


ACTA BIOLOGICA TURCICA

© 1950-1978 Biologi, Türk Biologi Dergisi, Türk Biyoloji Dergisi, Acta Biologica

E-ISSN: 2458-7893, <http://www.actabiologicturcica.com>

Original research

A faunistic research on Diptera in almond orchards of Manisa and Muğla provinces

Mehmet Fatih TOLGA^{1,*} , Zeynep YOLDAŞ² 

¹Astranova Agricultural Trade and Industry, Bornova, Izmir, Turkey

²Ege University, Faculty of Agriculture, Department of Plant Protection, Izmir, Turkey

*Corresponding author e-mail: mfatihmolga@gmail.com.tr

Abstract: This study was conducted between 2014-2016 in the almond orchards of Datça, Fethiye, Seydikemer (Muğla) and Akhisar, Kula (Manisa) districts. During the study, 17 species belonging to 8 families belonging to Diptera were identified. These species were identified and recorded as *Machimus setibarbus*, *Bibio hortulanus*, *Chlorops interruptus*, *Chlorops pumilionis*, *Chlorops serenus*, *Thaumatomyia notata*, *Lyciella rorida*, *Agria affinis*, *Scathophaga stercoraria*, *Eristalis arbustorum*, *Eristalis tenax*, *Episyrphus balteatus*, *Eupeodes luniger*, *Paragus quadrifasciatus*, *Syrphus ribesii*, *Hybomitra bimaculata* and *Hybomitra ciureai*.

Keywords: Almond, Diptera, Muğla, Manisa

Citing: Tolga, M.F., & Yoldaş, Z. 2020. A faunistic research on Diptera in almond orchards of Manisa and Muğla provinces. *Acta Biologica Turcica*, 33(2): 64-69.

Introduction

Diptera is one of the insect order that began to spread in Asia during the middle and late Triassic periods (Rasnitsyn, 2002). It is assumed that 150,000 species belonging to 150 families of the Diptera order have been identified (Gullan and Cranston, 2010). There are many systematic studies about Diptera order to determine the Diptera fauna of Turkey (Giray, 1981; Koçak and Kemal, 2014; 2009; Verves et al., 2018; Kubik and Bartak, 2017; Civelek et al., 2009; Skartveit and Koç, 2007; Dursun et al., 2010; Eren and Ozerov, 2017; Kılıç, 1999a; Karsavuran, et al., 2005; Parvu, 2006). However, there is no data on Diptera species found in almond production areas in Aegean Region. Almond production is mostly made in Manisa and Muğla provinces in the Aegean Region. For this reason, field studies were carried out in Akhisar, Kula (Manisa) and Datça, Fethiye and Seydikemer (Muğla) districts where almond production was the highest in the Aegean Region.

Material and Methods

This study was carried out between 2014 and 2016 in the almond orchards of Akhisar, Kula Districts of Manisa and Datça, Fethiye, Seydikemer districts of Muğla. The surveys were conducted once a week or biweekly between January and November. Diptera specimens were observed on almond trees and collected by beating randomly chosen tree branches of different sides of each orchard. The sampling method of each orchard was the frappe method (hitting the 25 trees, 4 strokes per tree, and collecting the falling individuals on a 40×40 cm sized cloth). The insect samples dropped on the cloth were collected with the help of an aspirator and placed in tubes (50 ml) and brought to the laboratory. The samples brought to the laboratory were killed in killing jars containing ethyl acetate or potassium cyanide and labeled. The identification of the collected insect samples was carried out by Prof. Dr. Hasan Sungur CİVELEK and Dr. Oktay DURSUN in the Biology Department of Sıtkı Koçman University.

Results

As a result of the study, 17 species belonging to 8 families of Diptera were identified. The list of species with distribution data is given below.

Asilidae

Machimus setibarbus (Loew, 1849)

Locality: Manisa: Akhisar, 39°07'N, 28°01'E, 350 m a.s.l., 03.VII.2014, 1♂1♀; Muğla: Datça, 36°44'N, 27°34'E, 138 m a.s.l., 2♂♂.

Distribution in Turkey: Adana, Adıyaman, Ankara, Antalya, Artvin, Balıkesir, Denizli, Erzincan, Erzurum, Eskişehir, Hatay, Isparta, İstanbul, İzmir, Karaman, Konya, Kütahya, Mersin, Muğla, Niğde, Şanlıurfa, Van, (Lodos, 1961; Janssens, 1968; Giray, 1981; Hayat and Alaoğlu, 1996; Durmuş, 1999; Bosak and Hradsky, 2001; Çalışkan, 2002; Çalışkan and Şahin, 2003; Aral, 2011; Koçak and Kemal, 2009, 2012a, 2013, 2014, 2015; Koçak, 2014).

Bibionidae

Bibio hortulanus (Linnaeus, 1758)

Locality: Manisa: Akhisar, 38°57'N, 28°00'E, 700 m a.s.l., 04.IV.2014, 1♂; 39°00'N, 27°53'E, 340 m a.s.l., 04.IV.2014, 1♂, 1♀; 39°00'N, 27°53'E, 320 m a.s.l., 04.IV.2014, 1♀; 38°48'N, 27°54'E, 206 m a.s.l., 15.IV.2015, 2♀♀; 38°48'N, 27°54'E, 195 m a.s.l., 12.IV.2016, 2♀♀; Manisa: Kula, 38°36'N, 28°39'E, 650 m a.s.l., 23.IV.2014, 25.IV.2014, 1♀, 1♂; 38°31'N, 28°36'E, 700 m a.s.l., 25.IV.2014, 2♂♂; Muğla: Seydikemer, 36°48'N, 29°31'E, 1178 m a.s.l., 16.IV.2015, 1♂.

Distribution in Turkey: Afyon, Aydın, Bitlis, Burdur, Denizli, Hatay, Iğdır, Isparta, İzmir, Konya, Malatya, Nevşehir, Siirt, Van, Şırnak (Gül-Zümreoğlu, 1972; Skartveit and Koç, 2007; Koçak, 2014; Koçak and Kemal, 2009, 2012a, 2013, 2014, 2015; Kemal et al., 2016; Kemal and Koçak, 2015, 2016, 2017, 2018).

Chloropidae

Chlorops interruptus (Meigen, 1830)

Locality: Manisa: Kula, 38°30'N, 28°43'E, 590 m a.s.l., 20.III.2015, 2♀♀; Muğla: Datça, 36°44'N, 27°37'E, 140 m a.s.l., 13.III.2015, 1♂; 36°44'N, 27°38'E, 85 m a.s.l., 18.III.2015, 1♀; 36°41'N, 27°29'E, 171 m a.s.l., 27.III.2015, 1♀; 36°44'N, 27°37'E, 78 m a.s.l., 18.III.2015, 2♀♀; Muğla Fethiye, 36°35'N, 29°5'E, 240 m a.s.l., 19.III.2014, 1♀.

Distribution in Turkey: Samsun (Kubik and Bartak, 2017); (Koçak and Kemal, 2012a)

Chlorops pumilionis (Bjerkander, 1778)

Locality: Muğla: Datça, 36°44'N, 27°37'E, 78 m a.s.l., 18.III.2015, 2♀♀.

Distribution in Turkey: Muğla, Antalya (Koçak and Kemal, 2012a, 2013, 2014, 2015; Koçak, 2014; Kubik and Bartak, 2017).

Chlorops serenus (Loew, 1866)

Locality: Manisa: Akhisar, 38°57'N, 28°0'E, 754 m a.s.l., 26.III.2015, 4♀♀; Manisa: Kula, 38°30'N, 28°44'E, 610 m a.s.l., 20.III.2015, 2♂♂ 10♀♀; Muğla: Datça, 36°44'N, 27°39'E, 44 m a.s.l., 18.III.2015, 2♀♀; 36°41'N, 27°29'E, 144 m a.s.l., 27.III.2015, 1♂1♀; Muğla: Seydikemer, 36°49'N, 29°33'E, 1141 m a.s.l., 02.IV.2015, 1♂1♀.

Distribution in Turkey: Muğla (Kubik and Bartak, 2017); (Koçak and Kemal, 2012a)

Thaumatomyia notata (Meigen, 1830)

Locality: Muğla: Datça, 36°40'N, 27°25'E, 5 m a.s.l., 05.II.2015, 2♂♂3♀♀; Manisa: Kula, 38°31'N, 28°37'E, 740 m a.s.l., 26.II.2016, 3♀♀.

Distribution in Turkey: Antalya, Ardahan, Kayseri, Konya, İstanbul, İzmir, Manisa, Muğla, Samsun, Van (Civelek and Tezcan, 2005; Koçak and Kemal, 2012a, 2012b, 2013, 2014, 2015; Koçak, 2014; Kubik and Bartak, 2017; Kemal and Koçak, 2018).

Lauxaniidae

Lyciella rorida (Fallen, 1820)

Locality: Manisa: Kula, 38°30'N, 28°40'E, 775 m a.s.l., 01.IV.2014, 2♂♂4♀♀; Muğla: Datça, 36°41'N, 27°33'E, 30 m a.s.l., 07.V.2014, 3♂♂2♀♀; 36°44'N, 27°39'E, 41 m a.s.l., 07.V.2014, 2♀♀.

Distribution in Turkey: (Koçak and Kemal, 2012a).

Sarcophagidae

Agría affinis (Fallen, 1817)

Locality: 39° 4'N, 28° 2'E, 610 m a.s.l., 26.III.2014, 2♀♀.

Distribution in Turkey: Isparta, Tokat (Kara and Pape, 2002; Koçak and Kemal, 2009, 2012a, 2013, 2014, 2015); (Koçak, 2014); (Verves and Khrokalo, 2018).

Scathophagidae

Scathophaga stercoraria (Linnaeus, 1758)

Locality: Manisa: Kula, 38°32'N, 28°37'E, 712 m a.s.l., 17.III.2016, 1♂♂.

Distribution in Turkey: Ardahan, Bitlis, Edirne, Istanbul, Karaman, Siirt, Van (Koçak and Kemal, 2009, 2010, 2012a, 2012b, 2013, 2014, 2015; Kemal et al., 2016; Kemal and Koçak, 2016, 2017, 2018); (Çoban, 2013); (Koçak, 2014).

Syrphidae

Eristalis arbustorum (Linnaeus, 1758)

Locality: Muğla: Seydikemer, 36°49'N, 29°33'E, 1140 m a.s.l., 02.IV.2015, 1♂.

Distribution in Turkey: Adana, Afyon, Aksaray, Ankara, Antalya, Bartın, Bolu, Burdur, Çankırı, Denizli, Düzce, Diyarbakır, Edirne, Erciyes Dağı, Eskişehir, Erzurum, Hatay, Ilgaz ve Işık Dağları, Isparta, İzmir, Kahramanmaraş, Karabük, Kastamonu, Kayseri, Konya, Malatya, Mersin, Muğla, Niğde, Sinop, Sivas, Şanlıurfa, Tokat, Zonguldak (Tuatay et al., 1967, 1972; Özgür, 1986; Sarıbyık, 2014; Aktaş and Sarıbyık, 1996; Sarıbyık, 1998; Candemir and Kara, 2003; Sarıbyık and Hasbenli, 2006; Sarıbyık, 2009; Özkan and Çalışkan, 2010; Toth, 2013; Pehlivan and Atakan, 2014; Gözüaçık and Özgen, 2018; Sert and Özdemir, 2019).

Eristalis tenax (Linnaeus, 1758)

Locality: Muğla: Datça, 36°40'N, 27°29'E, 21 m a.s.l., 18.III.2015, 1♀.

Distribution in Turkey: Adana, Afyon, Ankara, Antalya, Aksaray, Aydın, Bolu, Çanakkale, Çankırı, Denizli, Diyarbakır, Düzce, Edirne, Erzurum, Eskişehir, Hatay, Isparta, Istanbul, İzmir, Kahramanmaraş, Kastamonu, Kayseri, Konya, Malatya, Manisa, Mersin, Muğla, Sivas, Trabzon, Tokat, Uşak, Van (Tuatay et al., 1967; Candemir and Kara, 2003; Sarıbyık and Hasbenli, 2006; Sarıbyık, 2009, 2014; Özkan and Çalışkan, 2010; Koçak and Kemal, 2009, 2010, 2012b, 2013; Toth, 2013; Pehlivan and Atakan, 2014, 2016; Gözüaçık and Özgen, 2018); (Koçak et al., 2009).

Episyrphus balteatus (De Geer, 1776)

Locality: Manisa: Akhisar, 38°51'N, 27°53'E, 233 m a.s.l., 26.IV.2016, 1♀; Manisa: Kula, 38°31'N, 28°38'E, 676 m a.s.l., 31.III.2016, 1♀.

Distribution in Turkey: Adana, Adıyaman, Aksaray, Ankara, Antalya, Bartın, Bitlis, Bolu, Burdur, Bursa, Çankırı, Çanakkale, Denizli, Diyarbakır, Edirne, Erzurum, Eskişehir, Hatay, Isparta, Istanbul, İzmir, Kahramanmaraş, Karabük, Kastamonu, Kayseri, Konya, Malatya, Mersin, Muğla, Niğde, Osmaniye, Siirt, Sinop, Sivas, Şanlıurfa, Tokat, Van, Zonguldak, (Düzgüneş et al.,

1982; Candemir and Kara, 2003; Sarıbyık and Hasbenli, 2006; Bayhan et al., 2006; Sarıbyık, 2009, 2014; Hazır and Ulusoy, 2012; Toth, 2013; Pehlivan and Atakan, 2014, 2016; Koçak and Kemal, 2009, 2010, 2012a, 2012b, 2013, 2014, 2015; Koçak, 2014; Kemal and Koçak, 2015, 2018; Gözüaçık and Özgen, 2018).

Eupeodes luniger (Meigen, 1822)

Locality: Manisa: Akhisar, 38°50'N, 27°54'E, 347 m a.s.l., 20.III.2015, 1♀.

Distribution in Turkey: Adana, Ankara, Bolu, Çankırı, Çanakkale, Denizli, Edirne, İzmir, Karabük, Kastamonu, Mersin, Muğla, Van (Sarıbyık, 2009, 2014; Koçak and Kemal, 2009, 2012a, 2014, 2013, 2015; Toth, 2013; Koçak, 2014; Kemal and Koçak, 2017, 2018).

Paragus quadrifasciatus Meigen, 1822

Locality: Manisa: Akhisar, 38°48'N, 27°54'E, 210 m a.s.l., 31.V.2016, 4♀♀; Muğla: Seydikemer, 36°50'N, 29°33'E, 1186 m a.s.l., 15.VI.2016, 1♂.

Distribution in Turkey: Afyon, Ankara, Antalya, Çankırı, Eskişehir, İzmir, Mardin, Mersin, Muğla, Kayseri, Kırşehir, Konya, Tokat, Van (Gül-Zümreoğlu, 1972; Candemir and Kara, 2003; Sarıbyık and Hasbenli, 2006; Koçak and Kemal, 2009, 2010, 2013; Van de Weyer, 2010; Toth, 2013; Sarıbyık, 2014; Gözüaçık and Özgen, 2018).

Syrphus ribesii (Linnaeus, 1758)

Locality: Manisa: Kula, 38°30'N, 28°40'E, 775 m a.s.l., 31.III.2016, 2♀♀.

Distribution in Turkey: Ankara, Antalya, Bitlis, Bolu, Çankırı, Edirne, Erzurum, Isparta, İzmir, Kahramanmaraş, Karabük, Kastamonu, Kayseri, Malatya, Mardin, Mersin, Sinop, Tokat, (Candemir and Kara, 2003; Sarıbyık and Hasbenli, 2006; Sarıbyık, 2009, 2014; Toth, 2013; Koçak and Kemal, 2009, 2012a, 2013, 2014, 2015; Sert and Özdemir, 2019); (Koçak, 2014).

Tabanidae

Hybomitra bimaculata (Macquart, 1826)

Locality: Muğla: Fethiye, 36°28'N, 29°21'E, 95 m a.s.l., 27.V.2014, 2♀♀; 36°29'N, 29°21'E, 110 m a.s.l., 21.V.2015, 1♂.

Distribution in Turkey: Bursa, Istanbul, Kırklareli, Kütahya, Tekirdağ (Koçak et al., 2009); (Kılıç, 1999a, 1999b; Koçak and Kemal, 2009, 2012a, 2013, 2014, 2015; Koçak, 2014).

***Hybomitra ciureai* (Seguy, 1937)**

Locality: Muğla: Datça, 36°40'N, 27°28'E, 53 m a.s.l., 29.IV.2016, 1♀; 36°28'N, 29°21'E, 95 m a.s.l., 27.V.2014, 2♂♂.

Distribution in Turkey: Adıyaman, Afyon, Antalya, Balıkesir, Bieçik, Bolu, Bursa, Çanakkale, Düzce, Erzurum, Eskişehir, Hakkari, Hatay, Isparta, İstanbul, İzmir, Kırklareli, Konya, Kütahya, Mersin, Sinop (Koçak et al., 2009); (Koçak and Kemal, 2009, 2012a, 2013, 2014, 2015; Koçak, 2014; Kemal and Koçak, 2015).

Discussion

This study, conducted for the first time in almond orchards of the Aegean region, contributed to the Diptera fauna of Turkey. All the species, except for *T. notate* (Chloropidae) and *E. tenax* (Syrphidae) species, were the first records for the province of Manisa. According to the results of the study conducted in Muğla, *B. hortulanus* (Bibionidae), *C. interruptus* (Chloropidae), *L. rorida* (Lauxaniidae), *A. affinis* (Sarcophagidae), *S. stercoraria* (Scathophagidae), *S. ribesii* (Syrphidae), *H. bimaculata* and *H. ciureai* (Tabanidae) species are the first records for the province. *C. interruptus* (Chloropidae), *L. rorida* (Lauxaniidae), *A. affinis* (Sarcophagidae), *S. stercoraria* (Scathophagidae), *H. bimaculata* (Tabanidae) species were recorded for the first time in the Aegean Region.

Acknowledgment

The authors are very thankful to Prof. Dr. Hasan Sungur CİVELEK and Dr. Oktay DURSUN (Muğla/Turkey) for diagnosis of insects and their help. Also, we thank Republic of Turkey Ministry of Agriculture and Forestry General Directorate of Agricultural Research and Policies for all its support (Project Number: TAGEM-BS-13/10-02/01-23). This study is a part of the first author's PhD studies.

References

Aktas M., Sarıbiyık S. 1996. Contribution to the Syrphidae fauna of Turkey (Diptera: Syrphidae) (II), Milesiinae. Gazi University Journal of Science, 9 (1): 15-27.
 Aral Alpay N. 2011. Systematic and faunistic evaluation of *Machimus* (Diptera, Asilidae) genus group of Orta Toros mountains. PhD thesis, Gazi University, Ankara, Turkey. 84 p. (in Turkish with an abstract in English)
 Bayhan Ölmez S., Ulusoy M.R., Bayhan E. 2006. Aphids and their predator in Malatya region and around, Turkey. Journal of Biology Science 6: 954-957.

Bosak J., Hradsky M. 2001. Some remarks on the distribution of Robber Flies (Diptera: Asilidae) in Turkey. Journal of the Entomological Research Society, 3: 1-28.
 Çalışkan H. 2002. Investigations on the Asilidae (Diptera) fauna of Eskişehir province. Anadolu University Journal of Science and Technology, 3:317-328.
 Çalışkan H., Şahin Y. 2003. Some remarks on the distribution of Robber Flies (Diptera: Asilidae) in South Marmara Region. Anadolu University Journal of Science and Technology, 4:39-46.
 Candemir D., Kara K. 2003. Syrphidae (Diptera) fauna in Tokat provinces (Turkey). Turkish Journal of Entomology, 27: 95-105.
 Civelek H.S., Çıkman E., Dursun O. 2009. Revised checklist of Turkish Agromyzidae (Diptera) fauna of Turkey. Turkish Journal of Zoology, 33:349-358.
 Civelek H.S., Tezcan S. (2005). Some new records for Diptera fauna of Turkey and additional notes on the dipterous fauna of cherry orchards. Turkish Journal of Entomology, 29:11-16.
 Çoban E. 2013. Contributions to Diptera fauna in Thrace Region. In: Proceedings of the First National Zoology Congress of Turkey, 28-31 August 2013, Nevşehir, Turkey, p. 71. (in Turkish)
 Durmuş Y. 1999. Studies on the systematic and the fauna of the family Asilidae in the province Ankara (Diptera). MSc thesis, Gazi University, Ankara, Turkey. (in Turkish with an abstract in English)
 Dursun O., Eskin A., Atahan T. 2010. Contributions to the Turkish Agromyzidae (Diptera) fauna with ten new records. Turkish Journal of Entomology, 34 (3): 299-306.
 Düzgüneş Z, Toros S, Kılınçer N, Kovancı B. 1982. Parasites and predators of Aphidoidea species in Ankara province. T.C. Ministry of Agriculture, Forestry, General Directorate of Plant Protection and Agricultural Quarantine, Ankara. (in Turkish)
 Eren G., Ozerov A.L. 2017. The first record of *Norellisoma spinimanum* (Fallén, 1819) (Diptera: Scathophagidae) for the fauna of Turkey. Acta Biologica Turcica, 30(2): 61-63.
 Giray H. 1981. A preliminary list of the fauna of Turkish Asilidae (Diptera). Journal of Plant Protection Turkey, 5: 171-183. (in Turkish with an abstract in English)
 Gözüaçık C., Özgen I. 2018. Contribution to the Syrphidae (Diptera) fauna in the cereal fields of Southeastern Anatolia, Turkey. Munis Entomology & Zoology, 13: 522-526.
 Gullan P.J., Cranston P.S. 2010. The Insects: An Outline of Entomology, 4th Edition, Wiley Blackwell, Chichester, West Sussex 559pp.
 Gül-Zümreoğlu S. 1972. İzmir Regional Plant Protection Research Institute Insect and General Pests Catalog (1928-1969) Part I. Regional Plant Protection Research Institute, Bornova-Izmir. (in Turkish)

- Hayat R., Alaoğlu Ö. 1996. Faunistic and systematic studies on the Asilidae (Diptera) species in Erzurum and neighbouring provinces III. Asilinae. Atatürk University Journal of the Agricultural Faculty, 27: 121-138. (in Turkish with an abstract in English)
- Hazır A., Ulusoy M.R. 2012. Pest, parasitoid and predator species determined in peach and nectarine orchards in Adana and Mersin provinces. Turkish Journal of Biological Control, 2: 157-168. (in Turkish with an abstract in English)
- Janssens E. 1968. Asilidae de Turquie et Region Voisines (Deuxieme Note). Bulletin (Institut royal des sciences naturelles de Belgique), 44: 1-8.
- Kara K., Pape T. 2002. Check list of Turkish Sarcophagidae (Insecta, Diptera) with new re-cords. Deutsche Entomologische Zeitschrift, 49: 291-295.
- Karsavuran Y., Pehlivan E., Tezcan S., Kılıç A.Y (2005). Notes on Tabanidae (Diptera) fauna of Turkey. Turkish Journal of Entomology, 29 (3):187-195.
- Kemal M., Koçak A.Ö. 2015. On the Pterygota fauna of Hatay Province (S. Turkey), based upon the info-system of the Cesa. Cesa News, 102: 16 - 233, 101 [+1] figs. 34 maps.
- Kemal M., Koçak A.Ö. 2016. First contribution to the knowledge of the Pterygota fauna of Bahcesaray (Van Province, East Turkey). Cent. ent. Stud., Misc. Pap., 161: 1-16, 21 figs.
- Kemal M., Koçak A.Ö. 2017. Observations and faunistic notes on some Diptera of Bahçesaray district (Van Province, East Turkey). Cesa News 144: 1-12, 10 figs.
- Kemal M., Koçak A.Ö. 2018. Revised synonymous list of the Pterygot insects in Van Province (East Turkey). Priamus, 17(1): 1-113.
- Kemal M., Koçak A.Ö., Ecer N. 2016. Second contribution to the knowledge of the Pterygota fauna of Bahçesaray (Van Province, East Turkey). Cesa News, 126: 1-11, 1 fig.
- Kılıç A.Y. (1999b) Trakya Bölgesi Tabanidae (Diptera) Faunası. Turkish Journal of Zoology, 23(1): 67-89.
- Kılıç A.Y. 1999a. Checklist of Tabanidae (Diptera) From Turkey. Turkish Journal of Zoology, 23:123-132.
- Koçak A.Ö. 2014. List of the 23773 Pterygot species in Turkey based upon the info -system of the CESA. Priamus, Suppl. 32: 1-877.
- Koçak A.Ö., Kemal M. 2009. List of the Dipteran genera and species recorded in Turkey based upon the info-system of the Cesa (Report of the temporary results of the entomofauna of Turkey-7). CESA News, 51: 3-106.
- Koçak A.Ö., Kemal M. 2010. List of the species of some Pterygot orders recorded in the Province Van (East Turkey) and a description of a new species in the family Cicadidae (Insecta). Priamus, 12(5):130-149.
- Koçak A.Ö., Kemal M. 2012a. List of the hitherto recorded Pterygot taxa of Turkey (Insecta) (temporary report of the Entomofauna Projekt of Turkey-10). CESA Memoirs, 6:1-1649.
- Koçak A.Ö., Kemal M. 2012b. List of the two thousand species of Pterygot insects in Van province (East Turkey) (Results of the entomofauna project of Turkey-7). p. 1- Editorial, p.87.
- Koçak A.Ö., Kemal M. 2013. Diptera of Turkey. Priamus (Suppl.) 28: ii+ 1-411, 186 figs. 166 maps, 3 Tables.
- Koçak A.Ö., Kemal M. 2014. Revised and advanced list of the Dipteran species of Turkey. Cesa News, 98: 14-105.
- Koçak A.Ö., Kemal M. 2015. Initial results of the entomofauna of SW Asia, based upon the info-system of the Cesa (excl. Lepidoptera). Priamus, 35: 1-1185, 185 maps.
- Koçak A.Ö., Kemal M., Özkol H., Kayci L. 2009. Report on the Entomofauna of Turkey 3- Revised and expanded index of the recorded genera and species of the Pterygot Insects of Turkey. Cesa News 40: 12- 83, 1 fig.
- Kubik S.I., Bartak M. 2017. Frit flies of Turkey with descriptions of two new species and new records (Diptera, Chloropidae). ZooKeys, 667:131-154.
- Lodos N. 1961. Turkey, Iraq, Iran and Syria views on *Eurygaster integriceps* Put. problems (spread, damages, biology, parasitoid and control). Ege University Faculty of Agriculture Publication no.51, Izmir, 115s.
- Özgür A.F. 1986. The Mediterranean Region coastline Syrphidae (Diptera) fauna. I. Subfamily Eristalinae. Çukurova University Faculty of Agriculture Publications, 1(2):72-85.
- Özkan M., Çalıřkan H. 2010. An investigation on Milesiinae fauna in Eskiřehir (Diptera: Syrphidae). Kastamonu Education Journal, 18:975-982.
- Parvu C.M., Popescu-Mirceni R. 2006. Faunistic data on some Dipteran families (Insecta: Diptera) from West Turkey. Travaux du Muséum National d'Histoire Naturelle, Grigore Antipa, 49: 283-295.
- Pehlivan S., Atakan E. 2014. Syrphidae (Diptera) species of the Balcalı location in Adana province, Turkey. Turkish Journal of Biological Control, 5:53-66. (in Turkish with an abstract in English)
- Pehlivan S., Atakan E. 2016. Population fluctuations of *Sitobion avenae* (Hemiptera: Aphididae) and predatory species of Syrphidae (Diptera) in wheat in Balcalı and Dođankent in Adana Province, Turkey, Turkish Journal of Biological Control, 7:111-122. (in Turkish with an abstract in English)
- Rasnitsyn A.P. 2002. Subclass Scarabaeona Laicharting, 1781 The winged insects (=Pterygota Lang, 1888). In: A.P. Rasnitsyn, L.J.D. Quicke (Ed.). History of Insects, Kluwer Academic Publishers, pp:75-93.
- Sarıbıyık S. 1998. Morphology, ecology, fauna and systematics of Syrphidae family for Ilgaz and Isik mountains (Diptera: Syrphidae). PhD thesis, Department of Biology, Gazi University. 254 p. (in Turkish with an abstract in English)

- Sarıbıyık S. 2009. Syrphidae Fauna of Ballıdag (Diptera), Kastamonu Education Journal 17:707-714. (in Turkish with an abstract in English)
- Sarıbıyık S. 2014. Check list of Turkish flower flies (Diptera: Syrphidae). Munis Entomology & Zoology, 9:570-585.
- Sarıbıyık S., Hasbenli A. 2006. Fauna of Syrphinae and Milesiinae (Diptera: Syrphidae) in the Region of South-West Anatolia. Journal of the Entomological Research Society, 8:43-52.
- Sert O., Özdemir S. 2019. A Study on the insect fauna in some provinces of Central, Eastern and Southeastern Anatolian Regions of Turkey. Hacettepe Journal of Biology and Chemistry, 47: 33-49.
- Skartveit J., Koç H. 2007. New records of Bibionidae (Diptera) from Turkey. Journal of the Entomological Research Society, 9: 49-52.
- Toth S. 2013. Additional data to the hoverfly fauna of Turkey (Diptera: Syrphidae). Natura Somogyiensis, 23:239-254.
- Tuatay N., Gül S., Demirtola A., Kalkandelen A., Çagatay N. 1967. Plant Protection Museum insect catalogue (1961-1966). Agricultural Control and Agricultural Quarantine General Directorate Publications, Professional Books Series, Ayyıldız Printing House, Ankara. pp:1-66. (in Turkish)
- Tuatay N., Kalkandelen A., Aysev N. 1972. Plant Protection Museum insect catalogue (1961-1971). Agricultural Control and Agricultural Quarantine General Directorate Publications, Professional Books Series, Ankara. 119p.
- Van de Weyer G. 2010. A new species of *Paragus* Latreille, 1804 from Turkey (Diptera: Syrphidae). Phegea, 38:16-20.
- Verves Y., Khrokalo L. 2018. The Sarcophagidae (Diptera) of the Middle East. Zoology in the Middle East, 1-10.