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An Overview of the Horsefly Fauna (Diptera: Tabanidae) of Baranja, Croatia

Pregled faune obada (Diptera: Tabanidae) Baranje, Hrvatska

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Abstract

This paper summarizes all data, including our own studies and literature data on horseflies recorded in the Croatian part of Baranja. A total of 33 species and one subspecies of horseflies (Tabanidae) belonging to seven genera were recorded from the Croatian part of Baranja. Species richness was highest in the Monjoroš Forest and Kopački rit Nature Park, each with 26 taxa. The fauna of both sites showed high similarity, with 80.76% compositional overlap. *Haematopota* Meigen, 1803 and *Tabanus* L., 1758 were the most species-rich genera, whereas the other genera were less diverse. *Tabanus bromius* L., 1758 was the most abundant species, representing 47.73% of all collected specimens. The number of recorded species and subspecies represents 44.15% of all recorded horsefly fauna in Croatia. Most recorded taxa belong to the Boreal-Eurasian faunal type, followed by the South European subtype and the Afro-Eurasian arid type.

Keywords: Baranja, Croatia, Diptera, Europe, Tabanidae

Sažetak

Sažeti su svi podaci, uključujući vlastita istraživanja i podatke iz literature o obadima (Tabanideae), zabilježenima u hrvatskom dijelu Baranje. Zabilježene su ukupno 33 vrste i jedna podvrsta obada (Tabanidae) svrstane u sedam rodova na području hrvatskog dijela Baranje. Najveća raznolikost vrsta zabilježena je u šumi Monjoroš i Parku prirode Kopački rit, pri čemu oba staništa bilježe po 26 svojti. Fauna oba lokaliteta pokazuje visoku sličnost, s 80.76% sastava zajedničkih svojti. Rodovi *Haematopota* Meigen, 1803 i *Tabanus* L., 1758 najbrojniji su po broju zabilježenih vrsta, dok su ostali rodovi zastupljeni s manjim brojem vrsta. *Tabanus bromius* L., 1758 je najbrojnija vrsta, koja čini 47.73% svih uzorkovanih jedinki obada. Broj zabilježenih vrsta i podvrsta predstavlja 44.15% faune obada Hrvatske. Većina zabilježenih svojti pripada borealno-euroazijskom tipu faune, zatim slijedi južnoeuropski podtip te afro-euroazijski aridni tip.

Ključne riječi: Baranja, Diptera, Europa, Hrvatska, Tabanidae

Introduction – *Uvod*

Horseflies are considered major dipteran pests of man and animals worldwide (Foil, 1989). Females seek blood meals and are involved in the transmission of agents of various diseases (Baldacchino et al., 2014). In this regard, faunistic and ecological research on horsefly species is important from a medical and veterinary parasitology perspective. The first studies of entomofauna in the Croatian part of Baranja began with research on the entomofauna of Kopački rit in 1943 as part of the Albertina Biological Station, which operated under the Hungarian National Museum in Budapest (Szént-Iványi, 1944). At that time, the fauna of Lepidoptera, Hymenoptera, Odonata, and Orthoptera was studied (Szént-Iványi, 1944). The first sporadic samplings of horseflies in the Croatian part of Baranja were carried out during the 1980s by Dr. sc. József Mikuska from the Department of Ecology, University of Osijek (Majer and Mikuska, 1988). Continuous sampling of the horsefly fauna of Baranja began at the beginning of the 21st century, focusing on the effectiveness of different types of traps and attractants. These studies resulted in more than 20 articles, 10 master's theses, and one PhD thesis. Despite this large number of publications, none of them summarizes data on the number of recorded horsefly species or their abundance. Therefore, the main goal of this article was to summarize all available data on the diversity of horsefly fauna in

Baranja (Croatia), previously scattered across numerous publications, and to integrate records obtained through a variety of collection methods into a single comprehensive synthesis.

Materials and Methods – *Materijali i metode*

Study area – *Područje istraživanja*

The Croatian part of Baranja is triangular in shape and extends from the Drava and Danube rivers to the border with Hungary. The Croatian part of Baranja covers 1147 km² and is predominantly lowland, with an absolute altitude that does not exceed 250 m (Feletar and Vuk, 2014). The most prominent part in terms of relief is Bansko Hill, which extends in a northeast-southwest direction for a length of 21 km. On the southeastern side, erosional processes by the Danube River have formed loess cliffs ranging from 25 to 58 meters in height (Purger and Csiky, 2008). Erosion on the plateau of Bansko Hill has also created ravines and loess valleys, which predominantly run in a northwest-southeast direction (Bognar et al., 1975; Purger and Csiky, 2008). The northeastern side of Bansko Hill is covered with secondary forest vegetation dominated by Black Locust (*Robinia pseudacacia*), Walnut (*Juglans regia*), Linden (*Tilia* sp.), Tree of Heaven (*Ailanthus altissima*), and Hornbeam (*Carpinus betulus*) (Figure 1). On the southwestern side, the landscape is predominantly composed of various agro-ecosystems, degraded semi-natural steppe grasslands, and small remnants of xerothermic forests, with sporadic occurrences of Downy Oak (*Quercus pubescens*) (Purger and Csiky, 2008) (Figure 2).



Figure 1 Northeastern side of Bansko Hill (Photo S. Krčmar)
Slika 1. Sjeveroistočna strana Banskog Brda (Slikao S. Krčmar).



Figure 2 Southwestern side of Bansko Hill (Photo S. Krčmar)
Slika 2. Jugozapadna strana Banskog Brda (Slikao S. Krčmar).

However, most of Baranja in Croatia is part of the fluvial wetland plain. The Danube and Drava are floodplain rivers that have deposited enormous amounts of material in their course over time. At their lowest points, where the water flow is slowest, wetlands have developed, the most famous of which is Kopački rit (Bognar et al., 1975). This is one of the largest fluvial wetlands in Europe (Mihaljević et al., 1999; Springer et al., 2003). The basic ecological feature of Kopački rit Nature Park is given by the dynamics of floods, and the entire area of Kopački rit depends on the intensity of floods (Springer et al., 2003). Parts of wetlands and water, arranged in a mosaic, change their size, shape, and function depending on the amount of incoming water. Despite the monotonous plain landscape, the micro-relief structure of Kopački rit NP is very complex (Mihaljević et al., 1999). Very significant are large depressions permanently filled with water, so- called lakes, periodically flooded areas, so-called ponds, and depressions in which water flows, so-called channels and waterways. The largest lake is Kopačko Lake and the deepest is Sakadaš Lake. Such hydrological characteristics create conditions for the development of diverse flora and fauna of Kopački rit Nature Park. Because of the specific micro-relief and constant flooding, Kopački rit has different types of vegetation.

Regarding the forest communities, the largest areas in the wetland are covered with White Willow forests (*Galio-Salicetum albae*) (Figure 3). On slightly higher terrain there are forests of White Willow and Black Poplar (*Salici-Populetum nigrae*), while on higher terrain there are White and Black poplar forests (*Populetum nigro-albae*). In drier areas, beyond the reach of floodwaters, around Tikveš Castle there are forests of Common Oak and Green Weeds (*Genisto elatae-Quercetum roboris*) and forests of Common Oak and Hornbeam (*Carpino betuli-Quercetum roboris*) (Figure 4).



Figure 3 The community of White Willow forests in the Kopački rit NP (Photo S. Krčmar)
Slika 3. Zajednica šume bijele vrbe u Parku prirode Kopački rit (Slikao S. Krčmar).



Figure 4 Common Oak forest community in Tikveš (Kopački rit NP) (Photo S. Krčmar)
Slika 4. Zajednica šume hrasta lužnjaka u Tikvešu (PP Kopački rit) (Slikao S. Krčmar).

The Monjoroš Forest borders the Kopački rit Nature Park which lies in a former floodplain along the western

bank of the Danube River. Monjoroš Forest is mainly covered with forest communitites of White Willow (*Galio-Salicetum albae*), White Willow and Black Poplar (*Salici-Populetum nigrae*) as well as White and Black Poplar (*Populetum - nigro albae*). These forest communities are regularly flooded during a part of the year, unlike small fragments of Common Oak (*Quercus robur*) forest that are beyond the reach of floodwaters (Figure 5).



Figure 5 Fragments of Common Oak forest in the Monjoroš Forest (Photo S. Krčmar)
Slika 5. Fragmenti šume hrasta lužnjaka u šumi Monjoroš (Slikao S. Krčmar).

The Haljevo Forest is situated at the foot of Bansko Hill, between the town of Beli Manastir and the village of Čeminac. The forest is comprised largely of Common Oak and Hornbeam (*Carpino betuli-Quercetum roboris*), which is considered a natural climax vegetation type of the whole area (Figure 6). However, vegetation in the Haljevo Forest shows varying degrees of degradation across different sections, mainly due to forestry management (Krčmar et al., 2009).



Figure 6 Haljevo Forest with community of Common Oak and Hornbeam (Photo S. Krčmar)
Slika 6. Šuma Haljevo sa zajednicom hrasta lužnjaka i običnog graba (Slikao S. Krčmar).

Sampling and identification of Tabanidae – *Uzorkovanje i identifikacija obada*

Horseflies were sampled from 1982 to 2022 at 29 localities (Figure 7). During this period, different types of traps were used to collect horseflies, and the effectiveness of the traps and the horsefly response to attractants were studied.

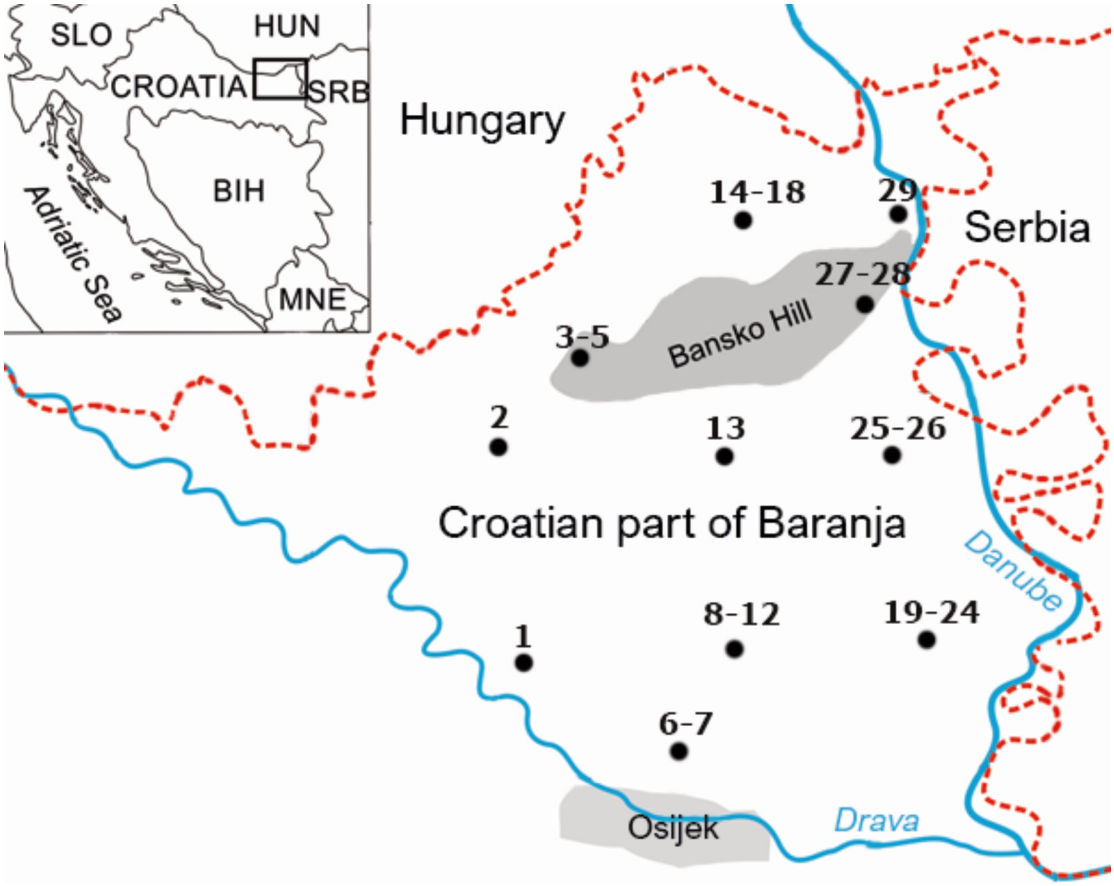


Figure 7 Horsefly sampling sites in Baranja (Croatia) listed according to UTM coordinates (Universal Transverse Mercator UTM grid)
Slika 7. Lokaliteti uzorkovanja obada u Baranji (Hrvatska) navedeni su prema UTM koordinatama (UTM kartografska mreža).

Legend/*Legenda*: 1. Bezdan (CR 14); 2. Haljevo Forest/Šuma (CR 16); 3.–5. Beli Manastir, Branjina, Popovac (CR17); 6.–7. Podravlje, Tvrđavica (CR 24); 8.–12. Bilje, Čonakut, Kopačevo, Mece, Sakadaš (CR 25); 13. Kneževi Vinogradi (CR 26); 14.–18. Draž, Kamenac, Karanac, Kotlina, Podolje (CR 27); 19.–24. Eblin, Ćošak šume, Kopačko jezero, Kopački rit, Podunavlje, Podunavska pumpa (CR 35); 25.–26. Tikveš, Vemeljski dunavac (CR 36); 27.–28. Monjoroš Forest, Zmajevac (CR 37); 29. Batina (CR 38).

Nine different types of traps were used: Malaise traps according to Townes (1962, 1972), canopy traps according to Hribar et al. (1991), Nzi traps according to Mihok (2002), modified box traps according to Hansens and Race (2011), liquid oil traps according to Horváth et al. (2008), sticky black traps according to Egri et al. (2013), H-traps (helio-thermal traps) according to Thorsteinson et al. (1966), and bottle traps. The canopy traps were baited with different synthetic attractants, including 1-octen-3-ol, acetone, ammonium hydroxide, 4-methylphenol, 3-isopropylphenol, naphthalene, lactic acid, a mixture of (1-octen-3-ol, acetone, ammonia solution), and a mixture of acetone and horse urine. Modified box traps, Nzi traps, and bottle traps were baited with 1-octen-3-ol only. Natural attractants included aged urine of domestic animals (cattle, horse, pig, sheep, donkey) and were used only in canopy traps. Liquid oil traps and sticky black traps do not require any special attractants other than oil and glue, while H-traps (heliothermal traps) did not require any attractants other than shiny black balls. In addition to traps, horseflies were also collected using entomological nets from vegetation or around vehicles. A complete list of studies included in the compilation of this faunal overview is provided in Tables 1 to 5. In the cited studies, collected horseflies were identified according to Chvála et al. (1972) and Krčmar et al. (2011), while in this study identification was partially revised following Zeegers (2018).

Data analyses – *Analiza podataka*

The similarity of horsefly fauna composition in four well-defined habitats in the Croatian part of Baranja (Kopački rit Nature Park, Bansko Hill, Monjoroš Forest, and Haljevo Forest) was analyzed using the Sørensen similarity index, based on species presence–absence data. The Sørensen index considers only qualitative species composition and not abundance (Durbešić, 1988).

Results and Discussion – *Rezultati i rasprava*

A total of 48,686 horseflies, classified into 33 species and one subspecies, were collected in the Croatian part of Baranja (Tables 1–5). The most numerous genus is *Haematopota* Meigen, 1803 with nine species, followed by *Tabanus* L., 1758 with eight species, *Hybomitra* Enderlein, 1922 with five species and one subspecies, *Chrysops* Meigen, 1803 with five species, *Atylotus* Osten Sacken, 1876 with four species, and the genera *Silvius* Meigen, 1820 and *Heptatoma* Meigen, 1803 with one species each (Table 1). The most abundant horsefly species in the study area is *Tabanus bromius* L., 1758, representing 47.73% of all collected specimens (Tables 2–5). It is followed by *T. tergestinus* Egger, 1859 (14.12%), *T. sudeticus* Zeller, 1842 (11.47%), *Haematopota pluvialis* (L., 1758) (10.05%), *T. maculicornis* Zetterstedt, 1842 (5.23%), *Atylotus loewianus* (Villeneuve, 1920) (3.00%), *Hybomitra solstitialis* (Meigen, 1820) nec Lyneborg (1959) (2.02%), *Chrysops relictus* Meigen, 1820 (1.29%), *T. bovinus* L., 1758 (0.87%), *H. bimaculata* (Macquart, 1826) (0.83%), *H. subcylindrica* Pandellé, 1883 (0.82%), *T. autumnalis* L., 1761 (0.66%), and *C. viduatus* (Fabricius, 1794) (0.49%). These 13 species account for 98.58% of all collected horseflies (Tables 2–5). This is consistent with the fact that these species are widely distributed in Central Europe and are common in suitable habitats (Chvála et al., 1972; Majer, 1987). Because not all methods are comparable in terms of the quantitative and qualitative data they provide, methodological limitations may also influence on this high abundance of these 13 species. The remaining 21 taxa account for 1.42% of the collected specimens (Tables 2–5). Horseflies were collected at 29 localities covering 11 fields of the UTM grid of Croatia. 96.08% of all horseflies were collected at 11 localities (Figure 8, Tables 2-5). The highest numbers of horseflies were collected in Monjoroš Forest (42.85%), followed by Tikveš (Kopački rit Nature Park) (30.00%), Podravlje (4.93%), Zmajevac (4.04%), Branjina (2.75%), Popovac (2.37%), Kopačevo (2.15%), Haljevo Forest (2.11%), Draž (1.86%), Vemeljski dunavac (Kopački rit NP) (1.59%), and Čonakut (Kopački rit NP) (1.43%). The highest species richness of horseflies was recorded in Monjoroš Forest with 26 species, followed by Tikveš (Kopački rit NP) with 22 species and one subspecies, Zmajevac with 20 species, Branjina and Kopačevo (Kopački rit NP) with 18 species each, Podunavska pumpa (Kopački rit NP) with 16 species, and Podravlje and Kopački rit (Kopački rit NP) with 15 species each. At the remaining 21 localities, fewer than 15 species were recorded per site (Figure 9, Tables 2–5).

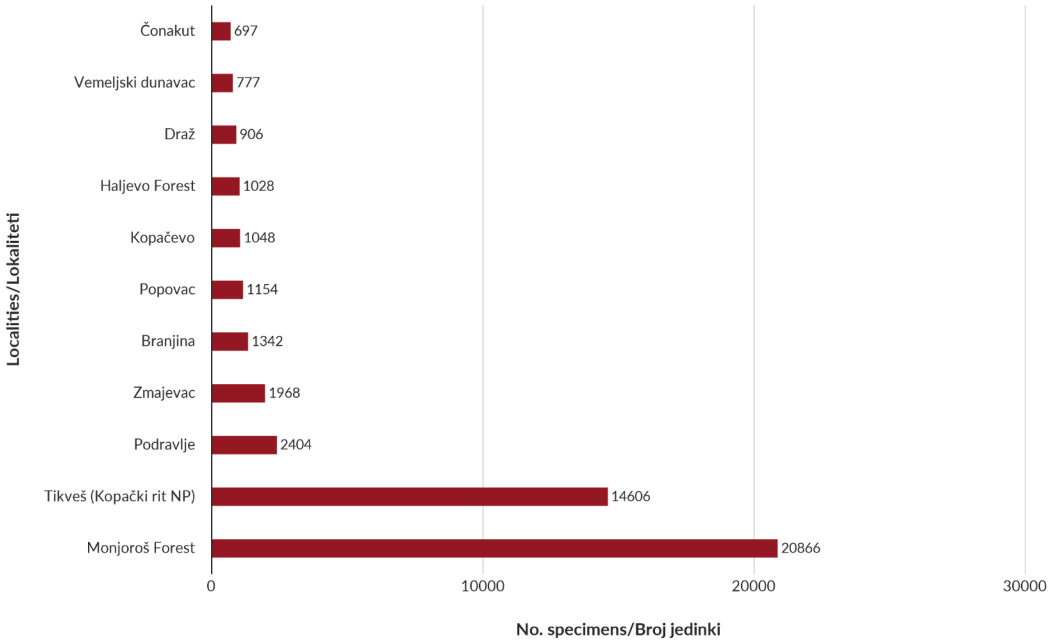


Figure 8 Localities with the largest number of sampled horseflies
Slika 8. Lokaliteti s najvećim brojem uzorkovanih obada.

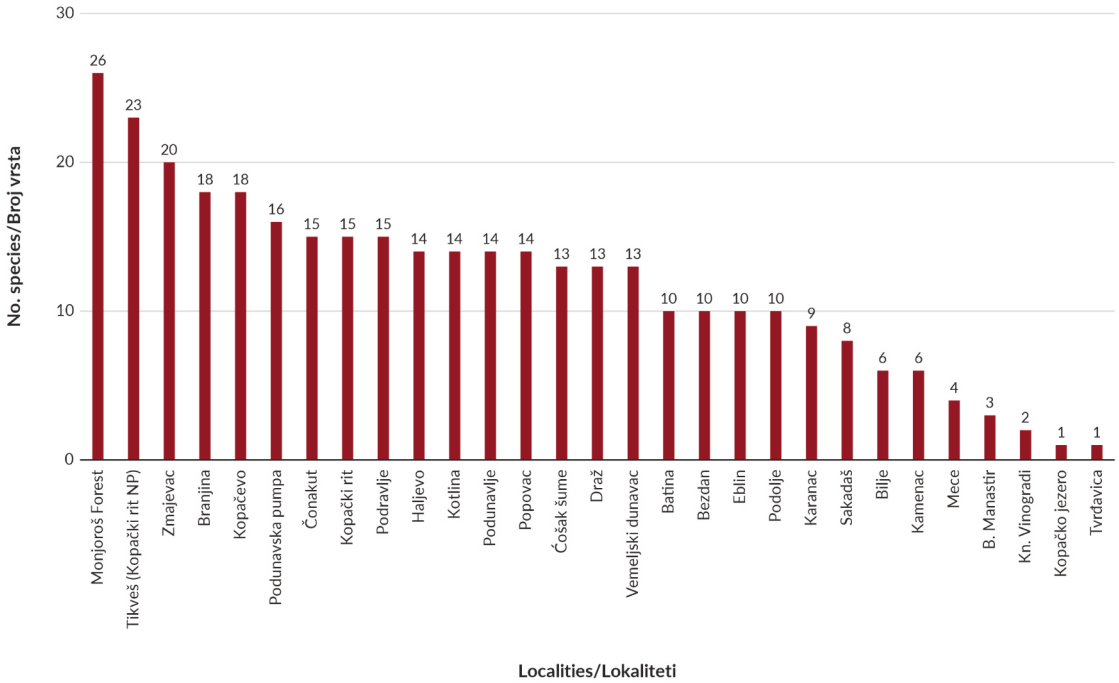


Figure 9 The diversity of horsefly fauna in the studied localities
Slika 9. Raznolikost faune obada na istraživanim lokalitetima.

Combined data from 11 localities within Kopački rit Nature Park (Eblin, Čonakut, Čošak šume, Kopačevo, Kopački rit, Kopačko jezero, Podunavlje, Podunavska pumpa, Sakadaš, Tikveš, and Vemeljski dunavac) accounted for 37.08% of all collected horseflies. In this area, 26 taxa were recorded, which represents the second

– highest number of horsefly taxa recorded in Croatian nature parks, shared with Medvednica Nature Park (Krčmar and Pezzi, 2024). Monjoroš Forest, which borders with Kopački rit Nature Park, accounted for 42.85% of all collected horseflies. At 11 localities on Bansko Hill (Batina, Beli Manastir, Branjina, Draž, Kamenac, Karanac, Kotlina, Kneževi Vinogradi, Podolje, Popovac, and partially Zmajevac), 8.78% of horseflies were collected, while 2.11% were collected in Haljevo Forest. In total, 90.82% of all horseflies in Baranja (Croatia) were collected in these four clearly defined habitat types. The similarity of forest communities between the Kopački rit NP and the Monjoroš Forest probably explains the equally large number of recorded horsefly taxa (26) in both areas, despite differences in habitat type. Bansko Hill represents a third habitat type and is the driest and highest relief element in the Croatian part of Baranja (Bognar et al., 1975). In total, 22 species of horseflies were recorded at the 11 surveyed localities on Bansko Hill (Krčmar and Kovačić, 2023). *Tabanus tergestinus* was the most abundant species, as expected, given that this habitat type is mainly preferred by species of the South European faunal subtype (Krčmar and Kovačić, 2023). At the foot of Bansko Hill lies Haljevo Forest, near the town of Beli Manastir. In this forest community of Common Oak and Hornbeam (*Carpino betuli - Quercetum roboris*), 14 horsefly species were recorded. In this habitat, as on Bansko Hill, *T. tergestinus* is the most abundant species, unlike in wetter habitats such as Kopački rit NP and Monjoroš Forest, where *T. bromius* is dominant. The greatest similarity in horsefly fauna (80.76%) was recorded between Monjoroš Forest and Kopački rit NP (Table 6). Sørensen similarity values among the four habitat types ranged from 60% to 80.76%, indicating moderate differences in species composition (Table 6). Earlier comparisons among forest communities (Monjoroš Forest, Haljevo Forest, and Tikveš Forest) showed higher similarity values ranging from 73.68% to 95.45% (Krčmar et al., 2009). The following seven species and one subspecies may be considered rare or accidental: *S. alpinus* (Scopoli, 1763); *A. fulvus* (Meigen, 1804); *Hybomitra nitidifrons confiformis* Chvála et Moucha, 1971; *T. glaucopis* Meigen, 1820; *T. miki* Brauer *in* Brauer and Bergenstamm, 1880; *H. bigoti* Gobert, 1880; *H. crassicornis* Wahlberg, 1848 and *H. scutellata* (Olsufjev, Moucha et Chvála, 1964). These taxa were represented by one or two specimens only (Tables 2–5). Only *Chrysops rufipes* Meigen, 1820 was collected using an entomological net on vegetation near water, while the remaining species were collected using traps with various attractants. Females of *C. rufipes* have not been observed attacking humans or animals (Chvála et al., 1972). It is likely that *C. rufipes* is autogenous and therefore not strongly attracted to baited traps. Recently, *C. parallelogrammus* Zeller, 1842 and *T. miki* were recorded for the first time in the Croatian part of Baranja (Krčmar, 2017; Krčmar and Kovačić, 2023), indicating that additional species may still be recorded in the region. In previous studies from the Croatian part of Baranja, *Hybomitra ciureai* and *Hybomitra solstitialis* were treated as separate species. However, Zeegers (2018) revised their taxonomic status, showing that *H. ciureai* (Séguy, 1937) is a junior synonym of *H. solstitialis* (Meigen, 1820) nec Lyneborg (1959), excluding misinterpretations by Lyneborg (1959). The name *H. solstitialis* sensu Lyneborg (1959) nec (Meigen, 1820) represents a lighter form of *H. bimaculata* (Macquart, 1826) (Zeegers, 2018). Accordingly, specimens previously identified as *H. solstitialis* sensu Lyneborg (1959) nec (Meigen, 1820) have been reassigned to *H. bimaculata* in this study, while *H. ciureai* has been synonymized with *H. solstitialis*. Eight species: *Silvius alpinus*; *A. flavoguttatus* (Szilády, 1915); *A. loewianus*; *T. tergestinus*; *Haematopota bigoti*; *Hae. grandis* Meigen, 1820; *Hae. ocelligera* (Kröber, 1922) and *H. pandazisi* (Kröber, 1936) belong to the South European subtype of fauna. Although these species have a predominantly southern European distribution, they also extend into Central Europe (Chvála et al., 1972). Two species, *Hybomitra acuminata* (Loew, 1858) and *H. ukrainica* (Olsufjev, 1952), belong to the Afro-Eurasian arid type of fauna, while the remaining 23 species and one subspecies belong to the Boreal Eurasian type of fauna (Olsufjev, 1977). Of the 13 most abundant horsefly species, 11 belong to the Boreal-Eurasian type, while *T. tergestinus* and *A. loewianus* belong to the South European subtype. This review summarizes all published data on horseflies recorded in the Croatian part of Baranja. Although it occupies only 2% of the land area of Republic of Croatia (Bognar et al., 1975), it is the best-researched area in Croatia in terms of the number of recorded horsefly taxa. This is most likely a consequence of numerous studies conducted in Baranja related to research into the effectiveness of various traps and attractants for horsefly sampling, as well as the focus of the Department of Biology of the Josip Juraj Strossmayer University in Osijek on researching the biodiversity of Baranja. Such systematic research on horsefly fauna is rare and sporadic in other parts of Croatia. The results presented in this review may encourage more systematic research into horsefly fauna in other areas of Croatia. Forests in Baranja today cover 20% of the territory (https://

www.enciklopedija.hr/clanak/baranja), and the largest number of the horsefly fauna (Monjoroš Forest and Tikveš Forest) has been recorded in them, which indicates the need to protect such habitats that are characterized by great biological diversity.

Table 1 Systematic list of horseflies (Diptera: Tabanidae) from Baranja (Croatia)
Tablica 1. Sistematski popis obada (Diptera: Tabanidae) u Baranji (Hrvatska).

Genus *Rod*	Species / *subspecies *Vrsta /*podvrsta*	Data source *Izvor podataka*
Silvius 1820	*Silvius alpinus* (Scopoly, 1763)	Krčmar et al., 2014
Chrysops Meigen, 1803	*Chrysops caecutiens* (L., 1758)	Krčmar et al., 2005
	Chrysops parallelogrammus Zeller, 1842	Krčmar, 2017
	Chrysops relictus Meigen, 1820	Krčmar et al., 2005
	Chrysops rufipes Meigen, 1820	Krčmar and Mikuska, 2001
	Chrysops viduatus (Fabricius, 1794)	Krčmar et al., 2005
Atylotus Osten Sacken, 1876	*Atylotus flavoguttatus* (Szilády, 1915)	Krčmar et al., 2014
	Atylotus fulvus (Meigen, 1804)	Krčmar et al., 2009
	Atylotus loewianus (Villeneuve, 1920)	Krčmar et al., 2005
	Atylotus rusticus (L., 1767)	Krčmar et al., 2005
Hybomitra Enderlein, 1922	*Hybomitra acuminata* (Loew, 1858)	Krčmar et al., 2005
	Hybomitra bimaculata (Macquart, 1826)	Krčmar et al., 2006
	Hybomitra muehlfeldi (Brauer *in* Brauer and Bergenstamm, 1880)	Krčmar et al., 2009
	**Hybomitra nitidifrons confiformis* Chvála et Moucha, 1971	Mikuška, 2010
	Hybomitra solstitialis (Meigen, 1820) nec Lyneborg (1959)	Krčmar et al., 2005
	Hybomitra ukrainica (Olsufjev, 1952)	Krčmar et al., 2006
Tabanus L., 1758	*Tabanus autumnalis* L., 1761	Krčmar et al., 2010
	Tabanus bovinus L., 1758	Krčmar et al., 2010
	Tabanus bromius L., 1758	Krčmar et al., 2006
	Tabanus glaucopis Meigen, 1820	Krčmar and Mikuska, 2001
	Tabanus maculicornis Zetterstedt, 1842	Krčmar et al., 2005
	T. miki Brauer *in* Brauer and Bergenstamm, 1880	Krčmar and Kovačić, 2023
	Tabanus sudeticus Zeller, 1842	Krčmar, 2021
	Tabanus tergestinus Egger, 1859	Krčmar and Lajoš, 2011
Heptatoma Meigen, 1803	*Heptatoma pellucens* (Fabricius, 1776)	Krčmar and Mikuska, 2001
Haematopota Meigen, 1803	*Haematopota bigoti* Gobert, 1880	Krčmar and Mikuska, 2001
	Haematopota crassicornis Wahlberg, 1848	Krčmar et al., 2014
	Haematopota grandis Meigen, 1820	Krčmar, 2004
	Haematopota italica Meigen, 1804	Krčmar et al., 2010
	Haematopota ocelligera (Kröber, 1922)	Krčmar and Gvozdić, 2016
	Haematopota pandazisi (Kröber, 1936)	Krčmar, 2004
	Haematopota pluvialis (L., 1758)	Krčmar, 2004
	Haematopota scutellata (Olsufjev, Moucha et Chvála, 1964)	Krčmar and Mikuska, 2001
	Haematopota subcylindrica Pandellé 1883	Krčmar and Mikuska, 2001
Σ 7	34	

Table 2 Number of horseflies collected in Baranja (Croatia) from the S. Krčmar collection
Tablica 2. Broj skupljenih obada u Baranji (Hrvatska) u zbirci S. Krčmar.

Species/Locality *Vrsta* /Lokalitet	01.	02.	03.	04.	05.	06.	07.	08.	09.	10.	11.	12.	13.	14.	15.	∑
T. bromius	5	12	195	94	52	2	16		64	12390	11	1406	133	6316	624	21320
T .tergestinus	5	44	803	691	487	9	118	1	359	1566	24	323	746	666	376	6218
T. sudeticus		2	118	91	226	1	14		23	1279	2	17	80	2446	497	4796
H. pluvialis			2	2	5		2			2752	1	443	13	375	191	3786
T. maculicornis			1	3	83	1	1		29	996	1	178	19	675	14	2001
A. loewianus			143	15	29		6		10	288	1	2	60	868	3	1425
H. solstitialis			9	1	85		1		3	240		14	13	149	28	543
C. relictus			3	1					4	338			5	15	151	517
H. bimaculata			4		21				1	334				26	5	391
T. bovinus			1						1	189		2	2	31	3	229
T. autumnalis			3	2					1	158	1	2	8	40	9	224
C. viduatus			9	2	10	3	1	1	10	103	13		17	16	2	187
Hae. subcylindrica			1			1				87		4		33	19	145
Hep. pellucens			10				1		2				54		1	68
Hae. italica					4					40		2		8	3	57
H. ukrainica				1					2	41		2		5	2	53
C. caecutiens			31	1					2	9		1	2	1	3	50
C. parallelogrammus										3		4			28	35
H. muehlfeldi					16					7	2		2	6	1	34
A. rusticus			3							7	1			8		19
Hae. pandazisi			2							10				4		16
H. acuminata										7		1		5		13
A. flavoguttatus										10						10
Hae. ocelligera										6				1		7
Hae. grandis				2						3						5
A. fulvus					1									1		2
Hae. crassicornis										2						2
S. alpinus										1						1
T. miki															1	1
Σ 29	10	58	1338	906	1019	17	160	2	511	20866	57	2401	1154	11695	1961	42155

Legend/*Legenda*: 01-Batina CR 38; 02-Beli Manastir CR 17; 03-Branjina CR 17; 04-Draž CR 27; 05-Haljevo Forest CR 16; 06-Kamenac CR 27; 07-Karanac CR 27; 08-Kneževi Vinogradi CR 26; 09-Kotlina CR 27; 10-Monjoroš Forest CR 37; 11-Podolje CR 27; 12-Podravlje CR 24; 13-Popovac CR 17; 14-Tikveš (Kopački rit NP) CR 36; 15-Zmajevac CR 37.

Table 3 Horseflies from Baranja (Croatia) in the A. Mikuska collection
Tablica 3. Obadi iz Baranje (Hrvatska) u zbirci A. Mikuska.

Species/Locality *Vrsta* /Lokalitet	1. Tikveš (Kopački rit), CR 36	2. Vemeljski dunavac (Kopački rit), CR 36	3. Čonakut (Kopački rit), CR 25	∑
T. bromius	1343	111	178	1632
T. sudeticus	464	98	85	647
T. tergestinus	483	54	66	603
Hae. pluvialis	36	316	155	507
T. maculicornis	393	49	18	460
T. bovinus	67	63	38	168
H. solstitialis	12	13	114	139
C. relictus	2	52	10	64
A. loewianus	33		2	35
T. autumnalis	29		2	31
H. muehlfeldi	5	7	9	21
Hae. subcylindrica	5	8	3	16
C. viduatus	8	2		10
H. ukrainica			10	10
H. acuminata	3	1	5	9
Hae. italica	3			3
Hae. pandazisi		3		3
H. bimaculata	1		2	3
H .nitidifrons confiformis	1			1
Σ 19	2888	777	697	4362

Table 4 Horseflies from Baranja (Croatia) in the J. Mikuska collection
Tablica 4. Obadi iz Baranje (Hrvatska) u zbirci J. Mikuska.

Species/Locality *Vrsta* /Lokalitet	01.	02.	03.	04.	05.	06.	07.	08.	09.	10.	11.	12.	13.	14.	15.	16.	17.	18.	Σ
T. bromius	8	2			4	97		33	28				24	52	7	4		1	260
H. solstitialis	11	7	1	1	14	8		94	26		8		27	32	1				230
Hae. pluvialis	10	4	9	1	14	2		70	35		1	3	21	44		5	6	1	226
Hae. subcylindrica	1	3	2	1	4		4	53	36	5			9	33	3	5			159
H. ukrainica			3		3	1		53	1		3		32	20					116
T. maculicornis					3			4	9		3		22	37		2		1	81
T. sudeticus	4	3			2	2	3	15	9				8	21	2	4			73
C. rufipes								43							26				69
T. autumnalis	1	1			3			22	4				3	25					59
C. relictus	1	1			5			2	18				7	9	3				46
T. tergestinus						1		2	2				5	22	3			1	36
C. viduatus		2			3	1			3				12	9		2		2	34
T. bovinus			2			1		3	2				3	11					22
A. rusticus					1	6								11					18
H. muehlfeldi	1	1	1					1	3				3	1	1	1			13
H. bimaculata	1	1			1			2	6									1	12
Hae. bigoti					2									3					5
H. acuminata						1		2	1										4
T. glaucopis							1	1											2
C. caecutiens													1						1
A. loewianus														1					1
Hae. italica							1												1
Hae.scutellata				1															1
Σ 23	38	25	18	4	59	120	9	400	183	5	15	3	177	331	46	23	6	7	1469

Legend/*Legenda*: 01-Batina CR 38; 02-Bezdan CR 14; 03-Bilje CR 25; 04-Branjina CR 17; 05-Ćošak šume (Kopački rit NP) CR 35; 06-Eblin (Kopački rit NP) CR 35; 07-Haljevo Forest CR 16; 08-Kopačevo CR 25; 09-Kopački rit NP CR 35; 10-Kopačko jezero (Kopački rit NP) CR 35; 11-Mece CR 25; 12-Podravlje CR 24; 13-Podunavlje (Kopački rit NP) CR 35; 14-Podunavska pumpa (Kopački rit NP) CR 35; 15-Sakadaš (Kopački rit NP) CR 25; 16-Tikveš (Kopački rit NP) CR 36; 17-Tvrđavica CR 24; 18-Zmajevac CR 37.

Table 5 Horseflies from Baranja (Croatia) in the Croatian Natural History Museum collection in Zagreb
Tablica 5. Obadi iz Baranje (Hrvatska) u zbirkama Hrvatskog prirodoslovnog muzeja u Zagrebu.

Species/Locality *Vrsta* /Lokalitet	1. Bilje CR 25	2. Eblin (Kopački rit), CR 35	3. Kopačevo, CR 25	Σ
Hae. pluvialis	47		327	374
Hae. subcylindrica			80	80
T. sudeticus			72	72
H. solstitialis			72	72
T. bromius			28	28
T. tergestinus			21	21
H. ukrainica			17	17
C. viduatus			8	8
T. autumnalis			7	7
T. bovinus			6	6
T. maculicornis			6	6
A. rusticus		5		5
C. relictus			2	2
Hae.bigoti			2	2
Σ 14	47	5	648	700

Table 6 Faunal similarity of horseflies from four different habitat types in Baranja (Croatia)
Tablica 6. Sličnost faune obada četiri različita tipa staništa u Baranji (Hrvatska).

Habitat type/ Tip staništa	Kopački rit NP/PP *Kopački rit*	Monjoroš Forest *Šuma Monjoroš*	Bansko Hill *Bansko Brdo*	Haljevo Forest *Šuma Haljevo*
Kopački rit NP *PP Kopački rit*				
Monjoroš Forest *Šuma Monjoroš*	80.76%			
Bansko Hill *Bansko Brdo*	75%	79.16%		
Haljevo Forest *Šuma Haljevo*	65%	60%	61.11%	

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