KSÜ Tarım ve Doğa Derg 27 (3), 622-634, 2024
KSU J. Agric Nat 27 (3), 622-634, 2024
https://doi.org/10.18016/ksutarimdoga.vi.1330418

A Taxonomical and Biogeographical Analysis of the Fauna Metopiinae (*Hymenoptera: Ichneumonidae*) of Türkiye

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ABSTRACT
This study was carried out to determine the faunistic, ecological, zoogeographical and hosts situation of the subfamily Metopiinae (Hymenoptera: Ichneumonidae) in Türkiye. The samples constituting the study were collected between 1995-2022. As a result of the study, 66 species from 10 genera were identified. Literature information, before 1995, also contributed to the study. Among these species *Exochus protuberans* Kolarov & Çoruh, 2009 are endemic for Türkiye at now. For each species, details of composition and the first record of the species from Türkiye are summarised.

Plant Protection

Research Article

Article History
Received : 20.07.2023
Accepted : 21.12.2023

Keywords
Hymenoptera
Ichneumonidae
Metopiinae
Fauna
Türkiye

Türkiye Metopiinae (*Hymenoptera: Ichneumonidae*) Faunasının Taksonomik ve Biyocoğrafik Analizi

ÖZET
Bu çalışma, Türkiye'deki Metopiinae (Hymenoptera: Ichneumonidae) altfamilyasının faunistik, ekolojik, zoocoğrafik ve konukçu durumunu belirlemek amacıyla yapılmıştır. Çalışmayı oluşturan örnekler 1995-2022 yılları arasında toplanmıştır. Çalışma sonucunda 10 cinse ait 66 tür tespit edilmiştir. 1995 öncesi literatür bilgisi de çalışmaya dahil edilmiştir. Bu türlerden ve *Exochus protuberans* Kolarov & Çoruh, 2009 Türkiye için şimdilik endemiktir. Her bir tür için kompozisyon detayları ve türlerin Türkiye'den ilk kayıtları özetlenmiştir

Bitki Koruma

Araştırma Makalesi

Makale Tarihçesi
Geliş Tarihi : 20.07.2023
Kabul Tarihi : 21.12.2023

Anahtar Kelimeler
Hymenoptera
Ichneumonidae
Metopiinae
Fauna
Türkiye

Atıf Şekli: Türkiye Metopiinae (Hymenoptera: Ichneumonidae) faunasının yeni verilerle taksonomik ve biyocoğrafik analizi. *KSÜ Tarım ve Doğa Derg 27* (3), 622-634. https://doi.org/10.18016/ksutarimdoga.vi. 1330418

To Cite : A taxonomical and biogeographical analysis of the fauna Metopiinae (Hymenoptera: Ichneumonidae) of Türkiye, with new data. *KSU J. Agric Nat 27*(3), 622-634. https://doi.org/10.18016/ksutarimdoga.vi.1330418

INTRODUCTION

The Hymenoptera have different ecological roles, such as pollinators, seed dispersers, and regulators of other arthropod populations, acting as predators and parasitoids (natural enemies) (Fernandes et al., 2018). Among these, Darwin wasps (Ichneumonidae) constitute one of the largest families, with about 25,285 valid species, distributed in 1,601 genera and 47 subfamilies (Yu et al., 2016; Klopfstein et al., 2019b).

Despite their ecological importance, Darwin wasps (Ichneumonidae) are among the most poorly studied groups of insect. It is therefore not surprising that their fossil record is even more poorly understood than their extant diversity (Viertler et al., 2022).

Metopiinae, one of the 47 subfamilies are a worldwide subfamily of the parasitic wasp family Ichneumonidae (Townes, 1971). This subfamily are koinobiont endoparasitoids of Lepidoptera.

Most metopiines are medium to large ichneumonids. A bulging shield-like face is diagnostic for members of this subfamily, but many members lack this character. They have a bulging face and with no groove between the face and clypeus. In most genera the upper portion of the face forms a triangular process that extends between the antennae (*Townes,*

1971). Many have stout, robust legs and generally have short ovipositors. Larger species may mimic aculeate wasps in coloration and by producing buzzing noises when captured (*Quicke, 2014).*

There are 27 extant genera and 862 species in the world (Yu et al., 2016). Up to 1995 (Kolarov, 1995) only 22 species belonging to 6 genera have been documented in Türkiye (Kohl, 1905; Fahringer, 1922; Clement, 1930; Meyer, 1936; Sedivy, 1959; Townes et al., 1965; Kasparyan, 1981; Aeschlimann, 1983, 1989; Tolkanitz, 1985, 1987; Kolarov, 1989; Öncüer, 1991; Kolarov & Beyarslan, 1993). After 1995, with the contributions which some studies (Kolarov & Özbek, 1998; Çoruh et al., 2002; Gencer, 2003; Sarıkaya & Avcı, 2005; Kolarov et al., 2009; Özdemir & Güler, 2009; Eroğlu, 2010; Kolarov & Çalmaşur, 2011; Çoruh & Özbek, 2011; Gürbüz et al., 2011; Çoruh &Kolarov, 2012; Özdan, 2014; Çoruh et al., 2014 a,b; Kolarov et al., 2014 a,b; Çoruh & Çalmaşur, 2016; Kolarov et al., 2016; Narmanlıoğlu & Çoruh, 2017; Kolarov et al., 2017; Özdan & Gürbüz, 2019; Kıraç & Gürbüz, 2020; Kolarov & Çoruh, 2022 and İneciklioğlu, 2022) the numbers of Metopiinae fauna of Turkey reached to 66 species and 11 genera.

The aim of this study is to analyze to studies related to this subfamily by taxonomical and biogeographical in Türkiye.

MATERIALS and METHODS

Adult metopiines samples were collect in the different habitats from Türkiye (Figure 1, 2) since 1995 using sweping nets, malaise and light traps by authors, other ichneumonis researchers (Dr. Hikmet Özbek, (retired), Dr. Ahmet Beyarslan (retired), Dr. Murat Yurtcan (Trakya University), Dr. Faruk Gürbüz (Süleyman Demirel University), and other collector Dr. Erol Yıldırım, Dr. Önder Çalmaşur, Dr. Göksel Tozlu (Atatürk University), Dr. İrfan Aslan (Yıldırım Beyazıt University),Coşkun Güclü (Eskişehir Osmangazi University) and published in different publications. Furthermore, all samples that have been collect before 1995 also evaluated. The specimens were then pinned and properly labelled for identification.

The genera and species are listed in the alphabetic order according the recent Interactive Catalogue of World Ichneumonidae (Yu et al., 2016). The distributional records were also used from this catalogue. The individual information, collected months and altitudes, including the regional, locality and literature data are given with tables and graphs (Tables 1, 2 and Figures 3,4,5,6).

Figure 1. Research area.
Şekil.1. Araştırma alanı.

RESULTS

Metopiine samples that were collect in whole of Anatolia since 1995 evaluated according to different situations as faunistic evaluations, ecological evaluatios, zoogeographical evaluations and evaluations of host and plant visited by adults.

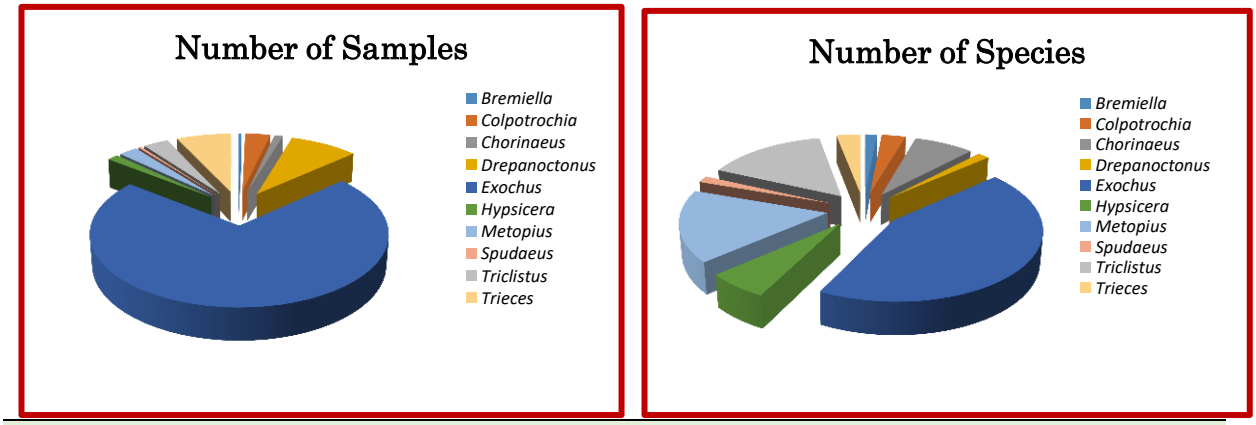
Faunistic evaluations

In total 66 species belonging to 10 genus are reported for the studied regions in this study. When evaluation is made according to the number of species and individuals possessed by the existing genera we will see that, one species and three samples belong to the genus *Bremiella*, two species and 24 samples belong to genus *Colpotrochia*, five species 8 samples belong to *Chorinaeus*, one species 65 samples belong to *Drepanoctonus*, 29 species 539 samples belong to *Exochus*, four species 11 samples belong to *Hypsicera*, 11 speceis 18 samples belong to *Metopius*, one speceies three samples belong to *Spudaeus*, 10 species 24 samples belong to *Triclistus* and two species 52 samples belong to *Trieces* were recorded. As a results, when all genuses are compared, the number of samples of the *Exochus* more dense than other genus (Figure 3a). Among the species determined, *Exochus castaniventris* (with 305 individuals), *Exochus mitratus* (80), *Trieces tricarinatus* (51) and *Exochus suborbitalis* (37) were the most abundant in research areas (Table 1). All species collected from by insect

net and light traps, but only *Drepanoctonus tricoloratus* was collected by malasia trap in our study area.

In contrast, *C. flavipes*, *C. scrobipalpae*, *C. subcarinatus*, *Exochus bolivari*, *E. ferus*, *E, frontellus, E. flavomarginatus*, *E. gravipes*, *E. morionellus*, *E. semilividus*, *E. separandus*, *E, tardigradus, Hypsicera curvator*, *H. subtilotor, M.* (*Cultrarius*) *turcestanicus*, *M.* (*Metopius*) *fulvicornis, M.* (*M.*) *septemcinctus, M.* (*Peltocarus*) *croceicornis, Metopius* (*P.*) *dirus, Triclistus areolatus, T. congener, T. lativentris, T. niger, T. pyrellae* and *Trieces bellulus* (with 1 individual) were rarely found in Anatolia (Table 1). The rate of speceis, collected as a single individual is 37.8%.

Figure 2. Research localities and research team.
Şekil 2. Çalışma alanından lokaliteler ve çalışma ekibi.



a b

Figure 3. Distribution of species: a) according to samples, b) according to speceis.
Şekil 3. Türlerin dağılışı: a) örnek sayısına göre, b) tür sayısına göre.

Table 1. Metopiinae list of Türkiye
Çizelge 1. Türkiye'nin Metopiinae listesi

Data of collected species: Individual numbers (IN), vertical distribution (VD), seasonal dynamics (SD), geographical regions (GR), zoogeographical regions (ZR), first record of Turkey (FRT) of specimens

Names of Taxa	IN	VD	SD	GR	ZR	FRT
SUBFAMILY METOPIINAE Förster, 1869						
Genus *Bremiella* Dalla Torre, 1901						
Bremiella pulchella (Kriechbaumer, 1890)	3	A, G	Ap, J	EAR, MtR	E, WP	Kolarov & Özbek,1998
Genus *Colpotrochia* Holmgren, 1856						
Colpotrochia cincta (Scopoli, 1763)	15	A, C, F, D	M, J, JL, S, N	MtR, EAR, BSR	EP, E, WP	Kolarov et al., 2009
Colpotrochia triclistor (Aubert, 1979)	9	E, F, G, H	J, Jl	CAR, EAR, SAR	E, WP	Aubert, 1979
Genus *Chorinaeus* Holmgren,1858						
Chorinaeus cristator (Gravenhorst, 1829)	2	A, D	M	MR, MtR	EP, E, WP	Kolarov et al., 2009
Chorinaeus flavipes Bridgman, 1881	1	E	Ap	MtR	EP, E, WP	Kolarov et al., 2009
Chorinaeus funebris (Gravenhorst, 1829)	3	C, F	Jl, O	CAR, EAR	EP, E, NEAR, WP	Kolarov et al., 2009
Chorinaeus scrobipalpae Aeschlimann,1983	1	C	J	MtR	EP, E, WP	Özdan, 2014
Chorinaeus subcarinatus Holmgren, 1858	1	F	M	MtR	EP, E, NEAR, WP	Kolarov et al., 2009
Genus *Drepanoctonus* Pfankuch, 1911						
Drepanoctonus tricoloratus (Sedivy, 1971)	65	E, F	J, Jl, Aug, S	EAR	EP, E, WP	Kolarov et al., 2009
Genus *Exochus* Gravenhorst, 1829						
Exochus albicinctus Holmgren, 1873	5	G, H, C	Jl, J	EAR, MtR	EP, E, WP	Kolarov & Beyarslan, 1993
Exochus alpinus Zetterstedh, 1838	3	A	J, Aug	BSR	EP, E, WP	Kolarov & Çoruh, 2022
Exochus bolivari (Seyrig, 1927)	1	E	Jl	BSR	EP, E	Çoruh & Kolarov, 2012
Exochus britannicus Morley, 1911	5	D, E, F	Jl, Aug	EAR, CAR, MtR, MR	EP, E, WP	Kolarov et al., 2009
Exochus castaniventris Brauns, 1896	305	A, B, C, D, F, E, G	M, Jl, Aug, S, N	MR, MtR, EAR, SAR, AR	EP, E, WP	Kolarov, 1989
Exochus carri Schmiedeknecht, 1924	5	A	Ap	CAR	EP, E	Kolarov et al., 2009
Exochus consimilis Holmgren, 1858	7	A, F, G, H	J, Jl	AR, BSR, EAR	EP, E, NEAR, WP	Kolarov et al., 2009
Exochus erythronotus (Gravenhorst, 1829)	5	A, D, E, C	Ap, M, S	AR, CAR, EAR, MtR	E, WP	Sedivy, 1959
Exochus foveolatus Schmiedeknecht, 1924	4	A, D, F	Ap, J	CAR, MtR, EAR,BSR	EP, E, WP	Kolarov & Özbek, 1998
Exochus ferus Tolkanitz, 1993	1	E	Jl	BSR	EP, E, WP	Çoruh & Kolarov, 2012
Exochus flavifacies Kusigemati, 1984	5	A	J	BSR,EAR	EP	Kolarov et al., 2017
Exochus frontellus Holmgren,1858	1	A	?	MtR	EP, E, WP	Yurtcan, 2013
Exochus flavomarginatus Holmgren, 1856	1	A	J	MR	EP, E, WP	Kolarov et al., 2009
Exochus flavifrons Boheman, 1863	5	B, H, C	J, Jl, S	BSR, EAR, MtR	E, WP	Çoruh & Kolarov, 2012
Exochus gravipes (Gravenhorst, 1820)	1	E	J	MtR	E, WP	Kolarov et al., 2009
Exochus gravis (Gravenhorst, 1829)	3	F	J	MtR	E, WP	Kolarov et al., 2009
Exochus lictor Holiday, 1838	5	D, E	May, Jl, J	BSR, EAR, MtR, AR	EP, E, NEAR, WP	Kolarov et al., 2009
Exochus lineifrons Thomson, 1887	6	D	J	MtR	EP, E, WP	Kolarov et al., 2009
Exochus marklini Holmgren, 1858	8	A, F	A, Jl	BSR, EAR, MtR,AR	E, WP	Kolarov, 1995
Exochus mitratus Gravenhorst, 1829	80	A, B, D, E, F, H	Ap, M, J, Jl, Aug	AR, BSR, CAR, EAR, MR, MtR,	EP, E, NEAR, WP	Kolarov & Özbek, 1993
Exochus morionellus	1	D	M	MtR	EP, E, WP	Kolarov et al., 2009

Holmgren, 1858						
Exochus prosopius Gravenhorst, 1829	9	A	J, Jl	AR, BSR	EP, E, WP	Kolarov et al., 2009
Exochus protuberans Kolarov & Çoruh, 2009	3	G, H, E	J, Jl	EAR	WP	Kolarov et al., 2009
Exochus semilividus Vollenhoven, 1875	1	A	M	MtR	EP, E, WP	Kolarov et al., 2009
Exochus separandus Schmiedeknecht, 1924	1	A	M	MtR	E, WP	Kolarov et al., 2009
Exochus suborbitalis Schmiedeknecht, 1924	37	A, D, F, H	M, J, Jl, Aug	BSR, EAR, MtR,MR	EP, E, WP	Kolarov & Beyarslan, 1993
Exochus tardigradus Gravenhorst,1829	1	A	?	MR	EP, E, WP	Yurtcan, 2013
Exochus thomsoni Schmiedeknecht, 1924	12	A, D, G, C	M, J	BSR, EAR, MtR,MR	EP, E, WP	Çoruh & Kolarov, 2012
Exochus vafer Holmgren, 1873	18	A, B, D, C, E F, H	M, J, Jl, Aug	AR, EAR, MtR	EP, E, WP	Kolarov et al., 2009
Genus *Hypsicera* Latreille, 1829						
Hypsicera britannica Tolkanitz, 2011)	?	?	?	?	E, WP	Aeschlimann, 1989
Hypsicera curvator (Fabricius, 1793)	1	D	J, Jl	MtR	EP, E, NEAR, WP	Kolarov et al., 2009
Hypsicera femoralis (Geoffroy, 1785)	9	A, D, E, H	J, Jl, Aug	BSR, EAR, MtR, MR	AFR, AUR, EP, E, NEAR, NTR, OCE, ORR, WP	Kolarov & Beyarslan, 1993
Hypsicera subtilitor Aubert, 1969	1	A	?	MR	E, WP	Kolarov et al., 2009
Genus *Metopius* Panzer, 1806						
Metopius (*Ceratopius*) *citratus* (*Geoffroy, 1785)*	2	A, B	M, Aug	MtR, MR	EP, E, ORR, WP	Fahringer, 1922
Metopius (*Ceratopius) erythropus* Kriecbaumer, 1894	3	A, D	?	AR, CAR	E, WP	Clement, 1930
Metopius (*Cultrarius*) *turcestanicus* Clement, 1930	1	E	J	MtR	EP, E, WP	Kolarov et al., 2009
Metopius (*Metopius*) *fulvicornis* Mocsary, 1883	1	B	?	EAR	WP	Tolkanitz, 1985
Metopius (Metopius) septemcinctus Clément, 1930	1	D	J	EAR	WP	Kolarov & Çalmaşur, 2011
Metopius (*Peltastes*) *pinatorius* Brullé, 1846	3	E, F,H	Jl	EAR	EP, E, WP	Kolarov, 1995
Metopius (*Peltocarus) croceicornis* Thomson, 1887	1	A	?	MR	EP, E, WP	Clement, 1930
Metopius (*Peltocarus*) *dentatus* (Fabricius, 1779)	3	A, F, H	J, Jl	MR, EAR	EP, E, WP	Clement, 1930
Metopius (*Peltocarus*) *dirus* Mocsary, 1883	1	A	?	MR	EP, E, WP	Clement, 1930
Metopius (Peltastes) brevispina Thomson, 1887	2	D	M	Anatolia, CAR	E, WP	Kohl, 1905
Metopius (Peltastes) leiopygus Förster, 1850	?	?	?	?	EP, E, WP	Clement, 1930;
Genus *Spudaeus* Thomson, 1883						
Spudaeus scaber (Gravenhorst, 1829)	3	E, H	J, Aug	EAR	EP, E, NEAR, WP	Çoruh et al., 2002
Genus *Triclistus* Förster, 1869						
Triclistus areolatus Thomson, 1887	1	F	Jl	EAR	EP, E, WP	Kolarov et al., 2009
Triclistus congener (Holmgren, 1858)	1	F	Jl	EAR	E, NEAR, WP	Kolarov et al., 2017
Triclistus globulipes (Desvignes, 1856)	2	A, F	J, Jl	BSR, MtR	EP, E, ORR, WP	Sarıkaya & Avcı, 2004
Triclistus lativentris Thomson, 1887	1	H	?	BSR	E, WP	Aeschlimann, 1985
Triclistus longicalcor Thomson, 1887	8	C, F, G, H	J, Jl	EAR,MR	E, WP	Çoruh & Kolarov, 2012
Triclistus niger (Bridgman, 1883)	1	D	J	MtR	E, WP	Kolarov et al., 2009
Triclistus pallipes Holmgren, 1873	2	A	Ap	MR	EP, E, NEAR, ORR, WP	Kolarov et al., 2009
Triclistus podagricus (Gravenhorst, 1829)	5	D, F, H	J, Aug	EAR, MtR	EP, E, NEAR, WP	Kolarov & Beyarslan, 1993
Triclistus pyrellae Tolkanitz, 1983	1	B	M	MtR	E, WP	Kolarov et al., 2009

Triclistus spiracularis Thomson, 1887	2	D	Jl	MtR	EP, E, WP	Kolarov et al., 2009
Genus *Trieces* Townes, 1946						
Trieces bellulus Kusigemati 1984	1	C	J	MtR	EP, WP	Özdan, 2014
Trieces tricarinatus (Holmgren, 1858)	51	E, G, H, D	M, J, Jl, Aug	CAR, MtR, EAR	E, WP	Aeschlimann, 1983

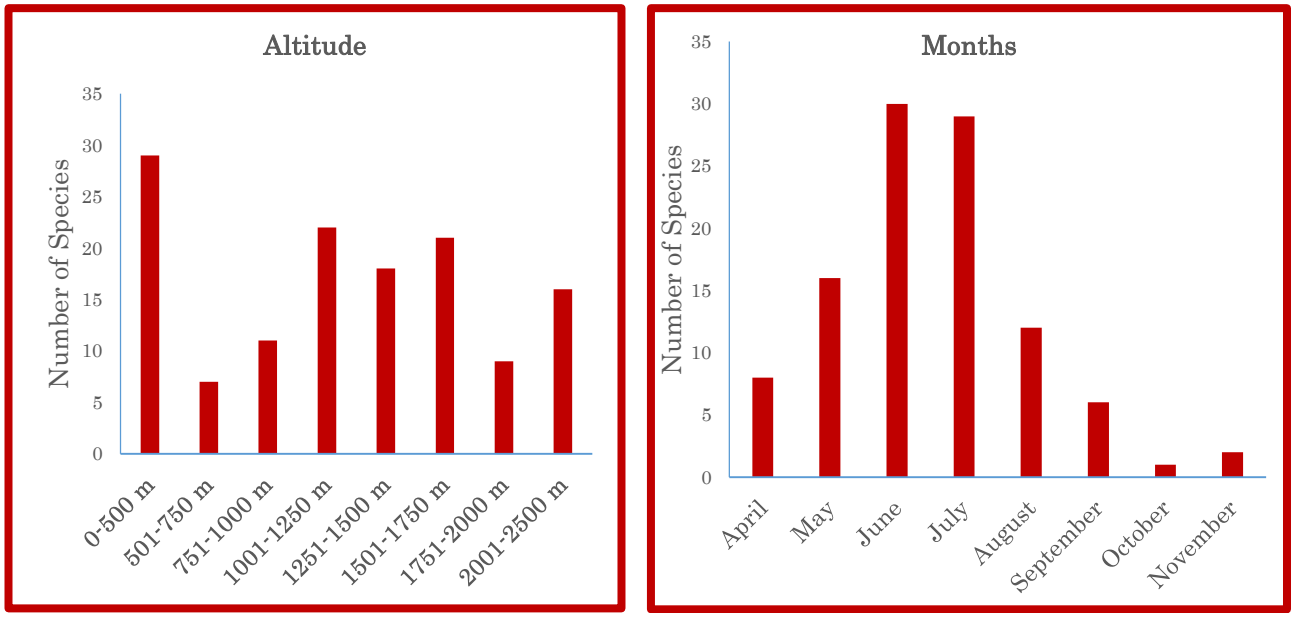
Vertical distribution (VD) (metre): A: 0-500 m, B: 501-750 m, C: 751-1000 m, D: 1001-1250 m, E: 1251- 1500 m, F: 1501-1750 m, G: 1751-2000 m, H: 2001-2500 m. Seasonal dynamics (SD): Ap: April, M: May, J: June, Jl: July, Aug: August, S: September, O: October, N: November. Geographical regions (GR): AR: Aegean Region, BSR: Black Sea Region, CAR: Central Anatolia Region, EAR: Eastern Anatolia Region, MR: Marmara Region, MtR: Mediterranean Region, SAR: Southeastern Anatolia. Zoogeographical regions (ZR): AFR: Afrotopical Region, AUR: Australian Region, E: Europe, EP: Eastern Palaearctic, NEAR: Nearctic Region, NTR: Neotropical, OCE: Oceanic, ORR: Oriental, WP: West Palaerctic.

Table 2. Provinces and references of collected species in Turkey
Çizelge 2. Türkiye'deki türlerindağılış gösterdiği iller ve ilgili referanslar

Names of Taxa	Distributions in Turkey	Reference (s)
SUBFAMILY METOPIINAE Förster, 1869		
Genus *Bremiella* Dalla Torre, 1901		
Bremiella pulchella (Kriechbaumer, 1890)	Erzurum, Hatay	Kolarov & Özbek, 1998; Gürbüz et al., 2011; Çoruh et al., 2014b
Genus *Colpotrochia* Holmgren, 1856		
Colpotrochia cincta (Scopoli, 1763)	Artvin, Erzurum, Isparta, Ordu, Rize, Tunceli	Kolarov et al., 2009; Çoruh & Özbek, 2011; Kolarov & Çalmaşur, 2011; Çoruh & Kolarov, 2012; Çoruh et al., 2014a, b; Kolarov et al., 2014a; Kolarov & Çoruh, 2022
Colpotrochia triclistor (Aubert, 1979)	Erzurum, Erzincan, Nevşehir, Kars, Şanlıurfa	Aubert, 1979; Çoruh et al., 2002; Kolarov et al., 2009; Çoruh & Özbek, 2011; Kolarov & Çalmaşur, 2011; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Genus *Chorinaeus* Holmgren, 1858		
Chorinaeus cristator (Gravenhorst, 1829)	Edirne, Isparta	Kolarov et al., 2009; Yurtcan, 2013
Chorinaeus flavipes Bridgman, 1881	Isparta	Kolarov et al., 2009
Chorinaeus funebris (Gravenhorst, 1829)	Erzurum, Eskişehir	Kolarov et al., 2009; Eroğlu, 2011; Çoruh et al., 2014b
Chorinaeus scrobipalpae Aeschlimann,1983	Isparta	Özdan, 2014; Özdan & Gürbüz, 2019
Chorinaeus subcarinatus Holmgren, 1858	Isparta	Kolarov et al., 2009
Genus *Drepanoctonus* Pfankuch,1911		
Drepanoctonus tricoloratus (Sedivy, 1971)	Kars	Kolarov et al., 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014b; Çoruh & Çalmaşur, 2016
Genus *Exochus* Gravenhorst, 1829		
Exochus albicinctus Holmgren, 1873	Erzurum, Isparta	Kolarov & Beyarslan, 1993; Kolarov, 1995; Kolarov et al., 2009; Çoruh & Özbek, 2011; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Exochus alpinus Zetterstedh, 1838	Rize	Kolarov & Çoruh, 2022
Exochus bolivari Seyrig, 1927	Artvin	Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Exochus britannicus Morley, 1911	Çanakkale, Edirne, Hatay, Kars, Konya	Kolarov et al., 2009; Çoruh & Kolarov, 2012; Yurtcan, 2013; Çoruh et al., 2014b
Exochus castaniventris Brauns, 1896	Adana, Afyonkarahisar, Antalya, Denizli, Edirne, Erzurum, Istanbul, Hatay, Kahramanmaraş, Kars, Konya, Manisa	Kolarov, 1989; Öncüer, 1991; Kolarov & Beyarslan, 1993; Kolarov, 1995; Özdemir & Güler, 2009; Kolarov et al., 2009; Çoruh & Özbek, 2011; Çoruh & Kolarov, 2012; Kıraç, 2012; Yurtcan, 2013; Çoruh et al., 2014b; Çulcu, 2015; Kıraç & Gürbüz, 2020
Exochus carri Schmiedeknecht, 1924	Sinop	Kolarov et al., 2009
Exochus consimilis Holmgren, 1858	Erzurum, Kırklareli, Rize	Kolarov et al., 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Exochus erythronotus (Gravenhorst, 1829)	Aydın, Isparta, Kars, Konya	Sedivy,1959, Öncüer, 1991; Kolarov, 1995, Kolarov et al., 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014b; Özdan, 2014; Çulcu, 2015; Özdan & Gürbüz, 2019
Exochus foveolatus Schmiedeknecht, 1924	Erzurum, Isparta, Sinop	Kolarov & Özbek, 1998; Kolarov et al., 2009; Çoruh et al., 2014b
Exochus ferus Tolkanitz, 1993	Rize	Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Exochus flavifacies Kusigemati, 1984	Erzurum, Ordu, Rize	Çoruh & Kolarov, 2012; Kolarov et al., 2017
Exochus flavomarginatus Holmgren, 1856	Balıkesir	Kolarov et al., 2009
Exochus flavifrons Boheman, 1863	Erzurum, Isparta, Rize	Çoruh & Kolarov, 2012; Çoruh et al., 2014a, b; Özdan, 2014; Özdan & Gürbüz, 2019
Exochus frontellus Holmgren, 1858	Edirne	Yurtcan, 2013

Exochus gravipes (Gravenhorst, 1820)	Isparta	Kolarov et al., 2009
Exochus gravis (Gravenhorst, 1829)	Osmaniye	Kolarov et al., 2009
Exochus lictor Holiday, 1838	Çanakkale, Ege kıyıları, Osmaniye, Kars, Rize	Kolarov et al. 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Exochus lineifrons Thomson, 1887	Osmaniye	Kolarov et al., 2009
Exochus marklini Holmgren, 1858	Anatolia, Adana, Erzurum, Isparta, İzmir, Osmaniye, Rize	Kolarov 1995, Öncüer 1991; Kolarov et al., 2009; Çoruh et al., 2014b
Exochus mitratus Gravenhorst, 1829	Ankara, Antalya, Artvin, Bayburt, Bingöl, Burdur, Denizli, Erzincan, Erzurum, Giresun, Isparta, Kars, Kırklareli, Ordu, Rize	Sedivy, 1959; Öncüer, 1991; Kolarov & Beyarslan, 1993; Kolarov, 1995; Kolarov & Özbek, 1998; Kolarov et al., 2009; Kıraç, 2012; Çoruh & Kolarov, 2012; Çoruh et al., 2014a, b; Çulcu, 2015; Kolarov et al., 2016; Kolarov et al., 2017; Kıraç &.Gürbüz, 2020
Exochus morionellus Holmgren, 1858	Antalya	Kolarov et al., 2009
Exochus prosopius Gravenhorst, 1829	Giresun, İzmir, Rize, Trabzon	Kolarov et al., 2009; Çoruh et al., 2014a; Kolarov et al., 2017; Kolarov & Çoruh, 2022;
Exochus protuberans Kolarov & Çoruh, 2009	Erzurum	Kolarov et al., 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Exochus semilividus Vollenhoven, 1875	Hatay	Kolarov et al., 2009
Exochus separandus Schmiedeknecht, 1924	Adana	Kolarov et al., 2009
Exochus suborbitalis Schmiedeknecht, 1924	Ağrı, Antalya, Ardahan, Artvin, Bayburt, Bingöl, Çanakkale, Edirne, Erzincan, Erzurum, Giresun, Isparta, Kahramanmaraş, Kars, Gaziantep, Kırklareli, Ordu, Osmaniye	Kolarov & Beyarslan, 1993; Kolarov, 1995; Kolarov & Özbek, 1998; Kolarov, 1995;, Kolarov et al 2009; Çoruh & Kolarov, 2012; Yurtcan 2013; Kolarov, 2014; Çoruh et al., 2014a, b; Kolarov et al., 2016; Kolarov et al., 2017
Exochus tardigradus Gravenhorst,1829	Edirne	Yurtcan, 2013
Exochus thomsoni Schmiedeknecht, 1924	Balıkesir, Çanakkale, Erzurum, Isparta, Rize, Tunceli	Çoruh & Kolarov 2012, Kolarov, 2014; Kolarov et al. 2014b, Çoruh et al. 2014b, Özdan 2014; Özdan & Gürbüz, 2019
Exochus vafer Holmgren, 1873	Denizli, Erzincan, Erzurum, Isparta, İzmir	Kolarov et al., 2009; Kolarov et al. 2017; Çoruh & Kolarov, 2012; Kıraç, 2012; Çoruh et al., 2014b; Özdan, 2014; Çulcu, 2015; Özdan & Gürbüz, 2019; Kıraç & Gürbüz, 2020
Genus *Hypsicera* Latreille, 1829		
Hypsicera britannica Tolkanitz, 2011	Anatolia	Aeschlimann, 1989; Kolarov, 1995
Hypsicera curvator (Fabricius, 1793)	Osmaniye	Kolarov et al., 2009
Hypsicera femoralis (Geoffroy, 1785)	Ağrı, Antalya, Anatolia, Çanakkale, Giresun, Erzurum, Isparta, Osmaniye, Tunceli	Kolarov & Beyarslan, 1993; Kolarov, 1995; Gürbüz, 2004, 2005; Buncukçu, 2008; Gürbüz et al., 2009
Hypsicera subtilitor Aubert, 1969	Çanakkale	Kolarov et al., 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014a, b; Kolarov et al., 2014b; Kolarov, 2014; Çulcu, 2015; Kolarov, 2014
Genus *Metopius* Panzer, 1806		
Metopius (*Ceratopius*) *citratus* (*Geoffroy, 1785*)	Burdur, İstanbul	Fahringer, 1922; Kolarov, 1995; Kolarov et al., 2009
Metopius (*Ceratopius*) *erythropus* Kriecbaumer, 1894	İzmir, Konya	Clement, 1930; Tolkanitz, 1985; Kolarov, 1995
Metopius (*Cultrarius*) *turcestanicus* Clement, 1930	Isparta	Kolarov et al., 2009
Metopius (*Metopius*) *fulvicornis* Mocsary, 1883	Malatya	Tolkanitz, 1985; Kolarov, 1995
Metopius (Metopius) septemcinctus Clément, 1930	Erzurum	Kolarov & Çalmaşur, 2011
Metopius (*Peltastes*) *pinatorius* Brullé, 1846	Anatolia, Erzurum	Tolkanitz, 1985; Kolarov, 1995; Çoruh & Kolarov, 2011; Çoruh & Özbek, 2011; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Metopius (*Peltocarus*) *croceicornis* Thomson, 1887	Bursa	Clement, 1930; Tolkanitz, 1985; Kolarov, 1995
Metopius (*Peltocarus*) *dentatus* (Fabricius, 1779)	Bayburt, Erzurum, İstanbul	Clement, 1930; Kolarov, 1995; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Metopius (*Peltocarus*) *dirus* Mocsary, 1883	Bursa	Clement, 1930; Meyer, 1936; Kolarov, 1995
Metopius (Peltastes) brevispina Thomson, 1887	Niğde	Kohl, 1905; Kolarov, 1995
Metopius (Peltastes) leiopygus Förster, 1850	Anatolia	Clement, 1930; Townes et al., 1965; Kasparyan, 1981; Tolkanitz, 1985; Kolarov, 1995
Genus *Spudaeus* Thomson, 1883		
Spudaeus scaber (Gravenhorst, 1829)	Erzurum, Bayburt	Çoruh et al., 2002; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Genus *Triclistus* Förster, 1869		
Triclistus areolatus Thomson, 1887	Erzurum	Kolarov et al., 2009; Çoruh et al., 2014b
Triclistus congener (Holmgren, 1858)	Erzurum	Kolarov et al., 2017
Triclistus globulipes (Desvignes, 1856)	Isparta, Giresun	Sarıkaya & Avcı, 2005; Çoruh et al., 2014a
Triclistus lativentris Thomson, 1887	Gümüşhane	Aeschlimann, 1983; Kolarov, 1995
Triclistus longicalcor Thomson, 1887	Artvin, Edirne, Erzurum	Çoruh & Kolarov, 2012; Yurtcan, 2013Çoruh et al., 2014b

Triclistus niger (Bridgman, 1883)	Isparta	Kolarov et al., 2009
Triclistus pallipes Holmgren, 1873	Kırklareli	Kolarov et al., 2009
Triclistus podagricus (Gravenhorst, 1829)	Bayburt, Isparta, Erzurum	Kolarov & Beyarslan, 1993; Kolarov, 1995; Kolarov et al., 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014b
Triclistus pyrellae Tolkanitz, 1983	Isparta	Kolarov et al., 2009
Triclistus spiracularis Thomson, 1887	Isparta	Kolarov et al., 2009
Genus *Trieces* Townes, 1946		
Trieces bellulus Kusigemati 1984	Isparta	Özdan, 2014;, Özdan & Gürbüz, 2009
Trieces tricarinatus (Holmgren, 1858)	Erzurum, Gümüşhane, Mersin, Sivas	Aeschlimann, 1983; Kolarov & Beyarslan, 1993; Kolarov, 1995; Gencer, 2003; Kolarov et al., 2009; Çoruh & Kolarov, 2012; Çoruh et al., 2014b; Narmanlıoğlu & Çoruh, 2017



a b

Figure 4. Distribution of species: a) according to altitude, b) according to months.
Şekil 4. Türlerin dağılışı: a) rakıma göre, b) aylara göre.

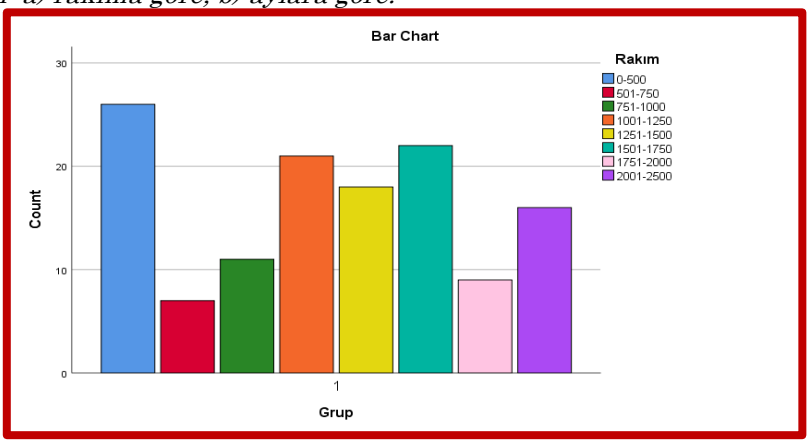
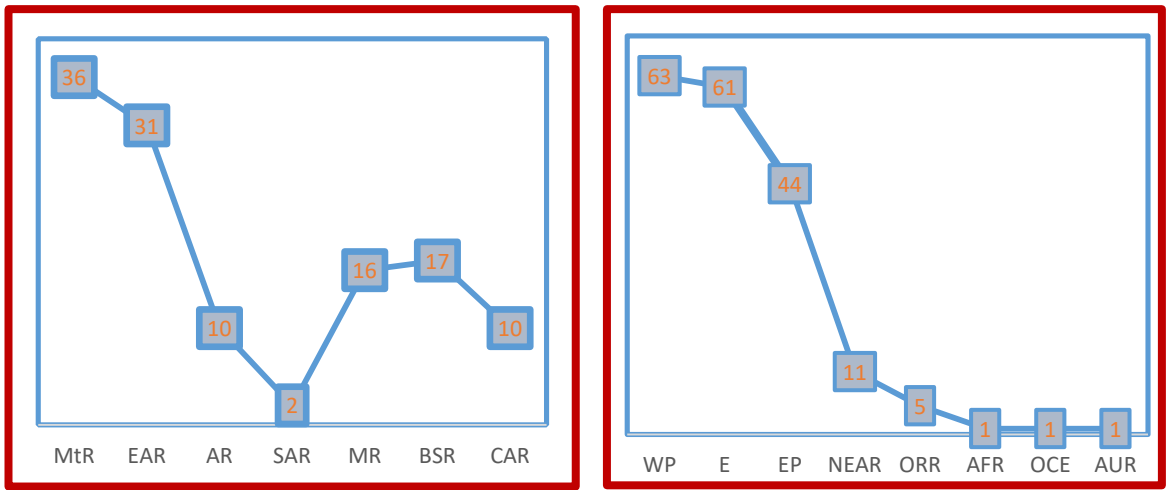


Figure 5. Difference between altitudes according to the chi-square test.
Şekil 5. Chi-square testine göre rakımlar arasındaki fark.



a b

Figure 6. Distribution of species: a) according to geographic regions, b) according to zoogeographical regions.
Şekil 6. Türlerin dağılış: a) coğrafik bölgelere göre, b) zoocoğrafik bölgelere göre.

Numbers of species belonging to genera are shown in the graph (Figures 3b). It is noted that, *Exochus castaniventris* is the most abundant species with the number of samples in Anatolia. The species is quite common in Anatolia.

Ecological evaluations:

Altitude and elevation is the same both are abiotic factors. They are vital for all living creatures. This is also true for insect. Metopiine specimens were collected from different altitudes in collection areas in this study.

Among them, 34 species collected from only one altitude. While *Exochus castaniventris* and *Exochus vafer* collected from seven different altitudes, *Exochus mitratus* collected from six different altitude. It is a fact the most species were from the range of 0-500 m, and the least species collected from the range of 501-750 m (Figure 4a). For example, While both the number of specimens and corresponding number of species reach a maximum between 400 and 600 m altitude in Switzerland (Klopfstein et al., 2019a). This situation was interpreted as the fact that the majority of the places selected as the study area were in the range of 0-500 m in this study.

The months is which insects collected are very important in terms of distributions evaluations. The samples mentioned in the study were also evaluated in this respect. These species were generally collected April, May, June, July, August, September, October and November months of the years in general (Figure 4b). Our figures and table 1 support Aranda & Gracioli (2015) results that peak abundance in Hymenoptera in the Brazilian Savanna is from August to October. However, June and July had more dense populations (Table 1). As seen in table 1, 26 species were collected in a single month, *Colpotrochia cincta, Exochus castaniventris, Exochus mitratus,* were collected in five different months in a year. It was observed that *Exochus castaniventris, Exochus mitratus* unlike other species, have a very high adaptations different altitude and different climate conditions.

The altitudes where the insects were collected were subjected to the chi-square test (Table 3), and it was determined that the altitudes were proportionally different from each other (Figure 5).

Table 3. Chi-Square Tests results
Çizelge 3. Ki-kare test sonuçları

	Value	Sig.
Pearson Chi-Square	7.125	0.006*
N of Valid Cases	130	

a No statistics are computed because grup is a constant.

Zoogeographical evaluations:

The research covers seven geographic regions of Türkiye (Table 1 and Figure 1). When table 1 is detailed it becomes is clear that, Mediterranean and Eastern Anatolia were the regions where samples were collected the most (36, 31); Aegean Region and Southeastern Anatolia (8, 2) were regions samples were least collected. Samples collected from the regions were not systematically collected on a regular basis. Since most of the studies were conducted in regions where samples were collected intensively, the number of samples increased, but in other regions this number was limited. The names of provinces where the samples were collected are summarized in Table 2 and Figure 7-8.

When Table 1 and 2 are elaborating as collected places, *Exochus mitratus* was collected from six regions, *Exochus mitratus* was collected from six

regions, *E. castaniventris* was collected from five regions. Besides, *Chorinaeus flavipes*, *C. scrobipalpae*, *C. subcarinatus*, *Drepanoctonus tricoloratus*, *Exochus alpinus*, *E. bolivari*, *E. carri*, *E. ferus*, *E. frontellus, E. flavomarginatus*, *E. gravipes*, *E. gravis*, *E. lineifrons*, *E. morionellus*, *E. protuberans*, *E. semilividus*, *E. separandus*, *E. tardigratus, Hypsicera curvator*, *H. subtilitor, Metopius* (*Cultrarius*) *turcestanicus*, *M.* (*Metopius*) *fulvicornis*, *M. (M.) septemcinctus, M.* (*Peltastes*) *pinatorius*, *M. (Peltocarus) croceicornis*, *M.* (*P.*) *dirus*, *Spudaeus scaber*, *Triclistus areolatus*, *T. congener*, *T. lativentris*, *T. niger*, *T. pallipes*, *T. pyrellae*, *T. spiracularis* and *Trieces bellulus* were collected from a single region. The remaining species are distributed in two to four different regions.

The study material was also analyzed according to their distributions in the world. These metopines fauna were divided into the following zoogeographical groups: West Palearctic 34,4%, Europe 32,7%, East Palearctic 22,5%, Nearctic 5,9% and Oriental 2.6%. Afrotopical, Australian, Oceanic and Neotropical Region have a five percent slice (Figure 6b).

According to these results, Western Palaearctic and European have the highest numbers of species (Figure 7). Among this species, *Hypsicera femoralis* showed distribution in eight different regions. This species is almost cosmopolitian species, similarly, *Triclistus pallipes* showed distribution in five different regions in zoogeographical regions. Also, among them four speceis were distributed in only one area in zoogeographical regions. *Exochus protuberans* is endemic species for Turkey for now. At the same time, *Exochus flavifacies* was founded only in Mongalia, *Metopius* (*Metopius*) *fulvicornis* was found in Lebanon, Syria and Turkey, *Scallama triclistor* was found Iran and Turkey, *Triclistus pyrellae* was found Moldova, Poland, Turkey and Ukraine.

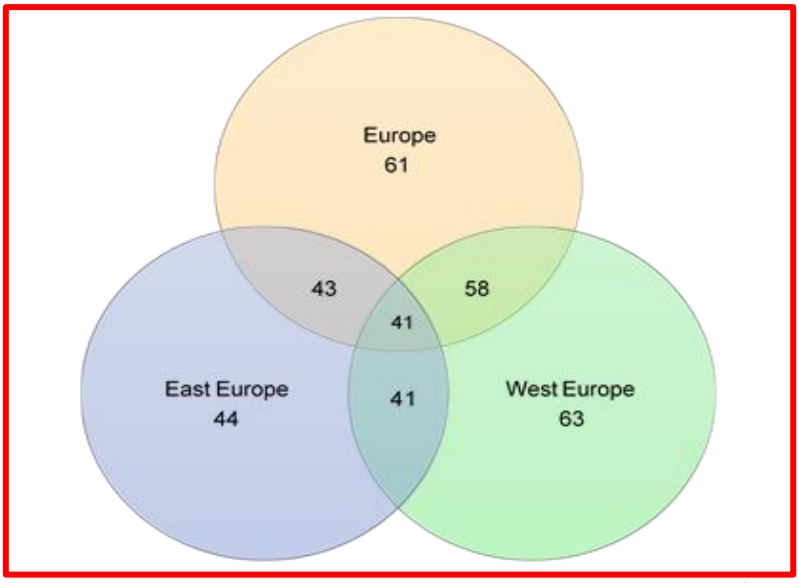


Figure 7. Venn diagram (Distribution of species according to zoogeographical regions).
Çizelge 7. Venn diyagramı (Türlerin zoocoğrafik dağılışına göre).

Figure 8. Distribution of species in Turkey.

Figure 8. Türkiye'de türlerin dağılışı.

Evaluations of host and plant visited by adults:

Several plant species have been recorded as associated host plants for ichneumonid species (Yu et al., 2006). Totally two metopiines species were obtained from different hosts in Turkey (Table 4). According to these results, *Triclistus globulipes* was obtained from *Choristoneura murinana* which feed that *Abies cilicica* (Sarıkaya & Avcı, 2005). Besides *Trieces tricarinatus* was obtained from *Yponomeuta malinellus* which that feed that *Malus* comminis L. (Narmanlıoğlu & Çoruh, 2017).

Table 4. Parasitoid metopiines obtained from different hosts in Turkey
Çizelge 4. Türkiye'de farklı konaklardan elde edilen parazitoid metopiinler

Names of Taxa	Obtained from	Order/Family	Host Plant	References
Triclistus globulipes (Desvignes, 1856)	*Choristoneura murinana* Hbn.	Lepidoptera: Tortricidae	*Abies cilicica* Carr.	Sarıkaya & Avcı, 2005
Trieces tricarinatus (Holmgren, 1858)	*Yponomeuta malinellus* Zell.	Lepidoptera: Yponameutidae	*Malus comminis* L.	Gencer, 2003; Narmanlıoğlu & Çoruh, 2017

At the end of the study, we can say the following:

- ✓ Since Türkiye, is located between three continents and has a very important toporaphical and climatic structure, it is home to many and different insect species.
- ✓ Due to this structure of Türkiye, it is necessary and important to examine ichneumonids in taxonomic and biogeographical aspects.
- ✓ Althought the ichneumonids are a very important parasitoid group, they have not been studied sufficiently in Türkiye.
- ✓ The number of species, which was 383 in 1995, increased 3,5 times in 23 years.
- ✓ We know that there are many icheuonids species waiting to be idendified in Türkiye.
- ✓ That is why we know also we have to work hard…..

ACKNOWLEDGEMENT

The author would like to thanks following persons who kindly help in the collection of the material: Dr. Hikmet Özbek (retired), Erol Yıldırım, Önder Çalmaşur, Göksel Tozlu (University of Atatürk), İrfan Aslan (Yıldırım Beyazıt University) and Coşkun Güclü (Eskişehir Osmangazi University).

Author's Contributions

Authors declare the contribution of the authors is equal.

Conflict of Interest Statement

There is no conflict of interest between the authors.

REFERENCES

Aeschlimann, J. P. (1983). Note sur les Metopiines Ouest-Palearctiques avec description de deux especes nouvelles (Hymenoptera, Ichneumonidae). *Annales de la Société Entomologique de France, 19*(1), 3-6.

Aeschlimann, J. P. (1989). Révision des espèces ouest-paléarctiques de genre Hypsicera Latreille (Hymenoptera: Ichneumonidae). *Annales de la Société Entomologique de France, 25*(1), 33-39.

Aranda, R., & Graciolli, G. (2015). Spatial-temporal distribution of the Hymenoptera in the Brazilian Savanna and the effects of habitat heterogeneity on these patterns. *Journal of Insect Conservation, 19*(6), 1173-1187.

Aubert, J. F. (1979). Huit Ichneumonides [non] pétiolées inédites. *Bulletin de la Société Entomologique de Mulhouse Avril-Juin*, 17-22.

Buncukcu, A. (2008). Isparta İli Merkez ve Adana, Yumurtalık İlçesi-Halep Çamlığı Ichneumonidae Türlerinin Tespiti ve Kültüre Edilebilen Türlerin Biyolojilerinin Araştırılması. (Tez no 179759). [Yüksek Lisans Tezi, Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Biyoloji Ana Bilim Dalı].

Clement, E. (1930). Opuscula hymenopterologica III. Die Palaarktischen Metopius-Arten (Hymenoptera, Ichneumonidae). *Konowia, 8*(4), 325-437.

Çoruh, S., & Özbek, H. (2011). New and little-known some Ichneumonidae (Hymenoptera) species from Turkey with some ecological notes. *Turkish Journal of Entomology, 35*(1), 119-131.

Çoruh, S., & Kolarov, J. (2012). Ichneumonidae (Hymenoptera) from Neart-Eastern Turkey. III. *Munis Entomology & Zoology, 7*(1), 629-633.

Çoruh, S., & Çalmaşur, Ö. (2016). A new and additional records of the Ichneumonidae (Hymenoptera) from Turkey. *Turkish Journal of Zoology, 40*(4), 625-629.

Çoruh, S., Özbek, H., & Kolarov, J. (2002). New and rare taxa of Ichneumonidae Hymenoptera) from Turkey. *Journal of the Entomological Research Society, 4*(1), 1-4.

Çoruh, S., Kolarov, J., & Çoruh, İ. (2014a). Ichneumonidae (Hymenoptera) from Anatolia. II. *Turkish Journal of Entomology, 38*(3), 279-290.

Çoruh, S., Kolarov, J., & Özbek, H. (2014b). The fauna of Ichneumonidae (Hymenoptera) of eastern Turkey with zoogeographical remarks and host data. *Journal of Insect Biodiversity, 2*(16), 1-21.

Eroğlu, F. (2010). Eskişehir ili Türkmen Dağı Ichneumonidae (Hymenoptera) Faunası Üzerine Bir Araştırma. (Tez no 259603). [Yüksek Lisans Tezi, Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Biyoloji Ana Bilim Dalı].

Fahringer, J. (1922). Hymenopterologische Ergebnisse einer wissenschaftlichen Studienreise nach der Türkei und Kleinasien (mit Ausschluß des Amanusgebirges). *Archiv für Naturgeschichte A, 88*, 149-222.

Fernandes, D. R. R., Santos, J. J. M., Lara, R. I. R., Silva Junior, J. C., Ferreira N. W., & Perioto, H. A. (2019). Fauna de Ichneumonidae (Hymenoptera: Ichneumonoidea) em áreas de Caatinga do Sudoeste da Bahia, Brasil. *EntomoBrasilis, 12*, 126-131.

Gençer, L. (2003). The parasitoids of Yponomeuta malinellus Zeller (Lepidoptera: Yponomeutidae) in Sivas. *Turkish Journal of Zoology, 27*(1), 43-46.

Gürbüz, M. F. (2004). Isparta İli Ichneumonidae (Hymenoptera) Familyası Türleri Üzerine Faunistik ve Sistematik Çalışmalar. (Tez no 184313). [Yüksek Lisans Tezi, Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Biyoloji Ana Bilim Dalı].

Gürbüz, M. F. (2005). A survey of the Ichneumonidae (Hymenoptera) of Isparta in Turkey. *Linzer Biologische Beitrage, 37*(2), 1809-1817.

Gürbüz, M. F., Aksoylar M. Y., & Buncukçu A. (2009). A faunistic study on Ichneumonidae (Hymenoptera) in Isparta, Turkey. *Linzer Biologische Beiträge, 41*(2), 1969-1984.

Gürbüz, M. F., Kolarov, J., Özdan, A., & Tabur, M. A. (2011). Ichneumonidae (Hymenoptera) fauna of natural protection areas in East Mediterranean Region of Turkey, Part I. *Journal Entomological Research Society, 13*(1), 23-39.

Inecikli̇oğlu, H. (2022). Trakya Bölgesi Ich

Inecikli̇oğlu, H. (2022). Trakya Bölgesi Ichneumonidae (Hymenoptera) Kontrol Listesinin Oluşturulması. (Tez no 759376). [Yüksek Lisans Tezi, Trakya Üniversitesi Fen Bilimleri Enstitüsü Biyoloji Ana Bilim Dalı].

Kasparyan, D. R. (1981). Opredelitel Nasekomich Europeiskoy Casti U.S.S.R. *Prepontchatokrilie, 3*, 1-688.

Kıraç, A. (2012). Honaz Dağı Milli Parkı (Denizli) ve yakın çevresinin Ichneumonidae (Hymenoptera) faunası üzerine bir araştırma. (Tez no 309697). [Yüksek Lisans Tezi, Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Biyoloji Ana Bilim Dalı].

Kıraç, A., & Gürbüz, M. A. (2020). Honaz Dağı Milli Parkı Ichneumonidae (Insecta, Hymenoptera) Faunası. *Bilge International Journal of Science and Technology and Research, 4*(2), 150-159.

Klopfstein, S., Riedel, M., & Schwarz, M. (2019a). Checklist of ichneumonid parasitoid wasps in Switzerland (Hymenoptera, Ichneumonidae): 470 species new for the country and an appraisal of the alpine diversity. *Alpine Entomology, 3*, 51-81.

Klopfstein, S., Santos, B., Shaw, M. R., Alvarado, M., Bennett, A. M. R., Dal Pos, D., Giannotta, M., Herrera Florez, A. F., Karlsson, D., Khalaim, I. A., Lima, A. R., Mikó, I., Sääksjärvi, I. E., Shimizu, S., Spasojevic, T., Van Noort, S., & Broad, G. R. (2019b). Darwin wasps: a new name heralds renewed efforts to unravel the evolutionary history of Ichneumonidae. *Entomological Communications, 1*, ec01006.

Kohl, F. F. (1905). Ergebnisse einer naturwissenschaftlichen Reise zum Erdschias Dagh (Kleinasien). *Annalen des Naturhistorische Museum Wien, 20*, 220-246.

Kolarov, J. (1986). A new Exochus species from Turkey (Hymenoptera: Ichneumonidae: Metopiinae). *Plant Protection Bulletin, 10*(2), 69-92.

Kolarov, J. (1989). Ichenumonidae (Hym.) from Balkan peninsula and some adjacent regions. III. Ophioninae, Anamaloninae, Metopiinae, Mesochorinae, Acaenitinae, Oxytorinae, Orthopelmatinae, Collyriinae, Orthocentrinae, Diplazontinae and Ichneumoninae. *Turkish Journal of Entomology, 13*(3), 131-140.

Kolarov, J. (1995). A catalogue of the Turkish Ichneumonidae (Hymenoptera). *Entomofauna, 7*(16), 137-188.

Kolarov, J. (2014). Metopiinare (Ichneumonidae: Hymenoptera) from Bulgaria and related regions. *Linzer Biologische Beiträge, 46*(2), 1343-1351.

Kolarov, J., & Beyarslan, A. (1993). New and little known Turkish Metopiinae (Hymenoptera, Ichneumonidae). *Second National Scientific Conference of Entomology. Union of the Scientists in Bulgaria, Bulgarian Society of Entomology*, 92-94.

Kolarov, J., & Özbek, H. (1998). New and little known Metopiinae (Hymenoptera, Ichneumonidae) from Turkey. *Linzer Biologische Beiträge, 30*(1), 127-130.

Kolarov, J., & Çalmaşur Ö. (2011). A study of Ichneumonidae (Hymenoptera) from North

Eastern Turkey. *Linzer Biologische Beiträge, 43*(1), 777-782.

Kolarov, J., & Çoruh, S. (2022). New records on the Ichneumonidae fauna (Hymenoptera) of the Black Sea Coast of Turkey. *Journal of the Entomological Research Society, 24*(1), 63-74.

Kolarov, J., Çoruh İ., & Çoruh, S. (2014a). Ichneumonidae (Hymenoptera) from Anatolia. I. *Linzer Biologische Beitrage, 46*(2), 1517-1524.

Kolarov, J., Çoruh, S., & Çoruh, İ. (2016). Contribution to the knowledge of the Ichneumonidae (Hymenoptera) fauna of Turkey from northeastern Anatolia, Part I. *Turkish Journal of Zoology, 40*(1), 40-56.

Kolarov, J., Çoruh, S., & Çoruh, İ. (2017). A study of Ichneumonidae (Hymenoptera) from Northeastern Anatolia III, with new records and description male of Temelucha pseudocaudata Kolarov, 1982. *Turkish Journal of Entomology, 41*(2), 125-146.

Kolarov, J., Çoruh, S., Yurtcan, M., & Gürbüz, M. F. (2009). A study of Metopiinae from Turkey with description of a new species (Hymenoptera: Ichneumonidae). *Zoology in the Middle East, 46*(1), 75-82.

Kolarov J., Yıldırım, E., Çoruh, S., & Yüksel, M. (2014b.) Contribution to the knowledge of the Ichneumonidae (Hymenoptera) fauna of Turkey. *Zoology in the Middle East, 60*(2), 154-161.

Meyer, N. F. (1933-1936). Tables systematiques des Hymenopteres parasites (fam. Ichneumonidae) de L'URSS et des pays limitrophes. *Moskva-Leningrad*.

Narmanlıoğlu, H. K., & Çoruh, S. (2017). Parasitoids of the apple ermine moth, Yponomeuta malinellus Zeller, 1838 (Lepidoptera: Yponomeutidae), in the Çoruh Valley, Erzurum Province, Turkey. *Turkish Journal of Entomology, 41*(4), 357-365.

Öncüer, C. (1991). Türkiye Bitki Zararlısı Böceklerinin Parazit ve Predatör Kataloğu. *Ege Üniversitesi, Ziraat Fakültesi Yayınları, 505: 354.* [In Turkish].

Özdemir, Y., & Güler, Y. (2009). Determination of Ichneumonidae (Hymenoptera) Species of Cherry Orchards in Sultandagi Reservoir. *Bulletion of Plant Protection, 49*(3), 135-143.

Özdan, A. (2014). Gelincik Dağı Tabiat Parkı ve Kovada Gölü Milli Parkı (Isparta) Ichneumonidae (Hymenoptera) Faunası. (Tez no 353429). [Doktora Tezi, Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Biyoloji Ana Bilim Dalı].

Özdan, A., & Gürbüz, M. F. (2019). Ichneumonidae (Hymenoptera) fauna of Kovada Lake National Park, Isparta, Turkey. *Turkish Journal of Entomology, 43*(3), 301-312.

Quicke, Donald L. (2014). The Braconid and Ichneumonid parasitoid wasps: biology, systematics, evolution and ecology. *Hoboken NJ: Wiley Blackwell.*

Sarıkaya, O., & Avcı, M. (2005). Studies on the parasitoid complex of Choristoneura murinana (Hbn.) (Lep.: Tortricidae) in Turkey. *Journal of Pest Science, 78*(2), 63-66.

Sedivy, J. (1959). Wissenschaftliche Ergebnisse Der Zoologischen Expedition Des National Museums in Prag Nach Der Turkei. *Acta Entomologica Musei Nationalis Pragae, 33*, 107-116 [In Germany].

Tolkanitz, V. I. (1981). Ichneumonidae, Phytodietini. *Fauna Ukraina, 11*(1), 1-148.

Tolkanitz, V. I. (1985). Ichneumon flies of the genus Melopius (Hymenoptera, Ichneumonidae). *Zoology Journal, 64*(9), 1392-1406.

Townes, H. K., Momoi, S., & Townes, M. (1965). A catalogue and reclassification of Eastern palearctic Ichneumonidae. *Memoirs of the American Entomological Institute, 5*, 1-661.

Townes, H. K. (1971). Genera of Ichneumonidae, Part 4 (Cremastinae, Phrudinae, Tersilochinae, Ophioninae, Mesochorinae, Metopiinae, Anomalinae, Acaenitinae, Microleptinae, Orthopelmatinae, Collyriinae, Orthocentrinae, Diplazontinae). *Memoirs of the American Entomological Institute, 17*, 1-372.

Viertler, A., Jouault, C., Spasojevic, T., & Klopfstein, S. (2022). Darwin wasps (Hymenoptera, Ichneumonidae) in Lower Eocene amber from the Paris basin. *Journal of Hymenoptera Research, 89*, 19-45.

Yu, D. S. Ki, Van Achterberg, C., & Horstmann, K. (2016). Taxapad 2016, Ichneumonoidea 2015. Database on flash-drive. www.taxapad.com, Nepean, Ontario, Canada.

Yurtcan, M. (2013). Türkiye Metopiinae (Hymenoptera: Ichneumonidae) faunasına katkılar. *1. Ulusal Zooloji Kongresi, Nevşehir, Türkiye, 28-31 Ağustos 2013.*

Yurtcan, M. (2017). Ichneumonidae (Hymenoptera) of Türkiye, with checklist of taxa. *Linzer Biologische Beiträge, 49*(1), 105-137.

Yurtcan, M., & Özbek, H. (2015). An updated checklist of Ichneumonidae (Hymenoptera) from Turkey. *Turkish Journal of Zoology, 39*(2), 337-356.

Yurtcan, M., & Özbek, H. (2016). The Ichneumonidae (Hymenoptera) fauna of Munzur Mountains National Park in Eastern Anatolia, Turkey. *Linzer Biologische Beiträge, 48*(1), 79-96.

Yurtcan, M., & Özbek, H. (2018). Additional faunistic notes on Ichneumonidae (Hymenoptera) from Turkey. *Zootaxa, 4504*(3), 436-450.