A Study on the Sphecoid (Hymenoptera) Fauna of Marshy Meadows, Its Zoogeographical and Ecological Aspects*

By

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In the vicinity of Veresegyház and the surroundings of the Tapolca brook, respectively, the author made faunistical examinations concerning the sphecoid population of the two respective marshy meadows during the years 1959–1967. When analyzing the sphecoid fauna of the environment of the Tapolca brook (BENEDEK, 1969) he found certain correlations which induced him to examine more deeply the sphecoid fauna of the marshy meadows.

Material and method

In our present paper, we compare the results of examinations made in the vicinity of Veresegyház (Lat. 47°40′ N, and Long. 19°15′ E) and the environs of the Tapolca brook (Lat. 47°12′ N, and Long. 17°32′ E), respectively, with the material of the faunistical collectings carried out on the marshy meadows near Bátorliget (Lat. 47°45′ N and Long. 22°15′ E) (MÓCZÁR, 1953). The examinations resulted in 90 species (1,615 specimens) near the Tapolca brook, in 76 species (1,093 exemplars) from Veresegyház, and in 73 species (572 individuals) from Bátorliget (Table 1). In our paper we treat 134 sphecoid species representing 50% of those occurring in Hungary (BAJÁRI, 1957*a*; MÓCZÁR, 1959).

The wasps examined have been grouped into ecological types according to the ecological characteristics of the species and their geographical distribution. When defining the ecological features we have relied primarily on the results of home investigations. Following MÓCZÁR (1948, 1953), we interpret the ecological types as follows:

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1. Stenooecic eremophilous: eremophilous species of definitely high thermal requirements. Frequent in low-lands; to be found generally below 200 m a.s.l. In the case of the sphecoid wasps, denoting generally psammophilous taxa.

2. Euryoecic eremophilous: species of a thermophilous nature but more self-adapting than the former group; generally wide-spread in low-lands but, as a rule, not penetrating to altitudes higher than 400–600 m a.s.l.

3. Hypereuryoecic intermedier: taxa of wide ecological valency; in the case of sphecoids rather eremophilous yet bearing slightly moist surroundings as well. Widespread and mostly common animals.

4. Euryoecic hylophilous: species favouring cool, slightly moist environments; in Hungary inhabiting forests or medium high mountains, and to be found also in low-land marshes or in groves along river banks.

5. Stenooecic hylophilous: decidedly favouring coolness and moisture; as a rule, Alpine or Boreal species. They only exceptionally in low-lands and then in marshy places.

The areas examined

Two of the examined marshy meadows (Bátorliget, Veresegyház) developed between sandhills, while the third one (the Tapolca brook area) came into being on heavy soil. The surroundings of Bátorliget and Veresegyház is dry and warm, that of the Tapolca brook is somewhat wet. The latter is situated along the foot of the Mts. Bakony at the junction of the mountain with the plains. The climate at Bátorliget and Veresegyház is influenced by the Great Hungarian Plains, whereas that of the Tapolca brook area by the Lesser Plains and the Mts. Bakony. The vegetation in all three areas is of the Molinion coeruleae or Molinio-Poetum trivialis type (Fig. 1). In sites near the water *Angelica silvestris* breeds in masses, and—in the drier border zone—*Pastinaca sativa* is common. In the extreme zone *Daucus carota* and *Achillea millefolium* constitute stands. In addition to those mentioned, several other flowering plants, offering food for sphecoids, may also be found in lesser quantities. The open water surface is bordered by reeds. The marshy meadows discussed are situated at an altitude of about 180 meters above sea level.

The sphecoid fauna of the examined marshy meadows

Of the 48 sphecoid genera known in Hungary 37 have been found in the areas examined. We have found 29 genera at Bátorliget, 30 at Veresegyház and 31 around the Tapolca brook; 21 genera were common for all three areas. In none of the three marshy meadows examined did we find exemplars belonging to the extremely eremophilous genera *Stizus* Latr., *Stizoides* Guér., *Sphecius* Dahlb., *Liris* Fabr., *Pison* Spin., *Entomosericus* Dahlb., *Tracheloides* Mor., and *Belomicrus* Costa, of a southern range; the genus *Ampulex* Jur., mountane in Europe, and the genera *Dolichurus* Latr., *Nitela* Latr., *Solierella* Spin., mid-mountane, were also missing.

In both Bátorliget and Veresegyház faunas of the marshy meadows, the thermophilous *Podalonia* Spin., *Bembix* Fabr., and *Palarus* Latr. genera equally occurred as well as the Mediterranean *Bembecinus hungaricus* Friv.,

and *Astata minor* KOHL, missing from the fauna of the Tapolca brook area. In Bátorliget, we have been able to show the definitely Mediterranean *Sphex albisectus* LEP. & SERV., *Cerceris albofasciata* (ROSSI), *Dinetus pictus* (FABR.), the Pontomediterranean *Lindenius ponticus* BEAUM., and the thermophilous *Crabro peltarius* SCHREB., as well as *Lindenius laevis* COSTA, wanting from the other two marshy meadows. At the same time, we have collected near Veres-

Fig. 1. A part of the marshy meadow at Veresegyház

egyház the Mediterranean *Astata rufipes* MOCS., *Astata lineata* MOCS., *Miscophus rubriventris* FERTON, and *Oxybelus aurantiacus* MOCS., absent from Bátorliget or the Tapolca brook area.

In comparison to the other two areas, the number of *Gorytes* LATR., and *Ectemnius* DAHLB. species is remarkably great in the fauna of the Tapolca brook region (Table 1). At the same time, while we have found but a single *Rhopalum* KIRBY species near Veresegyház, and not a single species of this genus at Bátorliget, 3 *Rhopalum* taxa have been collected near the Tapolca brook. The Mediterranean and decidedly eremophilous species listed above do not occur in the region of the brook and while 5 *Tachysphex* KOHL species have been found at Veresegyház and 4 at Bátorliget, only a single one was captured in the Tapolca brook region.

The composition according to ecological types of the sphecoid faunas of Bátorliget and Veresegyház resemble each other in accordance with the aboves but they differ significantly from the fauna of the Tapolca brook (Table 2). The proportion of the eremophilous species is 69.9% at Bátorliget and 66.5% at Veresegyház, but only 53.4% in the Tapolca brook region. The difference

in the proportion of the stenooecic eremophilous species is especially remarkable, since the quantity of these taxa living in the Tapolca brook region is only half of that in the case of Veresegyház and Bátorliget.

The proportion of the hypereuryoecic intermediär taxa is nearly the same for all three areas; that of the hylophilous species, however, differs significantly. The proportion of the euryoecic hylophilous wasps is almost twice as large in the Tapolca brook region than that found for Veresegyház and Bátorliget. The single stenooecic hylophilous species (*Passaloecus clypealis* FAERSTER), recently demonstrated in Hungary (BENEDEK, 1966), lives in all three marshy meadows.

Zoogeographical notes

According to MÓCZÁR (1948), the environments of Veresegyház and Bátorliget are situated in the faunal zone of the Eupannonicum, but VARGA (1964*a*, 1964*b*) is of the opinion that Bátorliget belongs to the Samicum, and Veresegyház to the sub-zone Praematricum. The Tapolca brook area lies in the faunal zone Arrabonicum near the Pilisicum (= Bakonyicum sensu VARGA). The faunal zones Eupannonicum and Arrabonicum form a part of the faunal district Pannonicum, but the Pilisicum belongs to the Matricum. According to VARGA (1964), the Arrabonicum is a part of the Eupannonicum—in other words, it ranks with the Praematricum and the Samicum.

As pointed out above, the vegetation of the marshy meadows is similar—they must therefore be similar from both the microclimatic and ecological points of view, too, despite the fact that the microclimate of those in the Eupannonicum is influenced by the Great Plains and that of the marshy meadows in the Arrabonicum by the Lesser Plains and in a certain respect by the climate of the Mts. Bakony. It may as well be mentioned here that Veresegyház lies near the border of the Matricum, wherefore its macroclimate cannot be free of the influence of the mountaneous microclimate of this region.

In spite of all this, the composition of the sphecoid fauna shows clearly noticable differences. The close relationship of the sphecoid faunas of the two areas situated in the Eupannonicum is in contrast with the significant diversity of the sphecoid fauna investigated in the Arrabonicum.

The two areas examined in the Eupannonicum must—in conformity with also our results—belong to sub-zones of an identical zoogeographical nature, but it seems that, contrarily to VARGA's (1964) opinion, it is justified to relegate the environment of the Tapolca brook to a separate zoogeographical unit. This means, that, in respect of the state of the Arrabonicum, MÓCZÁR's (1948) standpoint seems to be correct, thus, from a zoogeographical point of view, this region is assumably equal to the Eupannonicum. This is also supported by the fact that a significant part (18%) of species common to both sphecoid faunas examined in the two points of the Eupannonicum comprises stenooecic eremophilous species, while the proportion of the euryoecic hylophilous taxa is only 12%. On the other hand, of the mutual species of the sphecoids inhabiting the two areas and the Tapolca brook region only 4% and 6% respectively, are represented by stenooecic eremophilous taxa, while the proportion of the euryoecic hylophilous species is fairly higher, i.e. 18% and 23%, respectively. Details like these cannot, of course, serve as a conclusive proof to decide the problem, yet they are supplementary to previous statements in this respect.

The ecological composition of the sphecoid faunas of the two marshy meadows in the Eupannonicum is, so to speak, almost exactly similar, yet the characteristic species of the two regions also differ from each other; therefore the zoogeographical separation of certain parts of the Eupannonicum seems to be acceptable on the basis of also our investigations.

Ecological conclusions

Based on the details presented above, it seems that the composition of the sphecoid faunas of marshy meadows is not primarily determined by the ecological circumstances of the marshy regions themselves but rather by the conditions of the surrounding areas. This is the reason why most of the sphecoid taxa to be found in marshy meadows do not nest within these habitats but visit them only for obtaining food and prey. In the course of our examinations we have found that only a part of the *Trypoxylon* LATR., *Psenulus* KOHL, *Pemphredon* LATR., *Passaloecus* SHUCK., *Ectemnius* DAHLB. and *Rhopalum* KIRBY species find possibilities for nesting in the fresh and dry reed stalks and in the dry stems of other plants (e.g. *Angelica*).

The author has found that the sphecoid faunas of dry areas is always remarkably poorer than those of the marshy meadows, and that marshy meadows developed in the dry and warm areas provide for sphecoid wasps the most favourable living conditions. And this because the dry and warm areas offer excellent nesting possibilities and because, at the same time, the marshy meadows render, with their rich and multiferous blossoming flora, ample and varied food for the sphecoid species, thus making possible the evolvement of a sphecoid population rich in species. It is furthermore most important that, owing to the many plants flowering throughout the season in the marshy meadows, the food supply for the wasps is wellnigh continuous.

ZUSAMMENFASSUNG

Untersuchungen an der Sphecoidea- (Hymenoptera) Fauna von Moorwiesen, sowie ihre tiergeographischen und ökologischen Beziehungen

Der Verfasser vergleicht die Sphecoidea-Fauna von drei Moorwiesen. Von diesen liegen zwei (Bátorliget, Veresegyház) im Niederungarischen Becken (Alföld), die dritte (in der Umgebung des Tapolca-Baches) in der Oberungarischen Tiefebene (Kisalföld), also von tiergeographischem Gesichtspunkt im Gebiete des Eupannonicum bzw. des Arrabonicum. Die Wespen reiht der Verfasser unter die von MÓCZÁR (1948) vorgeschlagenen ökologischen Typen ein (Tabelle 1). Die Sphecoidea-Faunen der im Eupannonicum gelegenen zwei Moorwiesen sind einander nahe ähnlich, jedoch unterscheiden sie sich von der des Arrabonicum (Tabelle 1—2) in bedeutendem Maße. Aufgrund der Ergebnisse kann angenommen werden, daß das Eupannonicum und das Arrabonicum — im Gegensatz zum Standpunkt von VARGA (1964), der Auffassung von MÓCZÁR entsprechend (1948) — gleichrangige tiergeographische Zonen sind. Gleichzeitig läßt es sich feststellen, daß die Zusammensetzung der Sphecoidea-Fauna der Moorwiesen nicht von den ökologischen Verhältnissen der Moorwiesen, sondern in erster Linie von denen der umliegenden Gebiete bestimmt werden. Die Moorwiesen ermöglichen mit ihrer eine mannigfaltige und kontinuierliche Nahrung sichernden blütenreichen Pflanzenwelt die Entstehung einer artenreichen Sphecoidea-Fauna.

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Table 1. Sphecoid species collected at Bátorliget, Veresegyház, and the Tapolca brook region

Species collected	Ecological type	Number of specimens collected		
		Bátorliget	Veresegyház	Tapolca brook
Ammophila sabulosa (LINNAEUS)	hyper. int.	7	1	4
Ammophila apicalis BRULLE	steno. erem.	2	1	—
Ammophila campestris LATR.	eury. erem.	—		1
Podalonia hirsuta (SCOPOLI)	eury. erem.	2	—	—
Podalonia affinis KIRBY	eury. erem.	2	—	—
Podalonia tydei GUILL.	steno. erem.	1	6	—
Sphex albisectus LEP. & SERV.	steno. erem.	4	—	—
Sceliphron destillatorium ILLIG.	eury. erem.	4	—	57
Philanthus triangulum (FABR.)	eury. erem.	1	4	7
Cerceris rybyensis (LINNAEUS)	eury. hyl.	—	—	2
Cerceris hortivaga KOHL	eury. hyl	1	—	—
Cerceris sabulosa (PANZER)	eury. erem.	3	3	9
Cerceris albofasciata (ROSSI) (= *luctuosa* COSTA)	steno. erem.	48	—	—
Cerceris arenaria (LINNAEUS)	eury. erem.	10	4	41
Cerceris quadrifasciata (PANZER)	eury. erem.	2	—	—
Cerceris quinquefasciata (ROSSI)	hyper. int.	3	—	13
Cerceris flavilabris (FABR.) (= *aurita* LATR.)	eury. erem.	1	—	3
Cerceris ruficornis (FABR.) (= *labiata* FABR.)	eury. erem.	15	—	14
Gorytes laticinctus (LEP.)	eury. hyl.	—	1	2
Gorytes quadrifasciatus (FABR.)	eury. hyl.	—	—	17
Gorytes albidulus (LEP.) (= *dissectus* PANZER)	eury. erem.	1	—	1
Gorytes nigrifacies MOCSÁRY	eury. hyl.	—	—	3
Gorytes sulcifrons (COSTA)	eury. erem.	2	—	3
Gorytes quinquecinctus (FABR.)	hyper. int.	15	6	29
Gorytes pleuripunctatus (COSTA)	eury. erem.	2	—	—
Gorytes fallax HANDL.	eury. hyl.	2	—	3
Gorytes elegans (LEP)	eury. erem.	—	1	1
Gorytes lunulatus (DAHLB.)	eury. hyl.	—	—	1
Argogorytes fargei (SHUCK.)	hyper. int.	—	1	—
Bembecinus tridens (FABR.)	eury. erem.	47	22	1
Bembecinus hungaricus FRIV.	steno. erem.	1	7	—
Bembix megerlei DAHLB.	steno. erem.	20	2	—
Bembix rostrata (LINNAEUS)	eury. erem.	7	—	—
Bembix oculata pannonica MOCSÁRY	steno. erem.	—	21	—
Nysson trimaculatus (ROSSI)	eury. erem.	—	1	3
Nysson maculatus (FABR.)	hyper. int.	—	—	5
Nysson tridens GERST.	eury. erem.	—	1	—
Nysson fulvipes COSTA	steno. erem.	2	—	—
Nysson scalaris ILLIG.	eury. erem.	5	—	—
Alysson bimaculatus (PANZER) (= *fuscatus* PANZER)	eury. erem.	2	25	12
Mellinus arvensis (LINNAEUS)	hyper. int.	—	8	4
Astata boops (SCHRANK)	eury. erem.	—	—	10
Astata minor KOHL	eury. erem.	1	2	—
Astata rufipes MOCSÁRY	steno. erem.	—	3	—
Astata lineata MOCSÁRY	eury. erem.	—	9	—
Larra anathema (ROSSI)	steno. erem.	30	3	71
Tachysphex panzeri (LIND.)	eury. erem.	1	—	—
Tachysphex nigripennis (SPINOLA)	eury. erem.	1	1	—
Tachysphex lativalis (THOMS.)	eury. erem.	—	1	—

Table 1, condt.

Species collected	Ecological type	Number of specimens collected		
		Bátorliget	Veresegyház	Tapolca brook
Tachysphex pectinipes (LINNAEUS)	eury. erem.	4	1	4
Tachysphex nitidus (SPINOLA)	eury. erem.	1	1	—
Tachysphex helveticus KOHL	eury. erem.	—	2	—
Tachytes europaeus KOHL	eury. erem.	12	—	2
Miscophus bicolor JURINE	eury. erem.	—	—	1
Miscophus rubrivetris FERTON	steno. erem.	—	1	—
Dinetus pictus (FABR.)	eury. erem.	6	—	—
Palarus variegatus (FABR.)	steno. erem.	1	6	—
Trypoxylon figulus (LINNAEUS)	hyper. int.	—	2	23
Trypoxylon fronticorne GUSS.	eur. erem.	—	1	—
Trypoxylon attenuatum SMITH	hyper. int.	14	53	46
Trypoxylon clavicerum LEP.	eury. erem.	1	—	2
Trypoxylon scutatum CHEVRIER	steno. erem.	—	—	1
Psen unicolor (LIND.)	eury. hyl.	—	3	50
Psen fulvitarsis GUSS.	eury. hyl.	—	2	1
Psen bruxellensis BONDROIT	eury. hyl.	—	—	1
Psen causasicus MAIDL	eury. erem.	—	6	—
Psen equestris (FABR.)	hyper. int.	—	—	7
Psenulus fuscipennis DAHLB.	eury. hyl.	1	—	—
Psenulus pallipes (PANZER) (= *atratus* FABR.)	hyper. int.	5	25	20
Psenulus meridionalis BEAUM.	hyper. int.	—	11	—
Psenulus schencki (TOURN.)	eury. hyl.	—	1	—
Psenulus concolor (DAHLB.)	eury. hyl.	1	—	—
Pemphredon rugifer (DAHLB.) (= *unicolor* PANZER)	eury. erem.	1	7	12
Pemphredon shuckardi (A. MOR.)	eury. hyl.	1	1	6
Pemphredon lethifer (SHUCKARD)	eury. erem.	25	120	62
Passaloecus monilicornis DAHLB.	eury. hyl.	1	—	—
Passaloecus tenius A. MOR.	eury. hyl.	1	16	16
Passaloecus clypealis FAERSTER	steno. hyl.	2	7	1
Passaloecus corniger SHUCKARD	eury. hyl.	—	1	—
Passaloecus turionum DAHLB.	eury. hyl.	1	—	2
Diodontus minutus (FABR.)	hyper. int.	3	141	123
Diodontus luperus SHUCKARD	eury. erem.	2	2	20
Diodontus tristis (LIND.)	eury. erem.	—	5	4
Stigmus solskyi A. MOR.	eury. erem.	3	—	4
Spilomena troglodytes (LIND.)	eury. erem.	—	1	3
Ammoplanus hofferi SNOFLÁK	eury. erem.	—	—	2
Ammoplanus handlirschi GUSS.	eury. erem	—	—	1
Ectemnius fossorius (LINNAEUS)	eury. hyl.	—	—	1
Ectemnius quadricinctus (FABR.)	eury. hyl.	—	—	9
Ectemnius lituratus (PANZER)	eury. hyl.	—	—	3
Ectemnius cavifrons (THOMS.)	eury. hyl.	—	1	12
Ectemnius lapidarius (PANZER) (= *chrysostomus* LEP.)	eury. hyl.	12	1	7
Ectemnius continuus (FABR.)	eury. hyl.	—	12	28
Ectemnius schlettereri KOHL (= *vagus* MÓCZÁR)	eury. erem.	7	—	6
Ectemnius rubicola (DUF. & PERR.) (= *larvatus* WESM.)	eury. erem.	1	8	8
Ectemnius impressus SMITH	steno. erem.	—	—	1
Ectemnius laevigatus DESTEF.	eury. erem.	6	59	81
Ectemnius dives (LEP. & BRULLÉ)	eury. hyl.	—	1	1

Table 1, condt.

Species collected	Ecological type	Number of specimens collected		
		Bátorliget	Veresegyház	Tapolca brook
Ectemnius guttatus (LIND.)	eury. hyl.	—	—	1
Ectemnius rugifer DAHLB.	eury. hyl.	—	—	8
Lestica clypeata (SCHREB.)	hyper. int.	8	10	16
Lestica alata (PANZER)	steno. erem.	52	—	—
Crabro cribrarius (LINNAEUS)	eury. hyl.	5	—	10
Crabro scutellatus (SCHEVEN)	eury. hyl.	12	27	6
Crabro peltarius (SCHREBER)	steno. erem.	2	—	—
Crossocerus palmipes (LINNAEUS)	eury. hyl.	—	3	—
Crossocerus wesmaeli (LIND.)	eury. erem.	—	28	—
Crossocerus elongatulus (LIND.)	eury. erem.	1	23	72
Crossocerus distinguendus A. MOR.	steno. erem.	—	—	4
Crossocerus dentricus H. SCHAFFER	eury. hyl.	1	3	1
Crossocerus podagricus (LIND.)	eury. erem.	1	28	21
Crossocerus congener DAHLB.	eury. erem.	—	—	2
Crossocerus ambiguus DAHLB.	eury. hyl.	2	—	—
Crossocerus leucostomoides RICH.	eury. erem.	—	—	1
Lindenius albilabris (FABR.)	hyper. int.	11	23	26
Lindenius laevis COSTA (= *subaeneus;* MÓCZÁR)	eur. erem.	3	—	—
Lindenius panzeri (LIND.)	steno. erem.	—	4	6
Lindenius armatus (LIND.)	eury. erem.	—	22	27
Lindenius ponticus BEUAM.	steno. erem.	1	—	—
Entomognathus brevis (LIND.)	eury. erem.	90	16	175
Entomognathus dentifer NOSK.	eury. erem.	—	1	9
Rhopalum clavipes (LINNAEUS)	eury. hyl.		—	1
Rhopalum coarctatum (SCOPOLI)	eury. hyl.	—	—	4
Rhopalum nigrinum KIESENW.	eury. hyl.	—	5	3
Oxybelus latro OLIVIER	eury. erem.	—	1	—
Oxybelus latidens GERST.	eury. erem.	—	1	2
Oxybelus victor LEP.	eury. erem.	—	14	36
Oxybelus variegatus WESM.	eury. erem.	—	7	19
Oxybelus dissectus elegans MOCSÁRY	eury. erem.	—	1	—
Oxybelus mandibularis DAHB. (= *sericatus* GERST.)	steno. erem.	1	7	7
Oxybelus uniglumis (LINNAEUS)	eury. erem.	1	112	82
Oxybelus bipunctatus OLIVIER	eury. erem.	5	28	15
Oxybelus mucronatus (FABR.)	steno. erem.	—	—	58
Oxybelus quatuordecimnotatus JURINE	eury. erem.	21	102	124
Oxybelus aurantiacus MOCSÁRY	steno. erem.	—	1	—

Table 2. Proportion of ecological types in the sphecoid faunas of the Bátorliget, Veresegyház, and Tapolca brook regions

Ecological type	Proportion of ecological types in %		
	Bátorliget	Veresegyház	Tapolca-brook
stenooecic eremophilous	17,8	14,8	7,7
euryoecic eremophilous	52,1	51,7	45,7
hypereuryoecic intermedier	11,1	13,5	13,3
eryoecic hylophilous	17,8	18,7	32,2
stenooecic hylophilous	1,4	1,3	1,1