

Contribution to the Knowledge of the Orchard Aphid (Hemiptera: Aphididae) Fauna of Istanbul and Kahramanmaraş

RIMANTAS RAKAUSKAS¹, Mahmut Murat ASLAN^{2*}, Ali Arda I İKBER²
Audrius ZAREMBA¹, Rasa BERNOTIEN¹

¹Department of Zoology, Vilnius University, iurlionio 21/27, LT-03101 Vilnius, Lithuania

²Department of Plant Protection, Kahramanmaraş Sütçü İmam University, Av ar Campus, Kahramanmaraş, Turkey

Received (Gelişim): 06.11.2014

Accepted (Kabul): 03.02.2015

ABSTRACT: This study presents the list of aphid species (Family Aphididae, 16 species of 9 genera altogether) collected from Kahramanmaraş and Istanbul Province in 2011, with the comments on their distribution. DNA extraction, PCR amplification and sequencing protocols used. *Hyalopterus persikonus*, *Rhopalosiphum nymphaeae*, *Dysaphis (Pomaphis) reaumuri* and *Myzus (Myzus) varians* are reported for the first time from the aphid fauna of Kahramanmaraş Province. Comments on the biological characters and distribution of *Brachycaudus divaricatae* and *Hyalopterus* species complex are also given in present study.

Key words: Aphididae, Aphid, Orchards, Faunal list, Turkey

Istanbul ve Kahramanmaraş İllerinde Bazı Meyva Ağaçlarında Belirlenen Yaprakbiti Türleri

ÖZET: Bu çalışma, 2011 yılında Kahramanmaraş ve İstanbul illerinden toplanan yaprak biti türleri ve dağılımlarını ortaya koymaktadır (Aphididae familyası, 9 cinse bağlı 16 tür). DNA ekstraksiyon, PCR amplifikasyon ve sıralama protokolleri kullanılmıştır. *Hyalopterus persikonus*, *Rhopalosiphum nymphaeae*, *Dysaphis (Pomaphis) reaumuri* ve *Myzus (Myzus) varians* yaprakbiti türleri Kahramanmaraş bölgesi için ilk kez rapor edilmiştir. *Brachycaudus divaricatae* ve *Hyalopterus* yaprak biti türlerinin biyolojik karakterleri ve dağılım tanımlamaları bu çalışmada verilmiştir.

Anahtar Kelimeler: Aphididae, Yaprak biti, Meyva bahçeleri, Fauna Listesi, Türkiye

INTRODUCTION

Aphid fauna of Turkey has been subject of several studies (for recent review see Görür et al. 2011), yet it still demands further research when compared with respective research in adjacent countries (Görür et al., 2012). This particularly concerns the regular evaluation of local distribution of pest aphid species due to their economic importance (Barbagallo et al. 1997, Blackman and Eastop 2000, Holman 2009).

The aim of this paper is to present information on recent findings concerning orchard aphid fauna of Turkey, with particular concern to *Brachycaudus (Acaudus) divaricatae* Shaposhnikov, 1956 which recently has been invader to Europe, and *Hyalopterus* species complex which has been recently subject of substantial taxonomic revision (Lozier et al. 2008, Rakauskas et al. 2013).

MATERIAL and METHODS

The main aphid material (27 samples from 9 different plant species) has been collected by R. Rakauskas and M. Aslan on 28th and 31st of May, 2011 in the following localities of the Kahramanmaraş Province: Çataloluk, Tekir, Göksun and Afın. Six samples from Kahramanmaraş Province and four samples from Florya district of Istanbul collected by R. Rakauskason on 27th of May, 2011 were also included. For sampling of the

aphid materials, common methods were used (Emden 1972). Microscope slides of aphid samples prepared using Faure-Berlese mounting fluid or Canada balsam (Blackman and Eastop 1984). Aphid materials are deposited at the Department of Zoology of the Vilnius University (Vilnius, Lithuania).

Morphological identification of aphids was performed mostly by means of keys compiled by Heie (1982-1995) and Blackman and Eastop (2006); several other references were also used for the identification of certain species and are referred to in respective places of the text. In addition to morphological characters, molecular markers (partial CO-I sequences) were used for identification of problematic aphid species (*Hyalopterus* spp., *Myzus cerasi* complex, *Brachycaudus cardui-lateralis* complex, *Aphis pomi* – *spiraecola* complex, also *Myzus varians*). DNA extraction, PCR amplification and sequencing protocols used in present study were the same as those used by Rakauskas et al. 2013. Aphid synonymy is in accordance with Remaudiere and Remaudiere (1997), except when it is otherwise stated.

RESULTS and DISCUSSION

16 aphid species of 9 genera belonging to 2 subfamilies of the family Aphididae were found. Most of the species (15) were representatives of the

*Corresponding author: Aslan, M.M., aslan@ksu.edu.tr

subfamily Aphidinae (5 and 10 species from tribe Aphidini and Macrosiphini respectively), one species - of the subfamily Lachninae. *Hyalopterus persikonus* is reported for the first time from the aphid fauna of Turkey. In addition to the earlier published data (Görür et al. 2012), the list of aphid species in Turkey has grown to 467 species. In the listing below, general distribution of aphid species is given after Nieto Nafria et al. 2004, unless otherwise stated.

Subfamily Aphidinae

Tribe Aphidini

Subtribe Aphidina

***Aphis ruborum* (Börner, 1932)**

Material examined: Istanbul: Florya, 27.V.2011, *Rubus* sp., 4 apterous vivipare. Females. Leg. R. Rakauskas.

Distribution in Turkey: Tatvan- ükran (Tuatay and Remaudiere, 1964). Adana (Uygun et al., 2001). Kahramanmara - Af in, Çataloluk, Göksun-Fırnız (Aslan and Uygun 2005).

General distribution: Palaearctic species.

***Aphis spiraeicola* Patch, 1914**

Material examined: Kahramanmara , Azerbaycan Blv., 28.V.2011, *Spiraea* sp., leg. R. Rakauskas, No 11-16; Kahramanmara , Azerbaycan Blv., 28.V.2011, *Prunus armeniaca*, leg. R. Rakauskas, No: 11-17.

Distribution in Turkey: Adana, Ankara, Diyarbakır, Hatay, çel (Tuatay and Remaudiere 1964, Düzgüne et al. 1982; Yumruktepe and Uygun 1994; Ölmez 2000; Uygun et al. 2001). Kahramanmara - Karacasu (Aslan and Uygun, 2005).

General distribution: Holarctic species.

Subtribe Rhopalosiphina

***Hyalopterus pruni* (Geoffroy, 1762)**

Material examined: Istanbul: Florya, 27.V.2011, *Prunus cerasifera*, leg. R. Rakauskas, No: 11-11; Kahramanmara , Trabzon Blv., 29.V.2011, *Prunus armeniaca*, leg. R. Rakauskas, No: 11-18; Kahramanmara , Trabzon Blv., 29.V.2011, *Prunus cerasifera*, leg. R. Rakauskas, No: 11-19; Göksun, 31.V.2011, *Prunus cerasifera*, leg. R. Rakauskas and M. Aslan, No: 11-28.

Distribution in Turkey: Adana, Ankara, Antalya, Diyarbakır, Gaziantep, Hatay, çel, Ni de, (Düzgüne and Tuatay 1956; Bodenheimer and Swirski 1957; Çanakçio lu 1975; Düzgüne et al. 1982; Uygun et al. 2001). Kahramanmara : Center, A abeyli, Döngüle, Elbistan, Gaffarlı, Karacasu, Karaelbistan, Narlı, Pazarcık-Kirni (Aslan and Uygun 2005).

General distribution: Cosmopolitan species, although some records might concern *H. persikonus* (see below).

Hyalopterus pruni has been subject of the long lasting debate concerning the number of cryptic species involved in the complex (Basky and Szalay-Marszo 1987, Mosco et al., 1997, Lozier et al., 2007). Most recent complex analysis (Lozier et al., 2008) has suggested three host plants associated species. *H. pruni*

is supposed to be *Prunus* feeder, whilst *H. amygdali* and *H. persikonus* are associated with almond and peach respectively. Apricot is reported being "a shared resource among *Hyalopterus* species" (Lozier et al., 2008). Our material both from plums and from apricots was not easy to determine by the key of Lozier et al., (2008), the key morphological characters were controversial, partial CO-I sequences appeared of decisive value therefore (for details see Rakauskas et al. 2013).

***Hyalopterus persikonus* Miller, Lozier and Footitt, 2008**

Material examined: Kahramanmara , Azerbaycan Blv., 28.V.2011, *Prunus armeniaca*, leg. R. Rakauskas, No: 11-15.

Distribution in Turkey: West Central Anatolia (Senol et al., 2014).

General distribution: Difficult to summarize for the present, because of long lasted taxonomic uncertainty of the *Hyalopterus* species complex.

***Rhopalosiphum nymphaeae* (Linnaeus, 1761)**

Material examined: Göksun, 31.V.2011, *Prunus cerasifera*, leg. R. Rakauskas and M. Aslan, 11-29; Af in, 31.V.2011, *Prunus persica*, leg. R. Rakauskas and M. Aslan, No: 11-36.

Distribution in Turkey: Adapazarı, Ankara, Diyarbakır, zmir, Mersin Tatvan, (Bodenheimer and Swirski 1957; Tuatay and Remaudiere 1964; Giray 1974; Özdemir and Toros 1997). First record for Kahramanmara Province.

Tribe Macrosiphini

***Brachycaudus (Acaudus) cardui* (Linnaeus, 1758)**

Material examined: Kahramanmara : Çataloluk, 31.V.2011, *Prunus cerasifera*, leg. R. Rakauskas and M. Aslan, No: 11-22; Kahramanmara : Çataloluk, 31.V.2011, *Prunus cerasifera*, leg. R. Rakauskas and M. Aslan, No: 11-24; Göksun, 31.V.2011, *Prunus nigra*, leg. R. Rakauskas and M. Aslan, No: 11-26; Göksun, 31.V.2011, *Prunus armeniaca*, leg. R. Rakauskas and M. Aslan, No: 11-30.

Distribution in Turkey: Middle, North, East and West Anatolia, Marmara Region, Adana, Ahlat, Ankara, çel, Diyarbakır, Ni de, Tatvan, Trabzon-Arsen (Bodenheimer and Swirski 1957; Tuatay and Remaudiere 1964; Çanakçio lu 1975; Lodos 1986; Uygun et al. 2001). Kahramanmara : Çalancerit, Çalancerit-Homur, Göksun, Göksun-Fırnız, Güzlek-Ahırda 1, Kampüs, Sarıkaya, Suçatı, Süleymanlı, Tekir, Türkoglu (Aslan and Uygun 2005).

General distribution: Cosmopolitan species, except the Australian region.

***Brachycaudus (Acaudus) divaricatae* Shaposhnikov, 1956**

Material examined: none. We have failed to find any specimens of this species despite special search efforts. In addition to Istanbul and Kahramanmara province, we have also visited Gaziantep (Islahiye) and

Hatay (Hassa, Kırıkhan, Antakya). Altogether, 37 cherry plum trees were inspected in Istanbul, 93 in Kahramanmara , 41 in Gaziantep and 22 in Hatay province seeking for *B. divaricatae* yet without any success.

Distribution in Turkey: Bitlis (Tatvan) (Tuatay and Remaudiere 1964). Kahramanmara : Af in-Erçene (Aslan and Uygun 2005).

General distribution: *B. divaricatae* has been originally described from Turkmenia (Shaposhnikov 1956), its original distribution area is reported to be the Middle East (Iran, Turkey, Turkmenia) and Eastern Europe (Northern Caucasus, Crimea) (Blackman and Eastop 2000). Starting from 2002, it invaded the Eastern Baltic region of Europe, including also Belarus and North Ukraine, and is the most common pest on cherry plum (*Prunus cerasifera*) in this area for the present (Cichocka and Lubiarz 2003; Rakauskas 2004; Rakauskas and Tur inavi ien 2006; Rakauskas and Buga 2010). In 2011, *B. divaricatae* invaded also Czech Republic (Bašilova et al. 2012). When compared with the invasive area, *B. divaricatae* appeared to be unexpectedly rare in its homeland territories in Turkey (the present study), also in Georgia (Tur inavi ien and Rakauskas, unpublished).

Dysaphis (Pomaphis) plantaginea (Passerini, 1860)

Material examined: Istanbul: Florya, 27.V.2011, *Malus* sp. cult., leg. R. Rakauskas, No: 11-13.

Distribution in Turkey: Adana, Ankara, Antalya, Çanakkale, Diyarbakır, Gaziantep, Giresun, Gümü hane, Hatay, çel, Elazı , Ni de, Isparta, zmir, Kayseri, Sakarya, Samsun, anlıurfa, Tekirda (Tuatay 1990, Uygun et al. 2001). Kahramanmara : Çataloluk, Pazarcık-Ba sa ır (Aslan and Uygun 2005).

General distribution: Cosmopolitan species, except the Australian region.

Dysaphis (Pomaphis) pyri (Boyer de Fonscolombe, 1841)

Material examined: Af in, 31.V.2011, *Pyrus communis*, leg. R. Rakauskas and M. Aslan, No: 11-32; Af in, 31.V.2011, *Pyrus communis*, leg. R. Rakauskas and M. Aslan, No: 11-33; Af in, 31.V.2011, *Pyrus communis*, leg. R. Rakauskas and M. Aslan, No: 11-37.

Distribution in Turkey: Adana, Ankara, Diyarbakır, Isparta, zmir, Konya, Ni de, Van (Bodenheimer and Swirski 1957; Tuatay and Remaudiere 1964; Düzgüne et al., 1982; Giray 1974; Toros et al. 1996; Uygun et al., 2001).Kahramanmara : Çataloluk (Aslan and Uygun 2005).

General distribution: Holarctic species, widespread in southern and western Europe. It is also reported from the Oriental region.

Dysaphis (Pomaphis) reaumuri (Mordvilko, 1928)

Material examined: Kahramanmara : Göksun, 31.V.2011, *Pyrus communis*, leg. R. Rakauskas and M. Aslan No: 11-23.

Distribution in Turkey: Adana-Kızılda (Toros et al., 1996). First record for Kahramanmara Province.

General distribution: Palaearctic species.

Hyadaphis tataricae (Aizenberg, 1935)

Material examined: Kahramanmara , Trabzon Blv., 29.V.2011, *Lonicera* sp., leg. R. Rakauskas, No: 11-20.

Distribution in Turkey: Ankara, Diyarbakır (Toros 1986; Ölmez 2000). Kahramanmara : Ahır Mountain (Aslan and Uygun 2005).

General distribution: Holarctic species.

Myzus cerasi pruniavium Börner, 1926

Material examined: Kahramanmara : Tekir, 31.V.2011, *Cerasus avium*, leg. R. Rakauskas and M. Aslan, No: 11-25; Göksun, 31.V.2011, *Cerasus avium*, leg. R. Rakauskas and M. Aslan, No: 11-27.

Distribution in Turkey: Adana, Ankara, çel, znik, Ni de, (Bodenheimer and Swirski 1957; Toros et al. 2002).Kahramanmara : Andırın (smailli), 16.VI.2000, Göksun (Çataloluk), Pazarcık (Ba sa ır) (Aslan and Uygun 2005).

General distribution: Almost cosmopolitan species, absent from Neotropical and Afrotropical regions.

Myzus varians Davidson, 1912

Material examined: Kahramanmara : Çataloluk, 31.V.2011, *Prunus persica*, leg. R. Rakauskas and M. Aslan, No: 11-21.

Distribution in Turkey: Adana, Hatay (Toros et al. 2002). First record for Kahramanmara Province.General distribution: Holarctic species.***Myzus (Nectarosiphon) persicae (Sulzer, 1776)***

Material examined: Kahramanmara : Göksun, 31.V.2011, *Prunus armeniaca*, leg. R. Rakauskas and M. Aslan.

Distribution in Turkey: Common in Turkey (Bodenheimer and Swirski 1957; Yi it and Uygun, 1982; Lodos 1986; Uygun et al., 2001). Kahramanmara : Center, Çigce (Aslan and Uygun 2005).

General distribution: Cosmopolitan species.

Phorodon humuli (Schrank, 1801)

Material examined: Kahramanmara : Göksun, 31.V.2011, *Prunus armeniaca*, leg. R. Rakauskas and M. Aslan.

Distribution in Turkey: West Anatolia (Çanakçio lu, 1975), Istanbul-Bahçeköy (Lodos, 1986) Kahramanmara -Pazarcık (Aslan and Uygun 2005).

REFERENCES

- Aslan, M.M. Uygun, N. 2005. The aphids (Homoptera: Aphididae) of Kahramanmaras Province, Turkey. Turk. J. Zool., 29: 201-209.
- Barbagallo S., Cravedi, P., Pasqualini, E. Patti, I. 1997. Aphids of the principal fruit-bearing crops. Bayer S.p.A., Milan, 123 p.

- Başılova, J., Havelka, J., Rakauskas, R., Stary, P. Tur inavi ien , J. 2012. New information on the invasive to Europe aphid species *Brachycaudus divaricatae* Shaposhnikov, 1956 (Hemiptera: Aphididae). *Biologia (Bratislava)*, 67: 959-965.
- Basky, Z. Szalay-Marszo, L. 1987. Study of isolation mechanisms in the *Hyalopterus pruni* and *Hyalopterus amygdali* complex. In: J. Holman, J. Pelikan, A. F. G. Dixon and L. Weismann (eds) Population structure, genetics and taxonomy of aphids and Thysanoptera, 370-373.
- Blackman, R.L. Eastop, V.F. 2000. Aphids on the world's crops: An identification and information guide. 2nd Ed. John Wiley and Sons, Ltd., Chichester, 466 p.
- Blackman, R.L. Eastop, V.F. 1984. Aphids on the world's crops: an identification and information guide. Chichester: John Wiley and Sons, Ltd.
- Blackman, R.L. Eastop, V.F. 2006. Aphids on the World's Herbaceous Plants and Shrubs. Chichester: John Wiley and Sons, Ltd.
- Bodenheimer, F.S., Swirski, E. 1957. The Aphidoidea of the Middle East. The Weigmann Science Press of Israel, Jerusalem, 378 p.
- Canakcioglu, H., 1975. The Aphidoidea of Turkey. Üstambul Uni. Faculty of Forestry. 309 p.
- Cichocka, E. Lubiarsz, M. 2003. Aphids colonizing cherry plum (*Prunus cerasifera* Ehr.) trimmed hedges. *Aphids and other Hemipterous insects*, 9: 37-43.
- Duzgunes, Z., Toros, S., Kılincer, N. Kovancı, B. 1982. The Parasites and the Predators of Aphidoidea in Ankara. Turkish Ministry of Agriculture, Ankara, Turkey.
- Duzgunes, Z. Tuatay, N. 1956. Türkiye aphidleri. Ziraat Vekaleti, Ankara Zirai Mücadele Enstitüsü Müdürlü ü, Ankara.
- Emden, H. F. 1972. Aphid Technology. London: Academic Press.
- Giray, H. 1974. Preliminary list of the species of Aphididae (Homoptera) collected in the vicinity of Izmir Province, with notes on host-plants and types of damage. *Review of the Faculty of Agriculture Ege University*. 11: 39-69.
- Gorur, G., Tepecik, ., Akyıldırım, H. Olcabey, G. 2011. Additions to the Turkish Aphid fauna (Hemiptera: Aphidoidea: Aphididae). *N West J Zool* 7: 318-32.
- Gorur, G., Tepecik, ., Akyıldırım, H., Olcabey, G., Akyürek, B. 2012. The aphid fauna of Turkey: An updated checklist. *Arch Biol Sci, Belgrade* 64: 675-692.
- Heie, O.E. 1982. The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. II. *Fauna Entomologica Scandinavica*, 11: 176 p.
- Heie, O.E. 1986. The Aphidoidea (Hemiptera) of Fennoscandia and Denmark. III. *Fauna Entomologica Scandinavica*, 17: 314 p.
- Heie, O.E. 1992. The Aphidoidea (Hemiptera) of Fennoscandia and Denmark: IV. *Fauna Entomologica Scandinavica*, 25: 188 p.
- Heie, O.E. 1994. The Aphidoidea (Hemiptera) of Fennoscandia and Denmark: V. *Fauna Entomologica Scandinavica*, 28: 242 p.
- Heie, O.E. 1995. The Aphidoidea (Hemiptera) of Fennoscandia and Denmark: VI. Family Aphididae: Part 3 of tribe Macrosiphini of subfamily Aphidinae, and family Lachnidae. *Fauna Entomologica Scandinavica*, 31: 222 p.
- Holman, J. 2009. Host Plant Catalogue of Aphids, Palearctic Region, Springer, 1216 p.
- Lodos, N. 1986. Entomology of Turkey. 2nd edition, Practice and Faunistic. Review of the Faculty of Agriculture Ege University No. 429, Üzmir, 591 p.
- Lozier, J.D., Foottit, R.G., Miller, G.L., Mills, N.J. Roderick, G.K. 2008. Molecular and morphological evaluation of the aphid genus *Hyalopterus* Koch (Insecta: Hemiptera: Aphididae), with a description of a new species. *Zootaxa*, 1688: 1-19.
- Lozier, J.D., Mills, N. J. Roderick, G. K. 2007. Genetic evidence from mitochondrial, nuclear, and endosymbiont markers for the evolution of host plant associated species in the aphid genus *Hyalopterus* (Hemiptera: Aphididae). *Evolution* 61: 1353-1367.
- Mosco, M.C., Arduino, P., Bullini, L. and Barbagallo, S. 1997. Genetic heterogeneity, reproductive isolation and host preferences in mealy aphids of the *Hyalopterus pruni* complex (Homoptera: Aphidoidea). *Mol Ecol*. 6: 667-670.
- Nieto Nafria, J.M., Andreev, A.V., Binazzi, A., Mier Durante, M.P., Perez Hidalgo, N.J., Rakauskas, R. Stekolshchikov, A.V. 2004. Superfamily Aphidoidea. In *Fauna Europaea Service* [on line in <http://www.faunaeur.org>].
- Ozdemir, I. Toros, S. 1997. The Determination of Aphidoidea (Homoptera) species on seasonal ornamental plants in Ankara, Turkey. *Turk Entomol Derg.* 21 (4): 283-298.
- Rakauskas, R. 2004. Recent changes in aphid (Hemiptera, Sternorrhyncha: Aphididae) fauna of Lithuania: an effect of global warming? *Ekologija (Vilnius)*, 1: 1-4.
- Rakauskas, R., Buga, S. 2010. Contribution to the knowledge of the aphid (Hemiptera, Sternorrhyncha: Aphidoidea) fauna of the Gorodok Highland, Belarus. *Acta Zool. Lituanica* 20: 205-224.
- Rakauskas, R., Tur inavi ien , J. 2006. *Brachycaudus divaricatae* Shaposhnikov, 1956 in Europe: biology, morphology and distribution, with comments on its taxonomic position (Hemiptera, Sternorrhyncha: Aphididae). *Mitt Mus Nat kd Berl Zool Reihe* 82: 248-260.
- Rakauskas, R., Tur inavi ien , J., Başılova, J. 2011. How many species are there in the subgenus

- Bursaphis* (Hemiptera: Sternorrhyncha: Aphididae)? COI evidence. Eur J Entomol 108: 469–479.
- Remaudière, G., Remaudière, M. 1997. Catalogue of the Worlds Aphididae Homoptera-Aphidoidea. Paris: INRA.
- Senol O., Begen H. A., Gorur G., Demirtas E., Gezici G. 2014. ç Batı Anadolu Bölümünde Da ılım Gösteren Hyalopterus (Hemiptera: Aphidoidea) Üyelerinin Morfometrik Olarak De erlendirilmesi. 22. Ulusal Biyoloji Kongresi, 23-27 Haziran 2014, Eski ehir Osmangazi Üniversitesi, Eski ehir, Türkiye. s 233.
- Shaposhnikov, G.Kh. 1956. Filogeneticheskoe obosnovanie sistemy korotkochvostykh tlei (Anuraphidina) s uchedom ich sviazei s kormovymi rasteniami [Phylogenetic background of the system of the short tailed aphids (Anuraphidina) with reference to their host plants relationships]. Trudy Zool Inst Akad Nauk SSSR (in Russian) 23: 215-320.
- Toros, S. 1986. Some notes on *Hyadaphis tataricae* (Aizenberg) (Homoptera: Aphididae) new to Turkey. Turk J Plant Protec. 10: 141-148.
- Toros, S., Yasar, N., Ozgokce, M. S., Kasap, . 1996. Studies on Determination of Aphidoidea Species in Van Province. Third Turkish National Congress of Entomology (Ankara, Turkey), 549-556.
- Toros, S., Uygun, N., Ulusoy, M.R., Satar, S., Ozdemir, I.2002. The Aphidoidea Species of East Mediterranean Region. Turkish Ministry of Agriculture, Ankara, Turkey 108 p.
- Tuatay, N. 1990. Aphids (Homoptera: Aphididae) of Turkey II. Aphidinae: Macrosiphini (Part II). Turk J Plant Protec. 30: 29-44.
- Tuatay, N., Remaudiere, G. 1964. Premiere Contribution au Catalogue des Aphididae (Hom.) de la Turquie. Rev. de Path. Veg. Et Ent. Agr. de Fr. 43: 243-278.
- Uygun, N., Toros, S., Ulusoy, M.R., Satar, S., Ozdemir, I., 2001. Do u Akdeniz Bölgesi Aphidoidea (Homoptera) Türleri ile Bunların Parazitoit ve Predatörlerinin Saptanması. Bil. ve Tek. Ar t. Kur. Tar. ve Orman. Ar t. Grubu Proje. No. TÜB TAK-TOGTAK 1720, 214 p.
- Yumruktepe, R., Uygun, N. 1994. Determination of aphid species (Homoptera: Aphididae) and their natural enemies in citrus orchards in Eastern Mediterranean region. Proc. Third Turkish National Congress of Biological Control (İzmir, Turkey), 1-12.