Türk. biyo. müc. derg., 2012, 3 (1): 37-46
ISSN 2146-0035 *Orijinal araştırma* (*Original article*)

Coccinellid (Coleoptera: Coccinellidae) species feeding on coccoids (Hemiptera: Coccoidea) in Van Lake Basin, Turkey

M. Bora KAYDAN[1], Remzi ATLIHAN[1], Nedim UYGUN[2], Derya ŞENAL[3]

Van Gölü havzasında coccoid (Hemiptera: Coccoidea) avcısı coccinellid (Coleoptera: Coccinellidae) türleri

Özet: Ağrı, Bitlis, Hakkari, Iğdır ve Van illerinde 2005 ve 2008 yılları arasında, coccoidler ile beslenen gelin böcekleri toplanmıştır. Çalışma sonunda beş cinse ait *Exochomus* Rebtd (2), *Hyperaspis* Rebtd (3), *Nephus* Mulsant (1), *Pharoscymnus* Bedel (1) and *Scymnus* Kugel (1) sekiz coccinellid türü Coccidae, Diaspididae, Eriococcidae ve Pseudococcidae familyasına ait coccoid türleri üzerinde tespit edilmiştir. Bu türler arasında *Hyperaspis histeroides* Faldermann, *H. transversoguttata* Weise ve *H. uhligi* Fürsch Türkiye için ilk kayıt niteliğindedir.

Anahtar sözcükler: Coccoid avcısı, gelin böcekleri.

Abstract: Coccinellid species feeding on coccoids were collected in Ağrı, Bitlis, Hakkari, Iğdır and Van provinces, Turkey, during the years 2005 to 2008. In this study eight coccinellid species belonging to five genera *Exochomus* Rebtd (2), *Hyperaspis* Rebtd (3), *Nephus* Mulsant (1), *Pharoscymnus* Bedel (1) and *Scymnus* Kugel (1) were found feeding upon scale insect species belonging to the families Coccidae, Diaspididae, Eriococcidae and Pseudococcidae. Among the coccinellid species, *Hyperaspis histeroides* Faldermann, *H. transversoguttata* Weise and *H. uhligi* Fürsch were recorded for the first time in Turkey.

Key words: Scale insect feeding, lady beetles.

Introduction

Scale insects (Hemiptera: Sternorrhyncha: Coccoidea) are generally pests of cultivated plants, fruit trees, ornamental shrubs, forest trees, and of greenhouse and indoor plantings (Kosztarab & Kozár 1988). The main damage of scale insects is caused by their feeding on plant sap, causing chlorotic areas at feeding locations, leaf drop, and deformation on different plant parts, and by transporting viruses (Kozstarab & Kozár 1998). Generally, scale insects are not considered serious harmful insects in natural areas. But they can be very important pests on cultivated and ornamental plants. Because of the high amount of insecticides used for the control of scale insects and other harmful insects, population densities of natural

[1]Yüzüncü Yıl University, Agriculture Faculty, Plant Protection Department, Van
[2]Çukurova Universitesity, Agriculture Faculty, Plant Protection Department, Sarıçam, Adana
[3]Kocaeli University, Atabey Collage, Plant Protection Programe, Kocaeli
Sorumlu yazar (Corresponding author) e-mail: borakaydan@yyu.edu.tr
Alınış (Recieved): 12.03.2012 Kabul ediliş (Accepted): 04.05.2012

enemies have declined as a result. For a successful management of scale insect pest species on cultivated and ornamental plants, one of the potentially useful methods is to use natural enemies under integrated pest management (IPM) strategies. Thus it becomes important to understand the relationships between pest species and their natural enemies, especially in natural areas.

The family Coccinellidae (Coleoptera) which includes almost 6000 species all over the world, is one of the most important predatory groups in biological control of pests in general, and specializes in feeding upon scale insects, mealybugs, aphids and whiteflies (Magro et al. 2010). Although most ladybird beetles are predatory, members of the subfamily Coccinellinae (tribe Halyziini and genus *Tythaspis*) are mycophagous and those of the subfamily Epilachninae (genus *Epilachna*) are phytophagous (Almeida et al. 2011). There have been many successful classical biological and integrated pest management examples using coccinellids to control members of the Coccoidea, such as *Cryptolaemus montrouzieri* (Mulsant) on *Planococcus citri* (Risso) (Pseudococcidae), *Rodolia cardinalis* Mulsant on *Icerya purchasi* Maskell (Monophlebidae) which are also effective predators in Turkey (Ponsonby & Copland 1997).

The Coccinellidae is one of the largest families, the first comprehensive study on predatory coccinellid species in Turkey was conducted by Uygun (1981). Furthermore, other studies have been carried out in several regions of Turkey, such as those by Günther (1958); Giray (1970); Kavut et al. (1974); Soydanbay (1976); Öncüer (1977); Kreissl & Uygun (1980); Uygun & Fürsch (1981); Düzgüneş et al. (1982); Karaat et al. (1986); Kıran (1994); Yumruktepe & Uygun (1994) and Uygun & Aslan (2005). Other studies have reported several ladybird beetle species on scale insects in Turkey, e.g., Kaydan et al. (2006); Kansu & Uygun (1973); Öncüer (1977); Tunçyürek (1970); Erler & Tunç (2001) and Ülgentürk & Toros (2001).

In this study, predatory coccinellids of scale insects on natural and cultivated plants in the Van Lake basin (Ağrı, Bitlis, Hakkari, Iğdır and Van), Turkey, were investigated.

Material and methods

This study was conducted in Ağrı, Bitlis, Hakkari, Iğdır and Van provinces where altitudes range from 800 to 2300 m. The surveys were carried out in natural and cultivated areas. Sampling was carried out twice per week during spring and summer between the years 2005 and 2008. Scale insect specimens and their natural enemies were collected from ornamental, cultivated and wild plants. Infested plant parts with scale insect were inspected visually for adult ladybird beetles, and if present, they were collected using a sucking tube and immature stages of the predators were brought to the laboratory together with the associated scale insect colony on infested plant parts and were placed in plastic jars to allow them complete their development. Adult ladybird beetles were prepared for identification

using the methodology described by Uygun (1981), and were identified using the keys developed by Uygun (1981). All samplings and collection made by first author.

Preparation of scale insects specimens for identification was made using the methodology described by Kosztarab & Kozár (1988), and identifications were made using the keys and plates developed by Danzig (1980), Kosztarab & Kozár (1988) and Ter-Grigorian (1973). Specimens of the coccinellids and their prey were deposited in the Department of Plant Protection, Faculty of Agriculture, Yüzüncü Yıl University, Van, Turkey; the Plant Protection Department of the Agriculture Faculty, Çukurova University, Adana, Turkey.

Results and discussion

In this study eight coccinellid species belonging to five genera *Exochomus* (2 spp.), *Hyperaspis* (3 spp.), *Nephus* (1 sp.), *Pharoscymnus* (1 sp.) and *Scymnus* (1 sp.) were found feeding upon scale insect species belonging to the families Coccidae, Diaspididae, Eriococcidae and Pseudococcidae. Among these species *Hyperaspis histeroides* Faldermann, *H. transversoguttata* Weise and *H. uhligi* Fürsch were for the first time recorded in Turkey in this study.

Exochomus quadripustulatus (Linnaeus)

Material examined: 1 adult, Gaziler (Iğdır), N: 40°05’084’’, E: 043°27’570’’, 02.5.2005, *ex Prunus armeniaca*, feeding upon *Sphaerolecanium prunastri* (Boyer de Fonscolombe) (Coccidae); 1 adult; Melekli (Iğdır), N: 39°56’778’’, E: 044°06’227’’, 850 m, 02.5.2005, *ex Prunus spinosa*, feeding upon *Rhodococcus turanicus* (Archangelskaya) (Coccidae); 1 adult, Iğdır, N: 39°55’267’’, E: 044°02’200’’, 841 m, 29.6.2005, *ex Prunus domestica*, feeding upon *Sphaerolecanium prunastri*; 4 adults, Karakoyunlu (Iğdır), N: 39°58’218’’, E: 044°10’638’’, 850 m, 17.4.2007, *ex Ulmus* sp., feeding upon *Gossyparia spuria* (Eriococcidae); 2 adults, Çukurca (Hakkari), N: 37°14’930’’, E: 043°36’910’’, 1325 m, 08.5.2007, *ex Robinia pseudoacacia*, feeding upon *Parthenolecanium corni* (Bouché) (Coccidae); 1 adult, Aralık (Iğdır), N: 39°52’247’’, E: 044°31’682’’, 829 m, 15.5.2007, *ex Prunus armeniaca*, feeding upon *Sphaerolecanium prunastri*. Totally 10 ladybird beetle individuals were collected on three soft scale insect species.

Exochomus quadripustulatus is a Palaearctic species which has been hitherto recorded on 36 different scale insect species belong to the families Coccidae, Diaspididae, Eriococcidae, Kermesidae and Pseudococcidae (Ben-Dov et al. 2011). It has been recorded previously on Aphidoidea and Coccoidea samples in Turkey (Uygun 1981; Ülgentürk & Toros 2001; Kaydan et al. 2006).

Exochomus quadripustulatus was found only preying upon soft scale insects on stone fruit trees in this study.

Exochomus nigromaculatus (Goeze)

Material examined: 2 adults, Tuzluca-Gaziler road (Iğdır), N: 40°06'335'', E: 043°29'407'', 1022 m, 02.05.2005, *ex Tamarix* sp., feeding upon *Trabutina crassispinosa* Borchsenius (Pseudococcidae). Only two individuals were collected on mealybug.

Exochomus nigromaculatus is a Palaearctic species that has been recorded only on *Ferrisia virgata* (Cockerell) (Pseudococcidae) and *Coccus pseudomagnoliarum* (Kuwana) (Coccidae) among scale insects (Uygun 1981; Ben-Dov et al. 2011), and is generally regarded as an aphidophagous insect (Uygun 1981).

Hyperaspis histeroides Faldermann

Material examined: 2 adults, Başkale-Hoşap road (Van), N: 38°08'578'', E: 044°03'772'', 2144 m, 14.6.2006, *ex* a plant of the family Hypericaceae, feeding upon *Rhizopulvinaria* sp. (Coccidae); 4 adults, Hoşap-Başkale road (Van), N: 38°08'077'', E: 043°58'751'', 2369 m, 14.6.2006, *ex* undetermined plant species, feeding upon Pseudococcidae; 4 adults, Albayrak road (Van), N: 38°06'373'', E: 044°06'599'', 2095 m, 25.5.2007, *ex* a plant of the family Asteraceae, feeding upon *Rhizopulvinaria* sp. (Coccidae); 2 adults, Gürpınar (Van), N: 38°21'071'', E: 043°25'084'', 1855 m, 29.6.2007, *ex Noae* sp., feeding upon *Acanthopulvinaria orientalis* (Nasonov) (Coccidae); 1 adult, Iğdır-Aralık road, N: 39° 58'864'', N: 044°11'909'', 846 m, 27.6.2005, *ex Sinapis* sp., feeding upon *Phenacoccus tergrigorianae* (Pseudococcidae); 1 adult, Melekli (Iğdır), N: 39°56'778'', E: 044°06'227'', 858 m, 03.5.2005, *ex* undetermined plant species, feeding upon *Rhizopulvinaria* sp. (Coccidae). Totally 14 predator individuals were found on three different soft scale insect species and two different mealybug species.

Hyperaspis histeroides is recorded for the first time associated with scale insects and it is also a new record for the Turkish coccinellid fauna. The larvae of this species were collected inside ovisacs of soft scales and mealybugs.

Hyperaspis transversoguttata Weise

Material examined: 6 adults, Tuzluca-Gaziler road (Iğdır), N: 40°06'218'', E: 043°28'898'', 1019 m, 28.6.2005, *ex Tamarix* sp., feeding upon *Trabutina crassispinosa* Borchsenius (Pseudococcidae); 1 adult, Van-Hakkari road, N: 37°39'110'', N: 043°53'006'', 1318 m, 16.9.2005, *ex Euphorbia* sp., feeding upon Pseudococcidae; 5 adults, Tuzluca-Gaziler road (Iğdır), N: 40°06'335'', E: 043°29'407'', 1022 m, 31.8.2005, *ex Tamarix* sp., feeding upon *Trabutina crassispinosa* Borchsenius (Pseudococcidae). Totally 13 ladybird beetle individuals were collected only on mealybug sepecies *T. crassipinosa*.

Hyperaspis transversoguttata is recorded for the first time associated with scale insects and the Turkish coccinellid fauna. The larvae of this species were collected from ovisacs of its prey.

Hyperaspis uhligi Fürsch

Material examined: 2 adults, Gürpınar, Yalınca (Van), N: 39°00'122'', E: 043°32'471'', 2367 m, 01.6.2006, *ex* undetermined plant species, feeding upon *Rhizopulvinaria viridis* Borchsenius (Coccidae); 1 adult, Gürpınar-Çatak road (Van), N: 38°03'868'', E: 043°25' 108'', 1926 m, 29.4.2007, ex *Sanguisorba* sp., feeding upon *Trionymus multivorus* (Kiritchenko) (Pseudococcidae); 1 adult, Van-Yüksekova road, N: 35°41'940'', E: 044°03'039'', 1313 m, 05.7.2007, ex *Gallium* sp., feeding upon *Rhizopulvinaria* sp. (Coccidae); 3 adults, Melekli (Iğdır), N: 39°56'778'', E: 044°06'227'', 858 m, 03.5.2005, on undetermined plant species, feeding upon *Rhizopulvinaria* sp. (Coccidae). Totally 7 ladybird beetle individuals were collected on mealybug and soft scale insect species.

Hyperaspis uhligi is recorded for the first time feeding on scale insects in Turkey and is also a new record for the Turkish coccinellid fauna. The larvae of this species were collected from ovisacs of soft scales and mealybugs.

The species of the genus *Hysperaspis* is distributed worldwide, but the highest number of species occur in the Neotropical Region (Almeida & Vitorino 1997). According to the records found in the scale insect database Scalenet (Ben-Dov et al. 2011), there are 28 scale insect prey records associated with this genus, however, none of them belong to the species mentioned in this study.

Nephus kreissli Fürsch & Uygun

Material examined: 2 adults, Doğubeyazıt, Telçeker (Ağrı), N: 39°27'959'', E: 044°14'407'', 1570 m, 31.5.2005, *ex Ephorbia* sp., feeding upon *Phenacoccus tergrigorianae* (Pseudococcidae); 1 adult, Doğubeyazıt, Telçeker (Ağrı), N: 39°27'959'', E. 044°14'407'', 1570 m, 31.5.2005, *ex Peganum harmala*, feeding upon *Phenacoccus tergrigorianae* (Pseudococcidae); 1 adult, Gürpınar, Kırkgeçit (Van), N: 38°13'414'', E: 043°32'684'', 2143 m, 09.6.2005, *ex Silene capadocica*, feeding upon *Rhizopulvinaria* sp. (Coccidae); 1 adult, Iğdır-Aralık road, N: 39°58'864'', E: 044°11'909'', 846 m, 27.6.2005, *ex* a plant of the family Brassicaceae, feeding upon *Phenacoccus tergrigorianae*; 3 adults, Tuzluca-Gaziler road (Igdır), N: 40°06'717'', E: 043°34'183'', 993 m, 28.6.2005, *ex* undetermined plant species, feeding upon *Phenacoccus tergrigorianae*; 4 adults, Iğdır-Tuzluca road, N: 40°02'805'', E: 043°42'360'', 1053 m, 28.4.2005, *ex Euphorbia sequieriana*, feeding upon *Peliococcus kimmericus* (Kiritshenko) (Pseudococcidae); 1 adult, Tuzluca, Kula (Iğdır), N: 40°05'301'', E: 043°24'741'', 1440 m, 28.6.2005, *ex* a plant of the family Brassicaceae, feeding upon *Phenacoccus tergrigorianae*; 1 adult, Van-Özalp road, N: 38°36'285'', E: 043°34'146'', 1820 m, 05.7.2005, *ex* a plant of the family Poaceae, feeding upon *Phenacoccus tergrigorianae*; 1 adult; Van-Özalp road; N: 38°36'285'', E: 043°34'146'', 1820 m, 05.7.2005, collector, *ex Hordeum* sp., feeding upon *Phenacoccus tergrigorianae*; 1 adult, Çaldıran, Serpmetaş (Van), N: 39°11'143'', E: 043°54'748'', 2094 m, 21.7.2005, *ex Verbascum* sp., feeding upon *Phenacoccus tergrigorianae*; 1 adult, Hakkari, N: 37°34'052'', E: 043°43'607'', 1762 m,

04.8.2005, *ex Salix* sp., feeding upon *Acanthococcus salicis* (Eriococcidae); 1 adult, Hakkari-Esendere road, N: 37°42'804'', E: 044°36'084'', 1670 m, 03.8.2005, on undetermined plant species, feeding upon *Peliococcus turanicus* (Kiritshenko) (Pseudococcidae); 1 adult, Hakkari-Yüksekova road, N: 37°36'267'', E: 044°09'515'', 1875 m, 03.8.2005, on a plant of the family Apiaceae, feeding upon *Trionymus multivorus* (Kiritchenko) (Pseudococcidae); 1 adult; Aralık (Iğdır), N: 39°52'701'', E: 044°30'118'', 819 m, 01.9.2005, *ex Chenopodium* sp., feeding upon *Mirococcus inermis* (Hall) (Pseudococcidae); 1 adult, Ağrı, Doğubeyazıt, N: 39°26'847'', N: 044°14'405'', 1865 m, 27.9.2005, *ex Euphorbia sequieriana*, feeding upon *Peliococcus tritubulatus* (Pseudococcidae); 2 adults, Gürpınar, Taşçene (Van), N: 38°01'890'', E: 043°31'654'', 2408 m, 01.6.2006, *ex* undetermined plant species, feeding upon *Rhizopulvinaria turkmenica* Borchsenius (Coccidae); 1 adult, Hoşap-Başkale road (Van), N: 38°13'542'', E: 043°53'222'', 2322 m, 14.6.2006, *ex* plant of the family Poaceae, feeding upon *Euripersia subalpina* (Coccidae); 1 adult, Iğdır-Nahcivan road, N: 39°47'807'', E: 044°36'525'', 815 m, 16.5.2007, *ex Hordeum* sp., feeding upon *Phenacoccus tergrigorianae*; 1 adult; Başkale, Asolan (Van), N: 38°03'539'', E: 044°05'804'', 2095 m, 25.5.2007, *ex Poa bulbosa*, feeding upon *Phenacoccus tergrigorianae* (Pseudococcidae); 2 adults, Bitlis-Hizan road, N: 38°20'609'', E: 042°05'051'', 1520 m, 01.6.2007, *ex* undetermined plant species, feeding upon *Rhizopulvinaria* sp.; 1 adult, Van-Özalp road, N: 38°39'679'', E: 043°59'405'', 1926 m, 18.6.2007, *ex Euphorbia sequieriana,* feeding upon *Acanthococcus saxatilis* (Eriococcidae); 1 adult, Özalp, Karagündüz (Van), N: 38°42'886'', E: 043°39'502'', 1872 m, 18.6.2007, *ex Euphorbia sequieriana*, feeding upon *Acanthococcus saxatilis*; 1 adult, Muradiye, Beydağı (Van), N: 38°55'436'', E: 043°46'860'', 1863 m, 22.6.2007, *ex* a plant of the family Lamiaceae, feeding upon *Peliococcus chersonensis* (Kiritshenko) (Pseudococcidae); 2 adults, Hakkari-Esendere road, N: 37°42'423'', E: 044°32'047'', 1783 m, 05.7.2007, *ex* undetermined plant species, feeding upon *Trionymus multivorus*; 7 adults, Hakkari-Çukurca road, N: 37°28'725'', E: 043°32'831'', 1313 m, 04.7.2007, *ex Tamarix* sp., feeding upon *Trabutina crassispinosa* Borchsenius; 3 adults, Doğubeyazıt-Çaldıran road (Ağrı), N: 39°21'289'', E: 043°59'967'', 2603 m, 11.7.2007, *ex Helichryssium* sp., feeding upon *Rhizopulvinaria* sp.; 1 adult, Doğubeyazıt-Çaldıran road (Ağrı), N: 39°21'289'', E: 043°59'967'', 2603 m, 11.7.2007, *ex* a plant of the family Asteraceae, feeding upon *Phenacoccus pumilus* Kiritshenko (Pseudococcidae); 1 adult, Adilcevaz, Aşağı Danacı (Bitlis), N: 38°47'273'', E: 042°41'822'', 1714 m, 13.7.2007, *ex* a plant of the family Apiaceae, feeding upon *Trionymus multivorus*; 1 adult, Diyadin-Taşlıçay road (Ağrı), N: 39°37'950'', E: 043°24'978'', 1805 m, 08.6.2006, *ex Artemisia* sp., feeding upon *Phenacoccus tergrigorianae*; 7 adults, Hoşap-Başkale road (Van), N: 39°09'077'', E: 043°58'751'', 2369 m, 14.6.2006, *ex* undetermined plant species, feeding upon *Rhizopulvinaria variabilis* Borchsenius (Coccidae); 13 adults, Gürpınar (Van), N: 38°13'788'', E: 047°31'411'', 2064 m, 29.6.2007, *ex* undetermined plant species, feeding upon

Puto superbus (Putoidae); 1 adult, Tuzluca, Kula (Iğdır), N: 40°05'301'', E: 043°24'741'', 1440 m, 28.6.2005, *ex Medicago* sp., feeding upon *Phenacoccus tergrigorianae*. In total 65 predator individuals were collected on eight different mealybug, three different soft scale and two different felt scale species.

Although the genus *Nephus* has been recorded on 21 scale insect species in the world, in Turkey, this species has only been reported feeding on pseudococcids in Ankara (Kaydan et al. 2006). *Nephus kreissli* was described for the first time in Turkey by Fürsch & Uygun (1980) from citrus and apple plantations. In this study, immature stages of this coccinellid were collected inside ovisacs of the coccid and mealybug preys. Muştu & Kılınçer (2011) mentioned that especially the early stages of the larvae much prefer eggs of *Planococcus ficus* Signoret than other stages of the mealybug.

Pharoscymnus pharoides Marseul

Material examined: 1 adult, Çukurca (Hakkari), N: 37°14'935'', E: 043°36'911'', 1329 m, 10.5.2007, *ex Pistacia vera,* feeding upon *Salicicola dawatchi* and *Lephidosaphes pistaciae* (Diaspididae).

Pharoscymnus pharoides is a Palearctic species that has been mainly recorded feeding on diaspidid species. In Turkey, it has been hitherto found on several diaspidid species by several authors (Uygun 1981; Erkılıç & Uygun, 1995; Erler & Tunç 2001; Bolu 2004; Tüfekli & Ulusoy 2011).

Scymnus pallipediformis Günther

Material examined: 1 adult, Doğubayazıt-Çaldıran road (Ağrı), N: 39°25'475'', E: 043.57.110, 1975 m, 11.7.2007, *ex Sanguisorba* sp., feeding upon *Rhizopulvinaria* sp. (Coccidae).

Scymnus pallipediformis is a Palaearctic species regarded as a predator of aphids and mites found on horticultural and vegetable plants (Yabaş & Ulubilir 1993). It has not been recorded on scale insects previously.

In biological control, one of the most important predatory groups is the Coccinellidae, and the members of this family are specialized on aphids, mealybugs, scale insects and whiteflies. Among the species identified in this study, *E. quadraspidiotus* and *N. kreislii* were the commonest ladybird beetle species. While *E. quadraspidiotus* has been reported to attack various scale insect species in different parts of Turkey, *N. kreislii*, has been recorded only on mealybugs previously (Kaydan et al. 2006).

All species were typically collected as immature stages inside the ovisacs of scale insects suggesting that these coccinellid species have a potential to be used as biological control agents. On the other hand, the species belonging to the genus *Hyperaspis* recorded in this study are for the first record in Turkey.

Acknowledgments

This study was supported by Tübitak-Tovag 1040148. The authors would like to thank to Dr. Helmut FÜRSCH (Bayerwaldstraße, 26, D-94161, Ruderting GERMANY) for checking the identification of the new records for Turkey. The authors are grateful to Dr. Takumasa Kondo (Corpoica, Colombia) for useful comments.

References

Almeida L.M. & M.D. Vitorino 1997. A new species of *Hyperaspis* Redtenbacher (Col.: Coccinellidae) and notes about the life habits. *Coleopterists Bulletin,* 51: 213-216.

Ben-Dov Y., D.R. Miller & G.A.P. Gibson 2011. ScaleNet: a database of the scale insects of the world. Fact sheet: http://www.sel.barc.usda.gov (Accessed: June, 2011)

Bolu H. 2004. Coccinellidae species, their distribution areasand their impact on population fluctuations of *Agonoscena pistaciae* at Pistachio orchards in Southeastern Anatolia Region in Turkey. *Bulletin of Plant Protection*, 44 (14): 1-10.

Danzig E.M. 1980. Coccoids of the Far East USSR (Homoptera, Coccinea) with Phylogenetic Analysis of Scale Insects Fauna of the World. (In Russian). Nauka, Leningrad, 367 pp.

Düzgüneş Z. 1982. Studies on Turkish Pseudococcidae (Homoptera: Coccoidea) Species. Ankara University Press, 836: 88 pp (in Turkish with English abstract).

Erkılıç L. & N. Uygun 1995. Distribution, population fluctuations and natural enemies of the White peach scale, *Pseudaulacaspis pentagona* (Targioni Tozzetti) (Homoptera: Diaspididae) in the east Mediterranean Region of Turkey. *Israel Journal of Entomology*, 29: 191-198.

Erler F. & İ. Tunç 2001. A survey (1992–1996) of natural enemies of Diaspididae species in Antalya, Turkey. *Phytoparasitica*, 29 (4): 299-305.

Fürsch H. & N. Uygun 1980. Neue Scymnini aus der Türkei (Coleoptera: Coccinellidae) Sonderdruck aus dem Nachrichtenblatt der Bayerischen Entomologen 29. Jahrang, H.3., 189-202.

Giray H. 1970. Harmful and useful species of 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 (in Turkish with English abstract).

Günther V. 1958. Ergebnisse der Zoologischen Expedition des Nationalmuseums in Prag nach der Turkei. 22. Coleoptera, Coccinellidae. *Acta Entomologica Musei Nationalis Pragae* (XXXII), 498: 19-36.

Kansu I.A. & N. Uygun 1973. Insects of biological control agents on citrus pests in east Mediterranean region of Turkey. Tubitak Science Congress. Tubitak Publications, 240: 1-14 (in Turkish with English abstract).

Karaat S., M.A. Güven & C. Mart 1986. General situation of beneficial fauna in cotton Areas in southeastern Anatolia. Proceedings of the First Turkish National Congress of Biological Control, 12-14 February, 173-185 (in Turkish with English abstract).

Kavut N., J. Dinçer & M. Karman 1974. Preliminary studies on t h e parasites and predators of cotton pests in t he Aegean Region. *Bullettin of Plant Protection*, 14 (1): 19-28 (in Turkish with English abstract).

Kaydan M.B., N. Kılınçer, N. Uygun, G. Japosvilli & S. Gaimari 2006. Parasitoids and predators of Pseudococcidae (Homoptera: Coccoidea) in Ankara, Turkey. *Phytoparasitica*, 34 (4): 331-337.

Kıran E. 1994. Studies on cereal aphid (Homoptera: Aphididae) and their natural enemies in Southeast Anatolia. Proceedings of the Third Turkish National Congress of Biological Control, Ankara, 29-37 (in Turkish with English abstract).

Kosztarab M. & F. Kozár 1988. Scale Insects of Central Europe. Dr. W. Junk Publishers, Budapest, 456 pp.

Kreissl V.E. & N. Uygun 1980. Zur Kenntnis von Scymnus- Arten aus der Türkei (Coleoptera: Coccinellidae). *Mitteilungen der Abteilung für Zoologie Landesmus. Joaneum*, 9 (3): 189-202.

Magro A., E. Lecompte, F. Magne, J.L. Hemptinne & B. Crouau-Roy 2010. Phylogeny of ladybirds (Coleoptera: Coccinellidae): Are the subfamilies monophyletic. *Molecular Phylogenetics and Evolution,* 54: 833–848.

Muştu M. & N. Kılınçer 2011. Some Biological and Consumption Features of *Nephus kreissli* Fürsch & Uygun (Coleoptera: Coccinellidae), the Predator of *Planococcus ficus* Signoret (Hemiptera:Pseudococcidae). Türkish IV. Plant Protection Congress, KSÜ., 28-30 July 2011, Kahramanmaraş (in Turkish with English abstract).

Öncüer C. 1977. Studies on natural enemies, identification, distribution and efficiency of important scale insect pests in Coccidae (Homoptera) on fruit trees in Izmir province. *University of Ege*, Izmir, Turkey. (in Turkish with English abstract)

Ponsonby D.J. & J.W. Copland 1997. Predators. Coccinellidae and Other Coleoptera, 29-60 in Y. Ben-Dov & C.J. Hodgson (eds): Soft Scale Insects, their Biology, Natural Enemies and Control, Elsevier, Amsterdam, 439 pp.

Soydanbay M. 1976. The list of natural enemies of some agricultural crop pests in Turkey. *Part I. Journal of Turkish Plant Protection,* 16 (l): 32-46.

Ter-Grigorian M.A. 1973. Fauna of the Armenian SSR: Scale Insects (Coccoidea, Pseudococcidae). Akademii Nauk Armiansky SSR., Erevan, Armenia, 246 pp.

Tunçyürek M. 1970. Parasitoids and predators of citrus and fig scale insects in Aegean region of Turkey. *Bitki Koruma Bülteni*, 10: 32-52.

Tüfekli M. & M.R. Ulusoy 2011. The parasitoids and predators of the Olive psyllid [*Euphyllura straminea* Loginova (Hemiptera: Psyllidae)] in olive orchards in Adana and Mersin provinces (Turkey). *Türkish Journal of Biological Control*, 2 (1): 49-54 (in Turkish with English abstract).

Uygun N. 1981. Taxonomic research on Coccinellidae (Coleoptera) fauna of Turkey. Çukurova University., Faculty of Agriculture, Publications No: 157, Adana, Turkey, 48: 110. (in Turkish with Engilish abstract).

Uygun N. & H. Fürsch 1981. Die Hyperaspis-Arten der Türkei (Coleoptera: Coccinellidae). *Nachrichtenblatt der Bayerischen Entomologen Jahrang*, 30 (1): 12-15.

Uygun N. & M.M. Aslan 2005, The Aphidophagus Coccinellid (Coleoptera: Coccinellidae) species in Kahramanmaraş, Turkey. *Turkish Journal of Zoology*, 29: 1 - 8.

Ülgentürk S. & S. Toros 2001. Natural enemies of the oak scale insect, *Eulecanium ciliatum* (Douglas) (Hemiptera: Coccidae) in Turkey. Entomologica 33: 219-224.

Yabaş C. & A. Ulubilir 1993. Insect fauna on Bean growing areas in Mediterranean region. *Bulletin of Plant Protection*, 33 (1-2): 52–60 (in Turkish with English abstract).

Yumruktepe R. & N. Uygun 1994. Determination of aphid species (Homoptera: Aphididae) and their natural enemies in citrus orchards in Eastern Mediterranean region. Proceedings of the Third Turkish National Congress of Biological Control, 25-28 January, 1994, 1-12 (in Turkish with English abstract).