'10.05"N/ 32°20'49.07"E); 20.08.2015 Bartın Centrum (41°37'39.28"N /32°20'23.36"E); 06.09.2015 İnkum (41°39'30.58"N /32°12'53.11"E); 18.04.2015 Amasra (41°45'09.87"N/ 32°23'03.62"E); 18.04.2015 Amasra (41°44'45.67"N/ 32°23'14.67"E); 25.04.2015 Gözpınar (41°35'24.64"N/ 32°12'16.39"E); 26.04.2015 İnkum (41°39'53.31"N/ 32°13'24.73"E); 16.05.2015 Çukurbük (41°37'26.53"N/ 32°26'59.00"E); 41°37'28.24"N/ 32°27'17.34"E); Gürpınar (41°37'39.65"N/ 32°24'25.42"E); Kayadibi çavus (41°37'39.70"N/ 32°27'20.41"E); 26.05.2015 Bartın Centrum (Bahçeşehir College) (41°34'32.18"N/ 32°19'28.85"E); 04.06.2015 Kumluca (41°34'57.22"N/32°20'14.52"E; (41°34'58.45"N/ 32°20'14.55"E); 07.06.2015 Güzelcehisar (41°38'17.44"N/ 32°10'50.05"E); 09.06.2015 Ağdacı Village (41°36'08.62"N/ 32°20'43.26"E); 26.06.2014 Darıören and surroundings (41°39'05.39"N/ 32°31'33.9"E); 28.06.2014 Ulukaya Waterfall (41°40'03.61"N/32°45'44.8"E)
<i>Coccinella septempunctata</i>	26.06.2014 Darıören ve Çevresi (41°39'05.39"N/ 32°31'33.9"E); 25.08.2014 Bartın Centrum (41°37'39.28"N/ 32°20'23.36"E); 04.06.2015 Kumluca (41°24'15.03"N/ 32°29'04.18"E); Bağdatlı Village (41°24'15.03"N/32°29'04.18"E)
<i>Subcoccinella vigintiquatuorpunctata</i>	07.06.2014 İnkum (41°39'30.58"N/32°12'53.11"E)
<i>Oenopia conglobata</i>	21.07.2014 Bartın Centrum (41°37'39.28"N/ 32°20'23.36"E); 26.07.2014 Amasra (41°44'53.60"N/ 32°23'07.97"E); 01.08.2014 Bartın Centrum (41°37'39.28"N/ 32°20'23.36"E); 23.08.2014 İnkum (41°39'30.58"N/32°12'53.11"E)
<i>Psyllobora vigintiduopunctata</i>	30.07.2014 Bartın Centrum (41°38'22.16"N/32°20'18.56"E)
<i>Henosepilachna elaterii</i>	05.08.2014 Bartın Centrum (41°37'39.28"N/32°20'23.36"E); 07.11.2014 Kozcağız (41°28'46.22"N/32°20'26.61"E); 25.04.2015 Gözpınar (41°35'24.64"N/32°12'16.39"E); 26.05.2015; 09.06.2015 Ağdacı Village (41°36'06.92"N/32°20'46.34"E); 09.06.2015 Ağdacı Village (41°36'08.62"N/32°20'43.26"E)
<i>Chilocorus renipustulatus</i>	22.08.2014 İnkum (41°39'30.58"N/32°12'53.11"E)
<i>Halyzia sedecimguttata</i>	18.04.2015 Amasra (41°45'09.87"N/32°23'03.62"E); 02.06.2015 Ağdacı Village (41°36'07.87"N/32°20'42.53"E; 41°36'10.05"N/32°20'49.07"E)
<i>Adalia bipunctata</i>	16.05.2015 Çukurbük (41°37'26.53"N/32°26'59.00"E); 04.06.2015 Bağdatlı Village (41°24'15.03"N/32°29'04.18"E)
<i>Propylea quatuordecimpunctata</i>	16.05.2015 Kayadibi çavus (41°37'39.70"N/32°27'20.41"E)
<i>Scymnus quadriguttatus</i>	09.06.2015 Ağdacı Village (41°36'08.62"N/32°20'43.26"E)
<i>Adalia fasciatopunctata revelierei</i>	18.06.2015 Ağdacı Village (41°36'07.87"N/32°20'42.53"E)
<i>Adalia decempunctata</i>	

The larvae and pupae collected from the field were observed till they turn into adults and they were photographed on millimetric paper. Samples were pinned up accordance the modern technique (Figure 4); and put into collection boxes (Figure 5).



Figure 4. The view of adult-reproductive organ on the label.

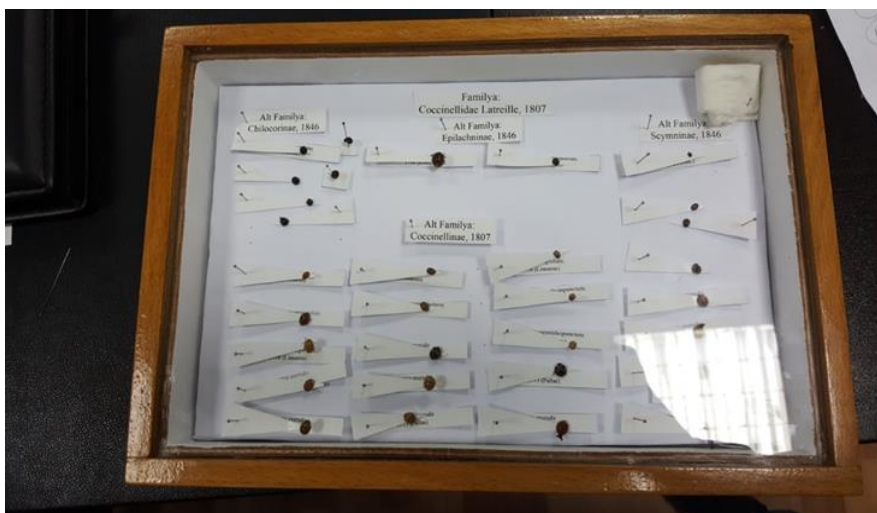


Figure 5. Coccinellidae samples put into insect storage box.

3. Results and Discussion

In the study, 220 Coccinellidae samples are examined. In order not to damage natural balance, the ones from the same species are photographed and released back to the nature. 14 species belonging to 11 genus of 4 subfamilies of Coccinellidae were found in Bartın. It is seen that the species with the highest population density and the species with the largest distribution area are *Coccinella septempunctata* (L.) and *Harmonia axyridis* (Pallas). The least seen species are *Scymnus quadriguttatus* (Capra), *Henosepilachna elaterii* (Rossi), *Halyzia sedecimguttata* (Linnaeus), *Oenopia conglobata* (Linnaeus), *Propylea quatuordecimpunctata* (Linnaeus), *Adalia decempunctata* (Linnaeus) (Figure 6). In addition, *Dinocampus coccinellae* (Schrank, 1802) (Hymenoptera; Braconidae: Euphorinae), parasitoid of *Coccinella septempunctata* (L.) is found in Kumluca. Also, *Subcoccinella vigintiquatuorpunctata* (Linnaeus), *Henosepilachna elaterii* (Rossi) are harmful species which is belonging to Epilachninae subfamily and feed on plants, are found in Bartın.

Taxonomy of Coccinellidae species in Bartın are given below:

Order	Coleoptera Linnaeus, 1758
Suborder	Polyphaga Emery, 1886
Infraorder	Cucujiformia Lameere, 1938
Superfamily	Coccinelloidea Latreille, 1807
Family	Coccinellidae Latreille, 1807
Subfamily	Coccinellinae Latreille, 1807

- Genus: *Coccinella* Linnaeus, 1758
Species: *Coccinella septempunctata* L., 1758
- Genus: *Harmonia* Mulsant, 1846
Species: *Harmonia axyridis* (Pallas, 1773)
Species: *Harmonia quadripunctata* (Pontoppidan, 1763)
- Genus: *Adalia* Mulsant, 1846
Species: *Adalia bipunctata* (Linnaeus, 1758)
Species: *Adalia fasciatopunctata revelieri* (Mulsant, 1866)
Species: *Adalia decempunctata* (Linnaeus, 1758)
- Genus: *Oenopia* Mulsant, 1850
Species: *Oenopia conglobata* (Linnaeus, 1758)
- Genus: *Propylea* Mulsant, 1846
Species: *Propylea quatuordecimpunctata* (Linnaeus, 1758)
- Genus: *Psyllobora* Chevrolat, 1837
Species: *Psyllobora vigintiduopunctata* (Linnaeus, 1758)
- Genus: *Halyzia* Mulsant, 1846
Species: *Halyzia sedecimguttata* (Linnaeus, 1758)
- Subfamily: Chilocorinae Mulsant, 1846
Genus: *Chilocorus* Leach, 1815
Species: *Chilocorus renipustulatus* (Scriba, 1790)
- Subfamily: Epilachninae Mulsant, 1846
Genus: *Subcoccinella* Huber, 1842
Species: *Subcoccinella vigintiquatuorpunctata* (Linnaeus, 1758)
Genus: *Henosepilachna* Li & Cook, 1961
Species: *Henosepilachna elaterii* (Rossi, 1794)
- Subfamily: Scymninae Mulsant, 1846
Genus: *Scymnus* Kugelann, 1794
Species: *Scymnus quadriguttatus* (Capra, 1924)

References (Kreissl and Uygun, 1980; Tezcan et al., 2003) were showing that, *Scymnus quadriguttatus* was found only in Kastamonu in Western Black Sea Region. But there are no records about existence of *Adalia fasciatopunctata revelieri* and *Adalia decempunctata* in Western Black Sea. Thus, these species are new records for Bartın province and the Western Black Sea Region.

Harmonia axyridis' adults were seen first time in Bartın-Hasankadı (28.04.2013). They were detected fed on aphids (*Cinara curvipes* (Patch, 1912) (Hemiptera; Aphididae)) found on young fir trees (Görür et al., 2015). *H. axyridis* has been reported a new record in Tekirdağ for the Turkish fauna. It is generally larger than other ladybirds and consumes the larval stages of them. So, it causes to reduce some native species. (Aysal & Kıvan, 2014). Although *H. axyridis* and *Scymnus quadriguttatus* species have recorded for first time to Turkish fauna recently, *Harmonia axyridis* stands out as a species with high population and wide distribution area in Bartın (Figure 6).

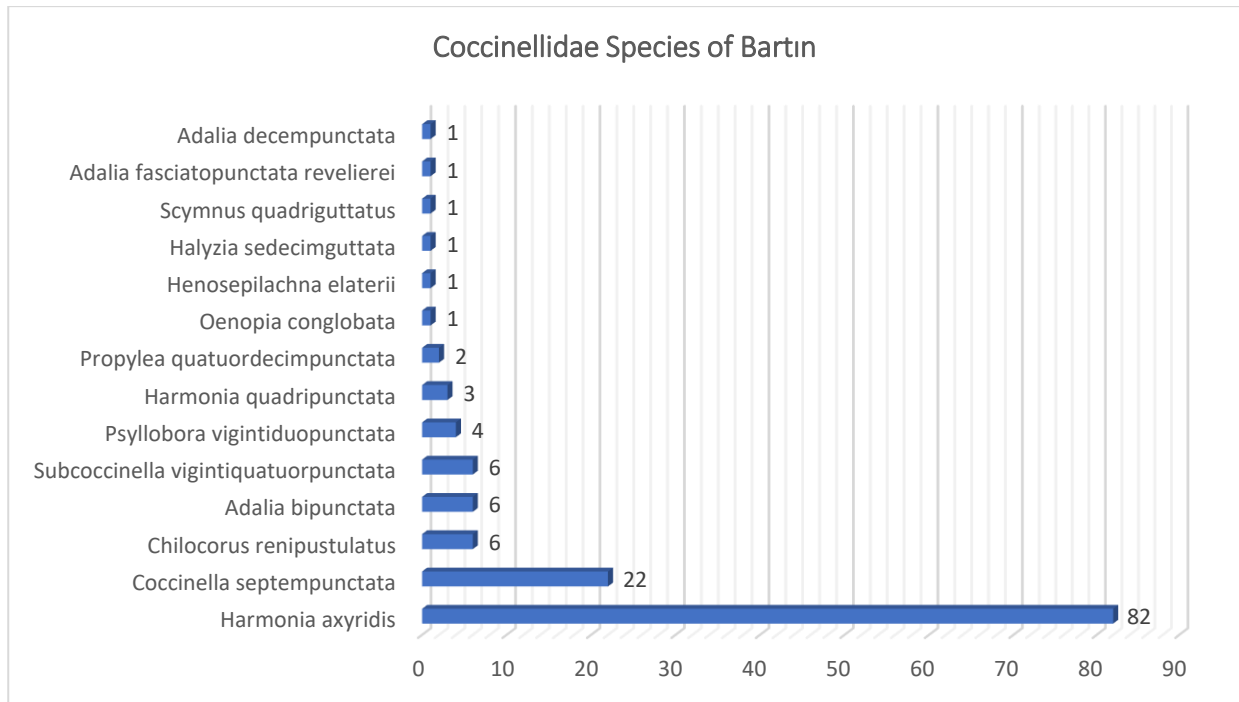


Figure 6. Individual Number of Coccinellidae species collected in the field.

It stands out that species diversity and population density was higher in areas where insecticides and pesticides are not used. This was clearly seen in Bartın University Ağdacı Village Campus where there is no pest control (Table 2).

Table 2. Number of Coccinellidae Samples in Different Location

Number of Coccinellid	Location
1	Çağlayan
1	Gürpınar
1	Güzelcehisar
1	Kozcağız
1	Kutlubeydemirci
1	Near the Ulukaya Waterfall
2	Gözpınar
2	Kayadibiçavus
2	Kuruçaşile
3	Bağdatlı
3	Bartın Centrum (Bahçeşehir College)
3	Çukurbük
4	Kumluca
7	Darıören
9	Amasra
14	Bartın Centrum
38	İnkum
47	Ağdacı Village

The species of Coccinellidae family, except some members of Epilachninae subfamily, are generally predators. The fact that the members of predator Coccinellidae are found in different habitats, they have a wide hunt diversity, their adults and larvae are predators that they have fast mobility and consumption power indicate how important they are in biological control. It is certain that like other useful insects in the nature, protection of this predators will have positive impacts on plant health and product quality.

The use of more pesticides to produce more products depending on increasing environmental pollution, global warming and increasing population cause to decrease in the population of many useful species and to the extinct of many unidentified species. Urgently biological diversity should be identified first within the country and around the world; and the endemic species, endangered species and also species which have a potential to be used in biological control should be identified with research.

There is no comprehensive study on identifying and determining the species of Coccinellidae family in Bartın before. Therefore, it is certain that this study will fill an important gap in the area.

Bartın city and its environs, where this study was carried out, has a rich fauna with its ecological structure, land shapes and structure. The number of species given in the study does not completely reflect the rich fauna in the area. It is believed that more comprehensive and detailed studies on this topic will show that the number of species will increase.

Acknowledgement

We would like to express our sincere appreciation to Dr. Nedim Uygun and Dr. Claudio Canepari for helping to diagnose the species.

This article has been accepted as an oral presentation at the 10th ISA (International Symposium on Aphids) (4-8/09/2017, Nevşehir) and its summary was printed in the symposium proceedings.

References

1. **Alaoğlu Ö, Özbek H (1987)**. Erzurum ve çevresinde patateslerde bulunan avcı böcek türleri. Atatürk Üniv. Zir. Fak. Ziraat Derg., 18 (1-4): 15-26.
2. **Aslan B (2004)**. Isparta ili ve ilçelerinde Meyve Bahçelerinde Zararlı Olan Yaprakbiti (Homoptera: Aphididae) Türleri ve Doğal Düşmanları Üzerinde Çalışmalar. Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, Isparta, 2004. 66s.
3. **Aysal K, Kıvanç M (2014)**. Occurrence of an invasive alien species *Harmonia axyridis* (Pallas) (Coleoptera: Coccinellidae) in Turkey, Türk. entomol. bült., DOI: <http://dx.doi.org/10.16969/teb.17261>, ISSN 2146-975X, 4 (3): 141-146.
4. **Baştuğ G, Kasap İ (2015)**. Çanakkale ili Coccinellidae (Coleoptera) familyası üzerine faunistik çalışmalar. Türk. Biyo. Müc. Derg., 6 (1): 41-50.
5. **Bayram Ş (2008)**. Ankara'da Karaağaç (*Ulmus glabra* Mill.)'da Gal Yapan Yaprakbitlerinde Avcı Coccinellidae (Coleoptera), Chrysopidae ve Hemerobiidae (Neuroptera) Familyasına Bağlı Türler. Ankara Üniversitesi Ziraat Fakültesi Tarım Bilimleri Dergisi, 14 (4) 386-393.
6. **Bayram Ş (2009)**. Ankara'da Elma Kırmızı Gal Yaprakbiti, *Dysaphis devectora* Walk. (Homoptera, Aphididae)'da Avcı Coccinellidae (Coleoptera) Türleri, Ankara Üniv. Zir. Fak. Tarım Bilimleri Dergisi, 15 (1) 53-57. <http://dergiler.ankara.edu.tr/dergiler/15/1492/16450.pdf>
7. **Bolu H, Özgen İ, Bayram A, Çınar M (2007)**. Güneydoğu ve Doğu Anadolu Bölgelerinde, Antepfıstığı, Badem ve Kiraz Bahçelerindeki Avcı Coccinellidae Türleri, Yayılış Alanları ve Avları. Harran Üniversitesi Ziraat Fakültesi Dergisi, 2007, 11 (1/2): 39-47.
8. **Bolu H, Uygun N (2003)**. Güneydoğu Anadolu Bölgesi Antepfıstıklarında Coccoidea Türleri, Yayılış Alanları, Bulaşma Oranları ve Doğal Düşmanlarının Belirlenmesi. Bitki Koruma Bülteni 2003. 43 (1-4): 111-123.
9. **Buğday H (2010)**. Yalova İlinde Coccinellidae (Coleoptera) Faunası Üzerine Araştırmalar. Yüksek lisans tezi, Yüzüncü Yıl Üniversitesi, Van, 62s.
10. **Canepari C (2011)**. Contribution to the knowledge of the Coccinellidae of Sardinia (Coleoptera). — *Conservazione Habitat Invertebrati* 5: 501-516.
11. **Çınar M, Çimen İ, Bolu H (2004)**. Elâzığ ve Mardin İlleri Kiraz Ağaçlarında Zararlı Olan Türler, Doğal Düşmanları ve Önemlileri Üzerinde Gözlemler. Türk. Entomol. Derg., 28 (3): 213-220.
12. **Demirözer O (2004)**. Isparta Bölgesi Meyve Ağaçlarında Zararlı Coccoidea (Homoptera) Türleri ve Doğal Düşmanları Üzerinde Araştırmalar. Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, Isparta, 2004, 55s.
13. **Düzgüneş Z, Toros S, Kılınçer N, Kovancı B (1982)**. Ankara ilinde Bulunan Aphidoidea Türlerinin Parazitoid ve Predatörlerinin Tespiti. T.C. Tarım ve Orman Bakanlığı, Zirai Müc. ve Zirai Karantina Genel Müdürlüğü, Yayın Şb., 251s.

14. **Erkin E (1983)**. İzmir ili ve çevresinde taş ve yumuşak çekirdekli meyve ağaçlarında zararlı Aphididae türlerinin doğal düşmanları, konukçuları, yayılışları ve önemlilerinin etkililik durumları üzerine araştırmalar. *Türk. Bitki Kor. Der.*, 7 (1): 29-49.
15. **Giray H (1970)**. Harmful and Useful Species Coccinellidae (Coleoptera) from Aegean Region, with Notes on their Localities, Collecting Dates and Hosts. *Yearbook of the Faculty of Agriculture of Ege University*, 1 (1): 35-50.
16. **Görür G, Toper Kaygin A, Şenol Ö, Beğen H (2015)**. *Cinara curvipes* (Patch, 1912) (Hemiptera; Aphididae) as New Aphid Species for Turkish Aphidofauna. *Artvin Coruh University Journal of Forest Faculty*. 16. 36-39. 10.17474/acuofd.75484.
17. **Grimaldi D, Engel MS (2006)**. Evolution of the Insects. Cambridge University Press, Hong Kong, 755 p.
18. **Hepdurgun B, Turanlı T, Uygun N, Kaplan C (2007)**. Balıkesir ve Çanakkale illerinde zeytin bahçelerinde bulunan Coccinellidae türleri. *Türkiye II. Bitki Koruma Kongresi Bildirileri*, Isparta, 164 s.
19. **Hodek I (1973)**. Biology of Coccinellidae. Part 1. Taxonomy and morphology of adults. Written by **Kovar**, I. 15-28pp. Springer-Science+Business Media B.V., ISBN 978-94-010-2714-4. ISBN 978-94-010-2712-0 (eBook)
20. **Holloway GJ, de Jong PW, Brakefield PM, de Vos H (1991)**. Chemical defence in ladybird beetles (Coccinellidae). I. Distribution of Coccinelline and individual variation in defence in 7-spot ladybirds (*Coccinella septempunctata*). *Chemoecology* 2, 7-14. https://openaccess.leidenuniv.nl/bitstream/handle/1887/11019/029_026.pdf?sequence=1
21. **Işıkber AA, Karçı A (2006)**. Kahramanmaraş ili ve Çevresinde Bazı Tarla Kültürlerinde Bulunan Avcı Böcek Türlerinin Yoğunluk ve Yaygınlıklarının Saptanması. *Kahramanmaraş Sütçü İmam Üniversitesi, Fen ve Mühendislik Dergisi*, 9(1): 111-116.
22. **Kansu İA, Uygun N (1973)**. Doğu Akdeniz Bölgesinde Turuncgil Zararlısı Türlerle Karşı Biyolojik Savaş Etmeni Olarak Böcekler. IV. Bilim Kongresi, Ankara, 13s.
23. **Keskin N (2012)**. Bornova (İzmir) İlçesinde Peyzaj Alanlarındaki Coccinellidae (Coleoptera: Insecta) Faunası. Yüksek Lisans Tezi. Selçuk Üniversitesi Fen Bilimleri Enstitüsü Bitki Koruma Anabilim Dalı. Konya, 48 s.
24. **Kreissl VE, Uygun N (1980)**. Zur Kenntnis von Scymnus- Arten aus der Türkei (Col., Coccinellidae). *Mitt Abt. Zoll. Landesmus. Joaneum*, 9 (3): 189-202. http://www.zobodat.at/pdf/MittZoolJoan_09_1980_0189-0202.pdf
25. **Narmanlıoğlu H, Güçlü Ş (2011)**. İspir (Erzurum) İlçesi'nde Meyve Ağaçlarında Bulunan Yaprakbiti Türleri (Homoptera: Aphididae) ve Doğal Düşmanları. *Atatürk Üniversitesi Ziraat Fakültesi Dergisi*, 39 (2), 225-229. Retrieved from <http://dergipark.gov.tr/ataunizfd/issue/2930/41767>
26. **Nedvəd O, Honěk A (2012)**. Ecology and Behaviour of the Ladybird Beetles (Coccinellidae), First Edition. Chapter 3. Life History and Development. p.55.
27. **Ölmez S (2000)**. Diyarbakır ilinde Aphidoidea (Homoptera) Türleri ile Bunların Parazitoid ve Predatörlerinin Saptanması. Ç.Ü. Fen Bilimleri Enstitüsü Yüksek Lisans Tezi, 109s.
28. **Öncüer C (1977)**. İzmir ili meyve ağaçlarında zarar yapan Coccidae familyasına bağlı önemli kabuk biti türlerinin doğal düşmanları, tanınmaları, yayılışları ve etkililik durumları üzerinde araştırmalar. *Ege Üniv. Zir. Fak. Yayınları*, 336, 129s.
29. **Öncüer C (1991)**. Türkiye Bitki Zararlısı Böceklerinin Parazit ve Predatör Kataloğu. *Ege Üniversitesi Yayınları*, 505: 974 s.
30. **Özbek H, Çetin G (1991)**. Contribution to the fauna of Coccinellidae (Coleoptera) from Eastern Anatolia along with some new records from Turkey. *Tr. J. Ent.*, 15: 193-202.
31. **Özgen İ, Karsavuran Y (2005)**. Siirt ili Antepfıstığı (*Pistacia vera*) Agroekosisteminde Bulunan Coccinellidae (Coleoptera) Türleri, Yoğunlukları ve Konukçuları Üzerinde Araştırmalar. GAP IV. Tarım Kongresi, 2. Cilt, s.1393-1396. Şanlıurfa.
32. **Özkan A (1986)**. Antalya ve çevresi yumuşak çekirdekli meyve ağaçlarının Coleoptera ve Heteroptera takımlarına ait faydalı böcek türleri, tanınmaları, konukçuları ve önemlilerinin etkinlikleri üzerinde araştırmalar. *Antalya Biyolojik Müc. Araş. Enst. Md., Araştırma Eserleri Serisi No: 5*, 80s.
33. **Öztürk N, Ulusoy MR, Erkiliç L, Bayhan S (2004)**. Malatya ili Kayısı Bahçelerinde Saptanan Zararlılar ile Avcı Türler. *Bitki Koruma Bülteni*, 44 (1-4): 1-13. <http://dergipark.ulakbim.gov.tr/bitkorb/article/view/1011001245/1011001220>
34. **Portakaldalı M, Satar S (2010)**. Research on Coccinellidae (Coleoptera) fauna in Artvin and Rize province. *Bitki Koruma Bülteni*. 50 (3). 89-99.
35. **Tezcan S, Beyaz G, Uygun N (2003)**. Manisa İlinde yetiştirilen kültür kekiği (*Origanum* spp.) (Lamiaceae)'ndeki Coccinellidae (Coleoptera) türlerinin belirlenmesi üzerinde çalışmalar. *Alatırım*, 2 (2): 30-33.

36. **Unal S, Er A, Akkuzu E, Salek L (2017)**. Predation Efficacy of the Predator *Coccinella septempunctata* L. on the Aphid Species *Macrosiphum rosae* (L.) in Kastamonu Province, Turkey. Pakistan Journal of Zoology, 49(1), 327-330.
37. **Uygun N (1981)**. Türkiye Coccinellidae (Coleoptera) Faunası Üzerinde Taksonomik Araştırmalar. Ç.Ü. Ziraat Fakültesi Yayınları: 157, Adana Bilimsel Araştırma ve İnceleme Tezleri, 48: 110s.
38. **Vandenberg NJ (2002)**. Coccinellidae. American Beetles Vol. 2, Eds.: Arnett, R. H., Jr., Thomas, M. C., Skelley, P. E., Frank, J. H., CRC Press, Boca Raton, pp. 371-389.
39. **Ware R (2005)**. Beetles and beetle recording in Great Britain. The ladybird life cycle. WEB, <http://www.coleoptera.org.uk/coccinellidae/ladybird-life-cycle>
40. **Yaşar B, Özgökçe MS, Kasap İ (1999)**. Van İlinde Bulunan Coccinellidae (Coleoptera) Familyasına Bağlı Predatör Türlerinin Saptanması Üzerinde Araştırmalar. Türkiye 4. Biyolojik Mücadele Kongresi, Çukurova Üniversitesi, Ziraat Fakültesi, Bitki Koruma Bölümü, Adana: 445-454.
41. **Yiğit A, Uygun N (1982)**. Adana, İçel ve Kahramanmaraş illeri elma bahçelerinde zararlı ve yararlı faunanın saptanması üzerine çalışmalar, Bitki Kor. Bült., 4: 163-178.
42. **Yurtsever S (2001)**. A Preliminary Study on the Ladybirds (Coleoptera: Coccinellidae) of Edirne in North-Western Turkey. Turk J. Zool. 25. 71-75.
43. **Zeren O (1989)**. Çukurova Bölgesinde sebzelerde zararlı olan yaprak bitleri (Aphidoidea) türleri, konukçuları, zararları ve doğal düşmanları. Tarım Orman ve Köyişleri Bakanlığı, Ankara, 205s.