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New and Little Known Species of Ichneumonidae (Hymenoptera) for the Turkish Fauna

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ABSTRACT

The present contribution is based upon the ichneumonids collected from southern part of Turkey between 2007-2008. A total of 25 species belonging to Campopleginae, Collyriinae, Cremastinae and Ichneumoninae have been recorded. Among them 5 species are new records from Turkey. New data on distribution of previously known 20 species are given. Additionally, Ichneumonidae species diversities of three Nature Reserves (Halep Çamlığı, Kengerlidüz, Habib-i Neccar) from East Mediterranean Region of Turkey were compared.

Key words: Hymenoptera, Ichneumonidae, new record, Nature Reserve, Turkey.

INTRODUCTION

Ichneumonidae is the biggest hymenopteran family with 51 generally recognized subfamilies 1579 genera and 24.281 described species (Yu *et al*., 2012). Townes (1969) estimated that there could be about 60.000 Ichneumonidae species in the world, but because of the poor knowledge of the tropical faunas the present investigators estimate that the size of the family could be higher than 100.000 (Gauld, 1997). The number of species Ichneumonidae increases rapidly in the world. With having such a species richness, the family is surely one of the richest, if not the richest, animal families that have ever lived on Earth.

Ichneumonids have been used successfully as biocontrol agents and given the largely undocumented fauna there is a huge potential for their utilization in managed biocontrol programs (Gupta, 1987).

Studies on Ichneumonidae of Turkey have gained acceleration, particularly, since the last one and a half decades. Çoruh and Özbek (2008a) reported 757 species in 265 genera for Turkey Ichneumonidae fauna. With the below mentioned contributions (Çoruh and Özbek 2008b; Kolarov and Çoruh, 2008; Kolarov and Yurtcan, 2008a,b,

Yurtcan and Okyar, 2008; Çoruh, 2009, Kolarov and Yurtcan, 2009; Gürbüz *et al*., 2009, Kolarov *et al*., 2009; Kolarov and Gürbüz, 2009; Çoruh and Kolarov, 2010; Riedel *et al*., 2010; Riedel et al., 2011; Çoruh and Özbek, 2011; Çoruh *et al*., 2011; Khalaim and Yurtcan, 2011; Reshchikov, 2011; Kolarov and Çoruh, 2012a,b; Çoruh and Kolarov, 2012a,b; Çoruh and Khalaim, 2012; Okyar *et al*., 2012; Çoruh and Özbek, 2013), the numbers of Ichneumonidae fauna of Turkey reached to 975 species and 282 genera.

In addition, researchers are continuing discover undescribed species from Turkey. Recently, 13 new species were described by Riedel (2008), Kolarov and Yurtcan (2008b), Kolarov and Çoruh (2008), Kolarov *et al*. (2009), Kolarov and Gürbüz (2009) and Reshchikov (2011) from different regions of Turkey.

Turkey has great variability in topographic and climatic features because of its significant geographical location joining two continents (Çıplak, 2004). It is also one of the most remarkable regions of the world in terms of the biodiversity hotspots such that three of them have major extensions into Turkey: Caucasus, Irano- Anatolian, and Mediterranean Basin (Myers *et al*., 2000) (Fig. 1).

The aims of this study are; to determine the species existing in the selected Natural Protection Areas of East Mediterranean; to point out which hotspots the species located in and to evaluate the diversity index.

MATERIAL AND METHODS

Study site

The present study material was collected from Adana, Hatay, İskenderun and Osmaniye in Turkey during 2007-2008. Yumurtalık Halep Çamlığı Natural Protection Area (Adana) which is situated in Eastern Mediterranean, Turkey (37˚47'N 38˚39'E), covers an area from sea level to 3 m.a.s.l. Tekkoz Kengerlidüz Natural Protection Area (Hatay province, Dörtyol District) is located in Eastern Mediterranean Region (36˚ 57'N 36˚ 23'E) within the borders of the Küllü and Kızlarçayı villages. Field size is 172 ha. and covers an area from 930 to 1900 m. elevation a.s.l. Habibi Neccar Natural Protection Area (Hatay) is located within the border of Center district of Antakya (36˚ 25'N 36˚ 22'E), in the Eastern Mediterranean Region. Field size is 118 ha. (Fig. 2).

Yumurtalık Halep Çamlığı Natural Protection Area (Adana) which is situated in Eastern Mediterranean, Turkey (37˚47'N 38˚39'E), covers an area from sea level to 3 m. elevation a. s. l. Yumurtalık Lagoons have various habitat characters with abundant vegetation, existence of the animals and constitutes an open laboratory for scientific research (Fig. 2). Yumurtalık has been declared as a Natural Protection Area of Eastern Mediterranean in Turkey since 1994. *Astragalus subuliferus* and *Bupleurum polyactis* are two endemic plant species for Yumurtalık Lagoons. Also *Pinus halepensis*, which covers about 54 Ha. in Yumurtalık, is a unique natural sample. Vegetation: *Myrtus communis*, *Erica manipuliflora*, *Salicornia europaea, Juncus maritimus, Plantago maritima, Plantago lanceolata, Trifolium campestre, Juncus acutus, Pistacia lentiscus* and lots of lemur plants.

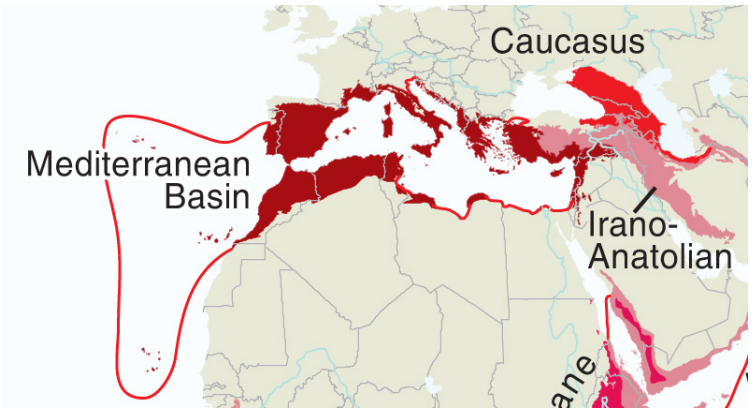

Fig. 1. Biodiversity hotspots of Turkey (Myers *et al*., 2000)

Tekkoz Kengerlidüz Natural Protection Area (Hatay province, Dörtyol District) is located in Eastern Mediterranean Region (36˚ 57'N 36˚ 23'E) within the borders of the Küllü and Kızlarçayı villages (Fig. 2). Field size is 172 Ha. and covers an area from 930 to 1900 m. elevation a.s.l. This area is in the forest zone, and has different features for ecosystem. Vegetation: *Fagus orientalis*, *Quercus cerris* and *Abies cilicica* are in Kengerlidüz; *Carpinus orientali*, *Ostrya spi, Fraxinus ornus, Pinus nigra* and *Acer plata noides* are in Tekkoz (Http2).

Habibi Neccar Natural Protection Area (Hatay) is located within the border of Center district of Antakya (36˚ 25'N 36˚ 22'E), in the Eastern Mediterranean Region. Field size is 118 Ha. (Fig. 2). Vegetation: *Quercus ilex, Quercus coccifera, Pinus brutia, Arbutus andrachne, Astragalus* sp., *Verbascum* sp., *Alhagi mannifera, Urtica pilulifera, Olea europeae, Malva nicaeensis* (Http1).

Fig. 2. Map of selected areas of East Mediterranean

Sampling method and collection

Totally 121 samples were collected by sweeping nets on flowering plants. Collected specimens were transferred into a handmade aspirator and were killed with ethyl acetate. Conventional standard methods (Çoruh and Özbek, 2008b) were used for preparation of the samples. All materials are preserved in Collection of University of Süleyman Demirel (Isparta). Generally terminology of Townes (1969) was followed. The general distributions of the species are given mainly after Taxapad (2012).

The Shannon-Wiener diversity index (H'), Simpson's index (1/D) and Berger-Parker index of dominance (1/d) were used as the alpha-diversity indices. The Jaccard (Cj) and Bray- Curtis (CN, quantitative version of Sørensen index) indices were used to determine the degree of similarity in species composition of different areas (Magurran, 2004). Data were analyzed by using the program BioDiversity Pro (Version 2).

RESULTS

A list of the species is given below along with the locations, collection dates, , specimen numbers for each sex, general and Turkey distributions.. New recorded species are marked by an asterisk in the list.

List of the species

Subfamily Campopleginae Förster, 1869

***Bathyplectes curculionis* (Thomson, 1887)**

Material examined: Adana, Halep Çamlığı, 25.IV.2007, 1 ♂, 2 ♀♀.

Distribution in Turkey: Ankara, İstanbul (Kolarov, 1989; Kolarov and Beyarslan, 1995, many localities).

Distribution in the World: Holarctic and Oriental region.

***Campoletis crassicornis* (Tschek, 1871)**

Material examined: Adana, Halep Çamlığı, 7-9.V.2007, 1 ♂, 3 ♀♀; 7-9.VI.2007, 1 ♀; 6-9.VI.2007, 1 ♂.

Distribution in Turkey: Adana, Burdur (Kolarov and Beyarslan, 1995).

Distribution in the World: Europe, Azerbaijan and Turkey.

***Campoletis latrator* (Gravenhorst, 1829)**

Material examined: Adana, Halep Çamlığı, 25.IV.2007, 1 ♂; Hatay, Samandağ, 10.V.2007, 1 ♂; Kengerlidüz, 4.VII.2007, 1 ♂; 12-15.V.2007, 1 ♀; 14.VII.2007, 2 ♀♀; 21.VI.2007, 1 ♀; 1.VII.2007, 2 ♀♀.

Distribution in Turkey: Adana, (Balkalı), Gaziantep (Oğuzeli), Edirne (Elmalı), Adana (Osmaniye), Isparta (Eğridir), Elazığ (Kolarov and Beyaslan, 1995).

Distribution in the World: Europe and Turkey.

***Campoletis viennensis* (Gravenhorst, 1829)**

Material examined: Hatay, Habib-i Neccar, 12-15.VI.2007, 1 ♀.

Distribution in Turkey: Adana (Feke) (Kolarov and Beyaslan, 1995); Bayburt (Özbek *et al*., 2000).

Distribution in the World: Europe, Turkey and Siberia.

***Casinaria ischnogaster* Thomson, 1887**

Material examined: Adana, Halep Çamlığı, 25.IV.2007, 1 ♂; 7.V.2007, 1 ♂.

Distribution in Turkey: Antalya (Elmalı), Adana (Feke, Saimbeyli) (Kolarov and Beyaslan, 1995); Afyonkarahisar, Muğla, Uşak (Kolarov *et al*., 2002a).

Distribution in the World: Europe, Turkey and Mongolia.

***Charops cantator* (DeGeer, 1778)**

Material examined: Hatay, Samandağ, 21.V.2007, 1♀.

Distribution in Turkey: Çanakkale (Kolarov *et al*., 1997); Erzurum (Özbek *et al*., 2000); Afyon, Muğla (Kolarov *et al*., 2002a).

Distribution in the World: Palaearctic region and South Africa.

***Chromoplex picticollis* (Thomson, 1887)**

Material examined: Hatay, Kengerlidüz, 21.VI.2007, 1 ♀; Habib-i Neccar, 9-12.VI.2007, 1 ♂, 1 ♀.

Distribution in Turkey: Çanakkale (Kolarov *et al*., 1997); Trabzon (Özbek *et al*., 2000); İzmir, Muğla (Kolarov, *et al*. 2002a); Isparta (Gürbüz, 2005).

Distribution in the World: France, Italy, Austria, Hungary, Croatia, Bosnia-Hercegovina, Greece, Bulgaria, Ukraine, Turkey, Israel and Egypt.

****Cymodusa (Cymodusa) antennator* Holmgren, 1860**

Material examined: Hatay, Kengerlidüz, 14.VII.2007, 1 ♂; 4.VII.2007, 1 ♂.

* New record for Turkey.

Distribution in the World: Europe, Azerbaijan, Lebanon, Kazakhstan, Mongolia, Pakistan and Siberia, introduced into South Africa.

****Diadegma crassiseta* (Thomson, 1887)**

Material examined: Hatay, Habib-i Neccar, 14.VII.2007, 2 ♀♀.

* New record for Turkey.

Distribution in the World: Norway, Finland, Sweden, Spain, France, Poland, Moldova and Bulgaria.

***Eriborus braccatus* (Gmelin, 1790)**

Material examined: Hatay, Habib-i Neccar, 27.VII.2007, 1 ♀.

* New record for Turkey.

Distribution in the World: Europe.

***Meloboris collector* (Thunberg,1824)**

Material examined: Hatay, Kengerlidüz, 12-15.VI.2007, 1 ♂ 1 ♀.

Distribution in Turkey: Ankara (Kolarov, 1995); Gaziantep (Islahiye), Isparta (Ergidir), Adana (Osmaniye, Zorkun, Tufanbeyli, Belemedih, Feke), İçel (Tarsus) (Kolarov and Beyarslan, 1995).

Distribution in the World: Europe, Azerbaijan, Turkey, Israel, Afghanistan, Mongolia, China (Qinghai and Shanxi) and South Africa.

Subfamily Cremastinae Förster, 1869

***Cremastus aegyptiacus* Szépligeti, 1905**

Material examined: Adana, Halep Çamlığı, 1-13.IV.2008, 1 ♂.

* New record for Turkey.

Distribution in the World: Canary Islands, Spain, France, Italy, Greece and Egypt.

***Cremastus lineatus lineatus* Gravenhorst, 1829**

Material examined: Adana, Halep Çamlığı, 16.IV.2007, 1 ♀; 13.IV.2008, 1 ♀.

Distribution in Turkey: Içel (Kolarov, 1997; Kolarov and Beyarslan, 1999).

Distribution in the World: Spain, Sweden, Germany, Austria, Greece, Ukraine and Turkey.

***Cremastus pungens* Gravenhorst, 1829**

Material examined: Hatay, Çevlik, 14.IV.2007, 1 ♂ 1 ♀.

Distribution in Turkey: Erzurum (Aşkale, Pırnakapan) (Pekel, 1998; Pekel and Özbek, 2000); Tekirdağ (Kolarov and Beyarslan, 1999; Beyarslan *et al*., 2006); Yozgat (Kabaktepe), Elazığ (Baskil), Malatya (Çiftlik), Eskişehir (Anadolu Univ. Campus), Kayseri (Pınarbaşı) (Kolarov and Yurtcan, 2009).

Distribution in the World: Europe, Turkey, Iran, Mongolia and Siberia.

***Pristomerus hebraicator* Aubert, 1979**

Material examined: Hatay, Habib-i Neccar, 1120 m, 24.VI.2008, 1 ♀.

* New record for Turkey.

Distribution in the World: Israel.

***Pristomerus vulnerator* (Panzer, 1799)**

Material examined: Hatay, Çevlik, 14.IV.2007, 1 ♂ 1 ♀; Samandağ, 460 m, 16.V.2007, 1 ♀; Osmaniye, Mitisin, 1700 m, 1 ♀; Fenk, 21.VI.2008, 1 ♀.

Distribution in Turkey: Kayseri (Kohl, 1905), Edirne (Kolarov and Beyarslan, 1999); Tekirdag (Kolarov,1997); Erzurum (Pekel and Özbek, 2000).

Distribution in the World: Holarctic and Oriental region.

***Temelucha caudata* (Szépligeti, 1899)**

Material examined: Adana, Halep Çamlığı, 13-16.IV.2007, 1 ♂ 1 ♀; 1-13.IV.2008, 1 ♀.

Distribution in Turkey: No localation (Kolarov, 1997); Edirne (Kolarov and Beyarslan, 1999); Elazığ (Baskil) (Kolarov and Yurtcan, 2009); Erzurum (Pekel and Özbek, 2000).

Distribution in the World: Spain, France, Italy, Austria, Czechoslovakia, Hungary, Lithuania, Croatia, Bulgaria, Russia-Dagestan, Turkey and Iran.

***Temelucha discoidalis* (Szépligeti, 1899)**

Material examined: Hatay, Habib-i Neccar, 15.IV.2007, 1 ♂.

Distribution in Turkey: Erzurum (Atatürk Univ. Campus) (Pekel and Özbek, 2000); Ankara (Temelli) (Kolarov and Yurtcan, 2009)

Distribution in the World: Spain, France, Germany, Poland, Czechoslovakia, Hungary, Yugoslavia, Romania, Bulgaria, Russia-Omsk, Turkey and Iran.

***Temelucha genalis* (Szépligeti, 1899)**

Material examined: Hatay, Habib-i Neccar, 9-12.VI.2007, 2 ♀♀.

Distribution in Turkey: Çanakkale (Kolarov *et al*., 1997); Edirne (Kolarov, 1997; Kolarov and Beyarslan, 1999); Isparta (Kolarov and Beyarslan, 1999; Kolarov et al., 2002b)

Distribution in the World: Spain, Germany, Italy, Poland, Czechoslovakia, Hungary, Bulgaria, Lithuania, Moldova, Azerbaijan, Turkey and Armenia.

***Temelucha tricolorata* Sedivy, 1968**

Material examined: Adana, Halep Çamlığı, 16.IV.2007, 1 ♂.

Distribution in Turkey: Isparta (Dere Mahallesi) (Gürbüz and Aksoylar, 2004; Gürbüz, 2005); Sivas (Ulaş), Eskişehir (Anadolu Univ. Campus), Niğde (Bor) (Kolarov and Yurtcan, 2009).

Distribution in the World: Canary Islands, Iran, Turkey and Afghanistan.

***Temelucha turcata* Kolarov and Beyarslan, 1999**

Material examined: Hatay: Samandağ, 15.IV.2007, 1 ♀; Arsis, 16-17.IV.2008, 1♀.

Distribution in Turkey: Şanlıurfa (Kolarov and Beyarslan, 1999); Diyarbakır, Elazığ, Kars, Şanlıurfa (Çoruh *et al*., 2005); Ankara (Kalecik), Sivas (Yıldızeli, Zara), Elazığ (Baskil), Malatya (Çiftlik), Eskişehir (Anadolu Univ. Campus), Kayseri (Pınarbaşı) (Kolarov and Yurtcan, 2009).

Distribution in the World: Turkey

Subfamily Collyriinae Cushman, 1924

***Collyria coxator* (Villers, 1789)**

Material examined: Adana, Halep Çamlığı, 16-19.III.2007, 8 ♂♂, 13.IV.2007, 1 ♂, 16.IV.2007, 2 ♂♂ 1 ♀. Hatay, Habib-i Neccar, 477 m, 19.III.2007, 3 ♂♂, 15.IV.2007, 12 ♀♀ 6 ♂♂, 16.IV.2007, 1♂ 4 ♀♀; Samandağ, 14.IV.2007, 1 ♀.

Distribution in Turkey: No location (Kohl, 1905; Fahringer and Friese, 1921); Konya (Altınayar, 1981); İstanbul, Ankara (Kolarov, 1989); Batman (Merkez), Diyarbakır (Bismil), Elazığ (Sivrice), Mardin (Derik) (Akkaya, 2005); Erzurum, Kars (Çoruh *et al*., 2005); Isparta (Şarkikaraağaç, Sütçüler, Yalvaç) (Gürbüz, 2005; Gürbüz *et al*., 2009).

Distribution in the World: Holarctic region.

Subfamily Ichneumoninae Latreille, 1802

Anisobas cingulatellus Horstmann, 1997

Material examined: Adana, Halep Çamlığı, 13-17.IV.2007, 1 ♀.

Distribution in Turkey: No location (Kohl, 1905; Heinrich, 1980); Konya (Beyşehir Lake) (Sedivy, 1959); Edirne, Tekirdağ (Yurtcan *et al*., 1999); Erzurum (Aşkale, Ilıca, Oltu) (Çoruh *et al*., 2005; Riedel *et al*., 2010).

Distribution in the World: Europe, Azerbaijan, Turkey, Iran and Kazakhstan.

***Diadromus collaris* (Gravenhorst, 1829)**

Material examined: Iskenderun, Güzelyayla, 22.VI.2008, 1150m, 29 ♀♀.

Distribution in Turkey: Erzurum (Özbek *et al*. 2003); Ankara, Kırşehir, Konya, Yozgat (Özdemir, 1996); Aydın (Germencik), Muğla (Yaras) (Kolarov *et al*., 2002a).

Distribution in the World: Almost cosmopolitan species.

***Vulgichneumon saturatorius* (Linnaeus, 1758)**

Material examined: Adana, Halep Çamlığı, 16-19.III.2007, 3 ♂♂.

Distribution in Turkey: Ardahan (Posof), Erzurum (Oltu) (Riedel *et al*., 2010)

Distribution in the World: Palaearctic and Oriental region.

DISCUSSION

In this study a total of 25 species within Campopleginae, Collyriinae, Cremastinae and Ichneumoninae have been recorded of which 5 species are new records from Turkey.

Ichneumoninae was found to be the dominant subfamily in Habib-i Neccar Nature Reserve, whereas; Collyrinae and Campopleginae were the dominating subfamilies Halep Çamlığı Nature Reserve and in Kengerlidüz Nature Reserve respectively (Fig. 3).

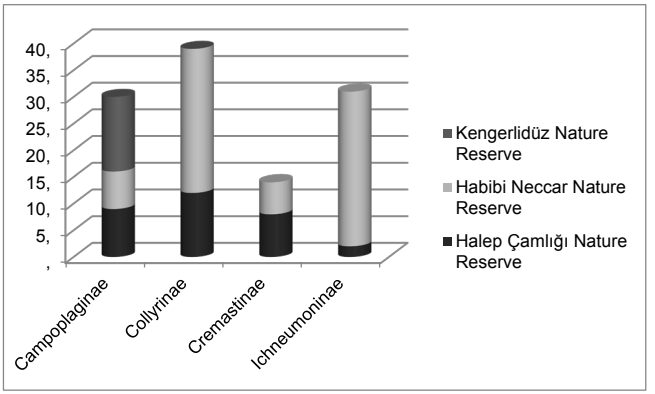

Fig. 3. Comparison of the number of species of four Ichneumonidae families recorded in the three Nature Reserves in Turkey.

According to Shannon, Simpsons and Berger-Parker diversity index, Halep Çamlığı Nature Reserve appeared to have the higher diversity values (Table 1). *Collyria coxator* and *Diadromus collaris* are the dominant species In Habibi Neccar. These two species impress negative because of dominance.

Table 1. The results of the diversity index.

	Halep Çamlığı Nature Reserve	Habibi Neccar Nature Reserve	Kengerlidüz Nature Reserve
Shannon H'	0,914	0,629	0,486
Simpsons Diversity (1/D)	6,848	3,083	2,87
Berger-Parker Dominance (1/d)	3	2,379	1,714

The comparison of the three natural reserves based on the species data obtained during the whole study period showed that the overall faunistic similarity of Habib-i Neccar Nature Reserve and Halep Çamlığı Nature Reserve was 24,76 according to Bray-Curtis index (Fig. 4). These two nature reserves found to be similar because they have lots of common species.

Turkey has three hotspots. These are Caucasus, Irano-Anatolian and Mediterranean Basin (Myers *et al*., 2000). The results of our study showed that 14 species are in Mediterranian Basin; two species are in Iran Turan and Mediterranean Basin; 5 species are in all three hotspots; three species are not in these three hotspots.

Ichneumonids are prone to travel from one to other hotspots. For instance, *Bathyplectes curculionis* was found initially in Mediterranean Basin, and later this species were found in Irano-Turanian hotspot. As a result, we can expect that if this species was found in two regions is possible for it to arrive also at Caucasus hotspot.

Charops cantator and *Cymodusa antennator* spread in these three hotspots. According to Yu *et al*., 2012 these insects were found in Mediterranean Basin after Irano-Turanian and Caucasus. Consequently, we can say that these insects may have followed these two latter regions to each Mediterranean Basin.

Temelucha genalis was first found in Caucasus and Irano-Turanian hotspots and then in Mediterranean Basin. As distinct from *Anisobas cingulatorius*'s rote was Iran Turan to Caucasus; Iran Turan to Mediterranean.

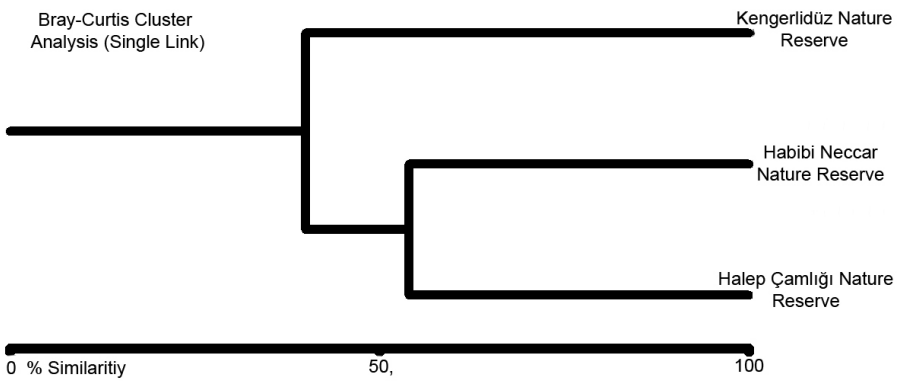

Fig. 4. Similarity between Ichneumonidae communities inhabiting natural reserves based on quantitative data (Bray-Curtis index).

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