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Coccid (Homoptera: Coccoidea) Species of Isparta Province, and Their Parasitoids from Turkey and Georgia

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Research Article

Coccid (Homoptera: Coccoidea) Species of Isparta Province, and Their Parasitoids from Turkey and Georgia

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Abstract: A list of coccids distributed in Isparta province (Turkey) is given in this paper. Their parasitoids determined in Isparta and previously reported from Turkey and Georgia are also discussed. As a result of the survey studies performed in June-November, 2001, 21 species of coccids were found on different host plants in Isparta province. From 16 of these coccids, 19 species of parasitoids were obtained. The similarity index of two countries in terms of their coccid parasitoids fauna was 0.635.

Key Words: Scale insects, parasitic Hymenoptera, similarity index

Isparta İlinde Bulunan Coccid (Homoptera: Coccoidea) Türleri ve Bunların Türkiye ve Gürcistan'daki Parazitoitleri

Özet: Bu makalede, Isparta ilinde bulunan coccid türleri liste halinde verilmiştir. Ayrıca bunların Isparta ilinde belirlenen parazitoitleri ile Türkiye ve Gürcistan'dan daha önce bildirilen parazitoitleri birlikte ele alınarak tartışılmıştır. Haziran-Kasım, 2001 tarihleri arasında yapılan sörvey çalışmaları sonucunda ilde değişik bitkiler üzerinde 21 coccid türü saptanmıştır. Sözkonusu bu coccidlerin 16 adedinden 19 parazitoit türü elde edilmiştir. Parazitoit faunası açısından bu iki ülke arasındaki benzerlik indeksi 0.635 olarak hesaplanmıştır.

Anahtar Sözcükler: Kabuklu bitler, asalak Hymenoptera, benzerlik indeksi

Introduction

Because of its geographical location between the Mediterranean and Central Anatolia regions and in a lake district, Isparta province has a high floristic diversity. A variety of agricultural crops such as pome and stone fruits, grapes, oil rose and vegetables can be grown in the province. Many kinds of insect species can be found on these plants. Among these, coccids are common and important pests. This group of insects are known to have lots of parasitoids from different taxa. Today it is important to use natural enemies against pests. Among these, chalcids (Hymenoptera: Chalcidoidea) are widely known as effective entomophagous insects. However, no investigation on coccids and their natural enemies has been performed in this region before. The aim of this study was to determine Coccoidea in cultivated and non-cultivated areas and their parasitoids in Isparta province. In addition, parasitoid species previously determined in Turkey and Georgia were also evaluated and the possibilities of using these natural enemies in the biological control of coccids in both countries were examined.

Materials and Methods

Coccid samples on various host plants were collected from different locations in Isparta province, between June and November 2001. Parasitoids were obtained from their host coccids by generally accepted methods (1). In addition, parasitoids from Turkey and Georgia of coccids found in Isparta province were determined by a detailed literature search and similarities between the two regions were determined by the Jaccard formula of similarity, $c/(a + b - c)$ (2,3), where a is the number of species in one location, b is the number of species in a second location, and c is the number of species which are similar in both locations.

Results and Discussion

Twenty-one species of coccids were determined in Isparta province, a list of which is presented below with their parasitoids.

Superfamily Coccoidea

Family Pseudococcidae

Genus *Planococcus* Ferrier

1. *Planococcus vovae* (Nassonov)

This species was found on cypress and juniper. Infestation was quite high (80%) and no parasitoid related with this species was found. There was no data about this pest in Georgia.

Family Kermesidae

Genus *Kermes* Boitard

2. *Kermes vermilio* (Planchon)

This species was recorded on oak trees. In this study this coccid was found to be parasitized by the species nr. genus *Saulea* Sugonjaev.

Family Coccidae

Genus *Pulvinaria* Targioni-Tozzetti

3. *Pulvinaria betulae* (Linnaeus)

It was found on willow in Eğirdir district, and was parasitised by *Coccophagus lycimnia*. Parasitization in Turkey was determined for the first time. In Georgia, there are also parasitoids of this host from Chalcidoidea: *Eusemion cornigerum*, *Encyrtus swederi*, *Coccophagus semicircularis* and parasitization rate was quite high (68%) (4).

Genus *Eulecanium* Cockerell

4. *Eulecanium tiliae* (Linnaeus)

It was found on apple but is not a dangerous pest since the influence of chemicals on this species is rather high. There is no recorded parasitoid from Turkey for this coccid. In Georgia this pest is highly parasitized (92%) (4) and there are several effective parasitoids, such as *Microterys duplicatus*, *Trichomasthus albimanus*, *Blastothrix britannica* and *Metaphycus dispar* (Encyrtidae).

Genus *Parthenolecanium* Sulc

5. *Parthenolecanium corni* (Bouché)

It was found on hazelnut, ash and plum. This pest is potentially dangerous. In Turkey, only the chalcid parasitoids *Microterys lunatus* (5) and *Cerapterocerus mirabilis* (6) of *P. corni* are known. However, in Georgia this pest was heavily infested by the following parasitoids: *Microterys duplicatus*, *M. sylvius*, *Trichomasthus albimanus*, *Blastothrix longipennis*, *Metaphycus insidiosus*, *Coccophagus lycimnia*, *Cheiloneurus claviger*, and *Pachyneuron muscarum*, some of which can be used as effective bioagents (7).

Genus *Rhodococcus* Borchsenius

6. *Rhodococcus perornatus* (Cockerell & Parrott)

This scale insect was firstly reported from Turkey in 2001 (8) and its distribution and economical importance are increasing day by day. *R. perornatus* is very harmful for oil rose plantations in Isparta province. However, it is parasitised only by one species, *Microterys bellae*, which was recorded for the first time from Turkey in 2001 (9).

Genus *Sphaerolecanium* Sulc

7. *Sphaerolecanium prunastri* Fonscolombe

This species was found on plum. In Isparta province it was found to be parasitized by the following species: *Coccophagus lycimnia* and *C. proximus spartanus* (Aphelinidae)(10,11); *Discodes coccophagus* and *Cerapterocerus mirabilis* (Encyrtidae); and *Pachyneuron muscarum* (Pteromalidae) (12). Besides these species, other known parasitoids of this pest from Turkey are *Microterys hortulanus* (13), *Metaphycus insidiosus*, *M. dispar* (6), and *M. silvestri* (Encyrtidae) (14). In Georgia, *Marietta picta*, *Coccophagus lycimnia*, *Coccophagus differens* and *C. proximus* (Aphelinidae); *Discodes coccophagus*, *Microterys hortulanus*, *Metaphycus silvestri* and *Cerapterocerus mirabilis* (Encyrtidae); and *Pachyneuron muscarum* (Pteromalidae) are known parasitoids of *S. prunastri* (15).

Genus *Coccus* Linnaeus

8. *Coccus hesperidum* Linnaeus

This species was found on ash. No parasitoid could be obtained from the samples collected in Isparta, but in Turkey many parasitoids of this pest (such as *Coccophagus lycimnia* (6,16,17) and *C. scutellaris* (Aphelinidae) (5); *Encyrtus lecaniorum* (6,14), *Metaphycus flavus* (5,17), *Microterys tricoloricornis* (16) and *Trichomasthus albimanus* (Encyrtidae) (5)) have been recorded. *Coccophagus lycimnia* and *C. scutellaris* (Aphelinidae), and *Encyrtus lecaniorum*, *Microterys tricoloricornis*, *Mahelencyrtus coccidiphagus* and *Trichomasthus albimanus* (Encyrtidae) (7) are known parasitoids of this pest from Georgia. The parasitization rate in Georgia reaches 82%, which is quite high (4).

Family Diaspididae

Genus *Lepidosaphes* Shimer

9. *Lepidosaphes malicola* Borchsenius

It was found on rose and walnut. Walnut trees are highly damaged by this pest in Isparta. It was determined to be parasitized by *Aphytis mytilaspidis*. *Aphytis libanicus* and *Coccobius testaceus* (Aphelinidae) (17) are other known parasitoids of this pest from Turkey. In Georgia this pest was recorded to be parasitized by *Aphytis proclia* and *Coccobius testaceus* (Aphelinidae), and *Zaomma lambinus* and *Epitetrachnemus zetterstedtii* (Encyrtidae). The parasitization rate was high (62%) (4).

10. *Lepidosaphes ulmi* Linnaeus

It was found on willow in Eğirdir and the parasitoid *Aphytis mytilaspidis* (Aphelinidae) was obtained from the samples. Other parasitoids of this pest recorded from Turkey were *Encarsia citrinus*, *Ablerus celsus* and *Coccobius testaceus* (Aphelinidae); *Epitetracnemus zetterstedtii* and *Zaomma lambinus* (Encyrtidae), and *Thysanus ater* (Signiphoridae) (18). In Georgia, it is recorded to be parasitized by *Aphytis mytilaspidis*, *Encarsia perniciosi*, *Encarsia citrinus* and *Coccobius testaceus* (Aphelinidae); and *Epitetracnemus zetterstedtii* and *Zaomma lambinus* (Encyrtidae) (7,19).

11. *Lepidosaphes newsteadi* (Sulc)

It was found on pine and was parasitized by *Encarsia leucaspidis*, *Aphytis* sp. nr. *phoenicus*, and *Parasaulea trjapitzin*. This is the first record of the parasitization of this pest from Turkey. L. newsteadi has not been recorded from Georgia yet.

Genus *Carulaspis* MacGillivray.

12. *Carulaspis caruelii* (Targioni-Tozzetti)

It was found on arbor-vitae in a low population and was parasitized by *Aphytis mytilaspidis*. This is the first record on the parasitization of this pest in Turkey. In Georgia *C. caruelii* was parasitized by *Encarsia citrinus*, *Apytis hispanicus*, *A. aonidia* and *A. mytilaspidis* (20).

Genus Salicicola Lindinger

13. *Salicicola kermanensis* (Lindinger)

This species was found on poplar and its population level was considerably high. *S. kermanensis* was parasitized by four species of parasitoid chalcids from the family Aphelinidae in Isparta province: *Aphytis mytilaspidis*, *Coccophagoides similes*, *Pteroptrix lauri* and P. bicolor. This is the first report on the parasitization of this species from Turkey. *A. mytilaspidis* (4) and *P. lauri* (15) were the parasitoids found on this pest in Georgia, with a very low degree of parasitization.

Genus *Diaspidiotus* Berlese & Leonardi

14. *Diaspidiotus prunorum* (Laing)

It was found on plum and was heavily parasitised by *Aphytis proclia* (Aphelinidae). Parasitisation of this species was determined for Turkey for the first time. From Georgia known parasitoids of this pest are *Ablerus atomon*, *Pteroptrix lauri*, *Coccophagoides similes* (15), A. celsus, *Aphytis proclia*, *A. aonidia*e and *Coccobius testaceus*. The parasitization rate in Georgia was 36% (4).

15. *Diaspidiotus ostreaformis* (Curtis)

It was found on plane tree. The population level was quite high, but the parasitization rate was also high. The parasitoids *Aphytis mytilaspidis*, *Coccophagoides similes*, *Ablerus celsus* and *Pteroptrix lauri* (Aphelinidae), and *Zaomma lambinus* (Encyrtidae) were obtained from the samples. This is the first report from Turkey on the parasitization of this species. Only one species, *Pteroptrix lauri*, is known as the parasitoid of *D. ostreaformis* from Georgia (15), which is a dangerous pest for fruit plantations (4).

16. *Diaspidiotus perniciosus* Comstock

It was found on walnut and apple and was parasitized by *Ablerus celsus* and *Aphytis proclia*. In Turkey this pest was recorded to be parasitized by *Aphytis aonidiae* (21), *A. hispanicus* (17), *A. melinus*, *A. mytilaspidis* (5) and *Encarsia perniciosi* (22). *Pteroptrix lauri*, *Encarsia citrinus* (4), and *E. perniciosi* (4,15) are known parasitoids of D. perniciosus in Georgia.

Genus *Leucaspis* Signoret

17. *Leucaspis loewi* Colveé

It was found on pine trees and was parasitized by *Ablerus atomon* and *Encarsia citrinus*. Parasitization of this species was not previously recorded in Turkey. *Anthemus funicularis* (Encyrtidae), and *Encarsia leucaspidis*, *Ablerus atomon* (15), *Coccophagoides similis* and *Aphytis aonidiae* (Aphelinidae) (19) are known parasitoids of *L. loewi* in Georgia.

Genus *Parlatoria* Targioni-Tozzetti

18. *Parlatoria oleae* (Colveé)

It was found on plum and was parasitized by *Aphytis proclia*. Other parasitoids of *P. oleae* previously reported from Turkey were *Aphytis maculicornis* (17,21,23), *A. melinus* (5), *A. mytilaspidis* (23), and *Encarsia leitrinus* ?(22) (Aphelinidae). *Aphytis hispanicus*, *A. proclia*, A. maculicornis, *Encarsia citrinus* and *Pteroptrix lauri* (15,24) are known parasitoids of this scale insect in Georgia. The parasitization rate was 28-29%. It is an important pest of fruit trees both in Georgia and in Turkey.

Genus *Nuculaspis* Ferris

19. *Nuculaspis abietis* (Schrank)

It was found on fir in Eğirdir. There is no data on the parasitisation of this pest in either country.

Genus *Chionaspis* Signoret

20. *Chionaspis salicis* (Linnaeus)

It was found on willow in Gölcük without parasitization. This pest is parasitized by *Aphytis proclia*, *A. mytilaspidis* and *Pteroptrix lauri* in Georgia.

Genus *Acanthomytilus* Borchsenius

21. *Acanthomytilus cedricola* Balachowsky et Alkan

It was found on cedar. Parasitization of this pest was determined for the first time in Turkey. *Coccophagoides similes* and *Aphytis* sp. nr. *phoenicus* were determined to be parasitoids of this species in Isparta province.

Conclusion

In the present study, 21 coccid species belonging to the families Pseudococcidae, Kermesidae, Coccidae, Diaspididae of the superfamily Coccoidea were determined in Isparta province. From 16 of these coccids, 19 parasitoid species belonging to three families were obtained. No parasitization was observed on five coccid species. It was found that eight parasitoid species were new records for the Turkish fauna.

A total of 42 parasitoid species from Turkey and 43 from Georgia were determined on coccids found during this study performed in Isparta province, and it was seen that 33 species were found in both countries. Regarding the coccid parasitoid fauna of Turkey and Georgia, the similarity index was calculated as 0.635. This shows that faunas of these two countries are very similar (Table).

Table. Coccids of Isparta province (Turkey) and their parasitoids in Turkey and in Georgia.

Coocids	Parasitoids	
	Turkey	Georgia
1. *Planococcus vovae*	-	-
2. *Kermes vermilio*	Species nr. Genus *Saulea*	-
3. *Pulvinaria betulae*	* *Coccophagus lycimnia*	*Eusemion cornigerum*, *Encyrtus swederi*, *Coccophagus semicircularis*
4. *Eulecanium tilia*	-	*Microterys duplicatus*, *Trichomasthus albimanus*, *Blastotrix britannica*,**Metaphycus dispar*
5. *Parthenolecanium corni*	*Microterys lunatus*, **Cerapterocerus mirabilis*	*Microterys duplicatus*, *M. sylvius*, **Trichomasthus albimanus*, *Blastothrix longipennis*, **Metaphycus insidiosus*, **Cheiloneurus claviger*, **Pachyneuron muscarum*, **Coccophagus lycimnia*
6. *Rhodococcus perornatus*	*Microterys bellae*	-
7. *Sphaerolecanium prunastri*	**Coccophagus lycimnia*, **C. proximus spartanus*, **Discodes coccophagus*, **Cerapterocerus mirabilis*, **Pachyneuron muscarum*, **Microterys hortulanus*, **Metaphycus insidiosus*, **M. dispar*, **M. silvestri*	*Marietta picta*, **Coccophagus lycimnia*, *C. differens*, **C. proximus*, **Discodes coccophagus*, **Microterys hortulanus*, **Metaphycus silvestri*, **Cerapterocerus mirabilis*, **Pachyneuron muscarum*

Table. Continued.

8. *Coccus hesperidum*	**Coccophagus lycimnia*, **C. scutellaris*, **Encyrtus lecaniorum*, *Metaphycus flavus*, **Microterys tricoloricornis*, **Trichomasthus albimanus*	**Coccophagus lycimni*, **C. scutellaris*, **Encyrtus lecaniorum*, **Microterys tricoloricornis*, **Trichomasthus albimanus*, *Mahelencyrtus coccidiphagus*
9. *Lepidosaphes malicola*	**Aphytis mytilaspidis*, *A. libanicus*, **Coccobius testaceus*	**Aphytis proclia*, **Coccobius testaceus*, *Zaoma lambinus, **Epitetrachnemus zetterstedtii*
10. L. ulmi	**Aphytis mytilaspidis*, **Encarsia citrinus*, **Ablerus celsus*, **Coccobius testaceus*, **Epitetrachnemus zetterstedtii*, * *Zaomma lambinus*, *Thysanus ater*	**Aphytis mytilaspidis*, **Encarsia perniciosi*, **E. citrinus*, **Coccobius testaceus*, **Epitetrachnemus zetterstedtii*, **Zaomma lambinus*
11. L. newsteadi	**Encarsia leucaspidis*, *Aphytis* sp. nr. *phoenicus*, *Parasaulea trjapitzin*	-
12. *Carulaspis caruelii*	**Aphytis mytilaspidis*, **Coccophagoides similis*	**Encarsia citrinus*, **Aphytis hispanicus*, **A. aonidia*, **A. mytilaspidis*
13. Salicicola kermanensis	**Aphytis mytilaspidis*, **Coccophagoides similis*, **Pteroptrix lauri*, P. bicolor	**Aphytis mytilaspidis*, **Pteroptrix lauri*
14. *Diaspidiotus prunorum*	**Aphytis proclia*	**Ablerus atomon*, **Pteroptrix lauri*, **Coccophagoides similis*, **Aphytis proclia*, **Ablerus celsus*, **A. aonidiæ*, **Coccobius testaceus*
15. *D. ostreaformis*	**Aphytis mytilaspidis*, **Coccophagoides similis*, **Ablerus celsus*, **Pteroptrix lauri*, **Zaomma lambinus*	**Pteroptrix lauri*
16. *D. perniciosus*	**Ablerus celsus*, **Aphytis proclia*, **A. mytilaspidis*, **A. aonidiæ*, **A. hispanicus*, *A. melinus*, **Encarsia perniciosi*	**Pteroptrix lauri*, **Encarsia citrinus*, **E. pernicosi*
17. *Leucaspis loewi*	**Ablerus atomon*, **Encarsia citrinus*	*Anthemus funicularis*, **Encarsia leucaspidis*, **Ablerus atomon*, **Coccophagoides similis*, *Aphitis aonidiae
18. *Parlatoria oleae*	**Aphytis proclia*, **A. maculicornis*, *A. melinus*, **A. mytilaspidis*, *Encarsia leitrinus?*	**Aphytis hispanicus*, **A. proclia*, **A. maculicornis*, **Encarsia citrinus*, **Pteroptrix lauri*
19. *Nuculaspis abietis*	-	-
20. *Chionaspis salicis*	-	**Aphitis proclia*, **A. mytilaspidis*, **Pteroptrix lauri*
21. *Acanthomytilis cedricola*	**Coccophagoides similis*, Aphytis sp. nr. *phoenicus*	-

* Parasitoids registered in both country

As mentioned above, the parasitoid fauna of the two countries were quite similar. However, there are some parasitoid species found only in one of the countries. Detailed studies on the use of these parasitoids in the biological control of coccids by introducing them from both countries will be useful.

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