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A New Pest on Almond Tree, the Soft Scale *Didesmococcus unifasciatus* (Archangelskaya) (Hemiptera: Coccidae) and its New Records Parasitoids, Turkey

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ABSTRACT

The present study was carried out in Diyarbakır province during 2006-2007 on almond trees infested with the coccid *Didesmococcus unifasciatus* (Archangelskaya) (Hemiptera: Coccidae). As a result of this study, four parasitoids species *Coccophagus piceae* Erdos, *Coccophagus lycimnia* Walker (Hymenoptera: Aphelinidae), *Microterys hortulanus* (Erdos), *Metaphycus* sp. near *zebratus* (Mercet) (Hymenoptera: Encyrtidae) and one hyperparasitoid species *Pachyneuron muscarum* (Linnaeus) (Hymenoptera: Pteromalidae) were obtained. The parasitoids of *D. unifasciatus*: *C. piceae,* and *M.* sp. near *zebratus* are the first records on *D. unifasciatus* from Turkey.

Key words: Didesmococcus unifasciatus, *Coccophagus piceae*, *Coccophagus lycimnia*, *Metaphycus* sp. near *zebratus*, new record, almond, Turkey.

INTRODUCTION

Almond culture is considered as having a great economic importance in Turkey. Approximately 15% of total almond production of Turkey is obtained from the GAP region (Adıyaman, Batman, Diyarbakır, Gaziantep, Kilis, Mardin, Siirt, Şırnak) (Anonymous, 2009).

The Coccidae (soft scales) is the third largest family after the Diaspididae (armouredscale insects) and Pseudococcidae (mealybugs) (Ben-Dov *et al*., 2009) and they are probably more abundant in the tropics and subtropics (Hodgson, 1994). Like other scale insects, softscales are sexually dimorphic, adult females apterous, paedomorphic and mostly phloem-sucking plant parasites, some of them are important pests in agricultrure, horticulture, ornamental plants and forestry (Ben-Dov, 1993). Members of this family mainly feed onperennial plants, woody plants, perennial herbaceous plants and some of them feed ongrasses (Ben-Dov, 1993; Kozár, 1998). On the other hand their feeding may cause deformation or death of plant shoots, and some species can transmit plant virus diseases (Fortusini *et al*., 1997). Soft scales often build large populations that can contaminate the foliage with their sticky honeydew excretions, which provide a substratefor sooty mould growth (Borchsenius,

1952). The family Coccidae contains 1157 described species worldwide while there are 318 species in 63 genera in the Palaearctic Zoogeographical Region (Ben-Dov *et al*., 2009). In Turkey, 267 species belonging to 187 genera in 12 families have been recorded in the superfamily Coccoidea, of which the family Coccidaecontains 48 species belonging to 25 genera and these species have a Palaearctic distribution in general (Öncüer *et al*., 2001; Kaydan *et al*., 2007).

Didesmococcus unifasciatus have been recorded in Palaearctic and Oriental regions on *Amygdalus* sp*., A. communis, A. nana, A. pedunculata, Armeniaca* sp*., Ficus carica, Malus domestica, Persica concolor , P. vulgaris, Prunus* sp*., P. dulcis, P. prostrata* and *Ulmus* sp. (Ben-Dov *et al*., 2009).

The Encyrtidae is the most speciose group of parasitoids attacking scale and psyllid insects. Members of the family are important in biological control. More than 400 encyrtid species have been used or are used today for suppression of various crop pests (Japoshvili and Noyes, 2006b). There are more then 1270 described species of encyrtids in the Palaearctic Region (Yasnosh and Japoshvili, 1999; Japoshvili, 2005-2007a, b; Japoshvili and Karaca, 2003; Japoshvili and Abrantes, 2006; Japoshvili and Noyes, 2005-2006b).

Aphelinids are a moderately sized, cosmopolitan family with circa 44 valid genera and 808 species by 1993 (Anonymous, 2011). Important morphological characters are antennae with 8 or less segments; parapsidal sutures complete but shallow; and middle leg tibial spur long but not thick (Anonymous, 2011). The body is small, yellow or brown, and the gaster is broad at its base (Anonymous, 2011). Most species are primary, solitary, endoparasitoids of mealybugs, scale insects, whiteflies and aphids (Anonymous, 2011). However, some species parasitize eggs and others are hyperparasitic (Anonymous, 2011). Various species of aphelinids may attack all host stages (Anonymous, 2011). The family is important in biological control, having been used worldwide, especially against scale insects and aphids (Anonymous, 2011). The better known common genera developing internally are *Aphelinus* in Aphididae*, Coccophagus* and *Aneristus* in Coccidae*, Encarsia* and *Eretmocerus* in Aleyrodidae, and *Prospaltella* in Coccidae and Aleyrodidae. *Aphytis* spp. are ectophagous parasitoids of Coccidae, and larvae of several species have been found feeding on their host eggs (Clausen, 1940).

The aim of this study was to determined the natural enemies of the harmful *Didesmococcus unifasciatus* on almond trees in Diyarbakır.

MATERIAL AND METHODS

Soft scale insect samples were collected from the province of Diyarbakır in the Southeastern Part of Turkey between 2006 and 2007. Specimens were taken from both wild and cultivated plants during irregular surveys carried out in the spring and summer seasons of the two-year study. Each sample was put into a plastic bag and taken to the laboratory for examination.

Representative specimens were sent to various taxonomic specialists for confirmation of identification. Host identification (*Didesmococcus unifasciatus*) was made by Prof. Dr. Selma Ülgentürk (Ankara University, Faculty of Agriculture, Department of Plant Protection, Ankara/Turkey) and the parasitoids identification was made by Dr. John Stuart Noyes (Natural History Museum, London, U. K.).

RESULTS AND DISCUSSIONS

As a result of this study, four parasitoids species *Coccophagus piceae* Erdos, *Coccophagus lycimnia* Walker (Hymenoptera: Aphelinidae), *Microterys hortulanus* (Erdos), *Metaphycus* sp. near *zebratus* (Mercet), (Hymenoptera: Encyrtidae) and one hyperparasitoid species *Pachyneuron muscarum* (Linnaeus) (Hymenoptera: Pteromalidae) were obtained.

Didesmococcus unifasciatus (Archangelskaya)

Distribution: Iran (Kazemi, 1985), Palaearctic and Oriental regions (Ben-Dov *et al*., 2009).

Distribution in Turkey: Hakkari (Kaydan and Kozár, 2010), New record to Diyarbakır.

Host plant: *Amygdalus* sp., *A. communis, A. nana, A. pedunculata, Armeniaca* sp., *Ficus carica, Malus domestica, Persica concolor, P. vulgaris, Prunus* sp., *P. dulcis, P. prostrata* and *Ulmus* sp. (Ben-Dov *et al*., 2009).

Material examined: Diyarbakır (37°53'N, 40°16'E at altitude of about 669 m.)

Parasitoids

***Coccophagus piceae* Erdos (Hymenoptera: Aphelinidae)**

Recorded hosts: *Pulvinaria* sp. (Herting, 1972; Yasnosh, 1978), *Pulvinaria vitis* (Herting, 1972), *Pulvinaria betulae* (Voynovich and Sugonjaev, 1987).

New record host: In the present study *Didesmococcus unifasciatus* was recorded as a new host of *Coccophagus piceae* from Turkey.

Host plant: *Betulla* sp. (Herting, 1972; Voynovich and Sugonjaev, 1987).

Distribution: Caucasus (Yasnosh, 1978), Czech Republic (Kalina, 1989), Hungary (Yasnosh, 1978), Poland (Herting, 1972; Yasnosh, 1978), Russia (Herting, 1972; Yasnosh, 1978; Voynovich and Sugonjaev, 1987), Slovakia (Kalina, 1989), Sweden (Hedqvist, 2003).

Distribution in Turkey: Ülgentürk (2001)

Material examined: 3♀♀, 11♂♂ (Many more samples have been obtained) Diyarbakır (37°53'N, 40°16'E at altitude of about 669 m).

***Coccophagus lycimnia* Walker (Hymenoptera: Aphelinidae)**

Recorded hosts: *Anapulvinaria pistaciae* (Tudor, 1982), *Ceroplastes floridensis* (Ben-Dov, 1972; Tudor, 1982; Abd-Rabou, 2003), *Ceroplastes rusci* (Öncüer, 1991; Abd-Rabou, 2003), *Ceroplastes sinensis* (Herting, 1972; Tudor, 1982), *Chloropulvinaria*

aurantii, C. floccifera (Tudor, 1982; Hoffmann and Schmutterer, 2003), *Coccus hesperidum* (Herting, 1972; Öncüer, 1974; Yasnosh, 1978; Tudor, 1982; Öncüer, 1991; Japoshvili and Karaca, 2002; Abd-Rabou, 2003), *Didesmococcus megriensis*, *Eriopeltis agropyri* (Tudor, 1982), *Eriopeltis lichtensteinii* (Herting, 1972; Tudor, 1982), *Eulecanium bituberculatum, E. coryli*, *E. nigrofasciatum*, *E. persicae*, *E. pomeranicum*, *E. pruinosum*, *E. rufulum, E. spiraeae, E. turanicum, E unifasciatum* (Herting, 1972), *Kermococcus quercus*, *Lecanium fletcheri, L. pomeranicum, L. pruinosum, L. quercifex (Tudor, 1982), Neopulvinaria imeretina* (Herting, 1972; Tudor, 1982), *Palaeolecanium bituberculatum* (Yasnosh, 1978; Tudor, 1982), *Parasaissetia nigra* (Abd-Rabou, 2003), *Parthenolecanium corni* (Yasnosh, 1978; Tudor, 1982; Liao *et al*., 1987; Moglan, 2000; Monta, 2001; Japoshvili and Karaca, 2002; Hoffmann and Schmutterer, 2003), *Parthenolecanium fletcheri* (Hoffmann and Schmutterer, 2003), *Parthenolecanium persicae* (Yasnosh, 1978; Tudor, 1982; Abd-Rabou, 2003; Hoffmann and Schmutterer, 2003), *Parthenolecanium rufulum* (Tudor, 1982; Hoffmann and Schmutterer, 2003), *Planococcus citri* (Herting, 1972; Tudor, 1982), *Pulvinaria amygdali*, *P. betulae* (Tudor, 1982; Japoshvili and Karaca, 2002), *Pulvinaria vitis* (Herting, 1972; Liao *et al*., 1987; Abd-Rabou, 2003; Hoffmann and Schmutterer, 2003), *Rhodococcus turanicus* (Yasnosh, 1978), *Saissetia oleae* (Herting, 1972; Tudor, 1982; Liao *et al*., 1987; Abd-Rabou, 2003), *Sphaerolecanium prunastri* (Yasnosh, 1978; Tudor, 1982; Japoshvili, 2001; Ülgentürk *et al*., 2001), *Aonidiella aurantii* (Öncüer, 1991).

Host plant: *Acer campestre, Agropyron intermedium, Cerasus japonica, Cornus sanguinea, Euonymus europaea, Fraxinus excelsior, Rhamnus cathartica, Robinia pseudoacacia, Vaccinium myrtillus, Viburnum lantana* (Tudor, 1982), *Citrus unshiu* (Öncüer, 1991), *Prunus armeniaca* (Özgen and Bolu, 2009), *Pistacia mutica* (Yasnosh, 1978), *Quercus* sp., *Thuja occidentalis* (Tudor, 1982; Hoffmann and Schmutterer, 2003), *Psidium guajava* (Abd-Rabou, 2003), *Prunus cerasifera* (Tudor, 1982; Moglan, 2000; Japoshvili, 2001), *Prunus domestica, P. persica,Vitis vinifera* (Tudor, 1982).

Distribution: Armenia (Moglan, 2000) Australia (Tudor, 1982; Liao *et al*., 1987), Belgium (Herting, 1972), Bulgaria (Moglan, 2000), Canada (Herting, 1972), Germany (Herting, 1972; Hoffmann and Schmutterer, 2003), Egypt (Abd-Rabou, 2003), Europe (Liao *et al*., 1987), France, United Kingdom (Herting, 1972), Georgia (Japoshvili, 2001; Japoshvili and Karaca, 2002), Hungary (Herting, 1972), India (Tudor, 1982; Liao *et al*., 1987), Israel (Ben-Dov, 1972), Italy (Herting, 1972), Japan (Tudor, 1982; Liao *et al*., 1987), Kazakhstan (Yasnosh, 1978), Morocco (Herting, 1972), Moldova (Herting, 1972; Moglan, 2000), Nearctic (Liao *et al*., 1987), Poland (Herting, 1972; Moglan, 2000), Portugal (Herting, 1972), Romania (Tudor, 1982; Moglan, 2000), Russia (Herting, 1972; Yasnosh, 1978; Liao *et al*., 1987; Moglan, 2000), Yugoslavia (Moglan, 2000), Ukraine (Herting, 1972), United States of America (Herting, 1972; Tudor, 1982).

Distribution in Turkey: Öncüer (1974-1991), Ülgentürk (2001), Japoshvili and Karaca (2002), Özgen and Bolu (2009).

Material examined: 5♂♂ (Many more samples have been obtained) Diyarbakır (37º53'N, 40º16'E at altitude of about 669 m).

***Microterys hortulanus* (Erdos) (Hymenoptera: Encyrtidae)**

Recorded hosts: *Didesmococcus unifasciatus* (Japoshvili and Noyes, 2006a), *Eulecanium ciliatum* (Ülgentürk and Toros, 2001; Japoshvili and Noyes, 2006a), *Sphaerolecanium prunastri* (Herting, 1972; Ülgentürk *et al*., 2001; Japoshvili and Karaca, 2002; Hoffmann and Schmutterer, 2003; Japoshvili and Noyes, 2005)

New record host: In the present study *Didesmococcus unifasciatus* was recorded as a new host of *Microterys hortulanus* from Turkey.

Host plant: *Armeniaca vulgaris, Prunus* sp. (Japoshvili and Noyes, 2005), *Prunus cerasifera* (Moglan and Moglan, 1997), *Prunus spinosa* (Hoffmann and Schmutterer, 2003).

Distribution: Armenia (Babayan and Oganesyan, 1985; Japoshvili and Noyes, 2005; Japoshvili and Noyes, 2006a), Azerbaijan (Japoshvili and Noyes, 2005; Japoshvili and Noyes, 2006a), Bulgaria, Czech Republic (Japoshvili and Noyes, 2006a), Germany (Hoffmann and Schmutterer, 2003; Japoshvili and Noyes, 2006a), United Kingdom, Greece (Japoshvili and Noyes, 2006a), Georgia (Japoshvili and Karaca, 2002; Japoshvili and Noyes, 2005; Japoshvili and Noyes, 2006a), Hungary (Herting, 1972; Japoshvili and Noyes, 2006a), Italy (Herting, 1972; Japoshvili and Noyes, 2006a), Kirgizia, Moldova (Japoshvili and Noyes, 2006a), Poland (Herting, 1972; Japoshvili and Noyes, 2006a), Romania, Russia, Slovakia (Japoshvili and Noyes, 2006a), USSR (Herting, 1972), Ukraine, Uzbekistan (Japoshvili and Noyes, 2006a).

Distribution in Turkey: Trjapitzin and Doğanlar (1997), Ülgentürk and Toros (2001), Ülgentürk *et al*., (2001) Japoshvili and Karaca, (2002); Japoshvili and Noyes, (2006a),

Material examined: 1♀, 8♂♂ (Many more samples have been obtained) Diyarbakır (37°53'N, 40°16'E at altitude of about 669 m).

***Metaphycus* sp. near *zebratus* (Mercet) (Hymenoptera: Encyrtidae)**

Recorded hosts: Unknown.

New record host: *Didesmococcus unifasciatus* was recorded as a new host of *Coccophagus piceae* from Turkey. This is the first time this taxon is collected on this host.

Host plant: Unknown.

Distribution: Turkey.

Distribution in Turkey: Diyarbakır.

Material examined: 7♀♀, 4♂♂ (Many more samples have been obtained) Diyarbakır (37°53'N, 40°16'E at altitude of about 669 m).

This study showed that there are many hitherto unrecorded parasitoids of *D. unifasciatus* in Turkey. More studies should be conducted on the parasitoid fauna of *D. unifasciatus*, including studies on their biology.

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