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Orijinal araştırma (Original article)

The distribution and biogeography of Vespidae (Hymenoptera: Aculeata) in Turkey[1]

Türkiye'de Vespidae (Hymenoptera: Aculeata) türlerinin dağılışı ve biocoğrafyası

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Summary

Faunistic studies on Vespidae from Turkey are reviewed and the distribution and biogeography of the Turkish vespid fauna are analyzed. A total of 298 species and subspecies belonging to 53 genera of the subfamilies Vespinae, Polistinae, Eumeninae and Masarinae have been recorded from Turkey. Species composition, diversity and proportion of endemism vary considerably among the biogeographic subregions of the country.

Key words: Hymenoptera, Vespidae, distribution, biogeography, Turkey

Özet

Bu çalışmada, Türkiye'nin Vespidae faunası gözden geçirilmiş ve faunanın bölgelere göre dağılış durumu analiz edilmiştir. Türkiye'de, Vespidae familyasının, Vespinae, Polistinae, Eumeninae ve Masarinae altfamilyalarına ait toplam 53 cinse bağlı 298 tür ve alttürünün bulunduğu tespit edilmiştir. Türkiye'deki tür kompozisyonu, çeşitliliği ve endemizm oranının biyocoğrafik bölgeler arasında önemli farklılıklar gösterdiği saptanmıştır.

Anahtar sözcükler: Hymenoptera, Vespidae, dağılış, biocoğrafya, Türkiye

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Introduction

Turkey occupies Asia Minor between the Mediterranean Sea and the Black Sea and stretches into continental Europe. It is a mountainous country averaging about 1,000 meters in altitude. The topographic and climatic diversity of the region are important preconditions for the development of a rich and diverse fauna. Turkey is generally divided into seven biogeographical regions (Erol, 1982). These are the Marmara Region, the Aegean Region, the Mediterranean Region, the Black Sea Region, and the Central, Eastern and South Eastern Anatolian Regions (Fig. 1, 2).

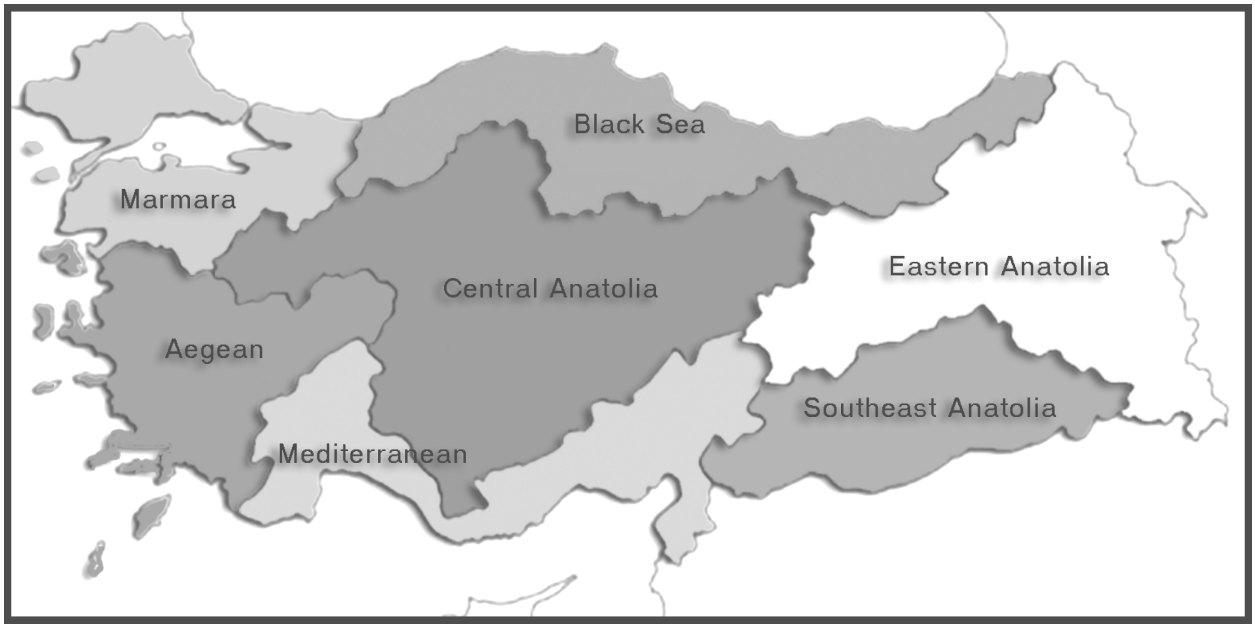

Figure 1. Biogeographical map of Turkey (Erol, 1982).

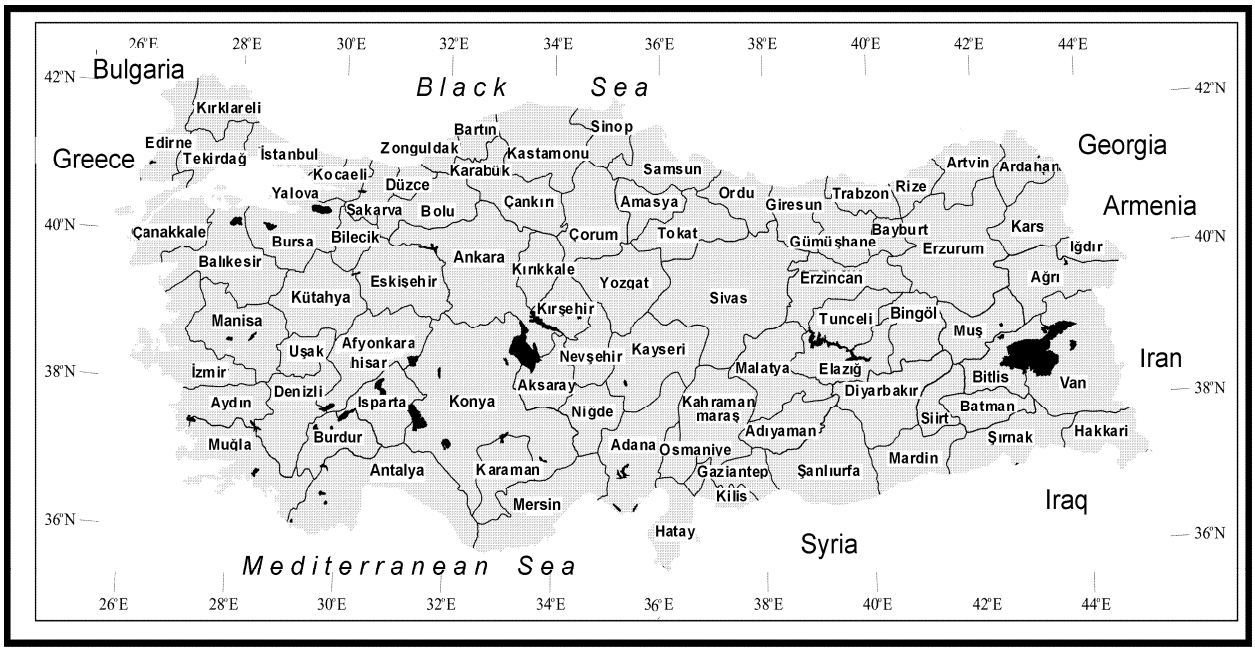

Figure 2. Administrative map of provinces of Turkey (Lelej & Yildirim, 2009).

Turkey is biogeographically one of the most interesting countries in the West Palaearctic region. It has long been known to have a diverse Vespidae fauna which is very rich in comparison with other Mediterranean countries well known for their high biodiversity. Many faunistic and systematic studies on Vespidae have been published by some foreign and native researchers in the Turkey. However, no attempt has been made to study the distribution of the Vespidae among the biogeographical regions of Turkey, although current knowledge of vespid fauna of Turkey is comprehensive.

In this study, surveys of the Vespidae in Turkey are reviewed (Yıldırım & Kojima, 1999; Yıldırım & Gusenleitner, 2001, 2004, 2007, 2009, 2012; Yıldırım, 2008; Gusenleitner, 2011a; Anlaş et al., 2009; Tezcan & Yıldırım, 2004; Tezcan et al., 2005, 2006; Bağrıaçık & Tüzün, 2004; Bağrıaçık, 2005; Tüzün & Kekillioğlu, 2003) and their distributions across the biogeographical regions are analyzed.

Material and Methods

In this study, studies on the Vespidae of Turkey are reviewed and the biogeographical distribution of the Turkish Vespidae is analyzed. The genera, species and subspecies whose type localities are in Turkey are marked with an asterisk.

Vespid similarities between the biogeographical regions of Turkey were evaluated, without regard to differences in region area, by using Sorensen's coefficient of similarity (Legendre & Legendre, 1998). The similarity matrix resulting from pair-wise calculations was then subjected to unweighted arithmetic average clustering (UPGMA; PAST program, version 1.57, Hammer et al., 2006).

Results and Discussion

A total of 298 species and subspecies in 53 genera of the subfamilies Vespinae, Polistinae, Eumeninae and Masarinae have been recorded from Turkey. Of them, 65 species and subspecies, comprising 22% of Turkish vespids, are endemic. Furthermore three genera, 71 species and 16 subspecies of Vespidae have been described from Turkey (Tables 1, 2, 3).

Table 1. Vespidae species reported from Turkey

		Present in Turkey		Described from Turkey		
Family	Subfamily	Genus	Number of species and subspecies	Genus	Species	Subspecies
Vespidae	Vespinae	*Vespa*	2	-	-	-
		Vespula	4	-	-	-
		Dolichovespula	6	-	-	-
	Polistinae	*Polistes*	9	-	-	-
		Parapolybia	1	-	-	-
	Eumeninae	*Raphiglossa*	2	-	-	-
		Psiliglossa	2	-	1	-
		Discoelius	2	-	-	-
		Paravespa	5	-	-	-
		Tropidodynerus	1	-	-	-
		Paragymnomerus	2	-	-	-
		Odynerus	13	-	-	-
		Gymnomerus	1	-	-	-
		Cephalochilus	1	-	1	-
		Hemipterochilus	5	-	1	-
		Pterocheilus	5	-	4	-

Table 1. (continued)

		Present in Turkey		Described from Turkey		
Family	Subfamily	Genus	Number of species and subspecies	Genus	Species	Subspecies
		Onychopterocheilus	10	-	2	2
		Alastor	11	-	5	-
		Microdynerus	17	-	5	-
		Eumicrodynerus	1	-	-	-
		Pseudosymmorphus	2	-	1	-
		**Acanthodynerus*	2	1	2	-
		Leptochilus	25	-	14	2
		Cyrtolabulus	5	-	3	-
		Tachyancistrocerus	5	-	1	-
		Stenancistrocerus	1	-	1	-
		Eustenancistrocerus	4	-	-	1
		Jucancistrocerus	3	-	1	-
		Stenodynerus	14	-	4	1
		Antepipona	14	-	5	1
		Brachyodynerus	5	-	2	-
		Parodontodynerus	2	-	-	-
		Allodynerus	5	-	-	1
		Antodynerus	1	-	-	-
		Pseudepipona	8	-	3	-
		**Brachypipona*	2	1	2	-
		Chlorodynerus	1	-	-	-
		Euodynerus	18	-	3	1
		Knemodynerus	1	-	1	-
		Syneuodynerus	3	-	1	1
		**Intereuodynerus*	2	1	2	-
		Rhynchium	2	-	-	-
		Ancistrocerus	16	-	-	2
		Symmorphus	8	-	-	-
		Pareumenes	2	-	-	-
		Eumenes	17	-	-	1
		Delta	4	-	-	-
		Ischnogasteroides	3	-	-	-
		Katamenes	7	-	-	2
	Masarinae	*Celonites*	7	-	3	1
		Ceramius	3	-	-	-
		Jugurtia	2	-	-	-
		Quartinia	4	-	3	-
	Total	53	298	3	71	16

There are great differences in species composition and richness among the biogeographic regions of Turkey (Table 2, Fig. 3): Two hundred three species and subspecies of the Vespidae have been recorded from Eastern Anatolia (67% of the recorded species and subspecies), 163 from Central Anatolia (55%), 122 from the Mediterranean region (41%), 106 from the Black Sea region (36%), 75 from South-eastern Anatolia (25%), 68 from the Marmara region (23%), and 64 from the Aegean region (22%). These data show that the highest species diversity of Vespidae is in the Eastern and Central Anatolian regions.

A cluster analysis of vespid fauna similarities among the regions revealed three major clusters. The first cluster is in the Eastern and Central Anatolian region, the second cluster is in the Mediterranean and Black Sea regions, and the third cluster is in the Marmara, Aegean and South-east Anatolian region (Table 2, Fig. 3).

Table 2. Distribution of Vespidae in the biogeographical regions of Turkey

Names of taxa	SA	EA	BS	CA	MD	A	M	E
VESPINAE								
Vespa Linnaeus, 1758								
Vespa crabro Linnaeus, 1758	-	+	+	+	+	+	+	-
Vespa orientalis Linnaeus, 1771	+	+	+	+	+	+	+	-
Vespula Thomson, 1869								
Vespula (Allovespula) rufa (Linnaeus, 1758)	-	+	+	-	-	-	-	-
Vespula (Paravespula) germanica (Fabricius, 1793)	+	+	+	+	+	+	+	-
Vespula (Paravespula) vulgaris (Linnaeus, 1758)	+	+	+	+	+	+	+	-
Vespula (Vespula) austriaca (Panzer, 1799)	-	+	-	-	-	-	-	-
Dolichovespula Rohwer, 1916								
Dolichovespula (Boreovespula) norwegica (Fabricius, 1781)	-	-	+	-	-	-	-	-
Dolichovespula (Boreovespula) saxonica (Fabricius, 1793)	-	-	+	-	-	-	-	-
Dolichovespula (Dolichovespula) media (Retzius, 1783)	-	-	+	-	-	-	+	-
Dolichovespula (Metavespula) sylvestris (Scopoli, 1763)	+	+	+	+	+	+	+	-
Dolichovespula (Pseudovespula) adulterina (du Buysson, 1905)	-	-	+	-	-	-	-	-
Dolichovespula (Pseudovespula) omissa (Bischoff, 1931)	-	+	+	+	-	-	-	-
POLISTINAE								
Polistes Latreille, 1802								
Polistes (Polistes) associus Kohl, 1898	-	+	+	+	+	+	+	-
Polistes (Polistes) biglumis (Linnaeus, 1758)	-	+	+	+	+	-	+	-
Polistes (Polistes) bischoffi Weyrauch, 1937	-	+	+	+	-	-	-	-
Polistes (Polistes) dominula (Christ, 1791)	+	+	+	+	+	+	+	-
Polistes (Polistes) gallicus (Linnaeus, 1767)	+	+	+	+	+	+	+	-
Polistes (Polistes) nimpha (Christ, 1791)	+	+	+	+	+	+	+	-
Polistes (Sulcopolistes) atrimandibularis Zimmermann, 1930	+	+	+	+	-	-	+	-

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
Polistes (Sulcopolistes) semenowi Morawitz, 1889	-	+	-	-	-	-	-	-
Polistes (Sulcopolistes) sulcifer Zimmermann, 1930	-	+	+	+	-	+	+	-
Parapolybia Saussure, 1854								
Parapolybia escalerae (Meade-Waldo, 1911)	-	+	-	-	-	-	-	-
EUMENINAE								
Raphiglossa S.S. Saunders, 1850								
Raphiglossa eumenoides caucasica Giordani Soika, 1970	+	-	-	+	-	-	-	-
Raphiglossa eumenoides eumenoides S.S. Saunders, 1850	-	+	-	+	-	-	-	-
Psiliglossa S.S. Saunders, 1872								
**Psiliglossa anatolica* Giordani Soika, 1979	+	+	-	+	-	-	-	+
Psiliglossa odyneroides (S.S. Saunders, 1850)	-	-	-	+	+	+	+	-
Discoelius Latreille, 1809								
Discoelius dufourii Lepeletier, 1841	-	+	-	-	-	-	-	-
Discoelius zonalis (Panzer, 1801)	-	-	+	-	-	-	-	-
Paravespa Radoszkowski, 1886								
Paravespa grandis caucasica (Kokujev, 1912)	-	+	-	-	-	-	-	-
Paravespa grandis grandis (Morawitz, 1885)	-	-	-	+	+	-	-	-
Paravespa mimetica (Schulthess, 1924)	+	-	-	-	-	-	-	-
Paravespa quadricolor (Morawitz, 1885)	+	-	-	-	-	-	-	-
Paravespa rex (Schulthess, 1924)	-	-	-	+	-	-	-	-
Tropidodynerus Blüthgen, 1939								
Tropidodynerus interruptus (Brullé, 1832)	-	+	+	+	-	-	-	-
Paragymnomerus Blüthgen, 1938								
Paragymnomerus amitinorum Blüthgen, 1952	-	+	+	+	+	-	+	-
Paragymnomerus spiricornis (Spinola, 1808)	-	-	+	-	-	-	-	-
Odynerus Latreille, 1802								
Odynerus (Odynerus) ezechiae Schulthess, 1924	-	-	+	+	-	+	-	-
Odynerus (Odynerus) femoratus Saussure, 1856	-	+	+	+	+	+	+	-
Odynerus (Odynerus) melanocephalus armeniacus (Morawitz, 1885)	+	+	+	+	+	+	-	-
Odynerus (Odynerus) melanocephalus melanocephalus (Gmelin, 1790)	-	+	+	+	-	-	-	-

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
Odynerus (Odynerus) poecilus Saussure, 1856	-	+	+	+	-	-	-	-
Odynerus (Odynerus) rotundigaster Saussure, 1853	-	+	+	+	-	-	-	-
Odynerus (Odynerus) serricrus (Blüthgen, 1963)	-	+	-	-	-	-	-	-
Odynerus (Odynerus) spinipes (Linnaeus, 1758)	-	+	+	-	-	-	-	-
Odynerus (Spinicoxa) albopictus albopictus Saussure, 1856	+	+	-	+	-	-	-	-
Odynerus (Spinicoxa) albopictus calcaratus (Morawitz, 1885)	-	+	-	+	+	+	+	-
Odynerus (Spinicoxa) fulvitarsis (Morawitz, 1895)	-	+	-	-	-	-	-	-
Odynerus (Spinicoxa) reniformis (Gmelin, 1781)	-	+	-	-	-	-	+	-
Odynerus (Spinicoxa) simillimus Morawitz, 1867	-	+	-	-	-	-	-	-
Gymnomerus Blüthgen, 1938								
Gymnomerus laevipes (Shuckard, 1837)	-	+	+	+	-	-	+	-
Cephalochilus Blüthgen, 1939								
**Cephalochilus draco* Giordani Soika, 1970	+	+	-	+	-	+	+	-
Hemipterochilus Ferton, 1909								
Hemipterochilus aberrans (Morawitz, 1885)	+	+	-	+	+	-	-	-
Hemipterochilus bembeciformis bembeciformis (Morawitz, 1867)	-	+	-	+	-	-	-	-
Hemipterochilus bembeciformis terricola (Mocsáry, 1883)	-	-	-	+	-	-	+	-
Hemipterochilus bicoloricornis (Giordani Soika, 1952)	-	-	-	-	+	-	-	-
**Hemipterochilus simplex* Gusenleitner, 2000	-	+	-	-	-	-	-	+
Pterocheilus Klug, 1805								
**Pterocheilus kamanensis* Gusenleitner, 1967	-	-	-	+	-	-	-	+
**Pterocheilus multimaculatus* Gusenleitner, 2004	-	-	-	+	-	-	-	+
**Pterocheilus perpunctatus* Giordani Soika, 1970	-	-	-	+	-	-	-	+
Pterocheilus phaleratus (Panzer, 1797)	-	+	-	-	-	-	-	-
**Pterocheilus schwarzi* Gusenleitner, 1994	-	-	-	+	-	-	-	+
Onychopterocheilus Blüthgen, 1955								
Onychopterocheilus albopictus (Kriechbaumer, 1869)	-	-	-	+	-	-	-	-
**Onychopterocheilus anatolicus* (Blüthgen, 1955)	-	+	-	+	-	-	-	+
Onychopterocheilus atrohirtus (Morawitz, 1885)	-	+	-	-	+	-	-	-
Onychopterocheilus ecarinatus (Morawitz, 1895)	-	+	-	-	-	-	-	-

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
**Onychopterocheilus fausti aurantiopictus* (Giordani Soika, 1970)	-	+	-	+	-	-	-	+
Onychopterocheilus hellenicus hellenicus (Morawitz, 1885)	-	+	-	-	-	-	-	-
Onychopterocheilus hellenicus syriacus (Blüthgen, 1952)	-	+	-	+	-	-	-	-
**Onychopterocheilus mavromoustakisi* (Giordani Soika, 1970)	-	+	-	+	-	-	-	+
Onychopterocheilus pallasii (Klug, 1805)	-	+	-	-	-	-	-	-
**Onychopterocheilus pamirensis pentheri* (Blüthgen, 1956)	-	-	-	+	-	-	-	+
Alastor Lepeletier, 1841								
Alastor (Alastor) ardens Kostylev, 1935	+	-	-	-	-	-	-	-
Alastor (Alastor) atropos Lepeletier, 1841	-	-	-	-	-	+	-	-
Alastor (Alastor) mocsaryi (André, 1884)	-	+	+	+	+	-	-	-
**Alastor (Alastor) pentheri* Kohl, 1905	-	+	+	+	+	-	+	+
**Alastor (Alastor) ruficornis* Gusenleitner, 2001	-	+	-	-	-	-	-	+
**Alastor (Alastor) seidenstueckeri* Blüthgen, 1956	-	+	+	+	-	-	-	+
**Alastor (Alastor) thymbrinus* Blüthgen, 1956	-	+	+	+	+	-	-	+
Alastor (Megalastor) asiaticus Morawitz, 1895	-	-	-	+	-	-	-	-
Alastor (Megalastor) esfandiarii Giordani Soika, 1970	+	-	-	-	-	-	-	-
Alastor (Megalastor) mediomaculatus Giordani Soika, 1952	-	+	-	+	+	+	-	-
**Alastor (Megalastor) schwarzi* Gusenleitner, 1967	+	+	-	-	+	-	-	+
Microdynerus Thomson, 1874								
Microdynerus (Alastorynerus) microdynerus (Dalla Torre, 1889)	-	+	-	+	-	-	-	-
Microdynerus (Microdynerus) abdelkader (Saussure, 1856)	-	-	-	-	+	+	-	-
Microdynerus (Microdynerus) aegaeicus Gusenleitner, 1998	-	-	+	-	-	+	-	-
Microdynerus (Microdynerus) appenninicus Giordani Soika, 1960	+	-	+	+	+	+	-	-
Microdynerus (Microdynerus) atriceps Morawitz, 1895	-	-	-	-	+	-	-	-
**Microdynerus (Microdynerus) confinis* Gusenleitner, 1979	-	+	-	+	+	+	-	+
**Microdynerus (Microdynerus) curdistanicus* Gusenleitner, 1988	-	+	-	+	-	-	-	+
**Microdynerus (Microdynerus) erzincanensis* Yıldırım and Özbek, 1995	-	+	-	-	-	-	-	+

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
Microdynerus (Microdynerus) exilis (Herrich-Schaeffer, 1839)	-	-	-	-	-	+	-	-
Microdynerus (Microdynerus) longicollis Morawitz, 1895	-	+	+	-	-	-	-	-
Microdynerus (Microdynerus) mirandus (Giordani Soika, 1947)	-	-	-	+	+	-	+	-
Microdynerus (Microdynerus) nugdunensis (Saussure, 1855)	-	+	-	+	+	-	-	-
**Microdynerus (Microdynerus) rubiculus* Gusenleitner, 2000	+	-	-	-	-	-	-	+
Microdynerus (Microdynerus) urdunus Gusenleitner, 2004	-	+	-	-	-	-	-	-
**Microdynerus (Pachymicrodynerus) anatolicus* (Blüthgen, 1938)	+	-	-	-	-	-	-	+
Microdynerus (Pachymicrodynerus) eurasius (Blüthgen, 1938)	+	+	-	+	+	-	+	-
Microdynerus (Pseudomicrodynerus) parvulus (Herrich-Schaeffer, 1838)	+	+	+	+	+	-	-	-
Eumicrodynerus Gusenleitner, 1972								
Eumicrodynerus europaeus (Giordani Soika, 1942)	-	-	-	-	+	-	-	-
Pseudosymmorphus Blüthgen, 1938								
**Pseudosymmorphus adnexus* (Gusenleitner, 1969)	+	-	-	-	-	-	-	+
Pseudosymmorphus propheta (Giordani Soika, 1969)	+	-	-	-	-	-	-	-
**Acanthodynerus* Gusenleitner, 1969								
**Acanthodynerus giordanii* Gusenleitner, 1969	+	-	-	+	+	-	-	+
**Acanthodynerus multimaculatus* Gusenleitner, 2000	+	-	-	-	-	-	-	+
Leptochilus Saussure, 1853								
**Leptochilus (Euleptochilus) limbiferus anatolicus* Blüthgen, 1955	-	+	+	+	+	-	+	+
Leptochilus (Lionotulus) aegineticus Gusenleitner, 1970	+	-	-	-	-	-	-	-
Leptochilus (Lionotulus) alpestris (Saussure, 1855)	-	+	+	-	-	-	+	-
**Leptochilus (Lionotulus) ambitiosus* Giordani Soika, 1986	-	+	-	-	-	-	-	+
**Leptochilus (Lionotulus) fuscipes* Gusenleitner, 1985	+	-	-	-	-	-	-	-
**Leptochilus (Lionotulus) gusenleitneri* Yıldırım and Özbek, 1995	-	+	-	-	-	-	-	+
**Leptochilus (Lionotulus) hermon* Gusenleitner, 1971	-	+	+	-	+	-	-	-
**Leptochilus (Lionotulus) hethiticus* Gusenleitner, 1985	-	+	-	+	+	-	-	+
Leptochilus (Lionotulus) josephi Giordani Soika, 1947	-	-	-	+	+	-	-	-
Leptochilus (Lionotulus) membranaceus (Morawitz, 1867)	+	+	-	+	-	-	-	-

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
**Leptochilus (Lionotulus) mimulus turcicus* Gusenleitner, 1971	+	-	-	+	+	-	-	+
**Leptochilus(Lionotulus) montivagus* Gusenleitner, 2002	+	+	-	-	-	-	-	+
**Leptochilus (Lionotulus) neutraliformis* Gusenleitner, 1977	+	-	-	-	+	-	-	+
**Leptochilus (Lionotulus) neutralis* (Giordani Soika, 1943)	+	-	+	+	+	+	-	-
**Leptochilus (Lionotulus) nigroclypeus* Gusenleitner, 1985	-	+	-	+	-	-	-	+
**Leptochilus (Lionotulus) ornatulus* Gusenleitner, 1977	+	-	-	-	-	-	-	+
**Leptochilus (Lionotulus) osmanicus* Gusenleitner, 1988	-	+	-	-	-	-	-	+
**Leptochilus (Lionotulus) palandokenicus* Yıldırım and Özbek, 1995	-	+	-	-	-	-	-	+
Leptochilus (Lionotulus) ressli Gusenleitner, 1985	-	+	-	-	-	-	-	-
Leptochilus (Lionotulus) tarsatellus Giordani Soika, 1970	-	+	-	-	-	-	-	-
Leptochilus (Lionotulus) tarsatiformis (Giordani Soika, 1943)	-	+	-	+	-	-	-	-
Leptochilus (Lionotulus) tarsatus (Saussure, 1855)	-	-	-	-	+	-	-	-
**Leptochilus (Neoleptochilus) kemali* Gusenleitner, 1977	-	+	-	+	+	-	-	+
Leptochilus (Neoleptochilus) regulus (Saussure, 1855)	+	+	+	+	+	+	+	-
**Leptochilus (Sarochilus) alterego* Gusenleitner, 1970	+	-	-	-	-	-	-	-
Cyrtolabulus van der Vecht, 1963								
**Cyrtolabulus anatolicus* Gusenleitner, 2006	+	-	-	-	-	-	-	+
Cyrtolabulus iranus (Giordani Soika, 1968)	+	-	-	-	-	-	-	-
**Cyrtolabulus mutinensis* Gusenleitner, 2006	-	-	-	-	+	-	-	+
**Cyrtolabulus yildirimi* Gusenleitner, 2006	+	-	-	-	-	-	-	+
Cyrtolabulus zarudnyi (Kostylev, 1939)	+	-	-	-	-	-	-	-
Tachyancistrocerus Giordani Soika, 1952								
**Tachyancistrocerus aereus* Giordani Soika, 1952	-	-	-	-	+	-	-	+
Tachyancistrocerus komarowi (Morawitz, 1885)	+	-	-	-	+	-	-	-
Tachyancistrocerus rhodensis (Saussure, 1855)	-	+	+	+	+	+	+	-
Tachyancistrocerus schmidti (Kokujev, 1912)	+	+	-	-	+	-	+	-
Tachyancistrocerus syriacus Giordani Soika, 1970	-	+	-	-	-	-	-	-
Stenancistrocerus Saussure, 1863								
**Stenancistrocerus (Paratropancistrocerus) liliput* Gusenleitner, 1993	+	-	-	-	-	-	-	+

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
Eustenancistrocerus Blüthgen, 1938								-
Eustenancistrocerus (Eustenancistrocerus) israelensis Giordani Soika, 1952	-	+	-	+	+	-	-	-
**Eustenancistrocerus (Eustenancistrocerus) jerichoensis iconius* Blüthgen, 1957	-	+	-	+	+	-	-	+
Eustenancistrocerus (Eustenancistrocerus) jerichoensis jerichoensis (Schulthess, 1928)	-	+	-	-	-	-	-	-
Eustenancistrocerus (Parastenancistrocerus) amadanensis (Saussure, 1855)	-	+	+	+	+	-	+	-
Jucancistrocerus Blüthgen, 1938								
Jucancistrocerus caspicus Giordani Soika, 1970	-	+	-	-	-	-	-	-
Jucancistrocerus citreodecoratus Giordani Soika, 1970	+	+	-	-	-	-	-	-
**Jucancistrocerus jucundus* (Mocsáry, 1883)	-	+	+	+	+	-	+	-
Stenodynerus Sausure, 1863								
Stenodynerus aequisculptus aequisculptus (Kostylev, 1940)	-	+	+	+	+	-	+	-
**Stenodynerus aequisculptus taurus* (Gusenleitner, 1966)	-	-	-	-	+	-	-	-
Stenodynerus bluethgeni van der Vecht, 1971	-	+	+	+	+	+	-	-
Stenodynerus chevrieranus (Saussure, 1855)	-	+	+	+	+	-	+	-
Stenodynerus chitgarensis Giordani Soika, 1970	-	+	-	-	-	-	-	-
**Stenodynerus claviger* Gusenleitner, 1981	-	+	-	-	-	-	-	+
Stenodynerus fastidiosissimus difficilis (Morawitz, 1867)	-	-	-	-	+	-	-	+
**Stenodynerus haladaorum* Gusenleitner, 1999	-	+	+	+	+	-	+	-
Stenodynerus orenburgensis (André, 1884)	-	+	+	-	-	-	-	-
**Stenodynerus pannosus* Gusenleitner, 1985	-	+	-	-	-	-	-	+
Stenodynerus pullus Gusenleitner, 1981	-	+	-	+	-	-	-	-
**Stenodynerus simulatus* Gusenleitner, 1981	-	+	+	+	+	-	-	+
Stenodynerus steckianus (Schulthess, 1897)	-	+	+	+	-	-	-	-
Stenodynerus trotzinai (Morawitz, 1895)	+	+	-	-	-	-	-	-
Antepipona Saussure, 1855								
**Antepipona albosignata* Gusenleitner, 1986	-	+	-	+	-	-	+	+
Antepipona cribrata (Morawitz, 1885)	-	+	-	-	-	-	-	-
Antepipona deflenda (S.S. Saunders, 1853)	-	+	+	+	+	+	+	-

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
Antepipona dentella Gusenleitner, 1991	-	+	-	-	-	-	-	-
**Antepipona iconia* (Blüthgen, 1951)	+	+	-	+	-	-	-	-
**Antepipona insana calva* Gusenleitner, 1988	-	+	-	-	-	-	-	+
Antepipona insana insana (Giordani Soika, 1943)	-	+	+	+	-	-	-	-
**Antepipona laevigata* (Blüthgen, 1951)	+	+	-	+	-	+	-	-
Antepipona nigricornis (Morawitz, 1885)	-	+	-	+	-	-	-	-
Antepipona orbitalis ballioni (Morawitz, 1867)	-	+	-	-	+	-	+	-
Antepipona orbitalis orbitalis (Herrich-Schaeffer, 1839)	-	+	+	+	-	-	-	-
**Antepipona osmania* Gusenleitner, 1986	+	+	+	-	+	-	-	+
**Antepipona tenuis* Gusenleitner, 1988	-	-	-	+	-	-	-	+
Antepipona varentzowi (Morawitz, 1895)	-	-	-	+	-	-	-	-
Brachyodynerus Blüthgen, 1938								
**Brachyodynerus chloroticus* Gusenleitner, 2004	-	+	-	-	-	-	-	+
Brachyodynerus kopetdagicus (Kostylev, 1940)	+	+	-	-	-	-	+	-
**Brachyodynerus kusdasi* Gusenleitner, 1967	-	+	-	+	+	-	-	+
Brachyodynerus magnificus (Morawitz, 1867)	-	+	-	-	-	-	-	-
Brachyodynerus quadrimaculatus (André, 1884)	-	+	-	+	-	+	-	-
Parodontodynerus Blüthgen, 1938								
Parodontodynerus aramaeus Blüthgen, 1955	-	+	-	-	+	-	-	-
Parodontodynerus ephippium (Klug, 1817)	-	+	+	+	+	+	+	-
Allodynerus Blüthgen, 1938								
Allodynerus delphinalis (Giraud, 1866)	-	+	+	+	+	+	+	-
Allodynerus dignotus (Morawitz, 1895)	-	+	-	+	+	-	-	-
Allodynerus floricola floricola (Saussure, 1853)	-	+	-	+	+	+	-	-
**Allodynerus floricola inaequalis* Giordani Soika, 1970	-	-	-	-	-	-	+	+
Allodynerus rossii (Lepeletier, 1841)	-	+	+	+	+	-	+	-
Antodynerus Saussure, 1855								
Antodynerus incomparabilis Giordani Soika, 1970	+	-	-	-	-	-	-	-
Pseudepipona Saussure, 1856								
**Pseudepipona (Deuterepipona) ankarensis* Giordani Soika, 1970	-	+	+	+	-	-	-	+
Pseudepipona (Deuterepipona) ionia clausa (Giordani Soika, 1943)	-	-	-	+	+	-	-	-
Pseudepipona (Deuterepipona) ionia ionia (Saussure, 1855)	-	+	-	+	+	-	-	-
Pseudepipona (Pseudepipona) herrichii (Saussure, 1856)	-	+	+	+	-	-	-	-
Pseudepipona (Pseudepipona) lativentris (Saussure, 1855)	+	+	-	+	-	-	-	-
**Pseudepipona (Pseudepipona) niveopicta* Giordani Soika, 1970	-	-	-	+	-	-	-	+

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
**Pseudepipona (Pseudepipona) pseudominuta* Gusenleitner, 1971	-	+	-	-	-	-	-	-
Pseudepipona (Pseudepipona) tricarinata (Kokujev, 1912)	-	+	-	-	-	-	-	-
**Brachypipona* Gusenleitner, 1967								
**Brachypipona orientalis* Gusenleitner, 2004	-	+	-	-	-	-	-	+
**Brachypipona schmidti* (Gusenleitner, 1967)	-	-	-	+	+	-	-	+
Chlorodynerus Blüthgen, 1951								
Chlorodynerus ypsilon rhodius (Blüthgen, 1954)	-	-	-	+	+	-	+	-
Euodynerus Dalla Torre, 1904								
Euodynerus (Euodynerus) cherkensis (Giordani Soika, 1942)	-	-	-	-	-	+	-	-
**Euodynerus (Euodynerus) clatratus* Blüthgen, 1951	+	+	-	+	-	-	-	+
Euodynerus (Euodynerus) curictensis Blüthgen, 1940	-	+	+	+	+	+	-	-
Euodynerus (Euodynerus) dantici (Rossi, 1790)	-	+	+	+	+	+	+	-
Euodynerus (Euodynerus) disconotatus disconotatus (Lichtenstein, 1884)	+	+	+	+	+	+	+	-
Euodynerus (Euodynerus) disconotatus sulfuripes (Morawitz, 1885)	+	+	-	-	-	-	-	-
Euodynerus (Euodynerus) fastidiosus (Saussure, 1853)	-	+	+	+	+	+	-	-
Euodynerus (Euodynerus) hellenicus Blüthgen, 1942	+	+	-	-	-	+	-	-
**Euodynerus (Euodynerus)maximilianus* Gusenleitner, 1998	+	-	-	-	-	-	-	+
Euodynerus (Euodynerus) semidantici (Giordani Soika, 1952)	-	-	-	-	+	-	-	-
Euodynerus (Euodynerus) semisaecularis macedonicus Blüthgen, 1951	+	-	-	+	+	-	-	-
Euodynerus (Euodynerus) semisaecularis semisaecularis (Dalla Torre, 1889)	-	+	+	+	-	-	-	-
Euodynerus (Euodynerus) velutinus Blüthgen, 1951	-	+	-	+	-	-	-	-
**Euodynerus (Pareuodynerus) breviventris* (Giordani Soika, 1952)	-	-	-	-	+		-	-
Euodynerus (Pareuodynerus) notatus (Jurine, 1807)	-	+	+	+	-	-	-	-
Euodynerus (Pareuodynerus) posticus (Herrich-Schaeffer, 1841)	-	+	+	+	+	+	+	-
Euodynerus (Pareuodynerus) quadrifasciatus quadrifasciatus (Fabricius, 1793)	-	+	+	+	-	-	-	-
**Euodynerus (Pareuodynerus) quadrifasciatus rufipes* Gusenleitner, 1984	-	+	-	-	-	-	-	+
Knemodynerus Blüthgen, 1940								
**Knemodynerus euodyneroides* Gusenleitner, 1997	-	-	-	+	-	-	-	+
Syneuodynerus Blüthgen, 1951								
**Syneuodynerus egregius egregior* Gusenleitner, 1970	+	-	-	-	+	-	-	-
Syneuodynerus egregius egregius (Herrich-Schaeffer, 1839)	-	+	-	+	+	+	-	-
**Syneuodynerus erichi* Gusenleitner, 1967	+	+	-	-	+	-	-	+
**Intereuodynerus* Gusenleitner, 1997								
**Intereuodynerus fritzi* Gusenleitner, 1997	+	-	-	-	-	-	-	+

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
**Intereuodynerus siegberti* (Gusenleitner, 1967)	+	-	-	-	+	-	-	-
Rhynchium Spinola, 1806								
Rhynchium oculatum hebraeum Giordani Soika, 1952	-	-	+	+	+	+	-	-
Rhynchium oculatum oculatum (Fabricius, 1781)	-	-	+	+	+	+	+	-
Ancistrocerus Wesmael, 1836								
Ancistrocerus antilope (Panzer, 1798)	-	+	+	-	-	-	-	-
Ancistrocerus auctus (Fabricius, 1793)	-	+	+	+	+	+	+	-
Ancistrocerus claripennis claripennis Thomson, 1874	-	+	+	+	-	-	-	-
**Ancistrocerus claripennis ponticus* Giordani Soika, 1970	-	+	+	-	-	+	-	+
Ancistrocerus dusmetiolus (Strand, 1914)	-	+	-	+	-	-	-	-
Ancistrocerus gazella (Panzer, 1798)	-	+	-	+	+	-	+	-
Ancistrocerus ichneumonideus (Ratzeburg, 1844)	-	+	-	-	-	-	-	-
Ancistrocerus longispinosus (Saussure, 1855)	-	-	-	-	+	-	-	-
Ancistrocerus nigricornis (Curtis, 1826)	-	-	+	+	-	+	+	-
**Ancistrocerus oviventris caucasicus* Gusenleitner, 1994	-	+	-	-	-	-	-	-
Ancistrocerus oviventris oviventris (Wesmael, 1836)	-	+	+	+	-	-	+	-
Ancistrocerus oviventris siculus Blüthgen, 1955	-	+	+	-	-	-	-	-
Ancistrocerus parietinus (Linnaeus, 1761)	-	+	+	+	-	-	-	-
Ancistrocerus parietum (Linnaeus, 1758)	-	+	+	+	-	+	+	-
Ancistrocerus scoticus (Curtis, 1826)	-	+	+	-	-	+	+	-
Ancistrocerus trifasciatus (Müller, 1776)	-	-	+	+	-	-	-	-
Symmorphus Wesmael, 1836								
Symmorphus (Symmorphus) allobrogus (Saussure, 1855)	-	+	+	-	-	-	-	-
Symmorphus (Symmorphus) bifasciatus (Linnaeus, 1761)	-	+	+	+	-	-	-	-
Symmorphus (Symmorphus) connexus (Curtis, 1826)	-	-	+	-	+	-	-	-
Symmorphus (Symmorphus) crassicornis (Panzer, 1798)	-	+	+	+	-	-	-	-
Symmorphus (Symmorphus) debilitatus (Saussure, 1855)	-	-	+	-	-	-	-	-
Symmorphus (Symmorphus) declivis Harttig, 1932	-	-	-	+	+	+	+	-
Symmorphus (Symmorphus) gracilis (Brullé, 1832)	-	+	+	+	+	+	-	-
Symmorphus (Symmorphus) murarius (Linnaeus, 1758)	-	+	-	+	-	-	-	-
Pareumenes Saussure, 1855								

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
Pareumenes (Nortonia) laminatus laminatus (Kriechbaumer, 1879)	-	-	-	+	+	-	+	-
Pareumenes (Nortonia) laminatus palaestinensis Giordani Soika, 1952	-	-	-	-	+	-	-	-
Eumenes Latreille, 1802								
Eumenes coarctatus coarctatus (Linnaeus, 1758)	-	+	+	-	+	+	+	-
Eumenes coarctatus lunulatus Fabricius, 1804	+	+	+	+	+	+	+	-
Eumenes coarctatus ordubadensis Blüthgen, 1938	+	+	-	+	+	-	-	-
**Eumenes coronatus corruetus* Gusenleitner, 1972	-	-	-	-	+	-	-	-
Eumenes coronatus detonsus Blüthgen, 1943	-	+	+	+	+	+	+	-
Eumenes dubius dubius Saussure, 1852	+	+	+	+	+	+	+	-
Eumenes dubius palaestinensis Blüthgen, 1938	+	-	-	-	+	-	-	-
Eumenes jarkandensis Blüthgen, 1938	-	+	+	+	-	-	+	-
Eumenes mediterraneus Kriechbaumer, 1879	+	+	+	+	+	+	+	-
Eumenes modestus Gusenleitner, 2006	-	+	-	-	-	-	-	-
Eumenes papillarius (Christ, 1791)	+	+	+	+	-	+	+	-
Eumenes pedunculatus (Panzer, 1799)	-	+	+	-	+	-	+	-
Eumenes pomifomis (Fabricius, 1781)	-	+	+	+	+	+	+	-
Eumenes punctaticlypeus kostylevi Kurzenko, 1976	-	+	-	+	-	-	-	-
Eumenes sareptanus insolatus Müller, 1923	-	+	-	+	+	-	-	-
Eumenes sareptanus sareptanus André, 1884	-	+	-	-	+	-	+	-
Eumenes subpomiformis Blüthgen, 1938	-	+	+	+	+	-	+	-
Delta Saussure, 1855								
Delta dimidiatipenne (Saussure, 1852)	-	+	-	-	+	-	-	-
Delta unguiculatum libanicum (Giordani Soika, 1941)	-	-	-	-	-	+	-	-
Delta unguiculatum unguiculatum (Villers, 1789)	+	+	+	+	+	+	+	-
Delta viatrix (Nurse, 1903)	+	+	-	-	+	-	-	-
Ischnogasteroides Magretti, 1884								
Ischnogasteroides picteti picteti (Saussure, 1852)	-	-	-	-	-	+	-	-
Ischnogasteroides picteti tenuis (Morawitz, 1888)	-	+	-	+	-	-	-	-
Ischnogasteroides zarudnyi (Kostylev, 1939)	+	+	-	-	-	-	-	-
Katamenes Meade-Waldo, 1910								

Table 2. (continued)

Names of taxa	SA	EA	BS	CA	MD	A	M	E
**Katamenes dimidiatus arrectus* Giordani Soika, 1970	-	+	-	+	-	-	-	+
Katamenes dimidiatus dimidiatus (Brullé, 1832)	-	+	-	+	+	-	-	-
Katamenes dimidiatus montanus (Nurse, 1904)	-	-	-	-	+	-	-	-
Katamenes flavigularis (Blüthgen, 1951)	-	+	+	+	+	-	-	-
Katamenes sichelii baerii (Radoszkowski, 1865)	-	+	-	+	-	-	-	-
Katamenes sichelii sichelii (Saussure, 1852)	-	-	+	+	-	-	-	-
**Katamenes sichelii tauriae* (Giordani Soika, 1960)	-	+	-	+	+	+	-	-
MASARINAE								
Celonites Latreille, 1802								
Celonites abbreviatus (Villers, 1789)	-	+	+	+	-	-	-	-
**Celonites cyprius smyrnensis* Richards, 1962	-	+	-	+	+	-	+	-
Celonites foveolatus nigrior Richards, 1962	-	+	-	-	-	-	-	-
**Celonites hamanni* Gusenleitner, 1973	-	-	-	-	+	-	-	-
**Celonites phlomis* Gusenleitner, 1973	+	-	-	-	-	-	-	+
Celonites rugiceps Bischoff, 1928	-	-	-	-	+	+	-	-
**Celonites spinosus* Gusenleitner, 1966	+	+	+	+	-	+	-	-
Ceramius Latreille, 1810								
Ceramius bureschi Atanassov, 1938	-	+	-	+	+	-	-	-
Ceramius caucasicus André, 1884	-	+	+	+	+	-	-	-
Ceramius palaestinensis (Giordani Soika, 1957)	+	+	-	-	-	-	-	-
Jugurtia Saussure, 1854								
Jugurtia escalerae Meade-Waldo, 1910	-	+	-	-	-	-	-	-
Jugurtia eurycara Kostylev, 1935	-	+	-	+	-	-	-	-
Quartinia André, 1884								
**Quartinia orientalis* Gusenleitner, 1973	-	-	-	+	-	-	-	-
Quartinia popovi Gussakowskii, 1936	-	+	-	-	-	-	-	-
**Quartinia separata* Gusenleitner, 1997	-	+	+	-	-	-	-	-
**Quartinia soikai* Richards, 1964	-	-	-	+	+	-	-	-
Total species and subspecies	75	203	107	163	122	63	68	65

SA - Southeastern Anatolia, EA - Eastern Anatolia, BS - Black Sea, CA - Central Anatolia, MD - Mediterranean, A - Aegean, M - Marmara, E - Endemic species and subspecies

*: The type locality is in Turkey

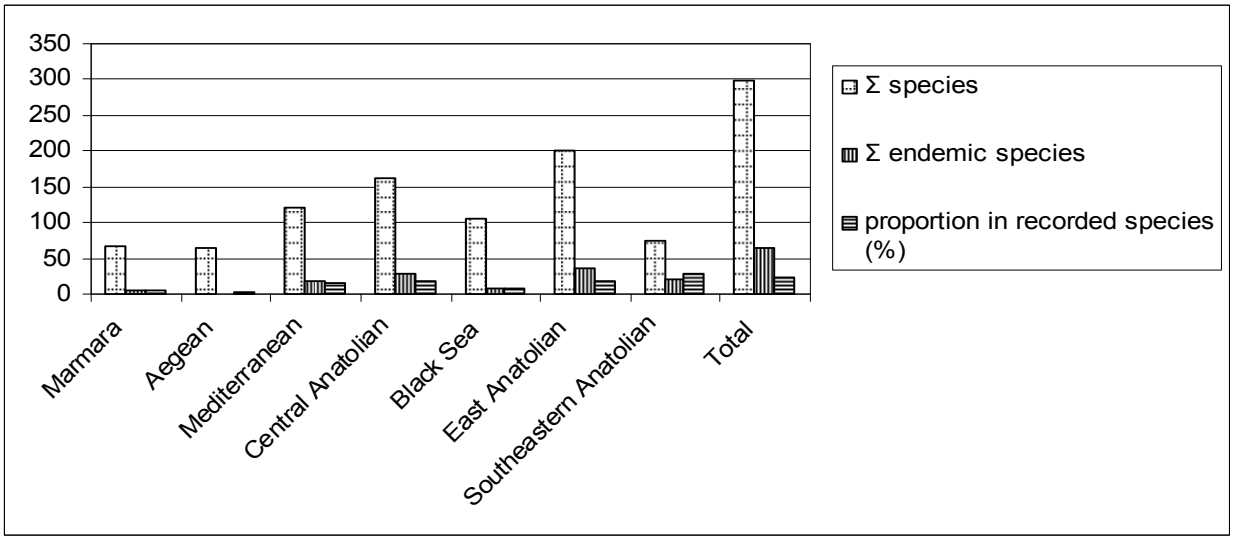

Figure 3. Number of species and subspecies of Vespidae in the biogeographical regions of Turkey.

Cluster analysis of faunal similarities among seven biogeographical regions of Turkey produced three major clusters (Figs 4, 5): Mediterranean, Marmara, and Aegean (bootstrap probability 20%) and Central Anatolia, Eastern Anatolia, and Black Sea (bootstrap probability 61%), which united in one (bootstrap probability 100 %). This large, united cluster belongs to the East Mediterranean province of the Palaearctic region (Semenov-Tian-Shanskij, 1935). Vespid fauna of the South-eastern Anatolia region shows minimal similarity (0.3) with other Turkish regions and it belongs to Sumerian province of the Palaearctic region. The East Anatolian and Central Anatolian faunas have the highest similarity (0.7) and most of the species. At the same time, the Eastern Anatolia and Southeast Anatolian vespids are strongly influenced by the Irano-Turanian province of the Palaearctic Region.

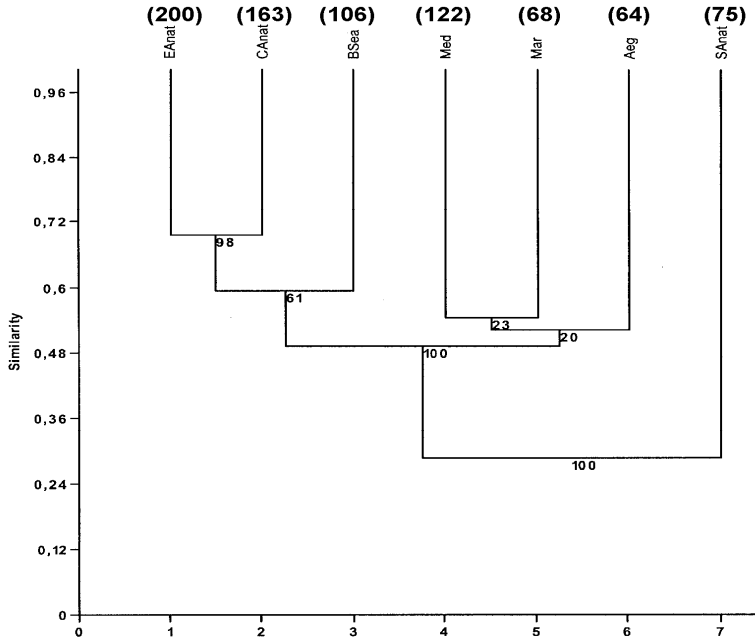

Figure 4. Similarities of the Vespidae from the seven biogeographical regions of Turkey. Bootstrap probabilities (expressed in percentages) are indicated at the node of each cluster. (Dice, r=0.92). The number of species is given above the region name. Names of regions: Aeg – Aegean, Bsea – Black Sea, CAnat – Central Anatolia, EAnat – Eastern Anatolia, Mar – Marmara, Med – Mediterranean, SAnat – Southeastern Anatolia.

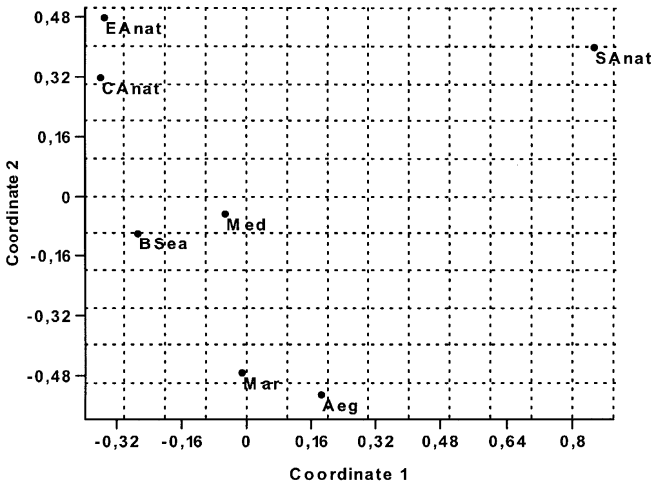

Figure 5. Ordination of the seven biogeographical regions of Turkey in the reduced space of the first two principal coordinates for 298 species of Vespidae. (Dice, r=0.92). Names of regions: Aeg – Aegean, Bsea – Black Sea, CAnat – Central Anatolia, EAnat – Eastern Anatolia, Mar – Marmara, Med – Mediterranean, SAnat – Southeastern Anatolia.

The proportion of endemic species varies considerably among the biogeographical regions. The highest level of endemism (28% of the recorded species; 21 species) is in the Southeastern Anatolia. The proportion of endemic species in other biogeographical regions is 18% in Eastern Anatolia (35 species), 17% in Central Anatolia (28 species), 16% in the Mediterranean region (19 species), 7% in the Black Sea region (7 species), 6% in the Marmara region (4 species), and 2% in the Aegean region (1 species) (Fig. 6).

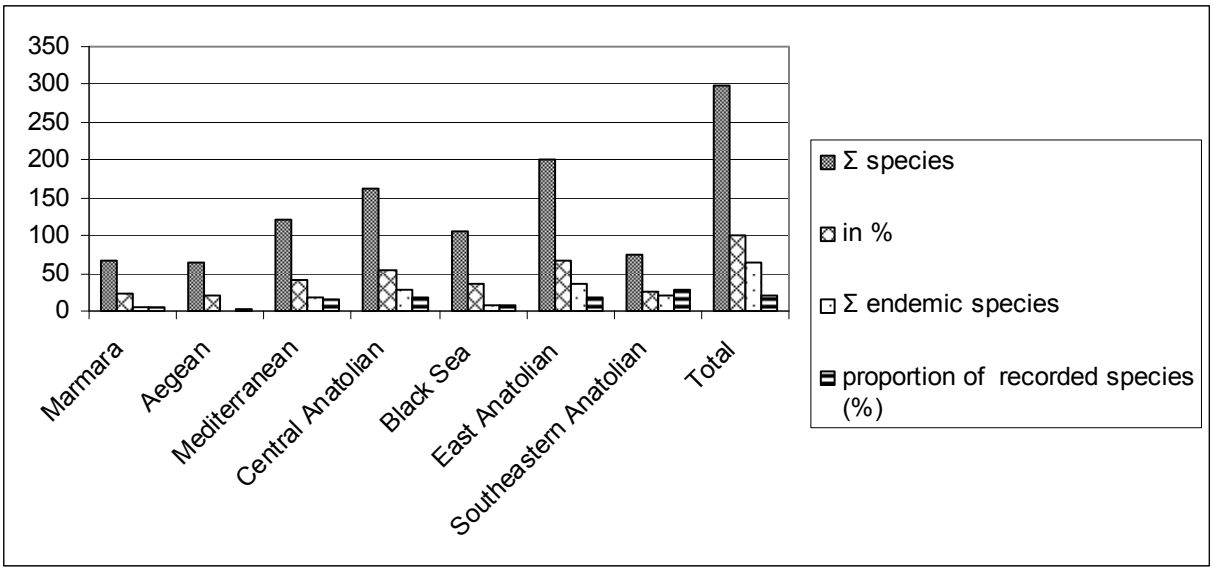

Figure 6. The number and percentages of endemic species and subspecies of Vespidae in the biogeographical regions of Turkey.

The vespid fauna of Turkey is known rather well and currently totals 298 species and subspecies in 53 genera. Of them, three genera, 71 species and 16 subspecies were described from Turkey. Moreover, 65 species and subspecies are endemic. The Turkish vespid fauna is richer than in others countries of the Mediterranean region. There are currently 357 species and subspecies in 45 genera reported from Europe (Gusenleitner, 2011b). The number of species of Vespidae in Turkey is therefore nearly as high as in the whole of Europe (Table 3, Fig. 7) and is probably the consequence of the high biogeographic diversity of the country.

Table 3. Numbers of Vespidae genera and species reported from Turkey (including type localities) and Europe

Family	Subfamily	Turkey		Type localities in Turkey			Europe	
		Genus	Species and sub species	Genus	Species	Sub species	Genus	Species and sub species
Vespidae	Vespinae	3	12	-	-	-	3	13
	Polistinae	2	10	-	-	-	1	9
	Eumeninae	44	260	3	65	15	37	312
	Masarinae	4	16	-	6	1	4	23
	Total	53	298	3	71	16	45	357

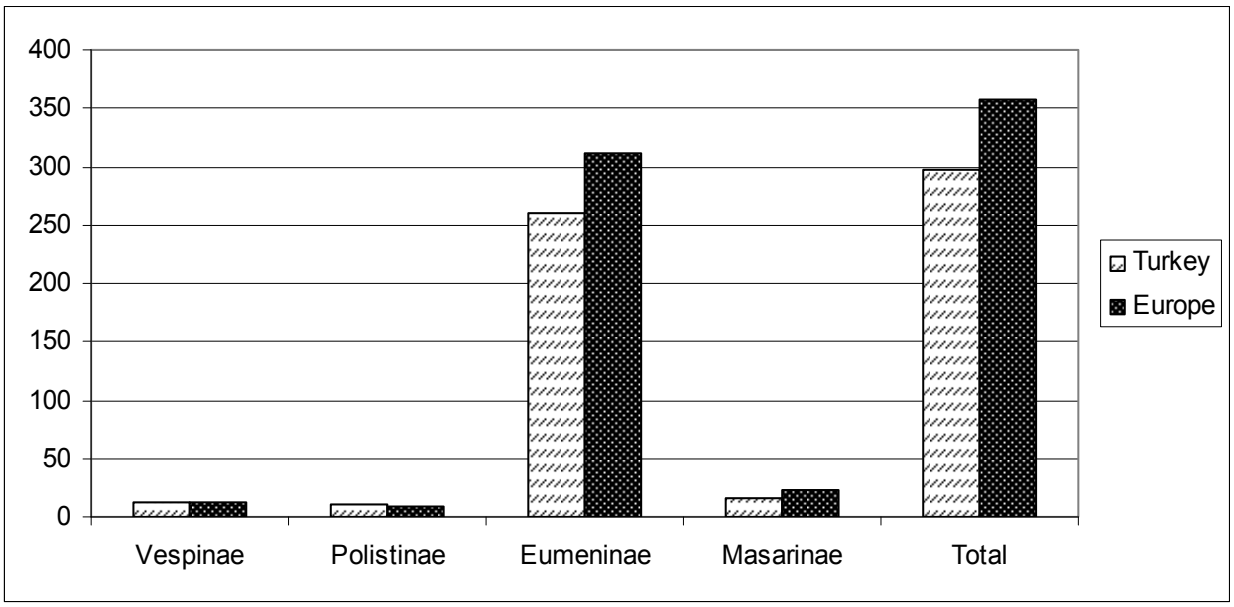

Figure 7. Number of species and subspecies of Vespidae in Turkey and Europe by subfamilies.

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References

Anlaş, S., S. Tezcan & E. Yıldırım, 2009. Bozdağlarda çukur tuzaklarla yakalanan Hymenoptera (Insecta) türleri üzerinde bir değerlendirme. Yüzüncü Yıl Üniversitesi Ziraat Fakültesi Tarım Bilimleri Dergisi, 19 (1): 23-32.

Bağrıaçık, N. & A. Tüzün, 2004. A faunistic study and some ecological observations on Eumenidae (Insecta: Hymenoptera) species of Ankara. Cumhuriyet Üniversitesi Fen-Edebiyat Fakültesi Fen Bilimleri Dergisi, 25 (1): 21-31.

Bağrıaçık, N., 2005. Niğde ili Eumenidae (Hymenoptera: Vespoidea) faunası üzerine bir araştırma ve bazı ekolojik gözlemler. Selçuk Üniversitesi Fen-Edebiyat Fakültesi Fen Dergisi, 25: 43- 50.

Erol, O., 1982. Naturräumliche Gliederung. Tübinger Atlas des Vorderen Orients. Wiesbaden: Dr. Ludwig Reichert Verlag. Map A VII 2.

Gusenleitner, J., 2011a. Bemerkenswertes über Faltenwespen XII (Hymenoptera: Vespidae: Eumeninae). Linzer Biologische Beiträge, 43 (1): 1127-1134.

Gusenleitner, J. 2011b. Fauna Europaea: Vespidae. Fauna Europaea Version 2. 4, (Web page: http://www.faunaeur.org), (Accessed Aug 2011)

Hammer, O., D. A. T. Harper & P. D. Ryan, 2006. Paleontological statistics, version 1.57 (Web page: http://folk.uio.no/ohammer/past), (Accessed Aug 2011)

Legendre, L. & P. Legendre, 1998. Numerical ecology. Developments in enviromental modeling, 2nd edn. Elsevier Scientific Publishing Co., Amsterdam, Oxford & New York. 853 pp.

Lelej, A. S. & E. Yıldırım, 2009. A review of the Mutillidae (Hymenoptera) of Turkey. - Zootaxa, 2160: 1–28.

Semenov Tian-Shanskij, A, 1935. Les limites et les subdivisions zoogeographiques de la région paléarctique pour les animaux terrestres, basées sur la distribution géographique des insectes Coléoptères. (Avec une carte géographique). Travaux del'Institut Zoologique de l'Academie des Sciences de l'URSS, 2-3, 397–410 + 1 map.

Tezcan, S. & E. Yıldırım, 2004. On the Vespidae, Sphecidae, Scoliidae, Megachilidae and Apidae (Hymenoptera) fauna of ecologically managed cherry orchards in western Turkey. Perspectives on Biosystematics and Biodiversity T.C.N. Com., Vol. March: 241-247.

Tezcan, S., Y. Karsavuran, E. Pehlivan, S. Anlaş & E. Yıldırım, 2005. Contribution to the knowledge of Vespidae (Hymenoptera, Aculeata) fauna of Turkey. Turkish Journal of Entomology, 29 (2): 101-110.

Tezcan, S., E. Yıldırım, S. Anlaş & G. Beyaz, 2006. Manisa ilinde kekiklerde (Lamiaceae) saptanan Hymenoptera türleri. Ege Üniversitesi Ziraat Fakültesi Dergisi, 43 (1): 55-62.

Tüzün, A. & A. Kekillioğlu, 2003. Ankara Vespidae (Insecta, Hymenoptera) türleri üzerine faunistik çalışmalar ve ekolojik gözlemler. Selcuk Üniversitesi Fen-Edebebiyat Fakültesi Fen Dergisi, 22: 97- 105.

Yıldırım E. & J. Kojima, 1999. Distributional checklist of the species of the family Vespidae (Insecta: Hymenoptera; Aculeata) of Turkey. Natural History Bulletion of Ibaraki University, 3:19-50.

Yıldırım E. & J. Gusenleitner, 2001. The present situation of the Vespidae-fauna (Hymenoptera; Aculeata) of Turkey. Linzer Biologische Beiträge, 33 (1): 217-221.

Yıldırım E. & J. Gusenleitner, 2004. The present situation of the Sapygidae and Vespidae-fauna (Hymenoptera, Aculeata) of Turkey. Linzer Biologische Beiträge, 36 (1): 131-135.

Yıldırım E. & J. Gusenleitner, 2007. The present situation of the Vespidae-fauna of Turkey (Hymenoptera: Vespidae). Linzer Biologische Beiträge, 39 (1): 105-109.

Yıldırım, E., 2008. The present situation of some families of Hymenoptera in Turkey. Linzer Biologische Beiträge, 40 (1): 973-978.

Yıldırım E. & J. Gusenleitner, 2009. The present situation of the Vespidae fauna (Hymenoptera, Aculeata) of Turkey. Linzer Biologische Beiträge, 41 (1): 937-941.

Yıldırım, E. & J. Gusenleitner, 2012. Contribution to the knowledge of the Vespidae (Hymenoptera, Aculeata) of Turkey, with a checklist of the Turkish species. Turkish Journal of Zoology, 36 (3): 361-374.