

Contribution to the Knowledge of Scale Insects (Homoptera: Coccoidea) of Coniferous Trees from Turkey

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Abstract: To date, a total of 31 species of scale insects have been recorded on coniferous trees in Turkey. The scale insect families Margarodidae, Pseudococcidae, Coccidae, Eriococcidae and Diaspididae consist of 3, 3, 6, 1 and 18 species, respectively. Thirteen out of 31 species were found in the European part of Turkey. From the zoogeographical standpoint, 3 are native, 11 are cosmopolitan and 17 are palearctic species.

Key words: Coccoidea, coniferous trees, Turkey

INTRODUCTION

Scale insects are a large one and contains forms that are minute and highly specialized. Many are so modified that they look very little like other Homoptera (Borror *et al.*, 1992). About 150 species of scale insects are known to develop on coniferous trees in different countries of the world. They cause various types of damage, including discoloration, premature needle fall, reduction of shoot growth, death of branches and even of the whole tree (Kozarzhevskaya, 1995).

The scale insect fauna on coniferous trees of Turkey was studied in some detail by several researchers (Lindinger, 1906, 1909, 1912; Fahringer, 1922; Hovasse, 1930a, b; Özek and Hovasse, 1931; Acatay, 1943; Selmi, 1979; Düzgüneş, 1982; Yaşar, 1995; Kaydan *et al.*, 2004; Ülgentürk *et al.*, 2004). The purpose of this study was to improve the knowledge on the coniferous tree damaging scale insect fauna of Turkey.

MATERIALS AND METHODS

This study was conducted during 2003 and 2004 in Turkey (39° 90' N, 35° 00' E). Some scale insects mentioned in the present study were collected in the field and the rest previously recorded in Turkey were taken from the literature. Collecting and preserving methods used in this study were based on the literatures of Schauff (1986) and Çanakçiođlu (1993).

Group and family of the scale insects given bellow are based mainly on the generic classification taken from Schmutterer (1972). Species under families are arranged in alphabetical order.

RESULTS

To date, totally 31 scale insect species on coniferous trees have been recorded by several researchers in Turkey. Distribution and host plants of these species were given below:

- Group Archaeococcoidea
- Family Margarodidae

Marchalina hellenica (Gennadius, 1883): Recorded on *Pinus* sp., *P. brutia*, *P. pinea* and *P. sylvestris* in İstanbul, Çanakkale, Tekirdađ, Balıkesir, Denizli, İzmir, Muđla, Antalya, Adana and Ankara (Hovasse, 1930a,b; Özek and Hovasse, 1931; Acatay, 1943; Schimitschek, 1944; Ermin, 1950; Bodenheimer, 1953; Besceli and Ekici, 1968; Giray, 1970; Tosun, 1975; Çanakçiođlu, 1977; Selmi, 1979, 1983; Çanakçiođlu *et al.*, 1982; Karsavuran *et al.*, 2001).

Matsucoccus josephi (Bodenheimer and Harpaz, 1955): Recorded on *Pinus brutia* and *P. halepensis* in Samsun, Sinop, İstanbul, İzmir, Aydın, Muđla, Antalya, İçel, Niđe, Adana and Hatay (Mendel, 1992).

Palaeococcus fuscipennis (Burmeister, 1835): Recorded on *Pinus brutia* in İstanbul (Schimitschek, 1944).

- Group Neococcoidea
- Family Pseudococcidae

Planococcus vovae (Nasonov, 1909): Recorded on *Calocedrus decurrens*, *Cupressus* sp., *C. goveniana*, *C. sempervirens*, *Juniperus* sp., *J. excelsa*, *J. virginiana*,

Taxus baccata and *Thuja occidentalis* in İstanbul, Çanakkale, Bursa, Uşak, Antalya, Isparta, Burdur, Adana and Hatay (Çanakçioğlu, 1972, 1977; Selmi, 1979; Çanakçioğlu *et al.*, 1982; Düzgüneş, 1982; Cox and Ben-Dov 1986; Şengonca *et al.*, 1998; Uygun *et al.*, 1998; Williams and Moghaddam, 1999; Japoshvili and Karaca 2002; Kaydan *et al.*, 2004).

Pseudococcus caricus (Gennadius, 1883): Recorded on *Pinus nigra* in Muğla (Gennadius, 1883).

Pseudococcus viburni (Signoret, 1875): Recorded on *Cephalotaxus harringtonia* in İstanbul and Bursa (Selmi, 1979).

• Family Coccidae

Coccus hesperidum Linnaeus, 1758: Recorded on *Abies concolor*, *A. nordmanniana* subsp. *bornmuelleriana*, *Cedrus atlantica*, *C. libani*, *Cephalotaxus harringtonia*, *Pinus pinaster*, *P. pinea* and *Taxus baccata* in İzmir, İstanbul, Bursa, Balıkesir, Kocaeli and Sakarya (Çanakçioğlu, 1977; Selmi, 1979; Çanakçioğlu *et al.*, 1982).

In this study, *C. hesperidum* was found on *Cedrus libani* in İstanbul and Adapazarı. Selmi (1979) reported that *C. hesperidum* had 3 generations per year in Marmara region.

Coccus pseudomagnoliarum (Kuwana, 1914): Recorded on *Pinus sylvestris* in Eskişehir and Trabzon (Çanakçioğlu, 1977).

Nemolecanium aptii (Bodenheimer, 1941): Recorded on *Abies nordmanniana* in Bolu (Bodenheimer, 1941, 1953).

Parthenolecanium pomericum (Kawecki, 1954): Recorded on *Taxus baccata* in Ankara and İstanbul (Selmi, 1979; Ülgentürk and Toros, 1999).

Physokermes piceae (Schrank, 1801): Recorded on *Abies nordmanniana* subsp. *bornmuelleriana*, *A. pinsapo*, *Picea abies*, *P. orientalis* and *P. pungens* in Ankara and İstanbul (Çanakçioğlu, 1972, 1977; Selmi, 1979; Çanakçioğlu *et al.*, 1982; Özkazanç and Yücel, 1985; Ülgentürk and Toros, 1999).

Pulvinaria floccifera (Westwood, 1870): Recorded on *Cephalotaxus harringtonia* and *Taxus baccata* in İstanbul and Bursa (Selmi, 1979).

• Family Eriococcidae

Eriococcus araucariae Maskell, 1879: Recorded on *Araucaria* sp. in İstanbul (Bodenheimer, 1953).

• Family Diaspididae

Acanthomytilus cedricola (Balachowsky and Alkan, 1956): Recorded on *Cedrus atlantica*, *C. deodara* and *C. libani* in İstanbul, Kocaeli, Bursa, Balıkesir, Antalya, Isparta, Edirne, İzmir, Ankara, Afyon, Uşak and Gaziantep (Balachowsky and Alkan 1956; Çanakçioğlu, 1977; Selmi, 1979; Çanakçioğlu *et al.*, 1982; Özkazanç and Yücel, 1985; Yaşar, 1995; Ülgentürk and Toros, 1996; Japoshvili and Karaca, 2002).

In this study, *A. cedricola* was found on *Cedrus libani* in Afyon. Selmi (1979) found that *A. cedricola* overwintered as the adult stage in Marmara Region.

Aonidia mediterranea (Lindinger, 1910): Recorded on *Cupressus sempervirens* and *Pinus* sp. in Antalya and Aydın (Erler *et al.*, 1996; Karsavuran *et al.*, 2001).

Aspidiotus nerii (Bouche, 1833): Recorded on *Cedrus libani*, *Picea abies* and *Taxus baccata* in İzmir, İçel and İstanbul (Tuatay *et al.*, 1972; Çanakçioğlu, 1977; Selmi, 1979).

Carulaspis juniperi (Bouché, 1851): Recorded on *Cedrus libani*, *Cupressus sempervirens*, *Juniperus* sp., *J. excelsa*, *J. sabina*, *Platycladus orientalis*, *Thuja* sp. and *T. occidentalis* in Amasya, Ankara, Antalya and İzmir (Lindinger, 1912; Bodenheimer, 1949; Gül-Zümreoğlu, 1972; Yaşar, 1995; Ülgentürk and Toros, 1996).

Carulaspis minima (Targioni-Tozzetti, 1868): Recorded on *Chamaecyparis lawsoniana*, *Cupressus* sp., *C. arizonica*, *C. goveniana*, *C. sempervirens*, *Juniperus communis*, *J. drupacea*, *J. foetidissima*, *J. oxycedrus*, *J. sabina*, *Platycladus orientalis*, *Sequoia sempervirens*, *Thuja gigantea*, *T. occidentalis* and *T. plicata* in İstanbul, Edirne, Tekirdağ, Kocaeli, Bursa, Sakarya, Balıkesir, Çanakkale, İzmir, Yalova, Isparta, Antalya and İçel (Çanakçioğlu, 1972, 1977; Selmi, 1979; Çanakçioğlu *et al.*, 1982; Yaşar, 1995; Erler *et al.*, 1996; Uygun *et al.*, 1998; Japoshvili and Karaca, 2002).

Chrysomphalus dictyospermi (Morgan, 1889): Recorded on *Taxus baccata* in İstanbul (Selmi, 1979).

Dynaspidiotus abieticola (Koroneos, 1934): Recorded on *Abies concolor*, *A. nordmanniana* subsp.

bornmuelleriana and *Picea pungens* in Ankara (Çanakçioğlu, 1977; Ülgentürk and Toros, 1996).

***Dynaspidiotus abietis* (Schrank, 1776):** Recorded on *Abies* sp., *A. nordmanniana* subsp. *bornmuelleriana*, *A. nordmanniana* subsp. *equi-trojani*, *Cedrus libani*, *Picea* sp., *Pinus* sp., *P. brutia* and *P. nigra* in Bolu, Çanakkale, Isparta, Çankırı and Bursa (Bodenheimer, 1949, 1952; Defne, 1954; Selmi, 1979; Ülgentürk and Toros, 1996; Japoshvili and Karaca, 2002).

***Lepidosaphes juniperi* (Lindinger, 1912):** Recorded on *Cedrus libani*, *Juniperus* sp., *J. excelsa*, *Pinus brutia*, *P. nigra*, *Platycladus orientalis* and *Thuja occidentalis* in İzmir, Balıkesir, Eskişehir, Konya and Amasya (Lindinger, 1912; Bodenheimer, 1949, 1953; Aysu, 1950; Selmi, 1979).

***Lepidosaphes newsteadi* (Sulc, 1895):** Recorded on *Abies nordmanniana* subsp. *bornmuelleriana*, *A. pinsapo*, *Picea pungens*, *Pinus* sp. and *P. nigra* in İstanbul, Konya, Çankırı and Isparta (Bodenheimer, 1949, 1953; Selmi, 1979).

***Lepidosaphes ulmi* Linnaeus, 1758:** Recorded on *Cupressus* sp. (Bodenheimer, 1953).

***Leucaspis knemion* Hoke, 1925:** Recorded on *Pinus* sp. in Gaziantep (Uygun *et al.*, 1998).

***Leucaspis lowi* Colvee, 1882:** Recorded on *Pinus* sp., *P. brutia*, *P. halepensis*, *P. nigra*, *P. pinea* and *P. sylvestris* in İstanbul, Bursa, İzmir, Manisa, Antalya, Eskişehir, Bolu, Kastamonu, Çankırı, Niğde, Trabzon, Ankara, Burdur, Isparta and Samsun (Lindinger, 1912; Özek and Hovasse, 1931; Acatay, 1943; Schimitschek, 1944; Bodenheimer, 1949, 1953; Tuatay *et al.*, 1972; Yaşar, 1995).

***Leucaspis pini* (Hartig, 1839):** Recorded on *Pinus* sp., *P. brutia*, *P. halepensis*, *P. nigra* and *P. pinea* in İzmir, Aydın, İstanbul, Antalya, Adana and Hatay (Lindinger, 1906, 1912; Fahringer, 1922; Bodenheimer, 1949, 1953; Aysu, 1950; Nizamloğlu and Gökmen, 1964; Gül-Zümreoğlu, 1972; Tosun, 1975; Yaşar, 1995; Uygun *et al.*, 1998; Karsavuran *et al.*, 2001).

***Leucaspis pusilla* Loew, 1883:** Recorded on *Pinus* sp., *P. brutia*, *P. elderica*, *P. halepensis*, *P. nigra*, *P. pinaster*, *P. pinea*, *P. ponderosa*, *P. radiata*, *P. roxburghii*, *P. strobus* and *P. sylvestris* in İstanbul, Edirne, Kocaeli,

Sakarya, Bursa, Balıkesir, Çanakkale, Manisa, İzmir, Isparta, Antalya, Adana, Aydın, Ankara, Zonguldak, Karabük, Kahramanmaraş, Konya and Samsun (Lindinger, 1906; 1909; Bodenheimer, 1949, 1953; Aysu, 1950; Gül-Zümreoğlu, 1972; Tuatay *et al.*, 1972; Çanakçioğlu, 1977; Selmi, 1979; Çanakçioğlu *et al.*, 1982; Yaşar, 1995; Şengonca *et al.*, 1998; Uygun *et al.*, 1998).

***Lineaspis striata* (Newstead, 1897):** Recorded on *Arceuthobium* sp., *Cupressus* sp., *C. sempervirens*, *Thuja* sp. and *T. occidentalis* in Antalya, Adana, İçel, Hatay and Gaziantep (Lindinger, 1912; Bodenheimer, 1949, 1953; Balachovsky, 1954; Çanakçioğlu, 1977; Yaşar, 1995; Erler *et al.*, 1996; Şengonca *et al.*, 1998; Uygun *et al.*, 1998; Erler and Tunç, 2001).

***Parlatoria oleae* (Colvee, 1880):** Recorded on *Juniperus* sp. and *Pinus* sp. in İzmir and Aydın (Gül-Zümreoğlu, 1972; Karsavuran *et al.*, 2001).

***Parlatoria parlatoriae* (Sulc, 1895):** Recorded on *Abies nordmanniana* subsp. *bornmuelleriana* in Bursa, Bolu and Çankırı (Bodenheimer, 1941, 1949, 1953).

DISCUSSION

Ülgentürk *et al.* (2004) reported that 25 coccid species have been recorded on coniferous species in Turkey. The number of scale insect species recorded has reached 31 on coniferous trees in Turkey, recently.

Acanthomytilus cedricola Balach. and Al., *Aspidiotus nerii* Bch., *Carulaspis minima* (Targ.), *Coccus hesperidum* L., *Eriococcus araucariae* Mask., *Lepidosaphes newsteadi* (Sulc), *Leucaspis lowi* Colv., *Leucaspis pusilla* Lw., *Marchalina hellenica* (Genn.), *Parthenolecanium pomoranicum* (Kaw.), *Physokermes piceae* (Schr.), *Pseudococcus viburni* (Sign.) and *Pulvinaria floccifera* (Westw.) were recorded in the European part of Turkey. The other scale insect species were only recorded in the Asian part of Turkey.

Pseudococcus viburni (Sign.) (Selmi, 1979), *Coccus hesperidum* L. (Çanakçioğlu, 1977; Çanakçioğlu *et al.*, 1982; Selmi, 1979), *C. pseudomagnoliarum* (Kuw.) (Çanakçioğlu, 1977), *Pulvinaria floccifera* (Westw.) (Selmi, 1979), *Eriococcus araucariae* Mask. (Gül-Zümreoğlu, 1972), *Aonidia mediterranea* (Lind.) (Erler *et al.*, 1996), *Aspidiotus nerii* Bch. (Çanakçioğlu, 1977; Selmi, 1979; Tuatay *et al.*, 1972), *Chrysomphalus dictyospermi* (Morg.) (Selmi, 1979), *Lepidosaphes ulmi* (L.) (Bodenheimer, 1953) and *Parlatoria oleae* (Colv.) (Gül-Zümreoğlu, 1972; Karsavuran *et al.*, 2001) cause damage on deciduous trees besides conifers.

From the zoogeographical standpoint, native species are *Acanthomytilus cedricola* Balach. and Al., *Nemolecanium aptii* (Bod.), *Pseudococcus caricus* (Genn.), cosmopolitan species are *Aspidiotus nerii* Bch., *Carulaspis juniperi* (Bch.), *Carulaspis minima* (Targ.), *Chrysomphalus dictyospermi* (Morg.), *Coccus hesperidum* L., *Coccus pseudomagnoliarum* (Kuw.), *Eriococcus araucariae* Mask., *Lepidosaphes ulmi* (L.), *Parlatoria oleae* (Colv.), *Pseudococcus viburni* (Sign.), *Pulvinaria floccifera* (Westw.) and the rest are palaeartic species.

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