

New data on hoverfly fauna (Diptera: Syrphidae) of Bosnia and Herzegovina

Novi podaci za faunu muha pršilica (Diptera: Syrphidae) Bosne i Hercegovine

Mihailo Vujić^{1*}, Dejan Kulijer², Toni Koren³, Matea Martinović⁴

¹ HabiProt, Cankareva 9/13, 21000 Novi Sad, Serbia

² National Museum of Bosnia and Herzegovina, Zmaja od Bosne 3, 71000 Sarajevo, Bosnia and Herzegovina

³ Association Hyla, Lipovac I no. 7, HR-10000 Zagreb, Croatia

⁴ Dubrovnik Natural History Museum, Androvićeva 1, HR-20000 Dubrovnik, Croatia

* Corresponding author email: mihailovujic01@gmail.com (M. Vujić)

Abstract

Hoverflies (Syrphidae) are a large Dipteran family, distributed almost worldwide. They play very important ecological roles such as plant pollination, nutrient recycling and predation of plant pests. The members of the genus *Epistrophe* Walker, 1852 are medium-sized hoverflies of which about 75 species have been described in the World, and 12 of them occur in Europe. During a survey, conducted from 16th June to 4th July 2021 at Blidinje Nature Park (Bosnia and Herzegovina), a new species, of the fauna of Bosnia and Herzegovina, was recorded – *Epistrophe diaphana* (Zetterstedt, 1843) and new records for species *Epistrophe leiophthalma* (Schiner and Egger, 1853) were observed. Specimens were collected from inflorescences of Common Hogweed (*Heracleum sphondylium* L.). Information about the records, species habitats, distribution and status in the country and the region is presented and discussed in this research work.

Keywords: Balkan Peninsula, *Epistrophe diaphana*, *Epistrophe leiophthalma*, new record, pollinators

Sažetak

Cvjetne muhe (Syrphidae) velika su porodica dvokrilaca, rasprostranjena u skoro cijelom svijetu. One sudjeluju u važnim ekološkim procesima kao što su oprašivanje biljaka, recikliranje hranjivih tvari i predacija nad biljnih štetočinama. Pripadnici roda *Epistrophe* Walker, 1852 srednje su velike cvjetne muhe kojih je do sada u svijetu opisano 75 vrsta od čega 12 u Europi. Tijekom istraživanja, provedenog od 16. lipnja do 4. srpnja 2021. godine u Parku prirode Blidinje (Bosna i Hercegovina), zabilježena je jedna nova vrsta za faunu Bosne i Hercegovine - *Epistrophe diaphana* (Zetterstedt, 1843), te i novi nalazi vrste *Epistrophe leiophthalma* (Schiner and Egger, 1853). Jedinke su prikupljene iz cvatova obične svinjske trave (*Heracleum sphondylium* L.). Predstavljani su i raspravljani podaci o nalazima, staništima vrsta, rasprostranjenosti te statusu u zemlji i regiji.

Ključne riječi: Balkanski poluotok, *Epistrophe diaphana*, *Epistrophe leiophthalma*, novi nalaz, oprašivači

Introduction

Hoverflies (Syrphidae) are a large family of flies (Diptera) with more than 6,200 described species, of nearly worldwide distribution, but absent from the Antarctic and some oceanic islands (Young et al. 2016). The European hoverfly fauna counts more than 950 species and they perform very significant ecological roles like plant pollination, predation of plant pests and nutrient recycling (Rotheray and Gilbert 2011; Speight 2020).

In the genus *Epistrophe* Walker, 1852 belong hoverflies with one generation per year (univoltine) and a long obligate diapause in the larval stage (Schneider, 1969.). They are associated with forests, where they occur in glades and clearings and frequently visit flowers (Goeldlin de Tiefenau 1974; van Veen 2004). The members of this genus are medium-sized (~10 mm) hoverflies characterized by the following characters: bare humerus, short and round antennae, face with distinct facial knob, yellow face and scutellum, bare anterior anepisternum, and thoracic pleurae without yellow spots, at least sternum 2 without black markings (van Veen 2004).

The genus *Epistrophe* contains 12 species found in Europe: *E. annulitarsis* (Stackelberg 1918), *E. cryptica* Doczkal and Schmid 1994, *E. diaphana* (Zetterstedt 1843), *E. eligans* (Harris 1780), *E. flava* Doczkal and Schmid 1994, *E. grossulariae* (Meigen 1822), *E. leiothalma* (Schiner and Egger 1853), *E. melanostoma* (Zetterstedt 1843), *E. nitidicollis* (Meigen 1822), *E. obscuripes* (Strobl 1910), *E. ochrostoma* (Zetterstedt 1849) and *E. olgae* Mutin 1993 (Speight 2011; 2020).

In the Balkan Peninsula, at least 10 species of the genus *Epistrophe* have been recorded so far, but their distribution in the region is not well known, primarily due to the lack of surveys in most of the Balkan countries (De Groot and Govedič 2008; Vujić et al. 2018; Speight 2020). The same stands for Bosnia and Herzegovina where the hoverfly fauna is poorly studied and most of the data is based on scarce historical records (Strobl 1898, 1900, 1902; Glumac 1955, 1972; Kula 1985).

North Herzegovina region of Bosnia and Herzegovina encompasses some of the highest peaks of the Dinaric Alps. It is characterized by a high diversity of karst phenomena that have influenced the development of unique habitat types with rich wildlife. Due to the extremely high level of endemism and relictiness, this area is regarded as an endemic development center and a biodiversity hotspot of great importance not only for the Mediterranean, but on a global scale (Redžić et al. 2011).

The exact number of hoverfly species recorded in Bosnia and Herzegovina is difficult to determine based on literature data, due to taxonomic problems and inaccuracies in locating the sites, but it is expected that real number is similar to other nearby countries, where the hoverfly fauna is better researched, such as Greece (418), Hungary (388) and Serbia (more than 420) (Tóth 2011; Likov 2018; Vujić et al. 2018; Vujić and Tot 2020; Vujić et al. 2021). Accordingly, new research is needed with purpose to contribute to the knowledge of the real diversity of hoverflies in this country.

The aim of this work was to present new records of the genus *Epistrophe* for the hoverfly fauna in Bosnia and Herzegovina.

Materials and Methods

The survey was conducted in period from 16th June to 4th July 2021 on the territory of Blidinje Nature Park and surrounding environment, in the high mountain area of North Herzegovina region of Bosnia and Herzegovina (Fig. 1), as a result of regional collaboration on biodiversity research and the development of Biologer, an open platform for collecting biodiversity data in South - Eastern Europe (Popović et al. 2020). The location of the research area belongs to the western part of the high mountain complex around the Neretva River, in the North Herzegovina region of the country. The central part of the study area is 12 km long location called Dugo polje valley (approx. 1.200 - 1.300 m.a.s.l.) that is surrounded by mountain peaks reaching 2.220 m.a.s.l. on Čvrsnica Mt. Data about many groups of insects was collected, including data about hoverflies. The specimens were caught by an entomological net, photographed and prepared by standard procedure. Identification was performed using the keys in Speight and Sarthou (2017) and van Veen (2004). The collected adult specimens are deposited in personal collections of T. Koren (T.K. coll.) and D. Kulijer (D.K. coll.).

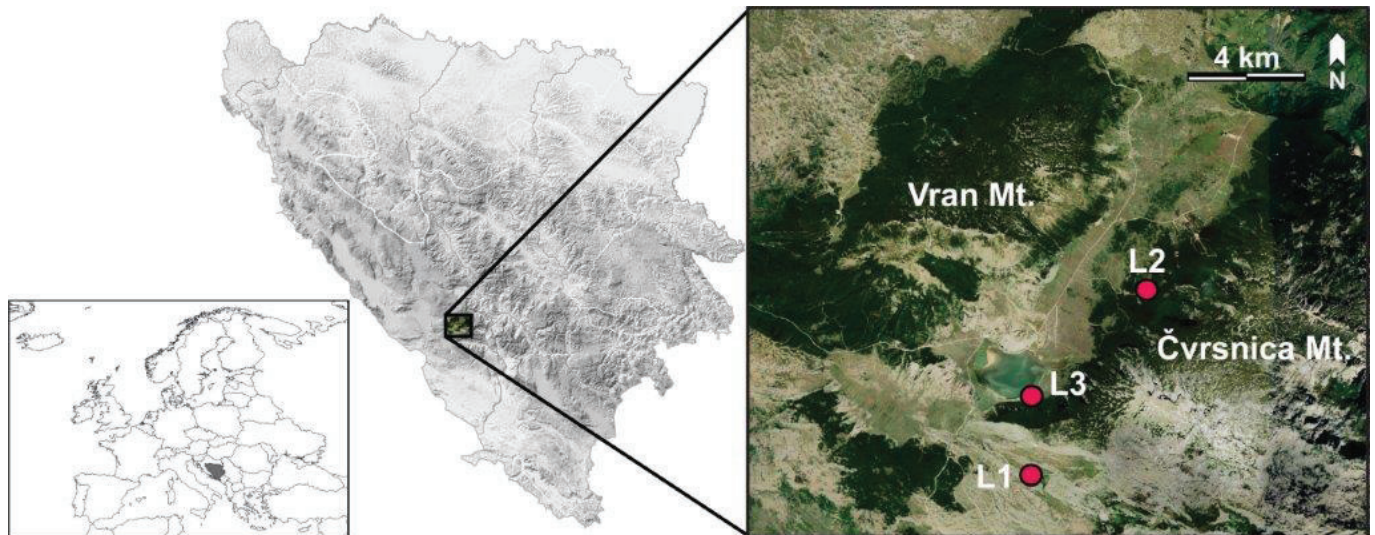


Figure 1. Map of Bosnia and Herzegovina with marked localities where *Epistrophe diaphana* and *E. leiophthalma* were collected; L1 – Bare; L2 –Blidinje jezero; L3 – Masna Luka.

Slika 1. Karta Bosne i Hercegovine s označenim lokalitetima na kojima su prikupljene *Epistrophe diaphana* i *E. leiophthalma*; L1 – Bare; L2 –Blidinje jezero; L3 – Masna Luka.

Results

From the collected material, one species of the genus *Epistrophe* was recorded in the country for the first time and for another species new county records were observed.

Epistrophe diaphana (Zetterstedt, 1843) (Fig. 2A-B)

New records: 1♂, Masna Luka, 43.634044N 17.551958E, 1214 m.a.s.l., 16.6.2021., leg. D. Kulijer (D. K. coll.); same collection data as for preceding, 3.7.2021., leg. T. Koren (T. K. coll.).

Notes: Two male specimens were swiped of an inflorescence of Common Hogweed, *Heracleum sphondylium*. *Epistrophe diaphana* is a widespread species that occurs in Europe and large part of Asia and usually inhabits wetlands, deciduous forests or montane grasslands (Speight 2020). This species is probably more widespread in Bosnia and Herzegovina, and it is expected that it will be registered in a larger number of localities in the country by further studies.

Published records for Balkan Peninsula: Bulgaria: Drensky, 1934.; Croatia: Langhoffer, 1918.; Glumac, 1972.; North Macedonia: Glumac, 1968.; Serbia: Glumac, 1959.; 1972.; Vujić and Šimić, 1994.; Vujić et al., 1998.; Nedeljković et al., 2009.; Šimić et al., 2008.; 2009.; Nedeljković, 2011.; Tot et al., 2018.; Slovenia: De Groot and Govedič, 2008.

***Epistrophe leiophthalma* (Schiner & Egger, 1853) (Fig. 2C-D)**

Material examined: 1♂, Bare, 43.576135N 17.502609E, 1394 m.a.s.l., 29.6.2021., leg. T. Koren (T.K. coll); 1♀, Masna Luka, 43.634044N 17.551958E, 1214 m.a.s.l., 1.7.2021., leg. D. Kulijer (D. K. coll.); 6♀, same collection data as for preceding, 3.7.2021., leg. T. Koren (T. K. coll.); 1♂, Jezero Blidinje, 43.600400N 17.505819E, 1187 m.a.s.l., 3.7.2021., leg. T. Koren (T. K. coll.).

Notes: *Epistrophe leiophthalma* is a mountain species and its range include Ardennes (Belgium), Alps, Pyrenees (France), the Carpathians and the Transcaucasus. There is no recent and exact data on the presence of this species in the Balkans. Speight (2020) noted that this species may be found in northern parts of the former Yugoslavia, but does not specify a more precise location. Van Steenis et al. (2013) registered *E. leiophthalma* as new for the fauna of Slovenia recently. The record of this species in Montenegro contained in publication of Šimić (1987.). This indicates that *E. leiophthalma* is rare in the region, although a long tradition of hoverfly research exists in some Balkan countries.

Published records for Balkan Peninsula: Bosnia and Herzegovina: Glumac 1955 (as *Ischyropsyrphus liophthalmus*); Montenegro: Šimić 1987 (as *Ischyropsyrphus liophthalmus*); Slovenia: van Steenis et al. 2013.

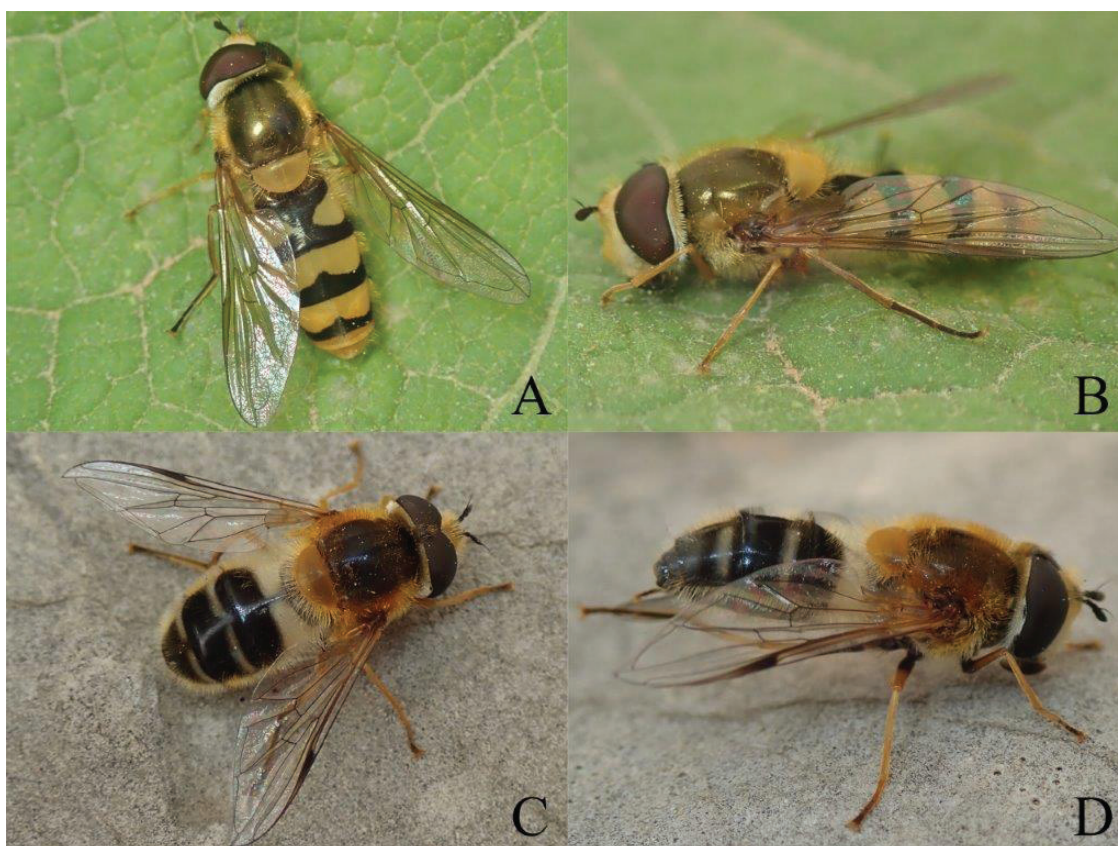


Figure 2. Males of *Epistrophe diaphana* (A-B) and *E. leiophthalma* (C-D), collected at Blidinje Nature Park. A) *E. diaphana*, dorsal view; B) *E. diaphana*, lateral view; C) *E. leiophthalma*, dorsal view; D) *E. leiophthalma*, lateral view. Photos: T. Koren.

Slika 2. Mužjaci *Epistrophe diaphana* (A-B) i *E. leiophthalma* (C-D), prikupljeni u Parku prirode Blidinje. A) *E. diaphana*, dorzalni pogled; B) *E. diaphana*, lateralni pogled; C) *E. leiophthalma*, dorzalni pogled; D) *E. leiophthalma*, lateralni pogled. Fotografije: T. Koren.



Figure 3. Habitats at Blidinje Nature Park where *Epistrophe diaphana* and *E. leiophthalma* were recorded. A) Bare; B) Jezero Blidinje; C) Masna Luka. Photos: A-B: T. Koren; C: D. Kulijer.

Slika 3. Staništa u Parku prirode Blidinje gdje su zabilježene *Epistrophe diaphana* i *E. leiophthalma*. A) Bare; B) Jezero Blidinje; C) Masna Luka. Fotografije: A-B: T. Koren; C: D. Kulijer.

Discussion

Epistrophe diaphana can be considered as a rather common in the Balkans (e.g. in Serbia, where it was registered in several localities (Nedeljković 2011; Vujić 2021), *E. leiophthalma* is seemingly scarcer. It is known that adults of *E. diaphana* usually visit the inflorescences of white-flowered or yellow-flowered umbellifers (e.g. *Foeniculum*) (Speight 2020). *Heracleum sphondylium* also belongs to the umbellifers (Apiaceae), and the specific subspecies, which the hoverflies visited, has a greenish inflorescences. Adults of the *E. leiophthalma* can usually be seen while visiting inflorescences of umbellifers that which inhabit places near streams in open areas in forests (Speight 2020). This was also the case during this study since all the observed specimens were caught while feeding on *H. sphondylium* inflorescences. At all three locations freshwater habitats were present: lakes/ponds (Fig. 3 A-B), streams (Fig. 3 C) and swampy meadows (Fig. 3. A-C). At all locations rich marshland vegetation was also present and at the time of survey *H. sphondylium* seemed to be the most attractive flowering source for pollinating insects, including these and many other hoverflies.

In general, it is very difficult to assess the conservation status of insect species without targeted ecological surveys, but such species with seemingly limited distribution can be considered that are threatened, at least at local levels. This, however, should be proven with targeted surveys. In the alpine region of Europe, *E. leiophthalma* is considered to be unthreatened, while it is decreasing in the continental region (Speight et al. 2010).

The visited area of Blidinje Nature Park is very diverse in terms of habitat diversity and species richness. However, almost nothing is known about its' insect diversity except from mostly historical Lepidoptera records (Lelo 2004; Kučinić et al. 2006). Because of the further surveys of the different habitats and altitudes of the Blidinje Nature Park, additional records of new or interesting hoverflies are to be expected. This is especially important in light of the EU Pollinators Initiative, which was launched in 2018 by the European Commission as an EU-wide strategy to address the decline of pollinators across the region (European Commission 2021).

Acknowledgements

This research was conducted within the scope of the project "Biologer - online database on biodiversity of Bosnia and Herzegovina" that is supported by the Environmental Protection Fund of the Federation of Bosnia and Herzegovina.

References

- De Groot, M., Govedič, M. 2008. Checklist of the Hoverflies (Diptera: Syrphidae) of Slovenia. *Acta entomologica slovenica*. 16 (1): 67-87.
- Drensky, P. 1934. Sirfide Bugarske. *Izvod Bulg. Entom. Druž.* 8: 109-131.
- EUROPEAN COMMISSION, 2021. Report from the Commission to the European parliament, the Council, the European economic and social committee and the Committee of the regions. Progress in the implementation of the EU Pollinators Initiative. European commission, 16 pp.
- Glumac, S. 1955. Zbirka sifrida (Syrphidae Diptera) Biološkog instituta u Sarajevu. *Godišnjak Biološkog instituta u Sarajevu*. 7 (1-2): 115-130.
- Glumac, S. 1959. Syrphidae (Diptera) Fruške gore. *Matica srpska, Zbornik za prirodne nauke*. 17: 37-78.
- Glumac, S. 1968. Sirfide (Syrphoidea, Diptera) u Makedoniji. *Godišnjak Filozofskog fakulteta u Novom Sadu*, knjiga 9/2.
- Glumac, S. 1972. *Catalogus faunae Jugoslaviae. Consilium Academicarum Scientiarum Rei Publicae Socialisticae Foederative Jugoslaviae. Academia Scientiarum et Artium Slovenica. Ljubljana. III/6. 69 pp.*
- Goeldlin de Tiefenau, P. 1974. Contribution à l'étude systématique et écologique de Syrphidae (Dipt.) de la Suisse occidentale. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*. 47 (1): 151-252.
- Kučinić, M., Stanić, S., Durbešić, P., Mihoci, I., Landeka, N., Deliće, A. 2006. Pregled Istraživanja Leptira (Lepidoptera: Rhopalocera) u Prirodnom Parku Blidinje (Bosna i Hercegovina). *Entomologia Croatica*. 9 (1-2): 11-28.
- Kula, E. 1985. Contribution to the knowledge of Syrphide (Diptera) in Yugoslavia. *Acta. Univ. Agric. Fac. Silvic. Series C* 54: 203-223.
- Langhoffer, A. 1918. Beitrage zur Dipterenfauna Kroatiens. *Glasnik hrvatskog prirodoslovnog društva*. 29: 132-135.
- Lelo, S. 2004. *Revizija Rebelovog Popisa Leptira Bosne i Hercegovine. CORON'S d.o.o., Sarajevo. 295 pp.*
- Likov, L. 2018. *Fauna osolikih muva (Diptera: Syrphidae) Grčke. Doctoral dissertation, University of Novi Sad, Novi Sad. 419 pp.*
- Nedeljković, Z. 2011. *Taksonomska analiza vrsta iz podfamilije Syrphinae (Diptera: Syrphidae) u Srbiji. Doctoral dissertation, University of Novi Sad, Novi Sad. 247 pp.*
- Nedeljković, Z., Vujić, A., Šimić, S., Radenković, S. 2009. The fauna of hoverflies (Diptera: Syrphidae) of Vojvodina Province, Serbia. *Archives of the Biological Sciences*. 61 (1): 147-154.
- Popović, M., Vasić, N., Koren, T., Burić, I., Živanović, N., Kulijer, D., Golubović, A. 2020. Biologer: an open platform for collecting biodiversity data. *Biodiversity Data Journal*. 8: e53014.
- Redžić, S., Barudanović, S., Trakić, S., Kulijer, D. 2011. Vascular plant biodiversity richness and endemo relictness of the karst mountains Prenj-Čvrstica-Čabulja in Bosnia and Herzegovina (W. Balkan). *Acta Carsologica*. 40 (3): 527-555.
- Rotheray, G.E., Gilbert, F. 2011. *The natural history of hoverflies. Forest Text, Ceredigion, UK. 334 pp.*

- Schneider, F. 1969. Bionomics and physiology of aphidophagous Syrphidae. *Annual Review of Entomology*. 14 (3): 103-124.
- Speight, M.C.D. 2011. Species accounts of European Syrphidae (Diptera). In: Speight, M.C.D., Castella, E., Sarthou J.P., Monteil, C. (ed) *Syrph the Net, the database of European Syrphidae*. Volume 65. Dublin: Syrph the Net publications. 285 pp.
- Speight, M.C.D. 2020. Species accounts of European Syrphidae, 2020. *Syrph the Net, the database of European Syrphidae (Diptera)*, vol. 104. Syrph the Net publications, Dublin. 314 pp.
- Speight, M.C.D., Sarthou, J.P. 2017. StN keys for the identification of the European species of various genera of Syrphidae 2017. *Syrph the Net, the database of European Syrphidae (Diptera)*, vol. 99. Syrph the Net publications, Dublin. 139 pp.
- Speight, M.C.D., Monteil, C., Castella, E., Sarthou, J.P. 2010. Stn_2010. In: Speight, M.C.D., Castella, E., Sarthou, J.P., Monteil, C. (ed) *Syrph the Net on Cd, issue 7. The database of European Syrphidae*. iSSn 1649-1917. Syrph the Net Publications, Dublin.
- Strobl, G. 1898. Fauna diptera Bosne, Hercegovine i Dalmacije. *Gl. Zem. Muz. Bosne i Hercegovine, Sarajevo*. 10: 387-466.
- Strobl, G. 1900. Dipterenfauna von Bosnien, Hercegovina und Dalmatien. *Wiss. Mitt. Bos. Herz*. 7: 552-670.
- Strobl, G. 1902. Novi prilozii fauni dipteral Balkanskog poluostrva. *Gl. Zem. Muz. Bosne i Hercegovine, Sarajevo*. 14: 461-517.
- Šimić, S. 1987. Fauna Durmitora. Syrphidae (Insecta, Diptera). *Crnogorska akademija nauka i umjetnosti Posebna izdanja knjiga 21, Odeljenje prirodnih nauka, knjiga 13*. Titograd. 154 pp.
- Šimić, S., Vujić, A., Radenković, S., Radišić, P. 2008. Hoverflies (Insecta: Diptera: Syrphidae) of the Fruška Gora Mountain. In: Šimić, S. (ed.) *Invertebrates (INVERTEBRATA) of the Fruška Gora Mountain, I*, Matica srpska, Novi Sad. 190 pp.
- Šimić, S., Vujić, A., Radenković, S., Radišić, P., Nedeljković, Z. 2009. Fauna osolikih muva (Diptera: Syrphidae) u ritovima Vojvodine. *Matica srpska, Novi Sad*. 226 pp.
- Tot, T., Vujić, M., Likov, L., Nedeljković, Z., Radenković, S., Vujić, A. 2018. Hoverfly fauna (Diptera: Syrphidae) of the Landscape of Outstanding Features "Vlasina". *Acta entomologica serbica*. 23: 33-50.
- Tóth, S. 2011. Magyarország zengőlégy faunája (Diptera: Syrphidae). *e-Acta Naturalia Pannonica, Supplementum*. 1: 5-408.
- Van Steenis, W., De Groot, M., Van Steenis, J. 2013. New data on the hoverflies (Diptera: Syrphidae) of Slovenia. *Acta entomologica slovenica* 21 (2): 131-162.
- Van Veen, M. 2004. Hoverflies of Northwest Europe: identification keys to the Syrphidae. KNNV Publishing, Utrecht. 256 pp.
- Vujić, M., Tot, I. 2020. *Brachyopa bimaculosa* Doczkal and Dziocck 2004 and *Callicera fagesii* Guérin-Méneville, 1844, two new hoverflies (Diptera: Syrphidae) in the fauna of Serbia. *Acta Entomologica Slovenica*. 28 (1): 75-79.
- Vujić, M. 2021. Alciphron - baza podataka o insektima Srbije (Diptera: Syrphidae), HabiProt <https://alciphron.habiprot.org.rs> [accessed: 24/09/2021].
- Vujić, M., Đurić, M., Tot, I. 2021. Six new hoverfly species (Diptera: Syrphidae) in the fauna of Serbia. *Kragujevac Journal of Science*. 43 (1): 149-155.
- Vujić, A., Radenković, S., Nedeljković, Z., Šimić, S. 2018. A new checklist of hoverflies (Diptera: Syrphidae) of the Republic of Serbia. *Matica Srpska Journal for Natural Sciences* 135: 7-51.
- Vujić, A., Šimić, S. 1994. Syrphidae (Insecta: Diptera) Vršackih planina. *Matica srpska, Odeljenje za prirodne nauke, Prosveta, Novi Sad*. 163 pp.
- Vujić, A., Šimić, S., Radišić, P. 1998. Fauna of hoverflies (Diptera: Syrphidae) of the Yugoslavian part of Banat. III International Symposium Interdisciplinary Regional Research (Hungary, Romania, Yugoslavia). 491-495 pp.
- Young, A.D., Lemmon, A.R., Skevington, J.H., Mengual, X., Ståhls, G., Reemer, M., Jordaens, K., Kelso, S., Lemmon, E.M., Hauser, M., De Meyer, M., Misof, B., Wiegmann, B.M. 2016. Anchored enrichment dataset for true flies (order Diptera) reveals insights into the phylogeny of flower flies (family Syrphidae). *BMC Evolutionary Biology*. 16: 143.