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THE VESPOIDEA OF ISRAEL (HYMENOPTERA)

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A B S T R A C T

160 species of Vespoidea are reported from Israel and Sinai, among them 11 Masaridae, 140 Eumeriidae and 9 Vespidae. The total number of endemic species amounts to 26.5%, being 29% in the Eumeriidae. A simplified zoogeographical analysis (Fig. A), in which the endemic species are classified according to their taxonomic relationships, gives the following faunal spectrum: Eurosiberian (ES) element 6.6%; Mediterranean (Med.) (chiefly Eastmediterranean) element 47.6%; Iranoturanian (IT) element 5.9%; Eremian element 32.8% and Ethiopian-Paleotropical element 7.2%.

The ES. element (Fig. G) is most frequent in the North of Israel, reaches its peak in the Judean Mountains, becomes rare in the Dead Sea region and is absent in the South. The Med. element is found in all geographical regions; it is dominant in the North and becomes less frequent towards the South. The IT. element, distributed through almost all regions, reaches its peak in the Lower Galilee and Jordan valley. The Er. element is absent in the North but becomes dominant in the Dead Sea-Arava region. The Eth. element is also absent in the North, rare in the Coastal plains and Judean Mountains and reaches its peak in the Dead Sea-Arava region. It becomes rarer toward the arid South.

The following taxa are described: Paracerasmus palaestinensis G.S ♀ (new description By.S.); Odynerus palaestinensis Gus. n. spec.; Pterocheilus chobauti calefactus G.S. ♂ (new descr. Gus.); Leptochilus pseudojosephi G.S. ♀ (new descr. By.S.); L. tar-satiformis G.S. ♀ (new descr. By.S.); L. hermon Gus. n. spec. ♂♀; L. mimulus turcicus Gus. n. ssp ♂♀; Salomon Gus. n. spec. ♀; L. amos Gus. n. spec. ♀; L. flegias G.S ♂ (new descr. By. ST); Eustiracistrocerus israelensis G.S ♀ (new descr. By. S.); Tachy-ancistrocerus komarowi derufata Gus. n. ssp ♂♀; Pseudepipona pseudominuta Gus. n. spec. ♀; Euodynerus semidantici G.S ♀ (new descr. By.S.)

I N T R O D U C T I O N

The present paper presents a total of 160 species of Vespoidea, divided into: Masaridae: 11 species; Eumenidae: 140 species and Vespidae: 9 species. More than 2300 specimens were examined, most of them in the senior author's collection and in that of the Department of Zoology, Tel Aviv University.

A survey of the literature on the vespoid fauna of Israel may be conveniently started with the compilation by Bodenheimer (1937). This list noted 3 Masaridae, 37 Eumenidae and 6 Vespidae. The sources were: an unpublished list of determinations by A. v. Schulthess-Schindler (Zurich) of the material collected by E. Enslin 1927 in Palestine; quotations found in a paper by Schulthess (1928), and some determinations by the late Prof. H. Bischoff and Prof. K. Zimmermann (*Polistes*) Berlin. The type material of Schulthess should now be in the collection of the Dept. Entomology of the Eidgenössische Hochschule, Zürich; that of Enslin through coll. Blüthgen in the Zoologische Museum Berlin. Of the Vespoidea collected by Morice in 1899, now in the Hope Museum Oxford, only the Masaridae have been published by O.W. Richards (1962).

The senior author started collecting Vespoidea in 1939, and the late J. Houška, secretary of the free Czechoslovak Consulate, collected Hymenoptera, Coleoptera and butterflies between 1942 and 1946. This material was passed to the National Museum in Prague, which sent it after the war for determination to Prof. A. Giordani-Soika, Venice. In 1948 I also sent part of my collection of Vespoidea to my friend of long standing, A. Giordani-Soika, but later letters to this scientist did not meet with any response. I was therefore much surprised when, during a visit to Venice in 1954, I received copies of Giordani-Soika's paper (1952). This work is the first "modern" elaboration of the Eumenidae of Palestine, threatening 78 species, among them 13 new species and 8 new ssp. and forms. Though the material collected by Houška was dealt with in its entirety, I sent only part of my collection [and especially not the larger Raphiglossinae, Discocoeliinae, Pareumenes, Eumenes, Katamenes, Delta etc. which I expected at that time to determine according to the literature (chiefly Giordani-Soika 1935)]. Had I known that Prof. Giordani-Soika was going to publish his paper, I would have sent to him all my material and thus would have prevented the separate (and by now, unavoidable) descriptions of Allo- and Paratypes. The list of species and the faunal analysis given by Giordani-Soika (1952) thus presents only an approximate and rather incomplete picture of the different faunal elements among the Eumenidae of Israel. From 1950 to 1964 most of my material was determined by P. Blüthgen (Naumburg), who published many new species and forms in several papers (chiefly 1954, 1955a,b); he further named, but did not describe several additional species from the senior author's collection. Most of these species and forms, as far as considered taxonomically valid, were described by the junior author (Gusenleithner, 1970) and some are included in the present paper. (Blüthgen in sched.).

FAUNAL ELEMENT

Families	ES.	Med.			IT.	Er.	Eth.+ Paltrop	E n d e m i c				Sa
		Circum Med.	South Med.	East Med.				ES.	East Med.	IT.	Er.	
<u>Eumenidae</u>		12	4	24.5				1	23.5	1.5	14.5	
		8.6%	2.8%	17.5%				0.7%	16.8%	1.1%	10.3%	
	6.5 4.6%	40.5 28.9%			8 5.7%	34.5 24.7%	10 7.2%	40.5 28.9%				140 species 100%
Endemic species included.	7.5 5.4%	64 45.7%			9.5 6.8%	49 35%	10 7.2%	140 species 100%				
<u>Masaridae</u>		-	1.5	2				-	2	1	-	
			13.6%	18.2%					18.2%	9.1%		
	-	3.5 31.8%			-	3.5 31.8%	1 9.1%	3 27.3%				11 species 100%
Endemic species included	-	5.5 50%			1 9.1%	3.5 31.8%	1 9.1%	11 species 100%				
<u>Vespidae</u>		5.5	-	-				-	-	-	-	
	3 33.3%	5.5 61.1%			-	-	0.5 5.6%	9 species 100%				
		50.5 31.6%			8 4.9%	38 23.7%	11.5 7.1%	42.5 26.5%				160 species 100%
Total Vespoidea	9.5 6.2%	50.5 31.6%			8 4.9%	38 23.7%	11.5 7.1%	42.5 26.5%				160 species 100%
Endemic species included	10.5	76			9.5	52.5	11.5	160 species				
	6.6%	47.6%			5.9%	32.7%	7.2%	100%				

Fig. A. Faunal spectra of the V E S P O I D E A and of their different families in number of species and percentages.

Endemic species (Fig. A) A very large number of species (26.5%) are recorded from Israel and Sinai only; among the Eumenidae the percentage even approaches 30%. This serves to show how little the fauna of the neighbouring countries is known. It is however possible to relate most of these endemic species and subspecies to taxonomically allied forms, whose geographical distribution is known. This is done in part of Fig. A and Fig. C so as to include this material also in the faunal analysis.

Many species occur in 2 or even 3 different faunal regions as ES/Med., Med/IT. Med/Er. or Er/Eth. In such cases each species was accorded for the statistical treatment, 1/2 or 1/3 point in each region, a method advocated by Bodenheimer (1935) and Bytinski-Salz (1953, 1967).

If we now look at the faunal spectrum of the Vespoidea in total (Fig. A) it may be said that the dominant element is the Mediterranean, followed by the Eremian and then by the Endemic species. The other elements: ES., IT., Eth., with less than 10% are of minor importance. The same is also true for the simplified spectrum (without the endemic species as a separate category), as in this endemic group the Med. and Er.-elements are also prevalent.

Among the Eurosiberian element only 4 species do not pass the Alps, while 11 have ES/Med. or ES/IT. affinities. Especially notable is the high percentage among the Vespidae (Polistes, Vespula), while the Masaridae have no representatives.

The Mediterranean element is dominant in all three families. In the Eumenidae it is prevalently of Eastmediterranean distribution, while in the Masaridae it is of Southmediterranean and in the Vespidae of Circummediterranean distribution. This is chiefly due to the species of Polistes, in which very few or no geographical races are so far recognized. The prevalence of the Eastmediterranean element is largely due to the occurrence of distinct Eastmediterranean subspecies of species which are otherwise distributed through the rest of the Mediterranean.

The Iranoturanian element with about 5.7% in the Eumenidae seems to lack among the Masaridae and Vespidae.

The Eremian element, second only in importance to the Mediterranean, is relatively high among the Masaridae. The number of total species is however too small to draw valid conclusions, as the small Quartinia species can be collected in quantities only by paying special attention to them or by sweeping (a method not so much in vogue among collectors of Aculeata).

The Ethiopian element is relatively well represented with 10 species in the Eumenidae (7.2%), with 1 in the Masaridae (9.1%) and only 0.5 in the Vespidae (Vespa orientalis Paltrop/Med.) (5.6%)

Analysis of the faunal elements of the Eumenidae in different geographical regions of Israel and Sinai.

Fig. B shows a somewhat simplified map of the different geographical regions of Israel. In Fig. C several regions with similar zoogeographical characters are united, to make the table not unduly cumbersome. However if a given species is found in 2 or 3 districts of the same region, it is counted as 2 or 3 (Lower Galilea + Jordan valley + Emeq = 3). The total of 356 equals the number of species, multiplied by the number of regions. A statistical treatment was possible only for the Eumenidae (140 species) while a few words on the geographical distribution of Masaridae and Vespidae will be added later.

A word of caution must however be inserted here: not all regions were explored to the same degree. In the environment of Greater Tel Aviv area (Bat Yam, Holon, Herzlyia, Ramat Gan), and in Jerusalem, Beersheba, Revivim, Yeroham, En Gedi, Jericho - Wadi Qilt, Lake Tiberias, Elon and Dan, collections were ample and were carried out through many seasons; most of the other localities were visited less often. Only 7 excursions were so far made to Mt. Hermon, and to Sinai only three; no collecting at all could be done in Samaria. In a few cases certain species were recorded from only two localities very distant from each other (Dan and Jerusalem) or from one locality only, but the great majority of species were found in at least two different adjoining regions. Nevertheless Graph 3 gives a highly instructive picture concerning the distribution of the different faunal elements of the Eumenidae.

The Eurosiberian element is most frequent in the North (15.4-19.2%) and reaches its peak in the Jerusalem area (30.8%); however this increase may be only apparent as it is based on a difference of 2 species only, and Jerusalem is probably the most intensely investigated area. In the Dead Sea region this element is rare (3.8%), and further South it is completely absent.

The Mediterranean element is distributed through all regions; it reaches its peak in the Upper Galilea (12.8%), Lower Galilea (14.5%), Coastal plains (19.2%), and Judean Mountains (18.6%) and it becomes less frequent toward the Southern part of the country.

The Iranoturanian element is more or less equally frequent in most regions down to the Negev; its peak of frequency is in the Lower Galilea and in the Jordan valley (21.1%) which agrees well with the phytogeographical division of Israel (Eig, 1931). Apparently this element does not occur in the Negev Mountains and Sinai, which may however be due to lack of data.

The Eremian element does not occur in the Golan and Upper Galilea, becomes more frequent toward the South; it is still of minor importance in the Coastal plains (4.5%) and Judean Mountains (9.4% chiefly penetration from the Dead Sea West into the Judean desert). It reaches its maximum in the Dead Sea and Arava region (35.1%) and decreases toward the Negev mountains (22% Negev (16.8%) and Sinai (11.5%).

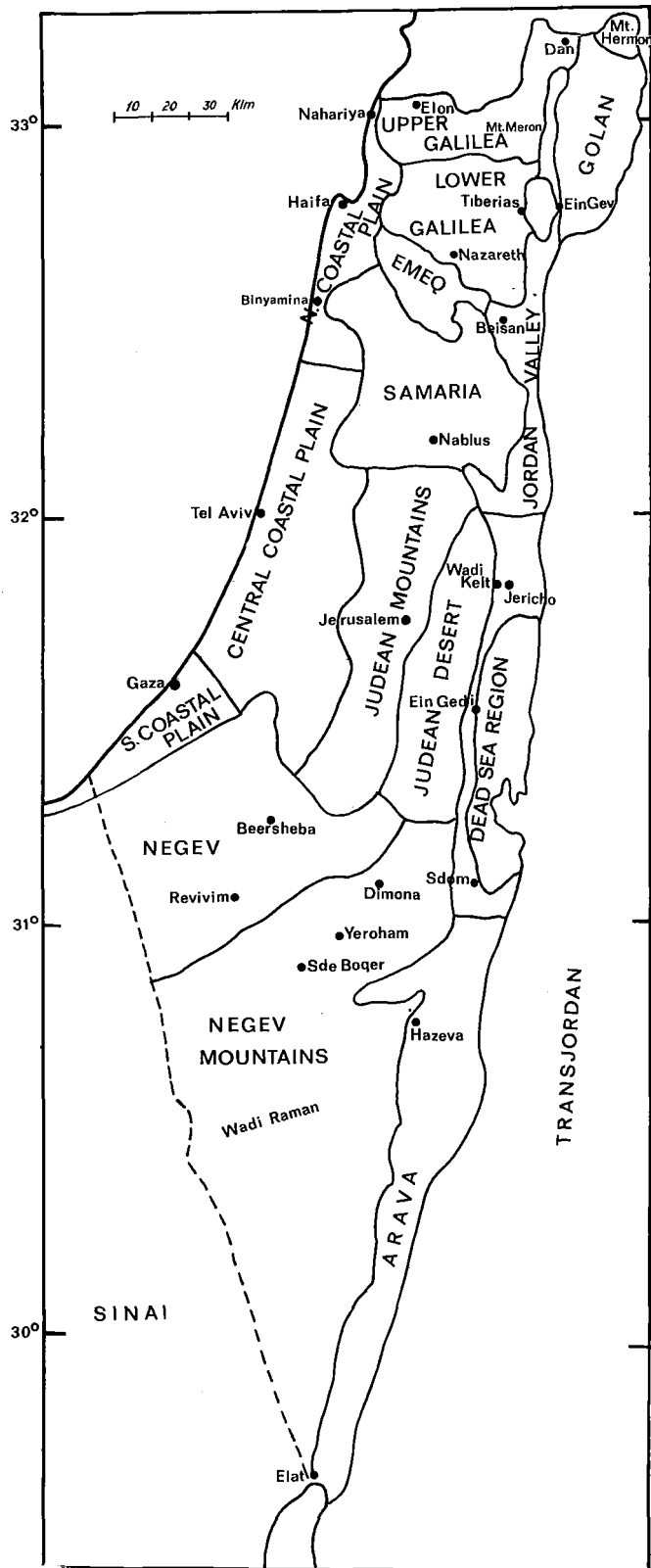


Fig. B. Geographical regions of Israel mentioned in this paper.

	%	Es.	Med.	IT.	Er.	Eth.	Sa.
Hermon Golan	80 60 40 20	2	11.5	2.5	0	0	16
Upper Galilea		2.5	22.5	3	0	0	28
Lower Galilea Jordan Valley Emeq		2	25.5	6	0.5	3	37
Northern Central Southern	Coastal Plain	2	34	4.5	4.5	3	48
Judean Mts Jud. Desert		4	33	4	9	3	53
Dead Sea Arava		0.5	32.5	4.5	33.5	21	83
Negev		0	13	4	16	2	35
Negev Mountains		0	11	0	21	6	38
Sinai		0	2	0	11	5	18
Sa.		13	176	28.5	95.5	43	356

Fig. C. Faunal spectra of Eumenidae in different geographical regions. Numbers indicate number of species multiplied with number of regions mentioned in each square. Distribution of faunal elements in each region should be read from above to below. Faunal spectra for each region should be read from left to right.

Also the Ethiopian-Paleotropic element is absent in the North. It penetrates from the South through the Jordan valley into the Lower Galilea, chiefly at Lake Tiberias (7%) and also penetrates from the Dead Sea up to Jerusalem (7%). The penetration into the Coastal plains (7%) is probably an extension from the Negev Northward. This element is concentrated chiefly in the Dead Sea-Arava (48.8%), at places rich of water: Jericho, Wadi Qilt, Wadi Auja, Wadi Faria, En Gedi, Hazeva etc. In the Negev mountains (14%) and Sinai (11.6%) it is confined to springs (Yeroham, Sede Boqer, Wadi Ramon, Oasis Feiran). Such places are rare in the Negev plains and therefore the minimum occurs there (4.6%).

Faunal elements in different geographical regions.

The Mediterranean element is the dominant one in all Northern regions, South to the Judean Mountains; from the Dead Sea region and South of it, this element is replaced by the Eremian as the dominant element.

Hermon and Golan (General geological character: basalt and limestone): This region is characterized by a relatively high percentage of Eurosiberian species (12.5%), chiefly found at altitudes of 1700-1900 m. Also the Iranoturanian element (15.6%) is high chiefly in the Golan (1000 m). Eremian and Ethiopian elements are lacking.

Upper Galilea (chiefly limestone and chalk): Also there both the Eurosiberian (8.9%) and Iranoturanian (10.7%) elements are still frequent, many of them found on Mt. Meron at 900-1200 m altitude. Eremian and Ethiopian elements are still lacking.

Lower Galilea + Jordan valley + Emeg: (Basalts, limestone, chalk, Pleistocene marls, alluvial soils): The Eurosiberian element is still frequent (5.4%); the Iranoturanian element (16.2%) reaches its peak in the Jordan valley and on the slopes around lake Tiberias. The Eremian (0.5%) and Ethiopian elements (8.1%) find their Northern limits there.

Northern, Central and Southern Coastal Plain: (Dunes, light and heavy alluvial soils, to the East chalk; Mt. Carmel: limestone and dolomite): all elements, except the dominant Mediterranean (70.8%) occur in frequencies not surpassing 10% each.

Judean Mountains and Judean desert (Limestone and chalks): The Mediterranean element still dominates (62.3%) in the Judean Mountains (up to 1000 m) the Eurosiberian and Iranoturanian elements are still well represented (7.5%). The Eremian (17%) element penetrates from the Dead Sea region into the Judean desert but only a few species reach Jerusalem. Also the Ethiopian element (5.7%) consists of species ascending from the Dead Sea region.

Dead Sea and Arava (Chalk, gravels, alluvial marls often highly saline): These are regions with a prevalently Eremian fauna (40.4%), though the percentage of Mediterranean elements is still high (28.3%); the Iranoturanian element (5.4%) is less than half of that in the Jordan valley

(16.2%) and in the Negev (11.4%) and disappears toward the Arava. The Ethiopian element is in ascendance and comprises 25.3% of the species.

The flat Western Negev (loess and sandy loess soils) is characterized by the total disappearance of the Eurosiberian element and a reduction of the Mediterranean (37.1%), Iranoturanian (11.4%) and Ethiopian (5.7%) elements. The dominant element is now the Eremian (45.8%).

The Negev Mountains (Limestone and chalks, palaeozoic and mesozoic sandstones): reaching up to 1000 m, the fauna is dominantly Eremian (55.3%) with a relatively high Mediterranean component (29%). No species with Iranoturanian affinities were found but these will ultimately be discovered, as the Iranoturanian floral element is well represented in this region, especially by Pistacia atlantica (Zohary 1962). In this dry and cold region there are only few biotopes suitable for the Ethiopian element (15.7%).

Sinai: The prevalent elements are the Eremian (61.1%) and Ethiopian (27.8%); too little is known of the fauna to decide whether the Mediterranean element (based on 2 species) and the Iranoturanian element (lacking) are not more common. With this the regional distribution of the Eumenidae, is summed up.

Masaridae: The regional distribution of the faunal elements in general follows that of the Eumenidae. An interesting endemic (Eastmed.) mountain species (Quartinia libanica) occurs on Mt. Hermon. Only 2-3 Mediterranean species have been found in the Upper and Lower Galilee, while in the Central Coastal plain 2 out of 4 species are already Eremian. In all other regions the elements are about half Mediterranean and half Eremian, while one species with Ethiopian affinities (Celonites jousseaumi) is found in the Dead Sea region and the Negev Mountains.

Vespidae: The Vespidae are characterized by the occurrence of up to 6 species of Polistes and Sulcopolistes which are either of ES. or ES/Med. origin. Their distribution is chiefly North of 32° N. Lat. with the exception of P. gallicus and P. omissus, which are found in all geographical regions. The Eth/Med. Vespa orientalis is distributed throughout Israel and Sinai (wherever water is available).

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