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***Sphaerolecanium prunastri* Boyer de Fonscolombe (Hemiptera: Coccidae):
distribution, host plants and natural enemies in the Turkish Lake District**

Abstract - *Sphaerolecanium prunastri* was an economically important pest of almond, apricot, and sweet cherry, sour cherry, peach and plum in the Turkish Lake District (Afyon, Burdur and Isparta provinces in Turkey) in 1999-2001. Although there are numerous natural enemies of *S. prunastri*, it reached very high population densities in Afyon. Hymenopteran parasitoids recorded were: *Discodes coccophagus* (Ratzeburg), *Microterys hortulans* Erdős, *Metaphycus* sp. (Hym., Encyrtidae); *Coccophagus lycimnia* (Walker), *Coccophagus* sp., (Aphelinidae); *Cerapterocerus mirabilis* Westwood, *Pachyneuron muscarum* (Linnaeus) (Pteromalidae); *Aprostocetus* sp. (Eulophidae). Predators recorded were: *Cybocephalus fodori minor* Endrödy-Younga (Col., Cybocephalidae); *Chilochorus bipustulatus* (L.), *Exochomus quadripustulatus* L. (Col., Coccinellidae); *Calymma communimacula* (Denis & Schiffermüller) (Lep., Noctuidae) and an unidentified species of Hemiptera (Heteroptera).

Key words: *Sphaerolecanium prunastri*, stone fruits, natural enemies, Turkish Lake District.

INTRODUCTION

Sphaerolecanium prunastri (Plum Scale) is a common pest on stone fruits in the Palaearctic Region (Ben-Dov, 1993) and in North America (Kozar, 1998). In Turkey it is widespread on stone fruits in some parts of the Aegean, Black Sea, Central, South-East Anatolian, Marmaran and Mediterranean regions (Bodenheimer, 1953; Gürkan, 1974; Kozár *et al.*, 1982; Ülgentürk & Toros, 1999). The Turkish Lake District is located in south-western Turkey and includes parts of the Mediterranean, Aegean and Central Anatolian regions (Fig. 1). The host plants of Plum Scale in Turkey are almond, apricot, cherry, peach and plum (Bodenheimer, 1953; Lodos, 1982); it hibernates as a second instar nymph and produces one generation per year. Plum Scale causes damage by sucking plant sap and by fouling the leaves with honeydew excretion, on which sooty mould develops (Bodenheimer, 1953; Gürkan, 1974).

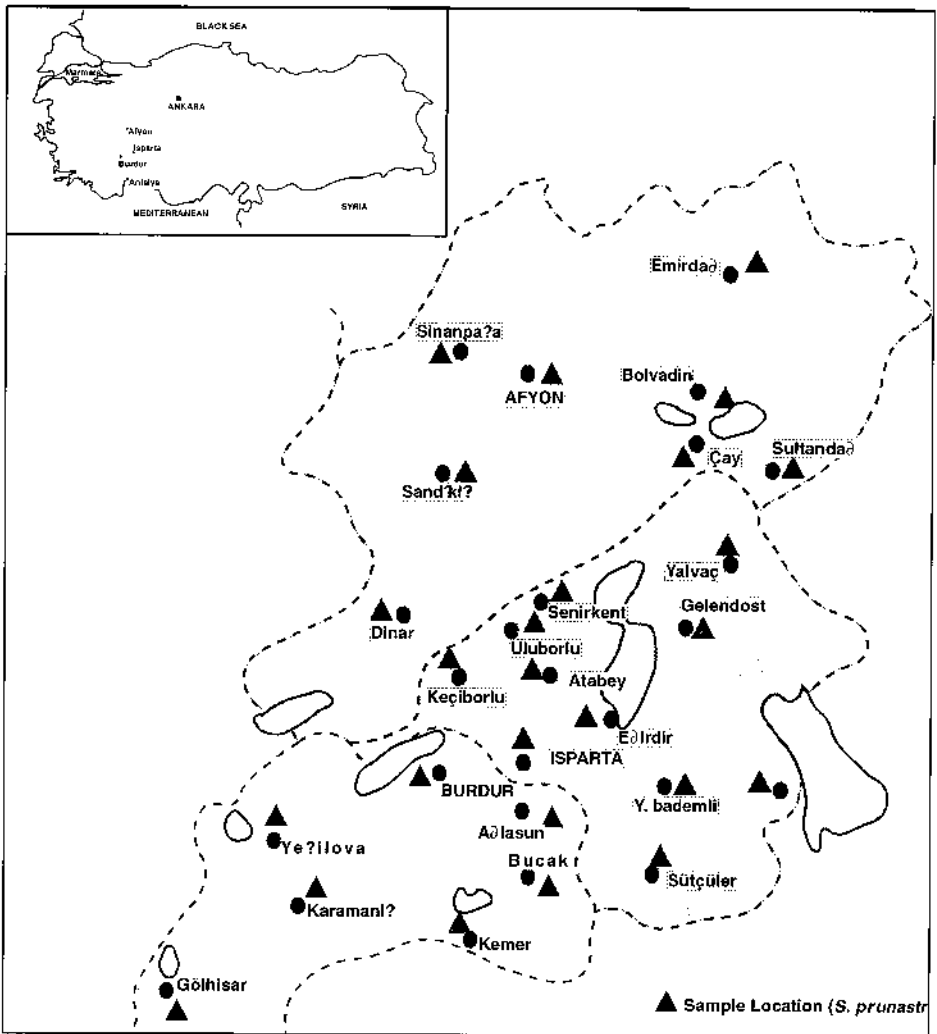


Fig.1 - Sample location of *S. prunastri* in Turkish Lake district.

In the Palaearctic Region, *S. prunastri* has a large parasitoid complex (Ben-Dov, 1968; Tranfaglia, 1972; Öncüer, 1977; Kozár *et al.* 1982; Bakogiannis, 1984; Moglan, 1988). Chalcidoid parasitoids of *S. prunastri* are: *Coccophagus differens* Jasnosh, *C. lycimnia* (Walker), *C. proximus* Jasnosh, and *Coccophagus* sp. nr. *palaeolecanii* Jasnosh (Aphelinidae); *Microterys lunatus* (Dalman), *Metaphycus dispar* (Mercet), *M. silvestri* Sugonyaev, *Blastothrix longipennis* Dalman, *Discodes aeneus* (Dalman), *D.*

coccophagus Ratz and *Cerapterocerus mirabilis* Westwood (Encyrtidae); *Aprostocetus tryapitzini* (Kostjukov) (Eulophidae); *Pachyneuron concolor* (Först.) and *P. muscarum* L. (Pteromalidae). Predators of *S. prunastri* are: *Orius minutus* L. (Heteroptera; Anthocoridae); *Cybocephalus fodori* Endrödy-Younga, *Cybocephalus fodori minor* Endrödy-Younga (Coleoptera; Cybocephalidae); *Scymnus apetzii* Mulsant, *S. interruptus* (Goeze), *Synharmonia conglabata* (L.) and *Exochomus quadripustulatus* (L.) (Coleoptera; Coccinellidae) (Soydanbay, 1976; Öncüler, 1977; Ülgentürk, 2001). Kozár *et al.* (1982) recorded a parasitization rate of 30% on *S. prunastri* by *D. coccophagus* in Turkey. On untreated plum trees in Italy, Tranfaglia (1972) observed that parasitic Hymenoptera caused 48.5% mortality of Plum Scale, and large numbers of *E. quadripustulatus* were present; but on trees treated with carbaryl, populations of this coccinellid fell sharply.

This study was carried out to determine distribution, host plants and natural enemies of *S. prunastri* in the Turkish Lake District.

MATERIALS AND METHODS

Twigs infested with *S. prunastri* were randomly collected from sampling sites in 22 villages in the Turkish Lake District (Afyon, Burdur and Isparta provinces). Samples were collected from infested stone fruit trees every 3 weeks between April and October, when Plum Scale was active. The distal portions of twigs in the lower canopy were taken randomly. Collected twigs were examined under the stereomicroscope and any other scale insect species or other insects were removed. Some samples were placed in 70% ethanol; others were placed in glass vials 15 cm x 10 cm under laboratory conditions ($25\pm 1^{\circ}\text{C}$; 16:8 (L:D); relative humidity $60\pm 10\%$), to await parasitoid

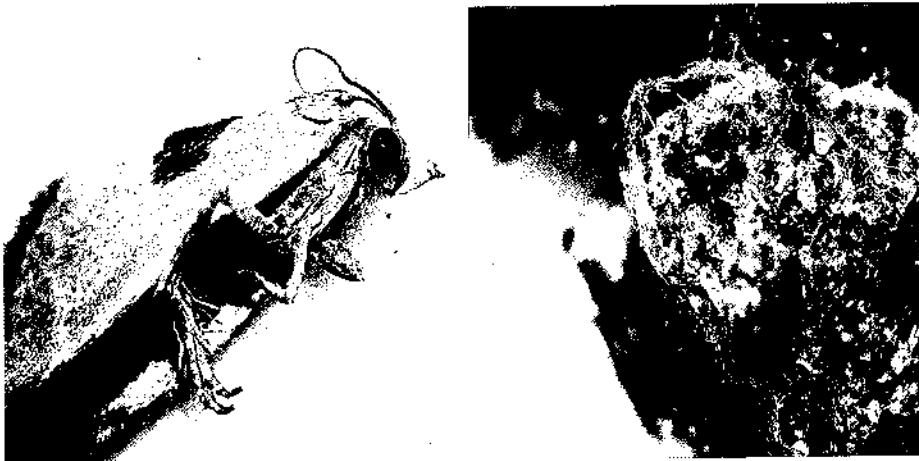


Fig 2 - a) Adult of *Calymma communimacula* . b) Cocoon of *Calymma communimacula* larvae.

emergence. The parasitoids were collected by an aspirator, identified and counted. Adult predators were collected by hand; any nymphs or larvae were placed with their host, *S. prunastri*, in glass vials under laboratory conditions to mature into adults.

RESULTS AND DISCUSSION

Distribution and host plants of S. prunastri

In 1999-2000, *S. prunastri* was found at 22 localities in three provinces of the Turkish Lake District, where it was the commonest scale insect pest on stone fruit trees (Fig.1). *Prunus amygdalus*, *P. armeniaca*, *P. avium*, *P. cerasus* and *P. domestica* were its main host plants in this area (Table 1). Very dense populations of Plum Scale occurred on plum trees in all three provinces. It was found mostly in private orchards, plum trees on the street and in hedges, and especially in untreated and neglected orchards. *Sphaerolecanium prunastri* was also found on ornamentals such as *Prunus cerasifera*, *P. cerasifera* var. *pissardii nigra* and *P. serrulata* var. *Shidare sakkura* in Ankara (Ülgentürk & Toros, 1999).

Table 1 - Parasitoids and predators of *S. prunastri* and their percentages in Turkish Lake District. Secondary parasitoids are indicated by *.

Parasitoids	Provinces and percentage of parasitoids			
	Afyon	Burdur	Isparta	Total
<i>Aprostocetus</i> sp. *	1.0	1.3	1.8	4.1
<i>Blastothrix</i> sp	-	0.2	-	0.2
<i>Ceropterocerus mirabilis</i> *	3.7	5.6	5.6	14.9
<i>Coccophagus</i> sp.	1.4	2.7	4.9	9.0
<i>Coccophagus lycimnia</i>	1.7	1.4	1.9	5.0
<i>Discodes coccophagus</i>	18.0	5.2	14.9	38.1
<i>Metaphycus silvestri</i>	-	3.0	0.9	3.9
<i>Microterys hortulans</i>	3.1	3.9	4.7	11.7
<i>Pachyneuron muscarum</i> *	7.0	2.3	3.5	12.8
Total	35.9	25.6	38.5	99.7
Predators				
<i>Calymma communimacula</i>	4.4	-	6.0	10.4
<i>Chilocorus bipustulatus</i>	1.5	-	5.1	4.6
<i>Cybocephalus fodori minor</i>	12.4	1.6	18.2	32.2
<i>Chrysopa</i> sp.	0.2	-	1.5	1.7
<i>Exochomus quadripustulatus</i>	23.7	2.3	20.3	46.3
One unidentified Heteroptera	0.5	-	1.9	2.4
Total	42.7	3.9	53.0	99.6

Plum Scale was common and damaging old, neglected orchards of sour cherry and sweet cherry in Çay, Sultandagi, Afyon, but not in most of the newly established and well managed orchards. In very high populations it reduced tree vitality and stunted leaves and fruits compared to uninfested trees. From mid-May to the end of June, *S. prunastri* produced copious honeydew that fouled leaves, twigs and fruits. In Sultandagi, Plum Scale caused dieback of cherry and sour cherry trees in three orchards. In Burdur and Isparta provinces, *S. prunastri* was mostly found on apricot and plum trees. The pest was rarely found on almond, except on arid land, where it was commoner in hedges. Hedges were the main infection source for other stone fruit trees in this area.

Natural enemies of S. prunastri

Parasitoids collected from samples of Plum Scale were identified as the hymenopterans *Coccophagus* sp. and *Coccophagus lycimnia* (Walker) (Aphelinidae); *Metaphycus silvestri* Sugonjaev, *Blastothrix* sp., *Microterys hortulans* (Erdös), *Discodes coccophagus* Ratz and *Cerapterocerus mirabilis* Westwood (Encyrtidae); *Aprostocetus tryapitzini* (Kostjukov) (Eulophidae); and *Pachyneuron muscarum* L. (Pteromalidae). Predators recorded were *Exochomus quadripustulatus* (L.) and *Chilocorus bipustulatus* L. (Coleoptera; Coccinellidae); *Cybocephalus fodori minor* Endrödy-Younga (Coleoptera, Cybocephalidae); *Calymma communimacula* (Denis & Schiffermüller) (Lepidoptera; Noctuidae); *Chrysopa* sp. (Neuroptera; Chrysopidae) and an unidentified species of Hemiptera (Heteroptera). Over all the surveyed sites, a total of 3659 parasitoids and 362 predators were collected. The commonest parasitoids of *S. prunastri* were *Discodes coccophagus* (38.1%) and *Microterys hortulans* (11.7%). The abundance of *D. coccophagus* was determined as 18.0% in Afyon, 14.9% in Isparta and 5.2% in Burdur. The largest numbers of parasitoids were found in the villages of Bolvadin (49%, Afyon province), Yesilova (28.2%, Burdur province) and Gelendost (20.6%, Isparta province). Secondary parasitoids were abundant in the Turkish Lake District; the commonest were *Cerapterocerus mirabilis* (14.9 %) and *Pachyneuron* sp. (12.8 %) (Table 1).

Exochomus quadripustulatus was the commonest predator of *S. prunastri*. This was followed by *Cybocephalus fodori minor* and *Calymma communimacula*. *C. communimacula* is the first record of a noctuid predator on *S. prunastri* in Turkey (Fig. 2). Larvae of *C. communimacula* consumed all stages of Plum Scale on the branches and became enveloped by the remains of their prey (Fig 2b). This noctuid has been recorded before as a predator of scale insects in the Palaearctic Region (Baisch *et al.*, 1998). Öncüer (1977) found *Scymnus apetzii* Mulsant, *S. interruptus* (Goeze), *E. quadripustulatus* and *C. fodori* as predators on Plum Scale in Izmir, Turkey.

In Egirdir (Isparta), we did not find any parasitoids, only larvae of *Exochomus* and *Calymma* in well-kept peach orchards where there was a very high Plum Scale population. Possibly intensive use of pesticides has damaged the natural balance there. Zakirov (1971) found that the effectiveness of parasitoids in cultivated orchards

differed from that in natural mountain districts, apparently because the systematic use of chemicals against the pests in orchards also kills their natural enemies.

In this study, Plum Scale was found to be a common and economically important pest on stone fruits in Turkish Lake District. Nine chalcidoid parasitoids (three of them secondary parasitoids) and six predators were identified on *S. prunastri*. We suppose that the effectiveness of the primary parasitoids of *S. prunastri* was reduced by the activity of the secondary parasitoids. Further research on the protection of natural enemies to increase their effectiveness will improve the control of *S. prunastri*.

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