

## Scale insects on oak trees (*Quercus* spp) in Bulgaria and Greece

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**Abstract:** In a comparative study of honeydew producing insects on oak trees, an extensive sampling was done in Bulgaria and Greece, mainly from regions with beekeeping interest. Nine species of scale insect associated with the genus *Quercus* spp. have been collected as a result of the survey in Bulgaria. They belong to five families, the most numerous of which are the Coccidae (three species), Diaspididae (two species), Kermesidae (two species), Eriococcidae (one species), Asterolecaniidae (one species). Representatives from four families have been determined during the survey in Greece. Diaspididae (four species), Coccidae (two species), Asterolecaniidae (one species) and Eriococcidae (one species). Among them *Diaspidiotus wuenni* (Lindinger) (Diaspididae) is the first record for Greece and *Asterodiaspis repugnans* (Russell) (Asterolecaniidae) is new to Bulgaria. The sampling was done between April and October in 2005 and 2006. A list of scale insect species, including the place, date of sampling, development stage, first report in Bulgaria and Greece, host plant, distribution and some phenological data are given.

**Key words:** scale insects, oak tree, faunal survey.

### Introduction

The first list of scale insects in Bulgaria was given by Tschorbadjiew in 1938. He reported 23 species on different host plants. Species associated with oaks were *Parthenolecanium rufulum* (Cockerell) (Coccidae), and *Quadrispidiotus ostreaeformis* (Curtis) and *Lepidosaphes ulmi* (Linnaeus) (Diaspididae). Since then, thirteen more species of scale insects have been reported in Bulgaria on oaks. The first list of scale insects in Greece was given by Bodenheimer in 1928. He reported 25 species on different host plants, of which only four were found on oak trees, one Coccidae, *Eulecanium tiliae* (Linnaeus), and three Diaspididae, *Aspidiotus nerii* (Bouché), *Chrysomphalus dictyospermi* (Morgan) and *Diaspidiotus zonatus* (Frauenfeld). Since then twenty-one more species of scale insects have been reported in Greece on oak trees.

According to Kozár and Kosztarab (1988), 17 species of scales are associated with oaks in Central Europe. In total, sixteen species are known from *Quercus* spp. in Bulgaria and twenty five species from Greece. The honeydew producing scale insect species in Bulgaria belong to 4 families, most numerous of which are the Coccidae (five species), Kermesidae (four species), Eriococcidae (one species) and Pseudococcidae (one species). In Greece, only six species are honeydew producing insects. Approximately 70% of the annual honey production in Greece is derived from honeydew. There are a lot of data concerning the phenology of the honeydew producing scale insects on pine and fir trees, but nothing about the scale insect species which parasitize oak trees, except one record by Santas (1983) of *Kermes quercus* (Kermesidae). In Bulgaria, only a few studies have been conducted with scale insects on oak trees (Tschorbadjiew, 1938; Tzalev, 1964, 1968; Kozár *et al.*, 1979).

The aim of this study is to obtain information on the distribution and species composition of honeydew producing scale insects on oak trees, mainly in regions of beekeeping interest in Bulgaria and Greece.

## Materials and methods

The coccoid samples were collected between April and October in 2005 and 2006 in Bulgaria and Greece at the following sampling sites:

**Bulgaria:** the Rhodopes mountains (Panichkovo), Strandja mountains (Izgreve, Fazanovo, Velika), Stara planina mountains (Preslav, Popovo), Pirin mountains (Predela, Melnik), and Vitosha mountain.

**Greece:** Rodopi mountains (county of Drama, Paranesti), Kerkini mountain (county of Serres, Nevrokopi), Paiko mountain (county of Pella), Edessa (county of Edessa), Grevena (central Pindos mountains, county of Grevena), "Plastira" lake (county of Karditsa), Pilio, Maurovouni mountain (county of Bolos), Agrinio, south Pindos mountains (county of Etolias & Akarnanias), Foloji forest (county of Hleia, central Peloponnesus).

To study the scale insects, leaves and bark samples were collected and examined under a dissecting microscope. The observations were recorded with a digital camera. The species were collected into small vials in ethyl alcohol and glycerin.

## Results

In Bulgaria, nine species of scale insect associated with the genus *Quercus* have been collected as a result of the survey, belonging to five families, the most numerous of which are the Coccidae (three species), Diaspididae (two species), Kermesidae (two species), Eriococcidae (one species) and Asterolecaniidae (one species). In Greece, representatives from four families have been collected during the survey: Diaspididae (four species), Coccidae (two species), Asterolecaniidae (one species) and Eriococcidae (one species). Of these, *Diaspidiotus wuenni* (Lindinger) (Diaspididae) is a first record for Greece and *Asterodiaspis repugnans* (Russell) (Asterolecaniidae) is a species new to Bulgaria.

## BULGARIA

### Family Coccidae:

*Eulecanium tiliae* Linnaeus, 1758

Material examined: Panichkovo on branches of *Quercus* sp., 18/VI/2005, ovipositing females, eggs, Izgreve on branches of *Quercus polycarpa*, 3/VII/2005, ovipositing females, eggs, crawlers.

The species was reported by Tschorbadjiew (1938) as *Eulecanium coryli* on *Rosa* sp. and Tzalev (1968) on *Tilia cordata* and *Aesculus hippocastanum* around Sofia, Varna and Ruse.

*Eulecanium ciliatum* Douglas, 1891

Material examined: Sofia (Vitosha) on branches of *Quercus* sp., 1/IX/2005, post-reproductive females, second-instar nymphs on underside of leaves.

The species was reported by Tzalev (1968) on *Quercus* sp. around Sofia.

*Parthenolecanium rufulum* Cockerell, 1903

Material examined: Panichkovo on branches of *Quercus* sp., 18/VI/2005, ovipositing females, eggs, Velika, Izgreve, Fazanovo on branches of *Quercus polycarpa* and *Quercus frainetto*, 3/VII/2005, postreproductive females, eggs, crawlers, first-instar nymphs on underside of leaves, Dolno Osenovo on branches of *Quercus pubescens*, 27/VII/2005, postreproductive females, first-instar nymphs on underside of leaves, Velika on branches of *Quercus* sp., 12/VIII/2005, postreproductive females, first-instar nymphs on underside of leaves, Popovo, Preslav on branches of *Quercus* sp., 25/VIII/2005, postreproductive females, first-instar nymphs on underside of leaves, Sofia (Vitosha) on branches of

*Quercus* sp., 8/IX/2005, postreproductive females, first- and second-instar nymphs on underside of leaves, Velika on branches of *Quercus polycarpa*, 23/III/2006, overwintering second stage, Melnik on branches of *Quercus pubescens*, 29/V/2006, young females, ovipositing females.

This species was reported by Tschorbadjiew in 1938 as *Eulecanium pulchrum* on *Quercus pedunculata* around Karlovo and by Tzalev (1968) on *Quercus* sp., *Castanea vesca*, *Corylus avellana* and *Ulmus* sp. It is very common on *Quercus* sp. in Bulgaria. The species has one generation a year and hibernates as a second instar on woody parts of the tree.

#### Family Kermesidae:

*Kermes roboris* Fourcroy, 1785

Material examined: Velika on branches of *Quercus* sp., 12/VIII/2005, postreproductive female, Fazanovo on branches of *Quercus polycarpa*, 13/V/2006, young females, Melnik on branches of *Quercus* sp., 29/V/ 2006, young females.

The species was reported by Tzalev (1964) on *Quercus* sp. around Sofia. It is rare on *Quercus* sp. in Bulgaria.

*Kermes gibbosus* Signoret, 1875

Material examined: Predela on branches of *Quercus* sp., 27/VII/2005, postreproductive females.

The species was reported by Tzalev (1964) on *Quercus* sp. in Sofia and Klisura.

*Kermes gibbosus* has been collected only from *Quercus cerris* as a host plant (Hoy, 1963; Kosztarab & Kozar, 1988).

#### Family Diaspididae:

*Targionia vitis* Signoret, 1876

Material examined: Velika on branches of *Quercus* sp., 15/V/2006, adult.

The species was reported by Tzalev (1968) on *Quercus pedunculata* and *Quercus* sp. in Varna, Burgas, Kazanluk, Klisura.

*Lepidosaphes ulmi* Linnaeus, 1758

Material examined: Velika on branches of *Quercus pubescens*, 15/V/2006, adult.

This species was reported for the first time by Tschorbadjiew in 1938.

#### Family Asterolecaniidae:

*Asterodiaspis repugnans* Russel, 1941

Material examined: Velika on branches of *Quercus* sp., 15/V/2006, adult.

This is the first reference of the occurrence of this species in Bulgaria.

Family Eriococcidae:

*Eriococcus* sp.

Material examined: Melnik on branches of *Quercus pubescens*, 29/V/ 2006, young females, ovipositing females, crawlers, males.

### GREECE

#### Family Asterolecaniidae:

*Asterodiaspis repugnans* Russel, 1941

Material examined: Foloi forest on branches *Q. frainetto*, 29/ VII /2006, ovipositing female, eggs and crawlers, Paranesti on branches of *Q. frainetto*, 24/VII/2006, ovipositing female, eggs and crawlers, Edessa on branches of *Q. frainetto*, 24/VII/2006, ovipositing female, eggs.

The species was reported for the first time by Russel (1941).

### Family Diaspididae:

*Diaspidiotus wuenni* Lindinger, 1911

Material examined: Foloji forest on branches of *Q. frainetto*, 16/VII/2006, adult, Paranesti on branches of *Q. frainetto*, 24/VII/2006, adult, Paiko on branches of *Q. petraea* (syn. *Q. sessiliflora*), 14/VIII/2006, adult.

This is the first reference of the occurrence of this species in Greece.

*Diaspidiotus zonatus* Frauenfeld, 1868

Material examined: Foloji forest on branches of *Q. frainetto*, 16/VI/2006, adult, Paranesti on branches of *Q. frainetto*, 24/VII/2006, adult.

The species was reported for the first time by Bodenheimer (1928).

*Targionia vitis* Signoret, 1876

Material examined: Paiko mountain forest on branches of *Q. petraea* (syn. *Q. sessiliflora*), 14/VIII/2006, adult, Edessa on branches of *Q. frainetto*, 24/VII/2006, adult.

The species was reported for the first time by Koroneos (1934).

*Diaspidiotus lenticularis* Lindinger, 1912

Material examined: Edessa on branches of *Q. frainetto*, 24/VII/2006, adult.

The species was reported for the first time by Koroneos (1934).

### Family Coccidae:

*Parthenolecanium rufulum* Cockerell, 1903

Material examined: Kerkini mountain, Nevrokopi on branches of *Q. frainetto*, 24/VII/2006, first-instar nymphs, Paiko mountain forest on branches of *Q. petraea* (syn. *Q. sessiliflora*), 14/VIII/2006, second-instar nymphs, Edessa on branches of *Q. frainetto*, 24/VII/2006, first-instar nymphs, Grevena, central Pindos mountains on branches of *Q. cerris*, 10/X/2005, second-instar nymphs, Pilio, Maurovouni mountain on branches of *Q. frainetto*, 16/VI/2006, first-instar nymphs, Foloji forest on branches of *Q. frainetto*, 16/VI/2006, first-instar nymphs.

The presence of this species was reported for the first time by Kozár (1991), but only for Crete. There are references for the main land.

*Eulecanium tiliae* Linnaeus, 1758

Material examined: Foloji forest on branches of *Q. frainetto*, 16/VI/2006, adult.

The species was reported for the first time by Bodenheimer (1928) and then by Argyriou (1983).

### Family Eriococcidae:

*Eriococcus* sp.

Material examined: Paiko mountain forest on branches of *Q. petraea* (syn. *Q. sessiliflora*), 14/VII/2006, crawlers, Foloji forest on branches of *Q. frainetto*, 16/VI/2006, crawlers, Grevena, central Pindos mountains, on branches of *Q. cerris*, 10/X/2005, second instar nymphs.

### Conclusion

Eight species of scale insects were collected as a result of this study in Greece and nine in Bulgaria. *Parthenolecanium rufulum*, *Eulecanium tiliae*, *Targionia vitis* and *Asterodiaspis repugnans* were found both in Bulgaria and Greece.

The dominant honeydew producing scale insect on oak tree in Bulgaria and Greece in regions of beekeeping interest is *Parthenolecanium rufulum*. It was observed in all sampling sites in Bulgaria and in most places with oak forests in Greece.

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