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NEW LOCALITY RECORDS FOR *XYLOCOPA* (HYMENOPTERA: APIDAE: XYLOCOPINAE) FAUNA OF TURKEY

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Background. The article presents the results of the research on carpenter bees (Hymenoptera: Apidae: Xylocopinae: *Xylocopa*) housed in the Lodos Entomological Museum (Ege University, Izmir, Turkey). There are 10 species of *Xylocopa* occurring on the territory of Turkey. Three of them are common and abundant (*X. violacea, X. valga* and *X. iris*) and the other species are moderately common or rare. The aim of this study is to present new locality records of the material on the *Xylocopa* fauna of Turkey preserved in the Lodos Entomological Museum, Turkey.

Material and Methods. The objects of our research were carpenter bees collected from different localities of Turkey between 1975 and 2018 and housed in the Lodos Entomological Museum. Insects were collected by researchers, students and amateurs. We used stereoscopic microscope Bresser Advance ICD 10x-160x and specialized keys for *Xylocopa* identification.

Results. We analyzed 262 specimens of carpenter bees that belong to four species (*Xylocopa iris*, *X. pubescens*, *X. valga* and *X. violacea*). The information on the specimens' location and brief notes on the plants on which they were foraging is provided. Three of the analyzed species namely *X. iris*, *X. valga* and *X. violacea* are listed in the category "Least Concern" of the IUCN Red List.

Conclusions. We found new locality records for three *Xylocopa* species: *X. iris* reported from Manisa province for the first time, *X. valga* – from Antalya, Aydın, Denizli

and Manisa and *X. violacea* – from Balıkesir, Denizli, Manisa and Tekirdağ provinces of Turkey. Further studies aiming to improve the knowledge on *Xylocopa* fauna should focus on collecting in little-known areas and some specific habitats of Turkey.

***Keywords*:** Hymenoptera, *Xylocopa*, fauna, species diversity, LEMT, Turkey

INTRODUCTION

A number of studies on *Xylocopa* fauna of Turkey have been conducted by many foreign and native researchers for the past 40 years. Among the most well-known of these are works of Warncke (1982), Özbek (2013), Özbek and Terzo (2016).

Additionally, during his long-term observations in Turkey, Özbek (1978, 2008a, b, 2018) pointed out that some bee species that belong to *Xylocopa* (*Xylocopa iris*, *Xylocopa valga*, *X. violacea*) are important for the pollination of apples, temperate fruits, alfalfa and red clovers.

In addition, during the faunistic studies conducted in recent years some *Xylocopa* species were listed from different parts of Turkey by Tezcan, Tezcan and Gülperçin (2010), Güler (2011), Aslan and Karaca (2012), Şenol, Eroğlu, Şentürk, Kaçmaz and Avcı (2017) and Üzüm, Kaya, Tezcan and Yıldırım (2017). According to Özbek (2013) and Özbek and Terzo (2016), there are 10 carpanter bee species known from the territory of Turkey viz. *Xylocopa* (*Ancylocopa*) *parviceps* Morawitz, 1895, *X.* (*Copoxyla*) *armeniaca* Warncke, 1982, *X.* (*Copoxyla*) *iris* (Christ, 1791), *X.* (*Koptortosoma*) *pubescens* Spinola, 1838, *X.* (*Proxylocopa*) *olivieri* Lepeletier, 1841, *X.* (*Proxylocopa*) *rufa* Friese, 1901, *X.* (*Xylocopa*) *iranica* Maa, 1954, *X.* (*Xylocopa*) *valga* Gerstäcker, 1872, *X.* (*Xylocopa*) *varentzowi* Morawitz, 1895, *X.* (*Xylocopa*) *violacea* (Linnaeus, 1758). Three species (*X. violacea, X. valga and X. iris*) are common and abundant, two species (*X. pubescens* and *X. olivieri*) are moderately common and the other species should be considered rare (Özbek, 2013).

The aim of this study is to present new locality records of the material on the *Xylocopa* fauna of Turkey preserved in the Lodos Entomological Museum, Turkey.

MATERIALS AND METHODS

The objects of our research were carpenter bees (Hymenoptera: Apidae: Xylocopinae: *Xylocopa*) collected from different localities of Turkey between 1975 and 2018 and housed in the Lodos Entomological Museum. Insects were collected by researchers, students and amateurs.

We used stereoscopic microscope Bresser Advance ICD 10x-160x and specialized keys for *Xylocopa* identification (Terzo, Iserbyt and Rasmont, 2007; Warncke, 1982).

RESULTS AND DISCUSSION

In this study, 262 specimens of carpenter bees that belong to four species were examined. We provided the information on the specimens' location and brief notes on the plants on which they were foraging below.

Family: Apidae Latreille, 1802
Subfamily: Xylocopinae Latreille, 1802
Genus: *Xylocopa* Latreille, 1802

***Xylocopa iris* (Christ, 1791)**

Note: Previously reported from Adana, Ağrı, Adıyaman, Amasya, Ankara, Antalya, Ardahan, Artvin, Aydın, Balıkesir, Bitlis, Burdur, Bursa, Çanakkale, Çorum, Denizli, Edirne, Elazığ, Eskişehir, Erzincan, Erzurum, Gaziantep, Hakkâri, Isparta, İzmir, Karaman, Kars, Kayseri, Kocaeli, Konya, Mersin, Niğde, Osmaniye, Samsun, Şırnak, Tokat, Van, Yalova by Warncke (1982); Özbek (2013); Terzo and Rasmont (2014); Özbek and Terzo (2016) and cited from Afyonkarahisar by Güler (2011) and recorded from Muğla by Warncke (1982); Özbek (2013); Terzo and Rasmont (2014); Özbek and Terzo (2016) and A. Üzüm *et al*. (2017). Reported from Manisa province for the first time (**Fig. 1**).

Fig. 1. Female of *Xylocopa iris* (Christ, 1791)

The species is listed in the category “Least Concern” in the International Union for Conservation of Nature Red List of Threatened Species (hereinafter – IUCN RL) (Nieto, Roberts, Kemp, Rasmont, Kuhlmann *et al.*, 2014).

Material examined: Antalya: 10.V.2012, weeds, 1 male.

İzmir: Bornova, 18.V.2002, 1 female; 25.V.2002, *Trifolium* sp., 1 female; 19.V.2004, weeds, 1 female; 21.X.2004, weeds, 1 female; 15.V.2015, *Sinapis arvensis*, 1 female. Bornova, Ege University Campus, 28.VI.2001, *Matricaria* sp., 1 female; 03.V.2010, weeds, 1 female; 12.V.2013, weeds, 1 male; 18.V.2013, *Salvia officinalis*, 1 female; 25.VII.2013, on the ground, 1 female, 1 male; 25.V.2016, *Lavandula angustifolia,* 1 male; 03.V.2017, *Salvia officinalis*, 1 male; 20.V.2017, *Thymus* sp., 1 male; 15.V.2018, *L. angustifolia*, 1 female; 22.V.2018, *Lavandula officinalis,* 1 female. Kemalpaşa, 03.V.2015, *Carduus* sp., 1 female. Kemalpaşa, Armutlu, 26.III.2005, *Prunus avium*, 1 female. Menemen, 07.V.2009, 1 female. Seferihisar, 19.IV.2010, *Triticum* sp., 1 female; 01.V.2016, weeds, 1 female. Tire, 21.VIII.2013, *Vitex agnus-castus*, 1 male.

Manisa: Sarıgöl, 22.VII.2013, *Pinus* sp., 1 female.

Mersin: Erdemli, 30.V.1984, aerial collector, 1 female.

Totally 25 specimens.

***Xylocopa pubescens* Spinola, 1838**

Note: Previously reported from Adana, Antalya, Hatay, Kahramanmaraş, Kars, Mersin, Osmaniye by Warncke (1982); Özbek (2013); Terzo and Rasmont (2014); Özbek and Terzo (2016).

Material examined: Adana: Çukurova, 19.V.2013 (**Fig. 2**), *Vicia faba*, 2 males. **Antalya:** Central province, 10.V.2006, *Papaver rhoeas*, 1 male. Totally 3 specimens.

Fig. 2. Male of *Xylocopa pubescens* Spinola, 1838

Xylocopa valga Gerstaecker, 1872

Note: Previously reported from Adıyaman, Ankara, Artvin, Bingöl, Çorum, Erzincan, Erzurum, Eskişehir, Gümüşhane, Hakkâri, Hatay, Iğdır, Isparta, İzmir, Kars, Kayseri, Kırıkkale, Konya, Mersin, Niğde, Samsun, Sivas, Van by Warncke (1982); Özbek (2013); Terzo and Rasmont (2014); Özbek and Terzo (2016) and recorded from Afyonkarahisar by Güler (2011). Reported from Antalya, Aydın, Denizli and Manisa provinces for the first time (**Fig. 3**).

Fig. 3. Male of *Xylocopa valga* Gerstaecker, 1872

The species is listed in the category “Least Concern” in the IUCN RL (Nieto *et al.*, 2014).

Material examined: Antalya: 12.VII.2009, ornamental plant, 1 female.

Aydın: Didim, 02.VII.2002, *Prunus persica,* 1 female, 1 male.

Denizli: Acıpayam, 19.V.2013, *Antirrhinum* sp., 2 males. Honaz, 17.V.2017, weeds, 1 female.

Erzurum: Horasan, 16.VIII.1975, 1 female.

Eskişehir: 09.VIII.2009, weeds, 1 male.

İzmir: Bornova, 22.V.1976, 1 female,1 male; 18.I.2001, *Malva sylvestris,* 1 male; 27.V.2003, *Anthemis* sp., 1 female; 28.V.2003, *Cirsium arvense,* 2 females; 03.VI.2004, *Nerium oleander*, 1 male; 10.V.2013, weeds, 3 females; 15.V.2015, *Daucus* sp., 1 female. Bornova, Ege University Campus, 30.IV.2013, *Salvia officinalis,* 1 female; 23.V.2016, *Lavandula angustifolia,* 1 male; 10.V.2018, *Thymus vulgaris,* 1 male; 15.V.2018, *L. angustifolia*, 1 female, 1 male. Menemen, 19.V.2015, *Matricaria recutita*, 1 female.

Manisa: Alaşehir, 04.V.2013, weeds, 1 female, 1 male.

Totally 26 specimens.

Xylocopa violacea (Linnaeus, 1758)

Note: Previously reported from Adana, Ağrı, Ardahan, Artvin, Aydın, Antalya, Bitlis, Burdur, Bursa, Çanakkale, Çankırı, Erzincan, Erzurum, Gümüşhane, Hakkâri, Hatay, Kars, Konya, Mersin, Muğla, Niğde, Samsun, Sinop, Trabzon, Van by Warncke (1982); Özbek (2013); Terzo and Rasmont (2014); Özbek and Terzo (2016); recorded from Isparta by Warncke (1982); Aslan and Karaca (2012); Özbek (2013); Terzo and Rasmont (2014); Özbek and Terzo (2016); listed from Izmir by Warncke (1982); Tezcan *et al.* (2010); Özbek (2013); Terzo and Rasmont (2014); Özbek and Terzo (2016); Şenol *et al.* (2017); and cited from Afyonkarahisar by Güler (2011). Reported from Balıkesir, Denizli, Manisa and Tekirdağ provinces for the first time (**Fig. 4**).

Fig. 4. Female of *Xylocopa violacea* (Linnaeus, 1758)

The species is listed in the category “Least Concern” in the IUCN RL (Nieto *et al.*, 2014).

Material examined: Antalya: 13.V.2009, weeds, 1 female; 12.VII.2009, ornamental plant, 1 female. Aksu, Kundu, 15.VII.2012, on the ground, 1 female. Kumluca, 17.V.2017, weeds, 3 females.

Aydın: 10.VIII.2008, weeds, 1 female; 10.IX.2008, weeds, 2 females. Didim, 02.VII.2002, *Prunus persica,* 1 female. Kuşadası, 08.III.1986, *Vicia faba*, 2 females. Söke, 06.VIII.2007, weeds, 1 female, 1 male. Sultanhisar, 07.V.2015, *Onopordum* sp., 1 female; 17.V.2015, *Onopordum* sp., 2 females.

Balıkesir: Bigadiç, 27.VII. 2013, *Pinus* sp., 2 females, 1 male. Edremit, Altınoluk, 3.VI.2013, weeds, 1 male. Havran, 18.V.2002, *Nerium oleander*, 1 female.

Çanakkale: Bayramiç, 12.VI.2011, 1 female.

Denizli: 14.V.2000, *Rosa* sp., 1 female; 12.V.2002, *Onopordum* sp., 1 female. Acıpayam, 19.V.2013, *Antirrhinum* sp., 1 female, 1 male. Honaz, 17.V.2017, weeds, 2 females.

İzmir: Balçova, İnciraltı, 15.VIII.1985, weeds, 1 female. Bergama, 22.IX.2013, ornamental plant, 1 male; 30.IX.2013, ornamental plant,1 male; 07.X.2013, ornamental plant, 1 male. Bornova, 29.V.1986, weeds, 1 female; 25.V.1996, *Antirrhinum* sp., 1 female; 29.IV.2000, weeds, 1 female; 23.V.2000, *Medicago sativa*, 1 female; 18.I.2001, *Malva sylvestris,* 1 female; 21.V.2002, *Poa* sp., 1 male; 24.V.2002, *Nerium oleander*, 1 female; 25.V.2002, 1 female; 25.V.2002, *Trifolium* sp., 1 female; 28.V.2002, *Trifolium* sp., 1 female; 02.VI.2002, ornamental plant, 1 female; 31.II.2003, 1 male; 16.III.2003, weeds, 1 male; 12.IV.2003, *Vicia faba*, 1 male; 30.IV.2003, *Sinapis arvensis,* 2 males; 20.V.2003, *Malva sylvestris,* 1 female; 26.V.2003, weeds, 1 female; 27.V.2003, *Anthemis* sp., 2 females; 31.V.2003, *Avena fatua,* 2 females; 31.V.2003, *Avena sativa,* 1 female; 02.VI.2003, *Anthemis* sp., 3 females; 17.X.2003, weeds, 1 male; 20.V.2005, weeds, 2 females; 25.V.2005, 1 female; 19.V.2006, *Salvia officinalis,* 1 female; 25.IV.2009, weeds, 1 female; 12.IV.2010, 1 female; 06.IV.2012, 1 female; 12.IV.2012, 1 male; 23.IV.2012, 1 female; 29.IV.2012, weeds, 2 females; 12.V.2012, 1 female; 18.IV.2013, weeds, 1 female, 1 male; 15.VII.2013, weeds, 1 male; 16.VIII.2013, weeds, 2 females; 05.V.2014, weeds, 1 female; 10.V.2015, *Salix* sp., 1 female; 15.V.2015, *Daucus* sp., 2 females; 06.IX.2015, *Pinus* sp., 1 female; 08.IX.2015, *Pinus* sp., 1 male; 21.IX.2015, *Pinus* sp., 1 male; 25.V.2016, weeds, 1 female, 1 male; 26.III.2017, *Lavandula angustifolia*, 1 female, 3 males; 13.V.2017, *L. angustifolia,* 1 female; 15.V.2017, *L. angustifolia,* 1 female; 15.V.2017, *Salvia officinalis,* 2 females; 16.V.2017, *Lavandula officinalis,* 2 females; 18.V.2017, *Thymus* sp., 2 females; 25.V.2017, *L. angustifolia*, 3 females; 27.V.2017, *L. officinalis,* 1 female. Bornova, Çiçekliköy, 28.IV.2013, weeds, 1 male; 03.V.2013, weeds, 1 female; 29.IX.2013, 1 female, 1 male; 18.X.2013, weeds, 1 female. Bornova, Ege University Campus, 01.VI.2002, fabaceous plants, 3 females; 22.V.2002, *Cichorium intybus,* 3 females; 10.IX.2004, medicinal plants, 1 female, 1 male; 17.V.2005, 1 female, 1 male; 30.IV.2013, *Salvia officinalis,* 1 female 1 male; 12.V.2013, weeds, 1 female; 18.V.2013, *Salvia officinalis,* 2 females, 2 males; 25.IX.2013, on the ground, 1 female; 16.V.2015, *Onopordum* sp., 1 female; 24.V.2015, *Onopordum* sp., 1 female; 12.V.2016, weeds, 1 male; 23.V.2016, *L. angustifolia,* 2 females; 25.V.2016, *L. angustifolia,* 2 males; 01.III.2017, weeds, 1 female; 03.V.2017, *Salvia officinalis*, 1 female, 1 male; 05.V.2017, *L. angustifolia,* 3 females; 17.V.2017, *L. angustifolia,*

1 male; 20.V.2017, *Thymus* sp., 1 female, 1 male; 26.V.2017, *L. angustifolia,* 1 female; 16.IV.2018, *Salvia officinalis,* 4 females; 18.IV.2018, *L. angustifolia*, 8 females, 2 males; 06.V.2018, *Rosmarinus officinalis,* 1 male; 09.V.2018, *L. angustifolia,* 2 females; 10.V.2018, *Thymus vulgaris,* 2 females; 12.V.2018, *L. officinalis,* 1 male; 15.V.2018, *L. angustifolia*, 3 females, 1 male; 22.V.2018, *L. officinalis,* 1 female. Bornova, Yakaköy, 07.IV.2012, weeds, 1 female; 25.IV.2012, weeds, 1 female. Çeşme, 15.V.1998, 1 male. Dikili, 03.IX.2012, *Rosa* sp., 1 male. Karaburun, 24.IV.2010, weeds, 1 male. Karşıyaka, 06.VIII.2004, weeds, 1 female. Kemalpaşa, 24.IV.2005, *Prunus avium*, 1 female, 2 males; 18.IV.2010, weeds, 1 female, 1 male; 27.IV.2013, weeds, 2 females; 03.V.2015, *Carduus* sp., 1 female; 13.V.2018, weeds, 2 females. Kemalpaşa, Armutlu, 26.III.2005, *Prunus avium*, 1 male. Menderes, 02.V.2009, weeds, 1 female. Menemen, 18.V.2013, *Acacia* sp., 1 male; 19.V.2015, *Matricaria recutita*, 2 females; 09.V.2017, weeds, 1 female. Seferihisar, 19.IV.2010, weeds, 1 female; 01.V.2016, weeds, 6 females. Tire, 14.VIII.2013, *Vitex agnus-castus*, 1 female. Urla, 02.V.2010, weeds, 1 female.

Konya: Ereğli, 04.V.2012, weeds, 1 female.

Manisa: Akhisar, 24.IV.2015, *Antirrhinum* sp., 1 female, 1 male. Alaşehir, 04.V.2013, weeds, 1 female; 05.V.2013, weeds, 3 males. Sarıgöl, 22.VII.2013, *Pinus* sp., 1 male.

Mersin: 31.VII.2013, ornamental plants, 2 females, 1 male.

Muğla: Ortaca, 04.V.2017, weeds, 1 female.

Tekirdağ: Çerkezköy, 13.VI, 2011, 1 female.

Totally 208 specimens.

CONCLUSIONS

According to Özbek (2013) and Özbek and Terzo (2016), the number of *Xylocopa* species occurring in Turkey is 10, and four species in total were presented in this study.

There are new locality records for three *Xylocopa* species: *X. iris* reported from Manisa province for the first time, *X. valga* **–** from Antalya, Aydın, Denizli and Manisa and *X. violacea* **–** from Balıkesir, Denizli, Manisa and Tekirdağ provinces.

Amongst those species, *X. iris, X. valga* and *X. violacea* are listed as "Least Concern" in the IUCN Red List (Nieto *et al.*, 2014).

We believe that further studies aiming to improve our knowledge on *Xylocopa* fauna should focus on collecting in little-known areas and some specific habitats of Turkey.

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COMPLIANCE WITH ETHICAL STANDARDS

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Human Rights: This article does not contain any studies with human subjects performed by any of the authors.

Animal Studies: All international, national and institutional guidelines for the care and use of laboratory animals were followed.

AUTHOR CONTRIBUTIONS

Conceptualization, [S.T.]; methodology, [I.S.]; validation, [-]; formal analysis, [-]; investigation, [S.T.; I.S.]; resources, [S.T.]; data curation, [-]; writing – original draft preparation, [S.T.]; writing – review and editing, [I. S.]; visualization, [I. S.] supervision, [S.T.]; project administration, [S.T.]; funding acquisition, [-]. All authors have read and agreed to the published version of the manuscript.

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НОВІ ЗНАХІДКИ ЛОКАЛІТЕТІВ БДЖІЛ РОДУ *XYLOCOPA* (HYMENOPTERA: APIDAE: XYLOCOPINAE) ФАУНИ ТУРЕЧЧИНИ

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Вступ. У статті представлено результати досліджень ксилокоп (Hymenoptera: Apidae: Xylocopinae: *Xylocopa*), котрі зберігаються у Лодоському ентомологічному музеї (Егейський університет, Ізмір, Туреччина). На території Туреччини трапляються 10 видів ксилокоп. Три з них є звичайними та поширеними (*X. violacea, X. valga* та *X. iris*), усі інші є відносно звичайними або рідкісними. Метою дослідження є презентувати нові знахідки локалітетів ксилокоп (з матеріалів Лодоського ентомологічного музею) у фауні Туреччини.

Матеріали та методи. Об'єктом досліджень були ксилокопи, зібрані з різних регіонів Туреччини протягом 1975–2018 років. Ці комахи були зібрані науковцями, студентами й аматорами і тепер зберігаються у Лодоському ентомологічному музеї. Для визначення ксилокоп використовували стереоскопічний мікроскоп Bresser Advance ICD 10x-160x та спеціальні визначники.

Результати. Упродовж досліджень ми проаналізували 262 особини ксилокоп, котрі належать до чотирьох видів (*Xylocopa iris*, *X. pubescens*, *X. valga* та *X. violacea*). У публікації подана інформація про місця знахідок кожного зразка та коротка інформація про рослини, на котрих ці комахи фуражували. Серед досліджуваних комах три види (*X. iris*, *X. valga* та *X. violacea*) занесені у Червоний список МСОП у категорію "Найменший ризик".

Висновки. Для трьох видів ксилокоп виявили нові локалітети: *X. iris* уперше виявлена з провінції Маніса, *X. valga* – з провінцій Анталія, Айдин, Денізлі та

Маніса, а *X. violacea* – з провінцій Баликесір, Денізл, Маніс і Текірдаг. Подальші дослідження, спрямовані на поглиблення знань про фауну джмелів, повинні бути спрямовані на збори і вивчення комах на малодосліджених територіях Туреччини та їхніх специфічних біотопах.

Ключові слова: Hymenoptera, *Xylocopa*, фауна, видове різноманіття, LEMT, Туреччина

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