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## THREE HALOPHILOUS SPECIES OF HORSE FLIES IN CROATIA (DIPTERA: TABANIDAE)

Stjepan KRČMAR, József MIKUSKA\* and Paula DURBEŠIĆ\*\*

\* Department of Biology, Faculty of Education, University J.J. Strossmayer, L. Jägera 9, HR-31000 Osijek, Croatia, e-mail: stjepan@knjiga.pedos.hr \*\* Department of Zoology, Faculty of Natural Sciences, University in Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia.

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A sample of 5155 horse flies (Tabanidae) specimens was collected in the Mediterranean part of Croatia (1995 - 1996). The sample contained 48 species, among which there were also three halophilous species: *Chrysops italicus* Meigen, 1804, *Hybomitra acuminata* (Loew, 1858), and *Hybomitra expollicata* (Pandellé, 1883). Halophilous species of horse flies were collected on the stations along the coast of the Adriatic Sea, and on stations in the vicinity of brackish waters of the Cetina river and in the delta of the river Neretva. The species *Hybomitra expollicata* has two peaks of activity - the first in June, and the second in August, whereas the species *Chrysops italicus* and *Hybomitra acuminata* has only one peak of activity over the season.

**Diptera, Tabanidae, *Chrysops*, *Hybomitra*, halophilous species, faunistic studies, Mediterranean, Croatia.**

KRČMAR, S., MIKUSKA, J.\*, DURBEŠIĆ, P.\*\*, \*Pedagoški fakultet Sveučilišta J.J. Strossmayer u Osijeku, Jägerova 9, HR-31000 Osijek, \*\* Zoologijski zavod PMF Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska. - Entomol. Croat. (1998) 1999. Vol. 4. Num. 1 - 2.: 21 - 28.

Na području mediteranske Hrvatske skupljeno je 5155 primjeraka obada (1995 - 1996). U skupljenom uzorku utvrđeno je 48 vrsta, među kojima su i tri halofilne vrste: *Chrysops italicus* Meigen 1804., *Hybomitra acuminata* (Loew, 1858.), te *Hybomitra expollicata* (Pandellé, 1883.). Halofilne vrste obada skupljene su na postajama uz obalu Jadranskog mora, te na postajama u blizini bočatih vodenih površina rijeke Cetine i delte Neretve. Vrsta *Hybomitra expollicata* ima dva maksimuma aktivnosti, prvi u lipnju a drugi u kolovozu, dok vrste *Chrysops italicus* i *Hybomitra acuminata* pokazuju jedan maksimum aktivnosti tijekom sezone.

**Diptera, Tabanidae, *Chrysops*, *Hybomitra*, halofilne vrste, faunističke studije, Sredozemlje, Hrvatska.**

### Introduction

Horse flies (Tabanidae) are the vectors of more than a hundred various vertebrate disease agents (FOIL 1989). By taking their blood meals, they disturb cattle and thus negatively influence the production (DRUMMOND 1987). Females of horse flies usually lay their impregnated eggs on vertical objects near or above water surfaces (CHVÁLA et al. 1972). The development of the larvae of the genus *Chrysops* and of some species in the genus *Hybomitra* usually takes place in the water, whereas the larvae of other genera live in humid or dry soil (CHVÁLA et al. 1972). It has been observed that the salinity of

water can significantly influence the distribution of some species of mosquitoes (ADAMOVIĆ 1984). Accordingly, the salinity of water certainly has some influence upon the distribution of horse flies, regarding the fact that the larvae of some species develop exclusively in water. Horse flies were collected in the Mediterranean part of Croatia, where both faunistic and ecological research works were carried out.

### Material and methods

Faunistic and ecological research of horse flies in the Mediterranean part of Croatia was carried out from May to September, in 1995 and 1996. Horse flies were collected on 77 stations. Specimens were collected mostly by means of a sampling net, when they were caught on cattle, by hand in the car, and by means of Malaise traps. The majority (53, 38%) of the horse flies were collected on the stations: Knapići, Omiš, Plužine, Kanfanar, Opuzen, Modro Oko and Funtana. The rest of (46, 61%) horse flies was collected on the remaining 70 stations in the Mediterranean part of Croatia. The number of specimens collected on individual stations depends on the presence of cattle during the vegetation season. This explains the great difference in the number of collected specimens and species of horse flies in comparison with other stations where cattle is present only periodically, or where there is no cattle at all. Species of horse flies were determined by means of keys (CHVÁLA et al. 1972; OLSUFJEV 1977; MAHER 1987) and the names of the species were written according to the catalogue (LECLERQ & OLSUFJEV 1981 and CHVÁLA 1988).

### Results

A sample of 5155 specimens horse flies was collected in the Mediterranean part of Croatia. These horse flies were divided into 48 species and 8 genera: *Chrysops*, *Atylotus*, *Therioplectes*, *Hybomitra*, *Tabanus*, *Haematopota*, *Dasyrhamphis* and *Philippomyia*. The collected sample also contained three halophilous species. The species *Chrysops italicus* Meigen, 1804 was collected on the cattle in the immediate vicinity of the Adriatic Sea and on the bank of a pond with brackish water near Obrovac. The collected sample contains 10 specimens that cover 3 fields on the UTM grid of Croatia (Table 1, Figure 1). Upon insight into literature, further 8 specimens covering two fields in the UTM grid of Croatia were determined (Figure 1). Species *Hybomitra acuminata* (Loew, 1958) was represented with 136 specimens collected in the Mediterranean part of Croatia on 3 stations with halophilous association *Scirpetum - maritimi* Br. - Bl. 1931 near the banks of the rivers Cetina and Neretva, and by the Vransko jezero lake (Table 2). Twelve specimens were also collected in the continental part of Croatia (Table 2). All collected specimens cover 11 fields on the UTM grid of Croatia (Figure 2). A sample of 18 specimens of the species *Hybomitra expollicata* (Pandellé, 1883) was collected on the stations near the mouths of the rivers Cetina and Neretva, and on the bank of a pond near Obrovac. These specimens cover 3 fields on the UTM grid of

Croatia (Table 3, Figure 3). All collected specimens are females caught mostly on cattle by means of a sampling net, with the exception of one caught by hand in the car.

Table 1. Stations and number of determined specimens of the species *Chrysops italicus* in Croatia.

Locality	UTM	Date - Specimens - Sex	Source
Funtana	UL90	21.VII.1995: 1 ♀	S. Krčmar collection
Obrovac	WJ59	2.VI.1996: 4 ♀	
Dinjiška	WK11	20.VII.: 1 ♀; 23.VII.1996: 4 ♀	
Lucija	VL02	10.VI.1964: 2 ♀, 5 ♂	Moucha 1965
Split	XJ11	1 ♂	Strobl 1893
Split	XJ11	--	Strobl 1898
Split	XJ11	--	Strobl 1900

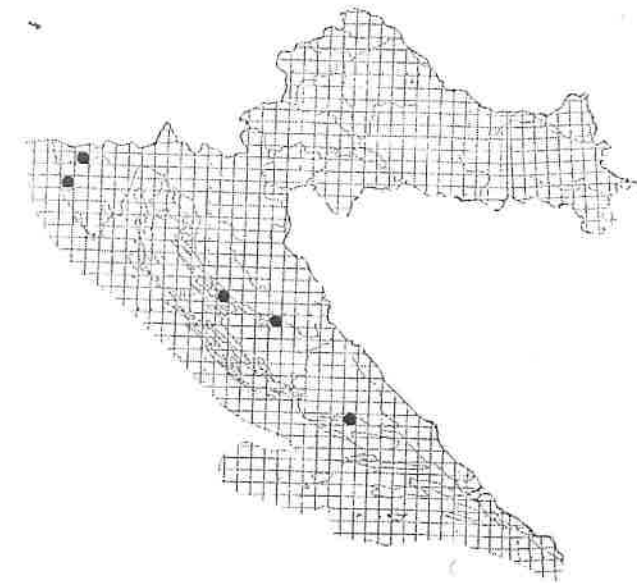


Figure 1 - Distribution of the species *Chrysops italicus* in Croatia (UTM grid 10x10)

Table 2. Stations and number of determined specimens of the species  
*Hybomitra acuminata* in Croatia.

Locality	UTM	Date - Specimens - Sex	Source	
Petrijevci	CR05	19.VI.1993: 1 ♀	S.Krčmar collection.	
Lijepa Greda	XM70	26.V.1994: 1 ♀; 11.VII.1995: 1 ♀		
Sveti Đurađ	BR86	4.VII.1994: 3 ♀		
Baćina	XH97	30.V.1995: 1 ♀		
Opuzen	YH06	30.V.1995: 5 ♀; 19.V.: 4 ♀ ; 4.VI.1996 8 ♀		
Modro Oko	YH06	30.V.1995: 2 ♀; 4.VI.1996: 18 ♀		
Omiš	XJ31	30.V.: 1 ♀; 31.V.1995: 4 ♀; 3.VI. 32 ♀; 5.VI.1996: 13 ♀		
Vransko jez.	WJ46	2.VI.: 2 ♀; 3.VI.1996: 11 ♀		
Metković	YH16	4.VI.1996 20 ♀		
Badžula	YH16	4.VI.1996: 15 ♀		
Grudnjak	YL35	18.VI.1996: 1 ♀		
Kopačevo	CR25	15.VI.: 1 ♀; 26.VI.1987: 1 ♀		J.Mikuska collection.
Eblin	CR35	6.VII.: 1 ♀; 12.VII.1987: 1 ♀		
Kopački rit	CR35	9.VII.1989: 1 ♀		

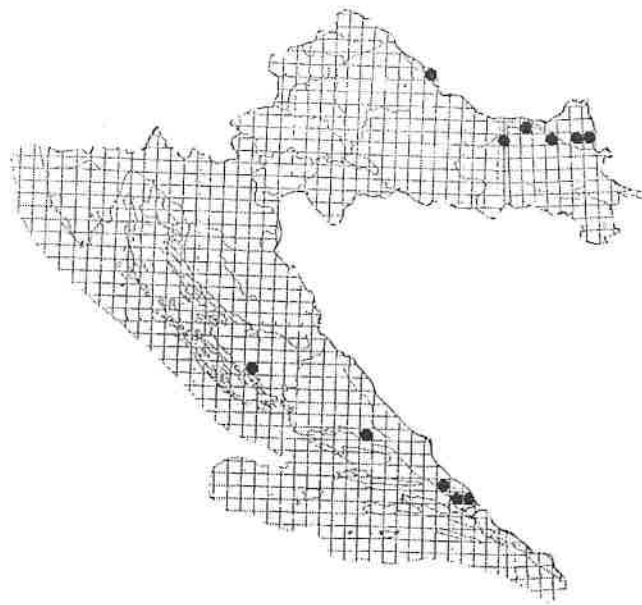


Figure 2 - Distribution of the species *Hybomitra acuminata* in Croatia  
 (UTM grid 10x10)

Table 3. Stations and number of determined specimens of the species  
*Hybomitra expollicata* in Croatia.

Locality	UTM	Date - Specimens - Sex	Source
Opuzen	YH06	30.V.1995: 1 ♀; 19.V.: 1 ♀; 4.VI.: 2 ♀; 7.VIII.1996: 1 ♀	S. Krčmar collection
Modro Oko	YH06	30.V.1995: 1 ♀; 4.VI.1996: 1 ♀	
Obrovac	WJ59	2.VI.1996: 1 ♀	
Omiš	XJ31	3.VI.: 1 ♀; 5.VI.: 3 ♀; 7.VIII.1996: 6 ♀	

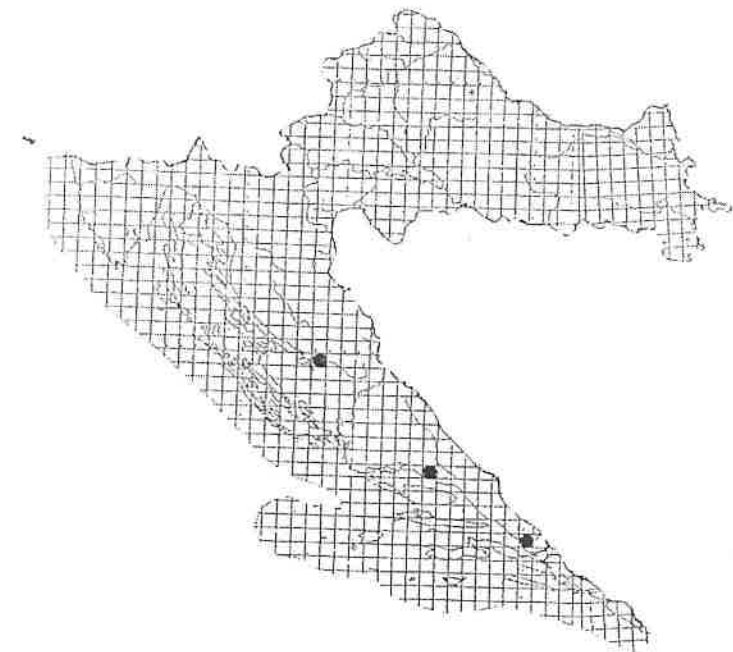


Figure 3 - Distribution of the species *Hybomitra expollicata* in Croatia  
 (UTM grid 10x10)

### Discussion

There are 75 species and 1 subspecies of horse flies in the fauna of Croatia (KRČMAR et al. 1996). The analysis of horse flies collected in the Mediterranean part of Croatia resulted in the determination of 3 halophilous species: *Chrysops italicus*, *Hybomitra acuminata* and *Hybomitra expollicata*. The development cycle of the species *Chrysops italicus* takes place in the soil of sea coves and in salt lakes (OLSUFJEV 1977). This is the most probable reason why imagoes were collected near the coast of the Adriatic Sea and near ponds with brackish water, since these are the locations on which females lay their eggs on the surrounding vegetation, and on which these species of horse flies undergo their development process. The species *Chrysops italicus* is widespread on the coasts of: Spain, France, Italy, Albania, Greece, Turkey, Cyprus, Bulgaria, Roumania, Ukraine, as well as along the coasts of the countries in North Africa: Morocco, Algeria and Tunisia (CHVÁLA 1988). In the continental part of Croatia, the species *Hybomitra acuminata* was on occasions collected in the vicinity of the rivers Drava, Danube and Karašica, however, most specimens were collected in the Mediterranean part of Croatia by the Vransko jezero lake, near the mouth of the river Cetina, and in the delta of the Neretva river, in places where sea water mixes with fresh water. On the banks of the above rivers, horse flies were collected on grazing cattle in places with visible grayish layers of salt on the ground; this salt was probably crystallized after the water had returned into riverbeds. Larvae of the species *Hybomitra acuminata* live in the soils with high percentage of salt and their imagoes occasionally reach some salty habitats in Central Europe (CHVÁLA et al. 1972). This is the most probable explanation why several specimens were also collected in the continental part of Croatia, which, by the way, should be no exception, since the northern border of distribution of these species is on the territories of Austria, the Czech Republic and Hungary. In addition to these countries, *Hybomitra acuminata* is also widespread in: France, Roumania, Moldavia, Ukraine, Kazakhstan, Uzbekistan, Russia, Azerbaijan, Armenia, Kirghisia, Tadzhikistan, Turkmenia, Iran, China and Mongolia (CHVÁLA et al. 1972; OLSUFJEV 1977). MOUCHA (1959) mentioned the presence of this species in Dalmatia, but gave no other data except for the location where the horse flies were collected, which he marked as "Dalmatia". This explains why the species *Hybomitra acuminata* was not described as new in the fauna of Croatia. The species *Hybomitra expollicata* is a new element in the fauna of Croatia (KRČMAR & LECLERCQ 1997). It has been recorded on 3 stations in the Mediterranean part of Croatia: by a pond with brackish water near Obrovac; around the mouth of the river Cetina; as well as in the delta of the Neretva river and near the lake Modro Oko. Larvae of the species *Hybomitra expollicata* were recently collected near a lake in Russia (OLSUFJEV 1977). This is a species that mainly appears locally, in salty habitats, and it is wide-spread in: Spain (PORTILLO 1985), France, Italy, Roumania, Germany, Denmark, Sweden, England, Belgium, the Netherlands, Russia, Moldavia, Ukraine, Kazakhstan, Uzbekistan, Georgia, Manchuria, Mongolia (OLSUFJEV 1977; PARVU & GIRAY 1984), China and Turkey (CHVÁLA 1988).

It has been determined that the species *Hybomitra expollicata* has two peaks of activity: one in June and the other in August, as opposed to species *Chrysops italicus* and *Hybomitra acuminata* that have only one peak of activity in the course of the year (KRČMAR et al. 1997). The above three species are most likely not the only halophilous species of horse flies in Croatia, considering the fact that the development stages (larvae) of many species in the genera: *Silvius*, *Atylotus*, *Theriopectes*, *Dasyrhamphis* and *Philipomyia* are not yet known (CHVÁLA et al. 1972). Without information on the development stages of horse flies or on the locations on which the development of horse flies takes place, it is impossible to classify horse flies into various ecological groups, because larval stage makes about 85% of the horse fly life span (ANDREEVA 1994).

### Conclusion

A sample of 5155 specimens of horse flies was collected in the Mediterranean part of Croatia. There were 48 species determined in the sample, and these species are classified into the following genera: *Chrysops*, *Atylotus*, *Theriopectes*, *Hybomitra*, *Tabanus*, *Haematopota*, *Dasyrhamphis* and *Philipomyia*. The collected sample also contained three halophilous species: *Chrysops italicus* Meigen, 1804, *Hybomitra acuminata* (Loew, 1858), and *Hybomitra expollicata* (Pandellé, 1883). These halophilous species were collected mainly on stations located along the Adriatic Sea, as well as on stations near the mouth of the river Cetina and around the delta of the Neretva river, in habitats with brackish water. The species *Hybomitra expollicata* has two peaks of activity in the course of a year one in June and the other in August. The species *Chrysops italicus* is mostly represented in July and the species *Hybomitra acuminata* in June. Specimens of the species *Hybomitra acuminata* occasionally reach the continental parts of Croatia as well, since the northern limit of their distribution lies in the countries of Central Europe. Specimens of the species *Chrysops italicus* and *Hybomitra expollicata* were collected only in the Mediterranean part of Croatia.

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## PRELIMINARY RESULTS OF LEPIDOPTERA FAUNA INVESTIGATIONS IN PREKMURJE (NE SLOVENIA)

STANISLAV GOMBOC

Biotechnical Faculty, Agronomy Department, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia,  
e-mail: stanislav.gomboc@bf.uni-lj.si

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More intensive research of Lepidoptera began after 1970 and especially after 1985, performed mostly by amateurs and S. G., the author of this article. The 6211 data from very different sources and 66 locations were collected and recorded. All together, they make 955 species of Lepidoptera (686 Macro -, 269 Microlepidoptera). The majority of species belongs to the families Noctuidae (258), Geometridae (198), Pyraloidea (97) Tortricidae (67) and 108 butterflies (Rhopalocera). Eight species are new for Slovenian fauna of Macrolepidoptera (mostly Subpannonian elements). The forest fauna prevails, while the meadow fauna is very affected because of intensive use of grass. Some very characteristic and common species disappeared from meadow lands (*Hypodryas maturna* L., *Mellicta britomartis britomartis* Assm., *Colias myrmidone* Esp.), whereas some others are appearing (*Colias erate* Esp., *Apamea sicula syriaca* Osth., *Xestia cohaesa* Herrich-Schäffer). During the investigations, changes in abundance of some species were noticed, as well as a general decline in abundance of all the fauna under investigation, especially on cultivated areas. The geographical, geological and climatic characteristics and vegetation of Prekmurje are described. The taxonomic system of Huemer & Tarman (1993) has been used.

**Lepidoptera, faunistic studies, lists, zoogeographical areas, abundance, Prekmurje, Slovenia**

GOMBOC, S., Preliminarni rezultati istraživanja faune Lepidoptera u Prekmurju (NE Slovenija). - *Entomol. Croat.* (1998) 1999. Vol. 4. Num. 1 - 2.: 29 - 55.

Intenzivnija istraživanja Lepidoptera započela su nakon 1970. a napose nakon 1985. Obavljali su ih pretežito amateri, a također i S. G., autor ovoga članka. Prikupljeno je približno ukupno 6211 podataka iz vrlo različitih izvora i sa 66 lokacija. Sveukupno, to iznosi 955 vrsta Lepidoptera (686 Macro- i 269 Microlepidoptera). Većina vrsta pripada slijedećim porodicama: Noctuidae (258), Geometridae (198), Pyraloidea (97), Tortricidae (67), uz 108 vrsta danjih leptira (Rhopalocera). Osam vrsta pritom je novo za faunu Macrolepidoptera Slovenije (većinom subpanonski elementi). Prevladava šumska fauna, dok je livadna fauna uvelike pogođena intenzivnim korištenjem travnatih površina. Neke su vrlo tipične i raširene vrste nestale s livadnih površina (*Hypodryas maturna* L., *Mellicta britomartis britomartis* Assm., *Colias myrmidone* Esp.), dok se u livadnim staništima pojavljuju i nove (*Colias erate* Esp., *Apamea sicula syriaca* Osth., *Xestia cohaesa* Herrich - Schäffer). Za vrijeme provođenja istraživanja, primjećene su promjene u broju pripadnika nekih vrsta, kao i sveopće smanjenje predstavnika faune koja je istraživana, napose u obrađivanim područjima. U radu se opisuju također i zemljopisne, geološke i klimatske značajke, kao i vegetacija Prekmurja. Korišten je taksonomski sustav Huemera i Tarmana (1993).

**Lepidoptera, faunističke studije, popisi, zoogeografska područja, gustoća populacija, Prekomurje, Slovenija.**