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Biology, natural enemies and the distribution of *Physokermes hellenicus* Kozàr & Gounari (Hemiptera: Coccidae) in Turkey

ABSTRACT

Physokermes hellenicus Kozár & Gounari (Hemiptera: Coccomorpha) is a new record for Turkish scale insect fauna. Studies on its biological cycle and natural enemies were made on *Abies nordmanniana* (Steven) (Pinaceae) in Ankara during 2014-2015. It was found that *P. hellenicus* hibernate as the third instar and has one generation in Ankara. The following natural enemies were found associated with *P. hellenicus*: *Anthribus nebulosus* Forster (Coleoptera: Antribidae), *Chilocorus renipustulatus* (Scriba) (Coleoptera: Coccinellidae), *Atroctotomus* spp. (Hemiptera: Anthocoridae) and the parasitoid *Aphycoides clavellatus* (Dalman) (Hymenoptera: Aphelinidae). Among the natural enemies, *A. clavellatus* was the main cause of mortality of *P. hellenicus* populations in Ankara. The scale insect was determined on *Abies cilicica* (Antoine & Kotschy) Carrière in Kahramanmaraş, Konya and on *A. nordmanniana* in Bolu, Eskişehir and Ankara, Turkey.

Key words: *Abies cilicica*, *Abies nordmanniana*, *Anthribus nebulosus, Chilocorus renipustulatus, Aphycoides clavellatus.*

INTRODUCTION

Physokermes (Targioni Tozzetti) is a unique genus of soft scale insect that absence of anal plates adult female. This genus was included in the Coccidae family in the past, mainly on the strength of presence of anal plates in immature stages (Hodgson, 1994). *Physokermes* species are found only on coniferous plants where they are sometimes important as pests but are also economically important as a honeydew source for honey production in some areas of the Mediterranean (Schmutterer, 1965; Gill, 1988; Kunkel, 1997; Kozár *et al.*, 2013). This genus currently contains 12 species, of which eight occur in the Palearctic region (Gill, 1988; Kozár & Ben-Dov, 1997; Kozár *et al.* 2013; Garcia *et al.* 2016). *P. hemicryphus* (Dalman) and *P. piceae* (Schrank) are widely distributed in Europe whereas *P. inopinatus* Danzig & Kozár is found in limited areas (Kosztarab & Kozár, 1988; Stathas & Kozár, 2010; Pellizzari *et al.*, 2015). Recently *Physokermes hellenicus* Kozar & Gounari was described on *Abies cephalonica* (Pinaceae) in

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Greece (Kozár *et al.* 2013). Hitherto, only *P. piceae* has been known in Turkey (Kaydan *et al.*, 2013). It is mainly a spruce pest found on urban spruces such as *Picea pungens* Engelm, *P. abies* (L.) H. Karst. (as *P. excelsa*), *P. orientalis* (L.) in Ankara, Eskişehir and Istanbul (Çanakçıoğlu 1977; Ülgentürk & Toros, 2000; Turguter & Ülgentürk 2006; Ülgentürk *et al.* 2008). *P. hellenicus* is a new record for Turkish fauna and the aim of the present study is to give information on its biology, hosts, natural enemies and distribution in Turkey.

MATERIAL AND METHODS

Biological observations are carried out in the campus of the Faculty of Sciences, University of Ankara, during 2014-2015. Samples are collected from the 8-100 cm branches of *A. nordmanniana* trees, weekly in April-October and once during the other months. The egg numbers are checked in laboratory. Biological stages of *P. hellenicus* are slide mounted using the methodology of Kosztarab & Kozár (1988) and identified according to Kozár *et al.* (2013). To obtain parasitoids, branches with *P. hellenicus* are put into jars covered by fine mesh material and placed into climatic room. The emerging adult parasitoids are transferred into vials containing 70% ethyl alcohol. Immature predators are put with their host into jars covered by fine mesh material and given fresh material if necessary, until the adulthood. Samples of parasitoid, predators and slides of *P. hellenicus* are deposited in Ankara University, Agriculture Faculty, Plant Protection Department, Ankara, Turkey. For the distribution and host plant of soft scale, surveys are conducted irregularly in different cities and forests of Turkey.

RESULTS AND DISCUSSION

P. hellenicus is overwintered in third stage female in Ankara. First adult females were found in the middle of April (15. iv. 2014). The derm of young female is membranous, creaming to pinkish in color. During maturation, female body enlarged and body part that out of plant nodes sclerotized and turned brown in color, remained body parts into nodes of fir is membranous (fig. 1. e). Eggs are stored in cavity of female body, oval in shape, pinkish in color (fig. 1. d). Numbers of eggs were 41-273. First crawlers (fig. 1. f) were seen first week of July in 2014, but they were emerged last week of May in 2015. First instar nymphs are settled and remained on fir needles till November. Second stages female nymphs are found very few in numbers in Ankara (29. x. 2014; 11. xi. 2015). All immature stages are pinkish in color, before overwintering they are covered a translucent and very thin cover. Any male is detected in sampling localities. Third stages female nymphs are migrated to overwinter under nodes of current year's growth or old year's. It has

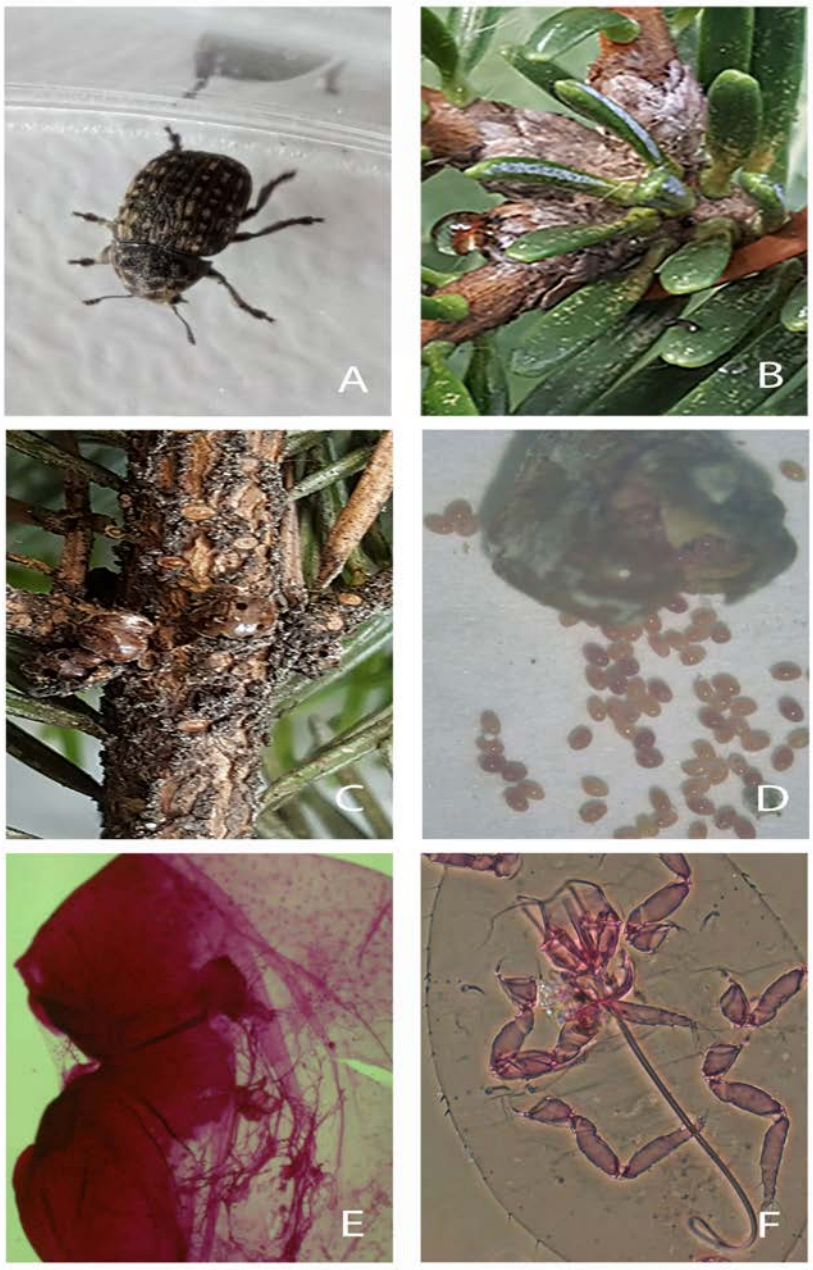

Fig. 1 - Predator *Anthribus nebulosus* Forster (a), honeydew (b), parasited female (c), eggs (d), mature female (e) and first instar nymph (f) of *Physokermes hellenicus* Kozar & Gounari).

one generation in Ankara. Kozár *et al.* (2013) reported that the male nymphs remain on the needles for the rest of their development but the second-instar female nymphs disperse to the nodes of the current year's growth where they settle and start feeding. The honeydew drops are seen in the middle of April and continued during growth season of adult female (fig. 1. b).

Natural enemies of *Physokermes hellenicus*

P. hellenicus is associated with *Anthribus nebulosus* Forster (Coleoptera: Antribidae) (fig. 1. a), *Chilocorus renipustulatus* (Scriba) (Coleoptera: Coccinellidae), *Atroctotomus* spp. (Hemiptera: Anthocoridae). *A. nebulosus* is recorded for the first time in Turkey. Predators of *P. hellenicus* are few in numbers. Four adult *A. nebulosus* and two larvae feeding eggs in body cavity of *P. hellenicus* are found in Ankara. *Anthribus nebulosus* was associated with 14 soft scale insects and controlled over 50 % population of *P. piceae* and *P. inopinata* (Kosztarab & Kozár, 1983). It was the most effective predator of *P. piceae* in Serbia and reducing populations by 68-80% (Graora *et al.*, 2012). On the other hand, the parasitoid *Aphycoides clavallatus* (Dalman) (Hymenoptera: Aphelinidae) is the main cause of mortality of *P. hellenicus* populations in Ankara (fig. 1. c). This parasitoid was recorded on *P. hemicryphus* (Dalman), *P. inopinatus* and *P. piceae* in Central Europe and Turkey (Schmutterer, 1965; Kosztarab & Kozár 1988; Ülgentürk, 2001)

Distribution and host plants of *P. hellenicus*

This soft scale insect is found in Ankara (Ankara/centrum, *A. nordmanniana*, 6 ♀♀, 15. iv. 2014; Ankara/ Çubuk, *A. nordmanniana*, 4 N_1, 1♀ 18. ix. 2014; Ankara/Kızılcahamam, *A. nordmanniana*, 3 N_2, 21 N_3 11. x. 2015; Bolu/centrum, *A. nordmanniana*, 3 ♀♀ 12. v. 2014; Eskişehir/ centrum, *A. nordmanniana*, 1 N_1, 3 N_3, 25. xi. 2013; 8♀♀, 12. iv. 2014; Kahramanmaraş (Başkonuş Yaylası), *Abies cilicica* (Antoine & Kotschy) Carrière, 5 N1, 4 ♀♀, 30. vi. 2013; Konya (Seydişehir, Tınaztepe), *Abies cilicica,* 5 ♀♀). *P. hellenicus* was determined only on *A. cephalonica* in Greece (Kozár *et al.*, 2013). In Turkey, it is found natural fir forest (*A. cilicica*) on The Taurus Mountains, and in parks (*A. nordmanniana*) in urban environments. It is supposed that this scale is common in natural fir forest in Turkey that is given here.

In conclusion *P. hellenicus* is feed on *A. cilicica* and *A. nordmanniana* in Turkey. It has one generation in a year and overwinters as third nymph stage. All predators and parasitoid are recorded first time for *P. hellenica*. As a source of honeydew honey it should be researched.

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