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FIRST SURVEY OF THE DRAGONFLY FAUNA (INSECTA, ODONATA) OF NORTHWESTERN BOSNIA

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Kulijer, D.: First survey of the dragonfly fauna (Insecta, Odonata) of northwestern Bosnia. Vol. 26, No. 1., 65–80, 2017, Zagreb.

The results of the first study of the dragonfly fauna in northwest Bosnia are presented. Field surveys were conducted in summer 2012 and 2013, resulting in the identification of 36 species. Out of these, 34 are new for the region. The present paper gives a detailed overview of the results and a comparison of the dragonfly fauna composition of the region studied with the neighboring areas within Bosnia and Herzegovina and Croatia is made. The most abundant species were: *Calopteryx virgo* (Linnaeus, 1758), *Sympetrum sanguineum* (Müller, 1764), *Onychogomphus forcipatus* (Linnaeus,1758), *Somatochlora meridionalis* Nielsen, 1935, *Calopteryx splendens* (Harris, 1782) and *Platycnemis pennipes* (Pallas, 1771). Noteworthy are the records of *Chalcolestes viridis* (Vander Linden, 1825) and *Coenagrion scitulum* (Rambur, 1842), two species that are rare in Bosnia and Herzegovina, and also *Coenagrion ornatum* (Selys, 1850) and *Cordulegaster heros* Theischinger, 1979, species of European conservation concern. Distribution and the status of these species and the conservation of dragonfly species in the country are briefly discussed. The data collected represent an important contribution to the knowledge of the dragonfly fauna of the Una River basin and Bosnia and Herzegovina.

Key words: Bosnia and Herzegovina, distribution, insects, *Coenagrion ornatum*, *Cordulegaster heros*, Odonata, Una River.

Kulijer, D.: Prvi pregled faune vretenaca (Insecta, Odonata) sjeverozapadne Bosne. Vol. 26, No. 1., 65–80, 2017, Zagreb.

U ovom radu predstavljeni su rezultati istraživanja faune vretenaca sjeverozapadne Bosne. Terenskim istraživanjem koje je provedeno tijekom ljeta 2012. i 2013. godine zabilježeno je ukupno 36 vrsta vretenaca, među kojima su 34 vrste nove za ovo područje. U radu je prikazana detaljna analiza rezultata te usporedba sa sastavom faune vretenaca susjednih područja BiH i Hrvatske. Najzastupljenije zabilježene vrste su bile *Calopteryx virgo* (Linnaeus, 1758), *Sympetrum sanguineum* (Müller, 1764), *Onychogomphus forcipatus* (Linnaeus,1758), *Somatochlora meridionalis* Nielsen, 1935, *Calopteryx splendens* (Harris, 1782) i *Platycnemis pennipes* (Pallas, 1771). Među najznačajnije nalaze spadaju pronalasci vrsta *Chalcolestes viridis* (Vander Linden, 1825) i *Coenagrion scitulum* (Rambur, 1842), rijetkih vrsta u BiH, kao i vrsta od europskog konzervacijskog značaja, *Coenagrion ornatum* (Selys, 1850) i *Cordulegaster heros* Theischinger, 1979. Raspravljena su staništa i rasprostranjenost ovih vrsta u regiji i u BiH, te zaštita vretenaca u BiH.

Ključne riječi: Bosna i Hercegovina, *Coenagrion ornatum*, *Cordulegaster heros*, rasprostranjenost, kukci, Odonata, rijeka Una.

INTRODUCTION

Until recently, the Odonata fauna of Bosnia and Herzegovina (B&H) received little attention and is poorly known (e.g. Kulijer *et al*., 2013, 2016). Only in the last decade were more comprehensive investigations undertaken, resulting in several papers with many new data and new species records for the country (e.g. Bedjanič, 2011; Jović *et al*.,

2010; Kulijer, 2012, 2014, 2015; Kulijer *et al*., 2012, 2013, 2016; Kulijer & Topić, 2013; Kulijer & Miljević, 2015). So far, 64 Odonata species have been recorded in Bosnia and Herzegovina (Kulijer *et al*., 2013; Kulijer & Miljević, 2015), and the most comprehensive knowledge of Odonata fauna in Bosnia and Herzegovina has been provided by Kulijer *et al*. (2013).

Although our knowledge of the dragonfly fauna of the country significantly improved in recent years, the occurrence of many species in several regions still remained largely unknown. The northwestern part of Bosnia is one of the least studied parts of the country for dragonflies. Odonatological surveys in this area have never been conducted and only some records of only two species from this region are known (Kerovec, 2005a, 2005b). The largest part of this region belongs to the Una River basin, the catchment shared between Bosnia and Herzegovina and Croatia. The dragonfly fauna of this area is insufficiently known not only in Bosnia and Herzegovina, but also in Croatia (Franković & Vilenica, 2009).

The aim of this study was to investigate dragonfly fauna of this region of Bosnia and Herzegovina for the first time and to determine species composition, their distribution and habitats, with a special focus on threatened species.

MATERIALS AND METHODS

Study area

The study area is the northwestern part of Bosnia and Herzegovina, located between 15° 43′ and 16° 32′ east, and 44° 09′ and 45° 13′ north. It encompasses the largest part of the Una River catchment, together with small parts of the Korana and Glina catchments that are situated within the borders of Bosnia and Herzegovina. The Una River is the main watercourse of the region. The Bosnian part of the upper Una River basin is situated in the mountainous region where the river flows through gorges and is often torrential (Bognar, 2005; International Sava River Basin Commission, 2009). In its lower reaches, particularly from the mouth of the Sana River, it changes into a mild and slow flowing river until its confluence with the Sava River (Matoničkin & Pavletić, 1963). Apart from the Una River, major landscape features of the study area are Grmeč, Klekovača, Osječenica and Plješevica mountains. The southeastern part of the study region encompasses several karst poljes, including: Lušci polje, Petrovačko polje and Grahovsko polje. The lowest elevation in the study area is at the confluence of the Sana and Una rivers (117 m a.s.l.), while the highest point is at the top of the Klekovača mountain (1.961 m a.s.l.). The Una River valley, like other right tributaries' catchments within Croatia and Bosnia and Herzegovina, has a moderate continental climate. In the rivers' downstream sections there is also some influence of the Pannonian climate (International Sava River Basin Commission, 2009).

The Korana and Glina catchments (subcatchments of the Kupa River) are mainly situated in Croatia, with only a small part (742 km^2) covering the northwestern corner of B&H. This hilly region is also characterized by the presence of numerous small streams and rivers and the absence of larger stagnant water bodies (Anonymous, 2012). While the Una, Korana and Glina rivers all belong to the Black Sea Basin, the southernmost localities in the Bosansko Grahovo area (L. 72 – 75) belong to the Cetina River catchment of the Adriatic Sea Basin (Anonymous, 2012).

By its administrative organization, most of the area belongs to the Federation of Bosnia and Herzegovina (Unsko-Sanski Canton). The southernmost localities (L. 65 – 75)

Tab. 1. List of localities with date of the survey, geographical coordinates In WGS84 and altitudes (m a.s.l.)

No.	Locality name	Date	N latitude	E longitude	Altitude
1.	Kladušnica River, Velika Kladuša	2005.11.02.	45° 10′ 59″	15° 49′ 13″	140
2.	Glinica River, Radiča Most, Vrnograč	2013.07.27.	45° 10′ 04″	15° 58′ 47″	153
3.	Stabandža Stream, Zborište 1	2013.07.27.	45° 08′ 28″	16° 01′ 45″	185
4.	Stabandža Stream, Zborište 2	2013.07.27.	45° 08′ 23″	16° 01′ 11″	183
5.	Kladušnica River, Mala Kladuša	2012.08.19.	45° 06′ 57″	15° 51′ 57″	168
6.	Čaglica Stream, Pašin Brod	2013.07.27.	45° 06′ 43″	15° 59′ 25″	186
7.	Barjaktarevići, Polje, lake near old manganise mine	2013.07.27.	45° 06′ 26″	16° 02′ 00″	236
8.	Bužimica Stream, Varoška Rijeka	2013.07.27.	45° 06′ 24″	15° 59′ 58″	184
9.	Pećina Stream, Donja Lučka	2012.08.19.	45° 04′ 06″	15° 53′ 24″	194
10.	Čava Stream, Dobro selo	2013.07.27.	45° 02′ 12″	16° 05′ 12″	228
11.	Una River, upstream from Bosanski Novi	2011.07.12.	45° 01′ 58″	16° 21′ 32″	120
12.	Baštra Stream	2013.07.27.	45° 01′ 39″	16° 04′ 13″	239
13.	Babinac Stream	2013.07.27.	45° 00′ 57″	16° 07′ 06″	197
14.	Mutnica River, Tržac	2005.11.02.	44° 59′ 42″	15° 47′ 16″	257
15.	Vodomut Stream	2013.07.27.	44° 59′ 24″	16° 09′ 20″	169
16.	Donja Koprivna, stream and small lake	2013.07.27.	44° 59′ 02″	15° 57′ 52″	399
17.	Small stream at Kapići, Cazin	2012.08.19.	44° 58′ 55″	15° 52′ 13″	270
18.	Una River, Bosanska Otoka	(a) 2005.07.26., (b) 2005.11.02.	44° 57′ 35″	16° 10′ 55″	140
19.	Ravska Stream, Donji Agići	2011.08.06.	44° 57′ 15′′	16° 28′ 11′′	145
20.	Gnjilovac Stream	2013.07.27.	44° 57′ 12″	15° 57′ 23″	376
21.	Valovita Stream, Donji Agići	2011.08.06.	44° 56′ 56′′	16° 28′ 33′′	156
22.	Ovanjska River, Marini	2013.07.28.	44° 54′ 17″	16° 28′ 21″	198
23.	Una River, Ostrožac na Uni	2012.08.19.	44° 54′ 15″	15° 56′ 57″	191
24.	Johovica Stream	2013.07.28.	44° 53′ 59″	16° 21′ 37″	208
25.	Canyon of the Una River	2013.07.27.	44° 53′ 57″	16° 02′ 20″	187
26.	Ostrožac, Cazin	2012.05.24.	44° 53′ 52″	15° 56′ 09″	190
27.	Japra River, Gradine	2013.07.28.	44° 53′ 39″	16° 25′ 47″	185
28.	Ovanjska River, Marini 2	2013.07.28.	44° 53′ 35″	16° 29′ 09″	219
29.	Mliništa Stream, Johovica	2013.07.28.	44° 53′ 33″	16° 22′ 14″	221
30.	Stream at Latinovića Dolina	2013.07.28.	44° 53′ 28″	16° 17′ 31″	196
31.	Spring and stream at Zelenac	2013.07.28.	44° 53′ 25″	16° 17′ 44″	194
32.	Bosanska Krupa, city	2013.07.28.	44° 53′ 01″	16° 09′ 15″	155
33.	Una River at Kostela, Bihać	2005.11.03.	44° 52′ 56″	15° 54′ 00″	215
34.	Stream near Mrkalji	2013.07.28.	44° 52′ 53″	16° 23′ 45″	209
35.	Dobrovac Stream	2013.07.27.	44° 52′ 27″	16° 10′ 27″	174
36.	Stream at Izačić Kula	2013.07.26.	44° 52′ 23″	15° 46′ 41″	280
37.	Canyon of the Una River, near Bosanska Krupa	2012.08.20.	44° 52′ 00″	16° 05′ 42″	242

38.	Small stream at Papari	2013.07.26.	44° 51′ 15″	15° 47′ 52″	231
39.	Pond at Kamenica, Bihać	2012.08.20.	44° 50′ 10″	15° 49′ 55″	215
40.	Mrežnica Stream, Klokot	2013.07.26.	44° 49′ 44″	15° 49′ 25″	215
41.	Hatiraj Stream, Čirkići	2013.07.28.	44° 49′ 32″	16° 30′ 50″	354
42.	Klokot spring and River	2013.07.26.	44° 49′ 24″	15° 48′ 18″	220
43.	Bihać, city	2013.07.26.	44° 48′ 51″	15° 52′ 34″	224
44.	Ponds at Vedro Polje	2012.08.19.	44° 48′ 39″	15° 50′ 19″	220
45.	Lisa rivulet, Vedro Polje	2012.08.19.	44° 48′ 23″	15° 49′ 24″	213
46.	Dry stream at Rastići polje	2013.07.26.	44° 48′ 00″	15° 50′ 34″	240
47.	Suvajčina Stream, Gornje Suvaje	2013.07.28.	44° 46′ 55″	16° 09′ 27″	416
48.	Banovac Spring, Naprelje	2013.07.28.	44° 46′ 49″	16° 30′ 00″	374
49.	Suvajčina Stream, Gornje Suvaje 2	2013.07.28.	44° 46′ 30″	16° 09′ 21″	444
50.	Una River, Ripač	2012.08.19.	44° 46′ 20″	15° 56′ 51″	228
51.	Zavaljska Draga Stream, Zavalje	2013.07.26.	44° 46′ 19″	15° 50′ 06″	438
52.	Dobrenica Stream, Dobrenica	2013.07.29.	44° 45′ 58″	15° 53′ 39″	273
53.	Skočajska Draga Stream near Crno vrelo	2013.07.26.	44° 45′ 35″	15° 50′ 35″	452
54.	Stream at Kuline, Lušci polje	2013.07.28.	44° 45′ 24″	16° 26′ 30″	397
55.	Ponds and stream between Lušci Palanka and Šiprage	2012.06.26.	44° 44′ 21″	16° 27′ 03″	383
56.	Praštali, by the road, Lušci polje	2012.06.26.	44° 43′ 00″	16° 26′ 41″	382
57.	Oko Spring, Lušci polje	(a) 2012.06.26., (b) 2014.08.04., (c) 2014.08.05.	44° 42′ 09″	16° 27′ 46″	387
58.	Ristinovac Spring, Lipa	2013.07.29.	44° 41′ 40″	16° 04′ 33″	720
59.	Madžarac Stream and nearby ponds, Bjelaj, Bjelajsko polje	(a) 2012.06.27., (b) 2012.08.19.	44° 34′ 55″	16° 11′ 29″	655
60.	Pećina Pond, Donji Rašinovac, Bosanski Petrovac	2012.06.27.	44° 33′ 44″	16° 21′ 01″	658
61.	Small canal and stream at Revenik, Petrovačko polje	2012.06.27.	44° 32′ 32″	16° 20′ 28″	632
62.	Stream at Bukovača, Petrovačko polje	2012.06.27.	44° 30′ 38″	16° 25′ 48″	700
63.	Una River at Martinbrod	(a) 2009.08.11., (b) 2010.09.05.	44° 28′ 53″	16° 08′ 34″	333
64.	Near the road to Martinbrod	2010.09.05.	44° 27′ 11′′	16° 15′ 56′′	652
65.	Bastasi Fishpond	2010.09.05.	44° 24′ 10″	16° 18′ 53″	450
66.	Bastašica Spring	2010.09.05.	44° 23′ 39″	16° 19′ 36″	460
67.	Unac River, Drvar	2005.11.03.	44° 22′ 52″	16° 23′ 00″	466
68.	Unac River, near cave, Drvar	2010.09.05.	44° 22′ 48″	16° 23′ 14″	471
69.	By the road between Petrovac and Drvar	2013.07.25.	44° 20′ 56″	16° 21′ 37″	692
70.	Ljeskovica Stream, Mrđe	2013.07.25.	44° 19′ 04″	16° 29′ 54″	560
71.	Joševac Stream, Jovandići	2013.07.25.	44° 13′ 30″	16° 19′ 57″	814
72.	Pečenačko Lake	2013.07.25.	44° 11′ 15″	16° 21′ 03″	822
73.	Korana River, Veliki Obalj	2013.07.25.	44° 10′ 36″	16° 23′ 05″	798
74.	Pond near Veliki Obalj	2013.07.25.	44° 10′ 28″	16° 24′ 39″	797
75.	Korana River at Pašića polje	2013.07.25.	44° 09′ 45″	16° 23′ 03″	793

in the area of Drvar and Bosansko Grahovo belong to Canton 10 (Livno Canton), while several localities (11, 19, 21, 22, 24, 27-31, 34) situated south of Bosanski Novi are in the territory of Republika Srpska (Anonymous, 2012).

Data collection

The Odonata fauna of the northwestern part of Bosnia was investigated during two short trips in 2012 (26 – 27 June and 19 – 20 August) and one longer trip in 2013 (25 – 29 July). In addition, all known publications, the collections of the National Museum of Bosnia and Herzegovina as well as the dragonfly database of Bosnia and Herzegovina, were checked for records referring to the study region. During this study, mainly adults were investigated. Adults were mainly visually observed or caught with a hand net and identified in the field. Several voucher specimens were collected and deposited in the entomological collections of the National Museum of Bosnia and Herzegovina. Larvae and exuviae were searched for only sporadically. They were collected and identified in the laboratory.

Records were gathered from 75 localities distributed between 120 m a.s.l. and 822 m a.s.l. (Tab. 1., Fig. 1.).

RESULTS

Altogether, 275 odonate records of 36 species from 75 different localities were collected (Tab. 2). Both hitherto known species for the region were found during this study.

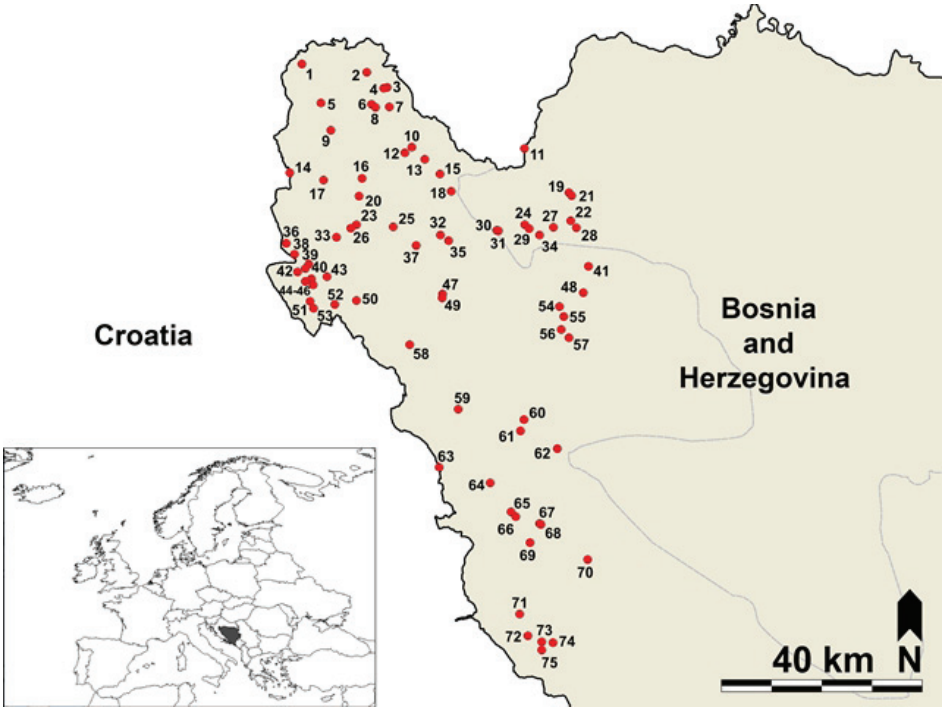


Fig. 1. Geographical position of the study area with the locations of dragonfly records. The numeration of each locality is presented in Tab. 1.

Tab. 2. List of species recorded in northwestern Bosnia with reference to the specific locality (* = marks two species previously known from the region).

No.	Species name	Locality
CALOPTERYGIDAE		
1.	*Calopteryx splendens* (Harris, 1782)	2, 5, 6, 7, 8, 11, 15, 23, 35, 40, 42, 52, 57(b)(c), 61, 63(a), 73
2.	*Calopteryx virgo* (Linnaeus, 1758) *	4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 38, 40, 41, 42, 46, 48, 51, 52, 53, 54, 55, 57(a), 61, 62, 43, 70, 71, 73
LESTIDAE		
3.	*Lestes dryas* Kirby, 1890	74, 75
4.	*Lestes barbarus* (Fabricius, 1798)	44, 65, 72, 74, 75
5.	*Lestes virens* (Charpentier, 1825)	17, 46, 72, 75
6.	*Chalcolestes viridis* (Vander Linden, 1825)	44
7.	*Chalcolestes parvidens* (Artobolevskii, 1929)	16
COENAGRIONIDAE		
8.	*Ischnura elegans* (Vander Linden, 1820)	7, 16, 17, 39, 40, 45, 59(a)(b), 60, 65, 73
9.	*Ischnura pumilio* (Charpentier, 1825)	39, 46, 59(a)(b), 60, 61
10.	*Enallagma cyathigerum* (Charpentier, 1840)	7, 16, 59(a), 60, 72
11.	*Coenagrion puella* (Linnaeus, 1758)	7, 16, 48, 50, 58, 59(a), 60, 72, 73, 75
12.	*Coenagrion ornatum* (Selys, 1850)	59(a), 61
13.	*Coenagrion scitulum* (Rambur, 1842)	59(b), 60, 61, 75
14.	*Erythromma lindenii* (Selys, 1840)	2, 7, 16, 39, 40, 75
15.	*Pyrrhosoma nymphula* (Sulzer, 1776)	73
PLATYCNEMIDIDAE		
16.	*Platycnemis pennipes* (Pallas, 1771)	2, 5, 6, 7, 8, 11, 16, 17, 23, 37, 40, 42, 48, 60, 61, 73
AESHNIDAE		
17.	*Aeshna mixta* Latreille, 1805	25, 41, 42, 47, 49, 52, 53, 58, 63(b), 64, 65, 66, 68
18.	*Aeshna affinis* Vander Linden, 1820	44, 46, 69, 72, 74, 75
19.	*Aeshna cyanea* (Müller, 1764)	16, 58
20.	*Anax imperator* Leach, 1815	6, 7, 16, 42, 60
GOMPHIDAE		
21.	*Gomphus vulgatissimus* (Linnaeus, 1758)	6
22.	*Onychogomphus forcipatus* (Linnaeus, 1758) *	1, 2, 6, 10, 15, 16, 18(a)(b), 19, 27, 28, 29, 30, 35, 37, 40, 56, 57(b), 67
CORDULEGASTERIDAE		
23.	*Cordulegaster heros* Theischinger, 1979	3, 4, 13, 15, 21, 35, 51, 53
24.	*Cordulegaster bidentata* Selys, 1843	26, 53
CORDULIIDAE		
25.	*Somatochlora meridionalis* Nielsen, 1935	3, 4, 5, 6, 7, 16, 17, 21, 28, 31, 35, 40, 41, 42, 46, 47, 52, 53
26.	*Somatochlora flavomaculata* (Vander Linden, 1825)	5, 17, 45, 73
LIBELLULIDAE		
27.	*Libellula depressa* Linnaeus, 1758	7, 16, 22, 40, 42, 46, 59(a)(b), 60, 61, 74

28.	*Libellula fulva* (Müller, 1764)	60
29.	*Orthetrum cancellatum* (Linnaeus, 1758)	65, 75
30.	*Orthetrum albistylum* (Selys, 1848)	7, 39
31.	*Orthetrum coerulescens* (Fabricius, 1798)	7, 12, 17, 22, 28, 31, 34, 45, 59(a)(b)
32.	*Orthetrum brunneum* (Fonscolombe, 1837)	7, 39, 40, 46, 52, 59(a)(b), 61
33.	*Sympetrum sanguineum* (Müller, 1764)	2, 5, 7, 8, 17, 31, 39, 40, 42, 44, 45, 46, 48, 52, 65, 72, 73, 74, 75
34.	*Sympetrum flaveolum* (Linnaeus, 1758)	73, 75
35.	*Sympetrum striolatum* (Charpentier, 1840)	16, 59(b), 75
36.	*Crocothemis erythraea* (Brullé, 1832)	7

Most important was the discovery of two species mentioned in Annex II of the Habitats Directive, *Coenagrion ornatum* (Selys, 1850) and *Cordulegaster heros* Theischinger, 1979, together with records of two species rare in B&H, *Chalcolestes viridis* (Vander Linden, 1825) and *Coenagrion scitulum* (Rambur, 1842) (Kulijer *et al*., 2013, 2016).

The majority of the observed species are widespread in the country (Kulijer *et al*., 2013). The most recorded were: *Calopteryx virgo* (Linnaeus, 1758) (48 localities), *Sympetrum sanguineum* (Müller, 1764) (20), *Onychogomphus forcipatus* (Linnaeus, 1758) (19), *Somatochlora meridionalis* Nielsen, 1935 (18), *Calopteryx splendens* (Harris, 1782) (17), *Platycnemis pennipes* (Pallas, 1771) (16). The dragonfly-richest sites were L. 7 – lake near mine at Bajraktarevići (15 species) and L. 16 – stream and small lake at Donja Koprivna (13 species). Both sites are characterized by a combination of flowing and stagnant water with rich and diverse vegetation.

Systematic account

Abbreviations used: M – male(s), F – female(s), MA – mature adult(s), Juv/Ten – juvenile(s)/teneral(s), Lar – larva(e), Ex – exuvium(ae), Cop – copula(e)/tandem(s), Ovip – ovipositing.

CALOPTERYGIDAE

Calopteryx splendens (Harris, 1782)

Loc. 2: >10MA; Loc. 5: 3M, 1F; Loc. 6: >10MA; Loc. 7: 2M; Loc. 8: 100MA; Loc. 11: 3M; Loc. 15: >10MA; Loc. 23: 3M, 1F; Loc. 35: 1M, 1F; Loc. 40: 15MA; Loc. 42: 30MA; Loc. 52: <10MA; Loc. 57(b): 1F, (c): 1F; Loc. 61: 15M, 5F; Loc. 63(a): 1M; Loc. 73: 30MA

Calopteryx virgo (Linnaeus, 1758)

Loc. 4: >100MA; Loc. 5: 2F; Loc. 6: <10MA; Loc. 7: 2M, 2F; Loc. 9: 2M, 4F; Loc. 10: >10MA; Loc. 11: 1M; Loc. 12: 1M, 1F; Loc. 13: >10MA; Loc. 14: 7MA; Loc. 15: >100MA; Loc. 16: 3M, 3F; Loc. 17: 3M, 2F; Loc. 19: 2M, 2F; Loc. 20: 30MA; Loc. 21: 50MA; Loc. 22: 2M, 2F; Loc. 23: 3M, 1Ovip; Loc. 24: >10MA; Loc. 27: >10MA; Loc. 28: >10MA; Loc. 29: >10MA; Loc. 30: >10MA; Loc. 31: >10MA; Loc. 32: 1M; Loc. 33: 1MA; Loc. 34: 1M; Loc. 35: >10MA; Loc. 36: 10M, 4F; Loc. 38: 7M, 2F; Loc. 40: 20MA; Loc. 41: >10MA; Loc. 42: 30MA; Loc. 43: 1F; Loc. 46: 8M, 3F; Loc. 48: >10MA; Loc. 51: 10M, 5F; Loc. 52: <10MA; Loc. 53: <10MA; Loc. 54: 3M; Loc. 55: >10MA; Loc. 57(a): 1F; Loc. 61: 2F; Loc. 62: 20M, 4F; Loc. 70: 10M; Loc. 71: 1M; Loc. 73: 20MA

LESTIDAE

***Lestes dryas* Kirby, 1890**

Loc. 74: >10MA; Loc. 75: 15MA

***Lestes barbarus* (Fabricius, 1798)**

Loc. 44: 1F; Loc. 65: 1F; Loc. 72: 1MA; Loc. 74: >10MA, >10Cop; Loc. 75: 2MA

***Lestes virens* (Charpentier, 1825)**

Loc. 17: 1F; Loc. 46: 1M; Loc. 72: 1MA; Loc. 75: 5MA

***Chalcolestes viridis* (Vander Linden, 1825)**

Loc. 44: 2M, 1Cop

***Chalcolestes parvidens* (Artobolevskii, 1929)**

Loc. 16: 3 Juv/Ten

COENAGRIONIDAE

***Ischnura elegans* (Vander Linden, 1820)**

Loc. 7: <10MA; Loc. 16: <10MA; Loc. 17: 1M; Loc. 39: >10MA, 1Cop; Loc. 40: 2MA; Loc. 45: 1M; Loc. 59(a): 1M, (b): 2M; Loc. 60: >10MA, 1Cop; Loc. 65: 6M, 1F, 2Cop; Loc. 73: 2M

***Ischnura pumilio* (Charpentier, 1825)**

Loc. 39: 5MA; Loc. 46: 1Cop; Loc. 59(a): 15M, 2Cop, (b): >10MA,<10Cop; Loc. 60: <10MA; Loc. 61: 10M, 1F, 1Cop

***Enallagma cyathigerum* (Charpentier, 1840)**

Loc. 7: <10MA; Loc. 16: >10MA, <10Cop; Loc. 59(a): 1Cop; Loc. 60: >10MA; Loc. 72: 5M, 2Cop

***Coenagrion puella* (Linnaeus, 1758)**

Loc. 7: <10M; Loc. 16: >10MA; Loc. 48: 2M; Loc. 50: 10M, 1F; Loc. 58: >10M; Loc. 59(a): >10MA, <10Cop; Loc. 60: >10MA, <10Cop, <10Ovip; Loc. 72: 2M; Loc. 73: >10MA, <10Cop, <10Ovip; Loc. 75: 10M, 2Cop

***Coenagrion ornatum* (Selys, 1850)**

Loc. 59(a): 30M, 3F, 3Cop; Loc. 61: 3M

***Coenagrion scitulum* (Rambur, 1842)**

Loc. 59(b): 1M; Loc. 60: 2M, 2Cop; Loc. 61: 1F; Loc. 75: 1M, 2Cop

***Erythromma lindenii* (Selys, 1840)**

Loc. 2: >10MA; Loc. 7: >100MA, >10Cop, <10Ovip; Loc. 16: >100MA, >10Cop, >10Ovip; Loc. 39: 1M; Loc. 40: 20M; Loc. 75: 50M, 2Cop

***Pyrrhosoma nymphula* (Sulzer, 1776)**

Loc. 73: 1M

PLATYCNEMIDIDAE

***Platycnemis pennipes* (Pallas, 1771)**

Loc. 2: >10MA, <10Cop; Loc. 5: >100MA, >10Juv/Ten; Loc. 6: >10MA, <10Cop; Loc. 7: >10MA, <10Cop, <10Ovip; Loc. 8: >10MA; Loc. 11: 2M, 2F; Loc. 16: >10MA, <10Cop; Loc. 17: 3M; Loc. 23: 1M; Loc. 37: 1M, 2F; Loc. 40: >10MA,>10Cop; Loc. 42: 20MA,1Cop; Loc. 48: <10MA, <10Cop; Loc. 60: 1Cop; Loc. 61: 1M, 1F; Loc. 73: >10MA, <10Cop, <10Ovip, <10Juv/Ten

AESHNIDAE

***Aeshna mixta* Latreille, 1805**

Loc. 25: <10MA; Loc. 41: 1MA; Loc. 42: 1M; Loc. 47: <10MA; Loc. 49: 1MA; Loc. 52: 2MA; Loc. 53: 1MA; Loc. 58: 1MA; Loc. 63(b): 4M; Loc. 64: 3M, 2F; Loc. 65: 2M; Loc. 66: 2M, 1F; Loc. 68: 1F

***Aeshna affinis* Vander Linden, 1820**

Loc. 44: 3M; Loc. 46: 1M; Loc. 69: <10MA; Loc. 72: 1M; Loc. 74: 1M; Loc. 75: 5M, 1Cop

***Aeshna cyanea* (Müller, 1764)**

Loc. 16: 1M; Loc. 58: 1F

***Anax imperator* Leach, 1815**

Loc. 6: 2M; Loc. 7: 3M; Loc. 16: 4M, 2F, 2Ovip; Loc. 42: 1M; Loc. 60: 2M, 2F, 1Ovip

GOMPHIDAE

***Gomphus vulgatissimus* (Linnaeus, 1758)**

Loc. 6: 2M

***Onychogomphus forcipatus* (Linnaeus, 1758)**

Loc. 1: 7Lar; Loc. 2: >10MA; Loc. 6: 2M; Loc. 10: 1M; Loc. 15: 3M; Loc. 16: 4M; Loc. 18(a): 2Lar, (b): 2Lar; Loc. 19: 2M; Loc. 27: 5M; Loc. 28: 1M; Loc. 29: 1M; Loc. 30: 2M; Loc. 35: 1M; Loc. 37: 1F; Loc. 40: 1F; Loc. 56: 1M; Loc. 57(b): 1M; Loc. 67: 1Lar

CORDULEGASTERIDAE

***Cordulegaster heros* Theischinger, 1979**

Loc. 3: 1M; Loc. 4: 1M; Loc. 13: 3M; Loc. 15: 3M; Loc. 21: 1M; Loc. 35: 1M; Loc. 51: 3M; Loc. 53: 15M

***Cordulegaster bidentata* Selys, 1843**

Loc. 26: 1M; Loc. 53: 10M

CORDULIIDAE

***Somatochlora meridionalis* Nielsen, 1935**

Loc. 3: 1MA; Loc. 4: 1MA; Loc. 5: 1M; Loc. 6: 1MA; Loc. 7: 1M; Loc. 16: 100MA; Loc. 17: 1MA; Loc. 21: 4M; Loc. 28: 1M; Loc. 31: >10MA; Loc. 35: 1MA; Loc. 40: 2M; Loc. 41: 1M; Loc. 42: 1MA; Loc. 46: 2M; Loc. 47: 1M; Loc. 52: <10MA; Loc. 53: 1MA

***Somatochlora flavomaculata* (Vander Linden, 1825)**

Loc. 5: 1M; Loc. 17: 1M; Loc. 45: 1M; Loc. 73: 1M

LIBELLULIDAE

***Libellula depressa* Linnaeus, 1758**

Loc. 7: 1M; Loc. 16: 3M, 1F; Loc. 22: 1M; Loc. 40: 1F; Loc. 42: 1F; Loc. 46: 1M; Loc. 59(a): 6M, (b): 1F; Loc. 60: 6M, 1Cop; Loc. 61: 3M; Loc. 74: 2M

***Libellula fulva* (Müller, 1764)**

Loc. 60: 2M

***Orthetrum cancellatum* (Linnaeus, 1758)**

Loc. 65: 1M; Loc. 75: 2M

***Orthetrum albistylum* (Selys, 1848)**

Loc. 7: >10MA, 1Ovip; Loc. 39: 1M

***Orthetrum coerulescens* (Fabricius, 1798)**

Loc. 7: 5M; Loc. 12: 1M; Loc. 17: 1M, 1F; Loc. 22: 2M, 1F; Loc. 28: 1M, 1F; Loc. 31: 30M, 2F, 1MA; Loc. 34: 1M; Loc. 45: 2M; Loc. 59(a): 3M, 1Juv, (b): 40MA, 10Cop, 5Ovip

***Orthetrum brunneum* (Fonscolombe, 1837)**

Loc. 7: 10M, 1F; Loc. 39: 2M; Loc. 40: 20M, 2F, 1Cop, 2Ovip; Loc. 46: 7M; Loc. 52: 3M; Loc. 59(a): 15M, 2Cop, (b): 3M, 1Ovip; Loc. 61: 1M

***Sympetrum sanguineum* (Müller, 1764)**

Loc. 2: 2M; Loc. 5: 1F; Loc. 7: 5M, 1F, 2Cop; Loc. 8: 1M; Loc. 17: 2M, 1F; Loc. 31: 1M; Loc. 39: 1M; Loc. 40: 15M, 1F; Loc. 42: 1M; Loc. 44: 6M; Loc. 45: 2M; Loc. 46: 3M; Loc. 48: 1M; Loc. 52: 1F; Loc. 65: 3M; Loc. 72: 3M, 1F; Loc. 73: 5M, 1Ovip; Loc. 74: 2M; Loc. 75: 10M, 10Cop, 3Ovip

***Sympetrum flaveolum* (Linnaeus, 1758)**

Loc. 73: 2M; Loc. 75: 1M

***Sympetrum striolatum* (Charpentier, 1840)**

Loc. 16: 2Juv/Ten; Loc. 59(b): 5M, 5Juv/Ten, <10Ex; Loc. 75: 3Juv/Ten

***Crocothemis erythraea* (Brullé, 1832)**

Loc. 7: 2M

DISCUSSION

Regional studies are of major importance in providing missing pieces of the distributional puzzle, and essential for an efficient protection of threatened species. Although this was a time-restricted survey, the number of 36 species recorded during the research is quite high, representing 56 % of all dragonfly species of the country (Kulijer *et al*., 2013; Kulijer & Miljević, 2015).

Among the most widely distributed species in the study area, the majority inhabit lotic waters (e.g. *C. virgo*, *C. splendens*, *P. pennipes*, *O. forcipatus*, *S. meridionalis*) while only

S. sanguineum prefers lentic habitats (Dijkstra & Lewington, 2006). As most of the investigated localities were brooks, streams or small rivers, the high dominance of rheophilic species is not surprising. Two *Calopteryx* spp. can be found in Bosnia and Herzegovina, *C. splendens* and *C. virgo*. Both are typical of running waters, common in the country and often found syntopically. In comparison with *C. splendens*, *C. virgo* prefers smaller, colder and shaded flowing waters (Dijkstra & Lewington, 2006). It was found at almost all the investigated brooks, streams and small rivers in the study area. The eurytopic *P. pennipes* is one of the most widespread dragonfly species in the country (Kulijer *et al*., 2013), and this was reflected in the study area. In accordance with the habitat preferences of *O. forcipatus* (Dijkstra & Lewington, 2006), many of the rocky bottom streams and rivers inspected during the study were found to be suitable habitat type for the species. *Somatochlora meridionalis* inhabits small and shaded streams and brooks (Dijkstra & Lewington, 2006), another abundant habitat type in the region. Although it typically reproduces in stagnant water bodies, *S. sanguineum* can be often seen far from suitable habitats (Dijkstra & Lewington, 2006). In the study area, it was observed at different habitat types including meadows, fields and along roads and rivers. It is the most abundant *Sympetrum* spp. and one of the most frequently observed dragonflies in B&H (Kulijer *et al*., 2013).

During the study, six species were recorded at only one locality, namely *Chalcolestes parvidens* (Artobolevskii, 1929), *C. viridis, Pyrrhosoma nymphula* (Sulzer, 1776), *Gomphus vulgatissimus* (Linnaeus,1758), *Libellula fulva* (Müller, 1764) and *Crocothemis erythraea* (Brullé, 1832). Although *P. nymphula, G. vulgatissimus* and *L. fulva* are common in B&H, they are typical spring species that are quite rare during the late summer, when most of the study was conducted (Dijkstra & Lewington, 2006; Kulijer *et al*., 2012, 2013). Additionally, *L. fulva* inhabits larger freshwater habitats with slow water currents and rich riparian vegetation (Dijkstra & Lewington, 2006). The scarcity of such habitats in the study area combined with the late-summer timing of the study resulted in a low occurrence of this species. *Crocothemis erythraea* is a common species countrywide (Kulijer *et al*., 2013) with a preference for open stagnant water habitats (Dijkstra & Lewington, 2006). It was found only at a small lake near Barjaktarevići (L. 7), the characteristic habitat type for the species, but a rare habitat among the investigated sites. This was probably the main reason why an otherwise common species was observed only once.

The genus *Chalcolestes* Kennedy, 1920 is represented with two species: *C. parvidens* and *C. viridis*, whose range widely overlaps in the Balkans (Olias *et al*., 2007). Both species are present throughout the country with *C. parvidens* being more frequently recorded in the north and south, while *C. viridis* is more common in the mountainous regions of the Dinaric Alps (Kulijer *et al*., 2013, 2016). During the study, each species was recorded at a single locality. The record of *C. viridis* at Vedro polje near Bihać (L. 44) is more interesting as this species is much scarcer in the country than its congener. Several specimens, including one copula, were found in dense *Salix* sp. shrubs at several small, almost dry and muddy ponds. Typical macrophyte vegetation at these ponds was scarce, probably due to their mostly temporary character. The ponds seemed to be artificial and the area is currently abandoned and used as a waste disposal site. It is expected that both species are more common in the region, but further investigations are required in late summer and autumn to confirm this.

In Europe, *C. scitulum* is widespread in its southern part, where it is more common in the south-west than in the south-east. In the Balkans the species is widely present but its populations are scarce (Boudot & Jović, 2015). This is also the case for the whole of

Bosnia and Herzegovina, where data of this species are rare and scattered throughout the country (Kulijer *et al*., 2013, 2016). In Bosnia and Herzegovina *C. scitulum* prefers small, sunny and shallow standing waters, particularly ponds and small ditches in the Mediterranean and Alpine regions (Kulijer, 2012, 2014; Kulijer *et al*., 2013, 2016). In the study region, the species was found at several localities in its southern parts, in Pašića, Petrovačko and Bjelajsko polje (L 59, 60, 61, 75). At Donji Rašinovac (L. 60) it was recorded at a cattle pond, while at other localities the small temporary or permanent pools and ponds were associated with nearby streams or ditches. At the Korana River (L. 75) several individuals, including copulae were found in a concrete tank that apart from algae almost lacked any other vegetation. *Lestes sponsa* (Hansemann, 1823), *Sympecma fusca* (Vander Linden, 1820), *Erythromma najas* (Hansemann, 1823), *Erythromma viridulum* (Charpentier, 1840), *Aeshna isoceles* (Müller, 1767), *Anax parthenope* Selys, 1839, *Brachytron pratense* (Müller, 1764), *Cordulia aenea* (Linnaeus, 1758), *Libellula quadrimaculata* Linnaeus, 1758, *Sympetrum fonscolombii* (Selys, 1840) and *Sympetrum meridionale* (Selys, 1841) are some of the species that are common in neighboring regions of Bosnia and Herzegovina (Kulijer, 2012; Kulijer *et al*., 2013, 2016) and Croatia (Belančić *et al*., 2008; Franković & Vilenica, 2009; Špánić *et al*., 2012; Vilenica & Dijkstra, 2014; Vinko & Vilenica, 2013), but were not found during this study. This could be primarily explained by the fact that these regions are better investigated, as this survey did not cover a full range of seasons and habitats. Among these are several species with an early flight season, such as *E. najas, A. isoceles*, *A. parthenope*, *B. pratense*, *C. aenea* and *L. quadrimaculata*, although *A. isoceles* and *A. parthenope* are also present during summer months. These species were probably missed due to the late period of the investigations, but also due to the scarcity of lentic habitat types.

The main reason why *L. sponsa*, *S. fusca*, *E. viridulum*, *S. fonscolombii* and *S. meridionale* were not recorded is the scarcity of stagnant water habitats at the localities surveyed. Species like *L. sponsa, E. viridulum* and *S. meridionale* are common summer species with a peak in July and August, while *S. fusca* and *S. fonscolombii* are present throughout the year as they have at least two generations in the region (Dijkstra & Lewington, 2006).

One of the largest stagnant water habitats in the region, Bastasi fishpond (L. 65), was investigated only partly in September when most species were not present anymore, so it should be revisited, both in spring and summer.

Further research, especially in the lower parts of the Una catchment that were not included in this study, could also result in new findings of several nationally rare species, i. e. *E. najas, Aeshna grandis* (Linnaeus, 1758), *Gomphus flavipes* (Charpentier, 1825), *Epitheca bimaculata* (Charpentier, 1825), *Leucorrhinia pectoralis* (Charpentier, 1825), *Leucorrhinia caudalis* (Charpentier, 1840) or *Sympetrum vulgatum* (Linnaeus, 1758). Some of them (*E. najas* and *E. bimaculata*) were recorded by Franković & Vilenica (2009) at the lower reaches of the Una River in Croatia. These species are expected in the lowland region of north Bosnia, in habitats that are not present or are very rare in the investigated part of the Una River catchment. Species such as *E. bimaculata*, *G. flavipes, L. pectoralis* and *L. caudalis* are rare in the country. So far, they were recorded only in the northern lowland region along the Sava River and lower reaches of its main tributaries (Kulijer *et al*., 2013; Kulijer & Miljević, 2015). Generally, the conditions for these lowland species seem to be limited in the study area.

In Bosnia and Herzegovina *A. grandis* is a rare species found only at mountain lakes (e.g. Kulijer *et al*., 2012, 2013; Kulijer & Miljević, 2017), while in Croatia it also occurs in slow flowing rivers, oxbows and ponds/lakes in the lowlands and forests. Some of

these habitats, such as Plitvice Lakes, are close to the border of this region (Belančić *et al*., 2008). As similar habitats (slow flowing parts of the larger river in hilly areas with rich water vegetation) also exist along the middle part of the Una River in B&H, there is a possibility that the species could be found here in the future. Jović *et al*. (2010) gave records of *A. grandis* from Mt. Šator, located several kilometers south of the study region. These individuals probably originate from mountain lakes and ponds in the vicinity, possibly Šatorsko or Glamočko Lake.

Conservation reference

The present study provided new observations of two species of European conservation concern, *C. ornatum* and *C. heros*. Both species are listed in the EU Habitats Directive, while *C. heros* is also listed as Vulnerable in the Mediterranean Red List of Dragonflies (De Knijf *et al*., 2015; Kalkman *et al*., 2010; Riservato *et al*., 2009). The knowledge of their distribution is important for the establishment of the Natura 2000 network. In Bosnia and Herzegovina *C. ornatum* can mainly be found in May/June and it usually disappears by the beginning of July (Boudot & Kulijer, 2015). Although most investigations were conducted later in the year, a brief inspection of several localities in karst poljes at the end of June resulted in two new localities and the first in the northwestern region. As the species is already known as regularly occurring in karst poljes of southwest Bosnia and west Herzegovina, this finding is not a surprise (Kulijer, 2012, 2014; Kulijer *et al*., 2013). In the present proposition of the potential Natura 2000 areas for B&H, only one area for *C. ornatum* was listed. *Cordulegaster heros* was not even included in the country's reference list (Milanović *et al*., 2015).

Cordulegaster heros is a widespread species in Bosnia and Herzegovina, found at streams and small rivers particularly in the southern region, and it was also expected to be widely distributed in north Bosnia (Kulijer, 2012, 2014; Kulijer *et al*., 2012, 2013, 2016). The results of this study confirmed these expectations. Partially shaded brooks and streams in hilly areas, particularly in the northeastern part, were found to have stable populations of the species. Several of these sites are close to the Croatian border, such as two streams (L 3 and L 53) located only several km from the border. The results of this study suggest that some parts of the study area are particularly important for *C. heros,* a species whose habitats should receive special attention in the process of the designation of Natura 2000 areas in B&H.

No Red List of the dragonflies of Bosnia and Herzegovina exists as yet. Although dragonflies are included in the Red Lists for both entities in Bosnia and Herzegovina, these lists do not reflect the actual threat status of dragonfly species in the entities, nor in the country. The Red List of Protected Species of Flora and Fauna of Republika Srpska („Crvena lista zaštićenih vrsta flore i faune Republike Srpske") includes 46 dragonfly species, but does not provide any threat category for any of the species (Službeni glasnik Republike Srpske, 2012). The list includes practically all the most common species (e.g. *C. splendens, Libellula depressa* Linnaeus, 1758, *Ischnura elegans* (Vander Linden, 1820)), but failed to include several species that are rare and/or threatened in Republika Srpska and Bosnia and Herzegovina, such as *Caliaeschna microstigma* (Schneider, 1845), *E. bimaculata* or *S. vulgatum*. All recorded species, apart from *Somatochlora flavomaculata* (Vander Linden, 1825), *C. heros*, *Cordulegaster bidentata* Selys, 1843 and *L. fulva*, are included in the Red List.

On the other hand, the recently published Red List of wild species and subspecies of plants, animals and fungi („Crvena lista divljih vrsta i podvrsta biljaka, životinja i gljiva")

in the Federation of Bosnia and Herzegovina does not assess any of the dragonfly species occurring in FB&H to be endangered (Službeni list Federacije Bosne i Hercegovine, 2014). Out of only three species mentioned on the list (all regarded as Near Threatened), *Lestes barbarus* (Fabricius, 1798) and *C. heros* were found during the survey.

This study contributes markedly to a better knowledge of the dragonfly fauna of the Una River catchment, an important area for biodiversity shared between Bosnia and Herzegovina and Croatia. Considering the size of the study area and the habitats diversity, a large part still remains insufficiently investigated, particularly its lentic habitats. In addition, the survey was conducted during the summer (95 % of records were collected from late June to mid-August). Future investigations will certainly add more species and give more precise distribution data for the region.

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SAŽETAK

Prvi pregled faune vretenaca (Insecta, Odonata) sjeverozapadne Bosne

D. Kulijer

Fauna vretenaca (Odonata) Bosne i Hercegovine je sve donedavno bila izuzetno slabo istražena. Tek su zadnjih desetak godina započeta prva detaljnija istraživanja ovih kukaca, što je rezultiralo velikim brojem novih podataka i većim brojem publikacija. I pored značajnog napretka u poznavanju rasprostranjenosti vrsta, neka područja zemlje su i dalje ostala slabo istražena. To se posebno odnosi na sjeverozapadni dio Bosne, za koji gotovo da nisu postojali podaci o fauni ovih kukaca.

Cilj rada bio je istražiti faunu vretenaca sjeverozapadne Bosne u cilju stjecanja što bolje slike o njihovoj fauni na području sliva rijeke Une, kojeg dijele Bosna i Hercegovina i Hrvatska.

Podaci su prikupljeni terenskim istraživanjima tijekom 2012. (26.–27.06. i 19.–20.08.) i 2013. (25.–29.07.) godine. Osim toga, analizirani su i podaci iz dostupnih publikacija, entomoloških

kolekcija Zemaljskog muzeja Bosne i Hercegovine i baze podataka vretenaca BiH. Istraživanje je uglavnom obuhvatilo odrasle jedinke, dok su ličinke i svlakovi sakupljani sporadično. Područje istraživanja je sjeverozapadni dio Bosne i Hercegovine, između 15° 43′ i 16° 32′ istočne geografske dužine i 44° 09′ i 45° 13′ sjeverne geografske širine. Ovo područje obuhvaća najveći dio sliva rijeke Une, kao i male dijelove slivova rijeka Korane i Gline koji se nalaze na teritoriju BiH.

Prikupljeno je ukupno 275 nalaza 36 vrsta (56 % faune Odonata BiH) sa 75 različitih lokacija. Najznačajniji su nalazi dvije vrste sa Dodatka II Direktive o staništima Europske unije: *Coenagrion ornatum* (Selys, 1850) i *Cordulegaster heros* Theischinger, 1979, kao i pronalasci vrsta *Chalcolestes viridis* (Vander Linden, 1825) i *Coenagrion scitulum* (Rambur, 1842) koje se na temelju postojećih podataka smatraju rijetkima u Bosni i Hercegovini. Tijekom ovog istraživanja *C. viridis* je zabilježen na lokalitetu Vedro polje kod Bihaća, dok je vrsta *C. scitulum* pronađena u južnom dijelu područja istraživanja na Pašića, Petrovačkom i Bjelajskom polju.

Vrsta *C. heros* je zabilježena na osam lokaliteta te se čini da je na ovom području rasprostranjena, posebno u njegovom sjeveroistočnom dijelu. *Coenagrion ornatum* je zabilježen jedino na Bjelajskom i Petrovačkom polju. No, s obzirom da se radi o proljetnoj vrsti, te da ovo područje u tom periodu nije bilo istraživano, moguće je da je ona i znatno šire rasprostranjena, posebno u krškim poljima i nižim dijelovima na sjeveru i istoku regije. Najveći broj nalaza ove vrste u BiH vezan je upravo za krška polja. S obzirom da su vrste *C. ornatum* i *C. heros* navedene u Dodatku II Direktive o staništima Europske unije, te da je *C. heros* također ranjiva (VU) vrsta na Crvenoj listi Odonata Mediterana, u budućnosti im treba posvetiti posebnu pažnju, prije svega u procesu identifikacije područja za mrežu Natura 2000 u BiH.

Po brojnosti lokaliteta primjetna je dominacija reofilnih vrsta, što je i očekivano s obzirom na značajnu zastupljenost potoka i manjih rijeka među istraživanim lokalitetima. Proljetne vrste i vrste koje primarno naseljavaju veće stajaćice su bile rijetke ili uopće nisu zabilježene. Među vrstama koje nisu zabilježene ovim istraživanjem nalaze se i neke koje su relativno česte u okolnim regijama BiH i Hrvatske. Razlog za njihovu neprisutnost je s jedne strane bolja istraženost okolnih područja, a s druge strane nedovoljna pokrivenost različitih sezonskih aspekata i mali broj većih stajaćih voda tijekom istraživanja.

Ovo istraživanje predstavlja značajan doprinos poznavanju vretenaca sliva rijeke Une i Bosne i Hercegovine. S obzirom na veličinu i kompleksnost istraživanog prostora, kao i na djelomičnu pokrivenost po pitanju različitih sezonskih aspekata i staništa, buduća istraživanja će sigurno rezultirati novim vrstama za ovo područje.