

Orijinal araştırma (Original article)

Honeydew producing insect species in forest areas in Western Turkey^{1,2}

Türkiye'nin batı kısmındaki ormanlarda ballımadde salgılayan türler

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Summary

Marchalina hellenica Gennadius (Hemiptera: Marchalinidae) is a renowned and significant species of scale insect in Turkey due to its production of honeydew in large quantities which is collected by honeybees and used pine honey production. The aim of this study was to survey alternative honeydew sources in forest and neighboring areas of the Aegean, Marmara and Mediterranean regions between the years 2009 and 2011. It was found that there are several species of scale insects and aphids on pine, cedar, olive, oaks, various shrubs and herbaceous plants. Among them, *Lecanodiaspis sardoa* Targioni Tozzetti (Lecanodiaspididae), *Puto israelensis* Ben-Dov (Putoidae) and *Cinara cedri* Mimeur (Aphididae) were found as alternative honeydew producers, all of which produce large amount of honeydew depending on their population size. The use of honeydew from these insects is discussed.

Key words: Honeydew, forest honey, scale insects, aphids, Turkey

Özet

Türkiye'de *Marchalina hellenica* Gennadius (Hemiptera: Marchalinidae), ballı maddesi balarılar tarafından toplanarak çambalı üretiminde yararlanılması nedeniyle iyi tanınan önemli bir türdür. Bu çalışmada 2009-2011 yılları arasında Akdeniz, Ege ve Marmara Bölge'leri ormanları ve çevresinde bulunan diğer ballı madde salgılayan türlerin tespit edilmesi amaçlanmıştır. Bu alanlardaki çam, sedir, zeytin, meşe, çalılar ve otsu bitkiler üzerinde bulunan yaprakbitleri ve coccoidler araştırılmıştır. Bunlardan *Lecanodiaspis sardoa* Targioni Tozzetti (Lecanodiaspididae), *Puto israelensis* Ben-Dov (Putoidae) ve *Cinara cedri* Mimeur (Aphididae) bal salgılayan diğer türler olarak dikkat çekmiştir. Bu türlerin salgı miktarı türe, popülasyon yoğunluğuna, konukçu bitki kalitesine ve iklim koşullarına bağlı olarak değiştiği gözlenmiş, alternatif bal kaynağı olarak kullanımları tartışılmıştır.

Anahtar sözcükler: Ballı madde, çambalı, koşnil, afit, Türkiye

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Introduction

Honey is classified according its botanical sources as flower honey and honeydew honey. Flower honey is obtained from nectars of the flowering plants whereas honeydew honey is produced from honeydew of floem-feeders that honeybees gather. Honeydew is a sugar excretion released out the anus of insects such as aphids, whiteflies, mealybugs, soft scale insect etc. (Hemiptera) with its high from carbohydrates, amino acids, water and low levels of nitrogen compounds contents derived from the plant phloem (Malumphy, 1997). The droplets of honeydew are collected by honeybees and used to make honeydew honey. This is very valuable in certain parts of the world and honey lovers like it for its strong flavor and healthful properties. Thus honeydew honey contains larger amounts of oligosaccharides (about 5%) than nectar honey as well as it has stronger antioxidant potential than other forms of honey (Otilia et al., 2008; Dinkov, 2013). It is especially well-known in European countries like Germany, Switzerland, Austria, Slovenia, Italy, Greece, and Turkey as well as in New Zealand for beech where it generally commands a higher price (Gürkan, 1988; Santas, 1983; Morales et al., 1988; Kunkel, 1997; Rybak-Chmielewska et al., 2013). Honeydew honey of *Xylococcus macrocarpae* (Coleman) (Xylococcidae) in USA, *Ultracoelostoma assimile* (Maskell) (Coelostomidiidae) in New Zealand; *Physokermes hemicryphus* (Dalman) (Coccidae) in Austria are recognized and have economical importance as a food source (Schmutterer, 1953, 1956; Pechhacker, 1977; Gürkan, 1988; Morales et al., 1988; Kunkel, 1997). In northern Italy and some other countries, the citrus flatid plant hopper (*Metcalfa pruinosa* (Say) (Hemiptera: Flattidae)) was an important new honeydew producer (Barbattini et al., 2001).

In Turkey and Greece, the honeydew of *Marchalina hellenica* Gennadius (Marchalinidae) is an important honeydew producer and its honeydew is collected by honeybees for production of pine honey (Bodenheimer, 1953; Gürkan, 1988; Gounari, 2006). Both countries are the leading producers of pine-honey in the world with 90% of it arise from Turkey. In Greece, nearly 60% of the annual honey production is pine honey (Santas, 1983; Kunkel, 1997; Gounari, 2006). In Turkey, mostly in and around the province of Muğla, approximately ten thousand (domestic and wandering) beekeepers live in the fields of pine honey production where *M. hellenica* is the most common and abundant species. According data of the year 1991-2011, beekeepers with 984.000 beehives were constructed and the yield of pine honey were 7970–15000 tones pear year in Muğla (Firatlı et al., 2005; Anonymous, 2013). In general, pine honey is exported to EU countries with revenue of about \$ 9-12 million. Due of its impact on the economy as well as on employment, beekeeping is an important sector in Turkey, especially in Muğla region. The decline in the yield of pine honey has been parallel with the reduction in densities of *M. hellenica* over the years due to environmental conditions such as predators, parasitoids, humidity, temperature etc. (Ülgentürk et al., 2012c; Ülgentürk et al., 2013a). Beekeepers get harmed because of low yield of pine honey production. Beekeepers need others honeydew sources for honey production.

The aim of this survey is to aid beekeepers gain information about other honeydew producing insects on the different plants in forests and neighboring areas in Western Turkey.

Material and methods

The surveys were carried out in pine forests and neighbor areas in the Aegean, Marmara and Mediterranean Regions of Turkey between the years 2009 and 2011. Samples were examined visually and each honeydew producing insects were collected and processed in 70% alcohol. Scale insects were slide mounted according to Kosztarab & Kozár, (1988) and aphids were mounted according to Hille Ris Lambers (1950). The identification according to the keys by Balachowsky (1953), Bodenheimer (1953), Blackman & Eastop, (2000), Stroyan (1984), Ben-Dov (1985) and Kosztarab & Kozár, (1988) were employed.

Dry and mounted specimens are stored in the Plant Protection Department, Ankara University, Agricultural Faculty, Dışkapı, Ankara, Turkey.

Results

A total of 35 honeydew producing species of Hemiptera were identified in forests and neighboring areas in the western part of Turkey. They belong to the superfamilies of Aphidoidea (10 species) and Coccoidea (24 species). The amount of honeydew produced by these insects varies according to the times of the year and mainly depends on the species of insect, the age of species, the population size, the host plant and the climatic conditions. The honeydew producing species were grouped according to the host plants such as coniferous trees, deciduous trees, evergreen shrubs and herbaceous plants (Table 1, 2, 3).

Twelve honeydew producer species has been recorded on coniferous trees in Turkey up to now (Table 1).

Table 1. Honey producing insects of conifers in the Aegean, Marmara and Mediterranean Regions

Aphidoidea
<i>Cinara cedri</i> Mimeur,
ADANA, Balcalı, 40 m, 2.VII.2011, <i>C. libani</i> , 4 ♀♀; AFYON, Merkez, 23.V.2008, <i>Cedrus libani</i> , 3 ♀♀; ANTALYA, Akseki, Zirvetepe, 1646 m, 23.XI.2010, <i>C. libani</i> , 5 ♀♀; Akseki, 1078 m, 23.v.2011, 1 ♀, <i>C. libani</i> ; Elmalı, Avlan Gölü, 1290 m, 12.V.2010, <i>C. libani</i> , 8 ♀♀; Elmalı, Işıkbeli Şahardıç, 1130 m, 12.V.2010, <i>C. libani</i> , 2 ♀♀; Kaş, Kıbrısçayı, 1123 m, 12.V.2010, 3 ♀♀ <i>C. libani</i> ; Center, 35 m, 12.V.2010, 5 ♀♀, <i>C. libani</i> ; İbradı, 1000 m, 23.XI.2010, 5 ♀♀, <i>C. libani</i> ; BURDUR, Center, 888 m, 14.VIII.2009, <i>C. libani</i> , 6 ♀♀; Bucak, Karlıktepe, 1262 m, 11.V.2010, 7 ♀♀, <i>C. libani</i> ; Center, 21m, <i>Pinus brutia</i> , 8 ♀♀, 22.X.2010; ISPARTA, Kovada, 4 ♀♀, 23.IV.2010 <i>P. brutia</i> ; Eğirdir, 706 m, 14.V. 2010, <i>C. libani</i> , 3 ♀♀; Şarkikaraağaç, Kızıldağ National Park, 1387m, 14.V.2010, <i>C. libani</i> 5 ♀♀; BALIKESİR, Edremit, 18 m, 16.VI.2009, <i>C. libani</i> , 3 ♀♀; BURSA, İznik, 90 m, 17.XI.2008, <i>C. libani</i> , 5♀♀; ÇANAKKALE, 10 m, 16.VI.2010, <i>C. libani</i> , 4 ♀♀; Çan, 453 m, 16.VI.2010, <i>C. libani</i> , 3 ♀♀; MANISA, 100 m, 15.VII.2010, <i>C. libani</i> , 2 ♀♀; KAHRAMANMARAŞ, Tekir, 1300 m, 27.VI.2011, <i>C. libani</i> , 8 ♀♀; KARAMAN, Ermenek, Kazancı, 1582 m, 12.VI.2008, <i>C. libani</i> , 4 ♀♀; MUĞLA, Fethiye- Babadağ, 942 m, 17.IV.2009, 6 ♀♀.
<i>Cinara palaestinensis</i> Hille Ris Lambers
MUĞLA, Akbük, 35 m, 30.X.2010, <i>Pinus brutia</i> , 10 ♀♀; ANTALYA, 17 m, 4.IV.2011, <i>P. brutia</i> , 4 ♀♀.
<i>Cinara pilicornis</i> (Hartig)
ANTALYA, 32 m, 4.IV.2011, <i>P. brutia</i> , 4 ♀♀
<i>Eulachnus rileyi</i> (Williams)
MUĞLA, Hisarönü, 51 m 14.VIII.2010, <i>Pinus brutia</i> , 4 ♀♀; BALIKESİR, Alibeyadası, 8 m, 17.vi.2009, <i>P. brutia</i> , 6 ♀♀.
<i>Schizolachnus pineti</i> (Fabricius)
ÇANAKKALE, 18 m, 17.VII.2010, <i>P. brutia</i> , 8 ♀♀.
Coccoidea
Coccidae
<i>Coccus hesperidum</i> Linnaeus
This species was found on <i>Cedrus libani</i> and <i>Pinus brutia</i> (Ülgentürk et al., 2012 a, b).
<i>Ceroplastes floridensis</i> Comstock
It was recorded on <i>Cedrus libani</i> in Antalya (Ülgentürk et al., 2012 b).
Marchalinidae
<i>Marchalina hellenica</i> Gennadius
ANTALYA, Akseki, 1009 m, 23.V.2011, <i>Cedrus libani</i> , 11 ♀♀; İbradı, 1000 m, 19.VIII.2011, <i>C. libani</i> , 13 nymphs; BURDUR, Gölhisar, 1115 m, 8 ♀♀, 7.VII.2013, <i>Pinus brutia</i> 11 nymphs; Muğla, Urla, 20.IV.2010, <i>C. libani</i> , 12 ♀♀.
Monophlebidae
<i>Palaeococcus fuscipennis</i> Burmeister
KAHRAMANMARAŞ, Başkonuş, 1360 m, 17.VII.2010; <i>Abies cilicica</i> , 8 ♀♀. <i>P. fuscipennis</i> was widespread species in west part pine forest of Turkey (Ülgentürk et al., 2012 a).
Pseudococcidae
<i>Phenacoccus arambourgi</i> Balachowsky
<i>P. arambourgi</i> was recorded on <i>Cedrus libani</i> (Ülgentürk et al., 2012 b).
<i>Phenacoccus yerushalmi</i> Ben-Dov
It was found on pine trees some pine forest areas (Ülgentürk et al., 2012 a).
<i>Planococcus vovae</i> (Nasonov)
MUĞLA, Güllük, <i>Juniperus</i> sp., 12.VIII.2008, 5 ♀♀, 12 m; ISPARTA, Kovada, <i>Juniperus oxycedrus</i> , 16.V.2010, 3 ♀♀; ANTALYA, <i>Juniperus horizontalis</i> , 14.IV.2011, 3 ♀♀, 20 m; Kalkan, <i>Juniperus</i> sp., 21.VI.2010, 5 ♀♀, 478 m, Akseki, <i>J. excelsa</i> , 9.VII.2011, 3 ♀♀, 911 m

Marchalina hellenica is the most significant species for pine honey production in pine forest (Gürkan, 1988; Ülgentürk et al., 2012c). Its population is sufficient and permanent for honeydew collection by honeybees although its population size is variable from year to year. *Cedrus libani* is a new host plant of *M. hellenica* (Fig. 1b). However, it was found on cedar only infested by artificial infection in urban environments (city Centrum of Ibradı, Akseki (Antalya) and Urla (Muğla). The biology of *M. hellenica* on cedar should be studied more deeply. Infested cedar trees could be a better alternative on high altitudes for honeybees that collecting honeydew. Apart from *M. hellenica*, other sap sucking insects (namely *Cinara cedri*, *C. palaestinensis*, *C. pilicornis*, *Eulachnus rileyi*, *Schizolachnus pineti*, *Palaeococcus fuscipennis* and *Phenacoccus yerushalmi* were recorded on pine trees (Table 1). Aphids were on generally pine leaf and branches. They produced among of honeydew early spring and late autumn. Generally *P. fuscipennis* and *P. yerushalmi* populations were not at high levels on pine trees infested by *M. hellenica* (Fig. 1c). Therefore they contribution to honeydew was rather insignificant but *P. fuscipennis* was common in the pine forests of eastern Mediterranean and Marmara regions uninfested areas by *M. hellenica*, and in case of high population, the presence of sooty mould on pine trunks and branches of trees was observed. *Abies cilicica* is a new host plant of this species.

The cedar aphid *Cinara cedri* (Fig. 1a) on *Cedrus libani* is second most important honeydew producer in the Mediterranean region. It excretes large quantities of honeydew in two periods: from April to late June and from September to late October. It could be a useful alternative for pine honey production. According to observations of local beekeepers, honeybees do not choose honeydew of cedar aphid, if the amount of *M. hellenica* honeydew is enough for honey production in the same area.

On the deciduous and evergreen plants 19 honeydew producing species (Table 2) were recorded. Among them only *Puto israelensis* (Putoidae) was discovered to be a large quantities of honeydew producer. *P. israelensis* had reached high population densities and it has been found excretes, on occasions, large amounts of honeydew in certain geographical locations in the months of spring. *P. rufulum* was recorded on oaks mostly in urban environment. *Acanthococcus melnikensis* Hodgson & Trencheva was recorded only *Myrtus communis* and it is a new record for Turkish fauna.

On the herbaceous plants 12 honeydew producing species were collected (Table 3). Of these, only *Lecanodiaspis sardoa* demonstrates to secrete a large amount of honeydew (Fig. 1d).

Table 2. Honeydew producing insects of deciduous and evergreen trees in the Aegean, Marmara and Mediterranean Regions

Aphidoidea
<i>Lachnus roboris</i> (Linnaeus)
ANTALYA, 35 m, 14.IV.2011, <i>Quercus suber</i> , 4♀♀.
Coccoidea
Coccidae
<i>Ceroplastes floridensis</i> Comstock
AYDIN, Söke, 105 m, 16.V.2009, <i>Citrus</i> sp., 3 ♀♀; MUĞLA, Bodrum, 56 m, 12.III. 2008 <i>Citrus</i> sp., 5 ♀♀, Fethiye, 23.III.2009, 20 m, <i>Laurus nobilis</i> , 2 ♀♀; Datça, 2 m, <i>L. nobilis</i> , 21.IV.2009, 11 ♀♀; Boğazköy, 42 m, 12.VII.2008, <i>Arbutus unedo</i> , 13♀♀, Boğazköy, 2 m, 12.VII.2008, <i>Myrtus communis</i> , 5 ♀♀.
<i>Ceroplastes rusci</i> (Linnaeus)
MUĞLA, Marmaris, İnbükü, 3 m, 21.IV.2009, <i>Myrtus communis</i> , 7 ♀♀.
<i>Ceroplastes sinensis</i> Del Guercio
MUĞLA, Boğazköy, 15m, 12.VIII.2010, Undetermined Poaceae, 2 ♀♀; Boğazköy, <i>Nerium oleander</i> , 12.VIII.2010; BURSA, İznik, 102m, 16.VI.2009, <i>Ilex aquifolium</i> , 4 ♀♀.
<i>Filippia follicularis</i> (Targioni Tozzetti)
MUĞLA, Güllük, 7 m, 18.VIII.2008, <i>O. europaea</i> , 7 ♀♀; Milas, Kırıyışlacık, 4 m, 8.VIII.2009, <i>O. europaea</i> , 3 ♀♀; BALIKESİR, Altınoluk, 3 m, 17.VI.2010, <i>O. europaea</i> , 6 ♀♀; BURSA, Gemlik, 36 m, 13.VI.2010, <i>O. europaea</i> , 8 ♀♀; İznik, 91m, 21.X.2008, <i>O. europaea</i> , 3 ♀♀.
<i>Lichtensia viburni</i> Signoret
MUĞLA, Güllük, 20 m, 15.VIII.2009, <i>Phyllirea</i> sp. 6 ♀♀; Aydın, Milet, 6 m, <i>Ceratonia siliqua</i> , 3 ♀♀, 8.viii.2011; AYDIN, Didim (Akbük) 5 m, <i>Olea europaea</i> , 5 ♀♀, Didim, 4 m, 8.VIII.2009, <i>Pistaciae</i> sp., 4 ♀♀.
<i>Parthenolecanium rufulum</i> (Cockerell)
MUĞLA, Fethiye (Kayaköy), <i>Quercus cerris</i> , 14.VIII.2010, 4 ♀♀; Güvercinlik, <i>Q. cerris</i> 17.VII.2008, 3 ♀♀; BALIKESİR, Edincik <i>Quercus</i> sp., 13.IX.2011, 6 ♀♀.
<i>Parthenolecanium persicae</i> (Fabricius)
MUĞLA, Fethiye, 3m, 23.IV.2009, <i>Morus alba</i> , 2 ♀♀.
<i>Saissetia oleae</i> (Olivier)
AYDIN, Milet, 6 m, 8.VIII.2011, <i>Nerium oleander</i> , 3 ♀♀, <i>C. siliqua</i> , 2 ♀♀; BALIKESİR, Erdek, 3 m, 13.IX.2011, <i>O. europaea</i> , 4 ♀♀; BALIKESİR, Marmara Island, 5 m, 22.IX.2011, <i>Hibiscus</i> sp., 6 ♀♀; Bandırma, 7 m, 17.VI.2009, <i>N. oleander</i> , 3 ♀♀; BURSA, İznik, 99 m, 12.xi.2008, <i>O. europea</i> , <i>N. oleander</i> , 8♀♀; MUĞLA, Güvercinlik, 17m, 8.VIII.2009, <i>Arbutus unedo</i> , 3 ♀♀; Boğazköy, 15m, 11.VIII.2010, <i>N. oleander</i> , 2♀♀.
Eriococcidae
<i>Acanthococcus roboris</i> Goux
MUĞLA, Fethiye (Kayaköy), 14.VIII.2010, 149 m, <i>Quercus cerris</i> , 8 ♀♀; BALIKESİR, Edincik, 13.IX.2011, 194m, <i>Quercus</i> sp. 4 ♀♀
<i>Acanthococcus melnikensis</i> Hodgson & Trencheva
MUĞLA, Akbük, 9m, 20.IV.200, <i>Myrtus communis</i> , 5 ♀♀; Boğazköy, 1 m, 11.VIII. 2010, <i>M. communis</i> , 8 ♀♀.
Monophlebidae
<i>Icerya purchasi</i> Maskell
AYDIN, Milet, 6 m, 8.VIII.2011, <i>Nerium oleander</i> , 4 ♀♀; MUĞLA, Güllük, <i>N. oleander</i> , 12.VIII.2009, 3 ♀♀; Güvercinlik, 17 m, 8.VIII.2009, <i>Arbutus unedo</i> , 3 ♀♀; ÇANAKKALE, Bozcaada, <i>N. oleander</i> , 12.VIII.2010, 2 ♀♀; İSTANBUL, Büyükkada, <i>N. oleander</i> , <i>Acacia</i> sp. 23. VII.2011, 5 ♀♀; BALIKESİR, Edincik <i>N. oleander</i> , 14.IX.2011, 2♀♀.
Putoidae
<i>Puto israelensis</i> Ben-Dov
BURDUR, Gölhisar (Kozagaç), 1227 m, 31.VI.2013, <i>Quercus</i> sp., 6 ♀♀.
Pseudococcidae
<i>Phenacoccus madeirensis</i> Green
Antalya, Kalkan, 15 m, <i>Jasminum</i> sp., 6.VII.2010, 5 ♀♀.
<i>Planococcus ficus</i> (Signoret)
ÇANAKKALE, Bozcaada, 6 m, <i>Vitis vinifera</i> , 14.IX.2011, 11 ♀♀; BURSA, Yenice, undetermined plant, 16.IX.2011, 3♀♀.
Kermesidae
<i>Kermes vermilio</i> Planchon
It was recorded on oaks in west part forest of Turkey (Ülgentürk et al., 2013b)
<i>Kermes palestiniensis</i> Balachowsky
It was reported on oaks in west part forest of Turkey (Ülgentürk et al., 2013b)
<i>Kermes greeni</i> Bodenheimer
It was found on oaks in west part forest of Turkey (Ülgentürk et al., 2013b)



Figure 1. *Cinara cedri* (a), *Marchalina hellenica* on *Cedrus libani* (b) on *Pinus brutia* (c) and *Lecanodiaspis sardoa* on *Cistus* sp. (d).

Discussion

Beekeeping plays a central role with the presence of 7.4 million bee colonies and 89162 tons of annual honey production in Turkey (Firatlı et al., 2010; Anonymous, 2013). The pine honey (15.000 tons in a year) has been produced from honeydew of *M. hellenica* and 85% of it has been exported to EU (Firatlı et al., 2005). In spite of knowledge of the circulates over the potential source of honeydew honey from other species, there are very limited data in Turkey. Only, Ermin (1950) reported that honey formed from the honeydew of *Cinara pectinatae* Nördl (Hemiptera: Lachnidae) on *Abies bornmulleriana* plays a significant role in Turkish beekeeping. In this study, honeydew producer such as *C. cedri*, *C. palaestinensis*, *C. pilicornis*, *E. rileyi*, *S. pineti* on conifers and *K. roboris*, *K. greeni*, *K. palestiniensis*, *K. vermilio*, *A. roboris* and *P. rufulum* on oak trees in west part forest of Turkey were determined. Santas (1983) reported *C. cedri*, *C. confidis* (Koch) and *C. palaestinensis* on conifers as useful to apiculture in Greece. Bloc & Montagner (1990) also accounted that honeydew of *C. pectinatae* and *C. pilicornis* were harvested by honeybees. Thirty eight honeydew producers were examined as insect food in Germany (Zoebelein, 1956). This study showed that *Parthenolecanium fletcheri* (Cockerell) (as *Eulecanium arion* Ldgr.), *Physokermes hemicyrphus* (Dalman), *P. piceae* (Schrank) (Hemiptera: Coccidae) were important

sources of honeydew honey. Kunkel (1997) recorded that about 50% of all honey produced in Middle Europe is obtained honeydew. Honeydew of *P. hemicyrphus* is more than half of the honeydew honey, the other main source being 2 or 3 aphids of genera *Cinara* on spruce and fir. Some authors were reported in typical honeydew producing insect; *Aphis pomi* Degeer, *A. fabae* Scop., *Aphis sambuci* L., *Chaetophorella aceris* L., *Hyalopterus pruni* (Geoffroy), *Lachnus roboris* L., *Myzocallis coryli* (Goeze), *Tetraneura ulmi* Frst., *Tuberculatus annulatus* (Hartig), *Kermes quercus* (Linnaeus), *Anapulvinaria pistaciae* (Bodenheimer), *Parthenolecanium rufulum* (Cockerell), *Physokermes hemicyrphus*, *P. piceae*, *Metcalfa pruinosa* (Say), *Pyllaphis fagi* L. in Europe countries (Schmutterer, 1953; Crane & Walker, 1985; Santas, 1983, 1985, 1988; Barbattini et al. 2001; Binazzi & Scheurer, 2009; Trencheva et al., 2009). A good honeydew flow is expected to be a long lasting flow. For this reason, only a few of species are really important.

Table 3. Honeydew producer on shrubs and herbaceous plants in Aegean, Marmara and Mediterranean Regions

Aphidoidea
<i>Aphis craccivora</i> Koch, EDİRNE, Keşan, 35m, 8.VIII.2011, <i>Salvia</i> sp., 3 ♀♀.
<i>Eucarazzia elegans</i> (Ferrari) EDİRNE, Kesan, 32 m, <i>Salvia</i> sp., 8.VIII.2011, 5 ♀♀.
Coccoidea
Coccidae
<i>Pulvinariella mesembryanthemi</i> (Vallot) BALIKESİR, Ayvalık, 8 m, 19.VI.2009, <i>Carpobrotus</i> sp., 7 ♀♀; ÇANAKKALE, Bozcaada, 4 m, 14.IX.2011, <i>Carpobrotus</i> sp., 5 ♀♀; MUĞLA, Bodrum, 7 m, 12.VII.2009, <i>Carpobrotus</i> sp., 3 ♀♀.
Eriococcidae
<i>Rhizococcus munroi</i> (Boratynski) BALIKESİR, Bilecik-Sakarya Karayolu, 450 m, roots of undetermined plant, 16.VI.2010, 5 ♀♀.
<i>Anophococcus cynodontis</i> (Kiritchenko) MUĞLA, Güllük, 3 m, 21.VIII.2008, <i>Agropyron</i> sp., 3 ♀♀; BALIKESİR, Altınoluk, 4 m, <i>Agropyron</i> sp., 15.VII.2010, 5 ♀♀; Marmara Island, 10 m, <i>Cynodon dactylon</i> , 22.IX.2011, 2♀♀; İZMİR, Tuzla, 1 m, <i>C. dactylon</i> , 15.VII.2010, 3 ♀♀.
<i>Anophococcus herbaceus</i> (Danzig) ÇANAKKALE, Bozcaada, 2 m, <i>Pittosporum</i> sp., 14.IX.2011, 6♀♀.
<i>Anophococcus insignis</i> Newstead BALIKESİR, Akçay, 1 m, <i>Cynodon</i> sp., 18.IX.2011, 7 ♀♀.
Lecanodiaspididae
<i>Lecanodiaspis sardoa</i> Targioni Tozzetti EDİRNE, Keşan, 110 m, 7.VIII.2011, <i>Cistus</i> sp. 3 ♀♀; İSTANBUL, Büyükkada, 20 m, 10.VIII.2011, <i>Cistus</i> sp. 4 ♀♀; ANTALYA, Kurşunlu, 67 m, 8.v.2010, <i>Cistus</i> sp. 6♀♀; BALIKESİR, Ayvalık, <i>Cistus</i> sp. 15.IX.2011, 2 ♀♀; Alibey Island, 6 m, 15.IX.2011, <i>Cistus</i> sp. 7 ♀♀.
Pseudococcidae
<i>Ceroputo pilosellae</i> (Šulc) ANTALYA, Kurşunlu, 67m, undetermined Poaceae, 13.IV.2010, 3 ♀♀; Akseki, 1214 m, <i>Salvia</i> sp., 16.VII.2012, 4 ♀♀; MUĞLA, Fethiye, 26 m, undetermined plant, 5.VIII.2010, 6 ♀♀; Fethiye (Hisarönü), 7 m, undetermined plant, 14.VIII.2009, 6 ♀♀; Güllük, 10 m, undetermined plant, 28.VIII.2011, 6 ♀♀.
<i>Trionymus multivorus</i> ANTALYA, Akseki, <i>Salvia</i> sp., 1210 m, 16.VI.2012, 2 ♀♀; MUĞLA, Güllük, <i>Salvia</i> sp., 16 m, 28.VIII.2011, 3 ♀♀.
<i>Trionymus cynodontis</i> (Kiritshenko) Balıkesir: Akçay, 2 m, <i>Agropyron</i> sp., 14.ix.2011, 9♀♀.
<i>Peliococcus salviae</i> Hadzibeji MUĞLA, Güllük, 3 m, <i>Agropyron</i> sp. 21.VIII.2012; AYDIN, Milet, 5 m, <i>Cirsium</i> sp. 25.VIII.2011, 8♀♀.

Turkey has recorded a decrease in 5 million hectare of forest lands as well as 16 million of graze lands previously utilized by honeybees. Furthermore, the dangers of erosion in 70% of the land in Turkey and due to agricultural activities have led to a reduction in nectar available to the bees (Fıratlı et al., 2010). Due to the hostile environment and adverse impacts on honey production, the Ministry of Forest and Water Affairs and the General Directorate of Forestry prepared and about to commence an action on bee forest. This action plan is aimed at honey production which will subsequently lead to the provision of income to the citizens and protection of forest lands. The first to be tackled with is the sources of nectar which will pave way for honey secreting insects such as *M. hellenica*. Currently, other honeydew

producers and their potential are unknown. In generally, the scarcity of flower nectar sources (in the late summer months and autumn) honey production is obtained from honeydew. It is significant to find out other honeydew producers and honeydew flow in different periods of the year. Determining the honey production potentials of the honeydew producing species which are situated on the covers of plants in and around forests would provide an option to artificially infest the forest areas designated to this project.

In conclusion, *M. hellenica* and other honeydew producer species have an importance in the synthesis for the honeydew collectors in different periods and plants in the ecosystem. However, it is necessary to examine the biology and ecology of these species, whether their secretions are preferred by the honeybees and the quality of the honey is good enough for marketing it.

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