IDF

International Dragonfly Fund Report

Journal of the International Dragonfly Fund

1-25

Dejan Kulijer, Iva Miljević & Jelena Jakovljev

Contribution of the participants of 4th Balkan Odonatological Meeting to the knowledge of Odonata distribution in Bosnia and Herzegovina

Published 26.04.2016

95

ISSN 1435-3393

The International Dragonfly Fund (IDF) is a scientific society founded in 1996 for the improvement of odonatological knowledge and the protection of species.
Internet: http://www.dragonflyfund.org/

This series intends to publish studies promoted by IDF and to facilitate cost-efficient and rapid dissemination of odonatological data..

Editorial Work:	Milen Marinov, Geert de Knijf & Martin Schorr
Layout:	Martin Schorr
IDF-home page:	Holger Hunger
Indexed:	Zoological Record, Thomson Reuters, UK
Printing:	Colour Connection GmbH, Frankfurt
Impressum:	Publisher: International Dragonfly Fund e.V., Schulstr. 7B, 54314 Zerf, Germany. E-mail: oestlap@online.de
Responsible editor:	Martin Schorr
Cover picture:	***Cordulegaster heros***
Photographer:	Falk Petzold

Published 26.04.2016

Contribution of the participants of 4th Balkan Odonatological Meeting to the knowledge of Odonata distribution in Bosnia and Herzegovina

Dejan Kulijer[1], Iva Miljević[2] & Jelena Jakovljev[3]

[1]National Museum of Bosnia and Herzegovina, Zmaja od Bosne 3, 71000 Sarajevo, Bosnia and Herzegovina. E-mail: dejan.kulijer@gmail.com

[2]Center for Environment, Cara Lazara 24, 78 000 Banja Luka, Bosnia and Herzegovina. E-mail: ms.iva.miljevic@gmail.com

[3]Univesity of Natural Resources and Life Sciences, Baumgasse 58/19 1030 Vienna, Austria. E-mail: jelena.jakovljev@gmail.com

Abstract

As a result of increased interest in dragonflies and close cooperation between odonatologists on the Balkan Peninsula, the Balkan Odonatological Meeting (BOOM) has been established in 2011. This report presents the results of the field trip during 4th Balkan Odonatological Meeting that was held in Bosnia and Herzegovina from 1st to 8th August 2014. With 69 surveyed localities and 496 records of 47 species, this was the most successful BOOM until now.

The noteworthy results are records of several nationally rare species: *Chalcolestes viridis*, *Coenagrion scitulum*, *Erythromma najas* and *Ceriagrion tenellum*, and new populations of *Cordulegaster heros*, a species mentioned in the Annexes of the EU Habitats Directive. The distribution of *Chalcolestes* spp. in Bosnia and Herzegovina is also presented and discussed.

Key words: Odonata, dragonflies, Balkan Odonatological Meeting, Bosnia and Herzegovina, Balkan Peninsula

Sažetak

Istraživanje vilinih konjica na području zapadnog Balkana doživjelo je proteklih godina značajan napredak. Jedan od rezultata rastućeg interesa za viline konjice u regionu je i Balkanski Odonatološki sastanak ili skraćeno BOOM, utemeljen 2011. godine. Glavni cilj ovog skupa je doprinos istraživanju i zaštiti vilinih konjica Balkankog poluostrva, kao jedne od najmanje istraženih regija Evrope.

Ovaj izvještaj predstavlja rezultate IV Balkanskog odonatološkog sastanka održanog u Bosni i Hercegovini od 1. do 8. avgusta 2014. godine. Sa 69 istraženih lokaliteta i 496 prikupljenih nalaza 47 vrsta, ovo je najuspješniji sastanak do sada. Prikupljeni podaci su od velikog značaja za bolje poznavanje distribucije vilinih konjica u Bosni i Hercegovini. Najznačajniji rezultat su pronalasci nekoliko rijetkih vrsta: *Chalcolestes viridis*, *Coenagrion scitulum*, *Erythromma najas* i *Ceriagrion tenellum*, kao i nove populacije vrste *Cordulegaster heros*, vrste zaštićene Direktivom o staništima Evropske unije. U radu su detaljnije obrađeni nalazi ovih vrsta, a dat je i pregled i analiza distribucije *Chalcolestes* spp. u Bosni i Hercegovini.

Ključne riječi: Odonata, vilini konjici, Balkanski odonatološki sastanak, Bosna i Hercegovina, Balkansko poluostrvo

Introduction

Interest in dragonflies is increasing in recent years not only in Bosnia and Herzegovina, but also in the other countries of the Balkan Peninsula (e.g. Boudot et al. 2009; Kulijer & Marinov 2010; Boudot & Kalkman 2015). Followed by better collaboration between odonatologists, particularly in the western part of the region this resulted in the establishment of the Balkan Odonatological Meeting or BOOM in 2011 (Jović 2011). The main goal of BOOM is the further development of odonatological research in the Balkans. The annually organized BOOM has quickly become a recognized event where dragonfly enthusiasts can meet, exchange their ideas, present their research and work together investigating dragonflies in one of the least known regions of Europe. New regional cooperation and joint research projects resulted in the publication of several papers dealing with the dragonfly fauna of the region (i.e. Kulijer & Marinov 2010; Vinko 2011; Šácha & Bedjanič 2011; Kulijer et al. 2012, 2013; Vinko & Vilenica 2013; Rajkov et al. 2015).

The dragonfly fauna of Bosnia and Herzegovina is still rather poorly investigated. After a good start in the nineteenth and the beginning of the twentieth century, poor research efforts in later years and the severe war in 1990's resulted in Bosnia and Herzegovina remaining one of the countries with least explored dragonfly fauna in Europe (Adamović 1948; Kulijer et al. 2013). This changed significantly in recent years when systematic investigations of dragonflies in Bosnia and Herzegovina started. Intensive research efforts resulted with notable increase of dragonfly knowledge in the country, although many regions are still insufficiently explored (i.e. Kulijer 2012; Kulijer et al. 2013; Kulijer 2015; Kulijer & Miljević 2015). The knowledge of the odonatofauna of Bosnia and Herzegovina, including new data collected up to 2013, has been summarized in Kulijer et al. (2013) and Boudot & Kalkman (2015).

This paper presents the results of the dragonfly survey conducted within the scope of the 4th Balkan Odonatological Meeting (BOOM 2014) and held between 1st and 8th August 2014 in Bosnia and Herzegovina (for more locality details see below in chapter "Study area").

Material & Methods

Data were collected mainly in the northern and southern part of Bosnia and Herzegovina during the meeting. Additionally, records from several localities visited by participants on 9th and 10th August on their trip back home are also included. Altogether, 69 localities were investigated (Fig. 1, Tab. I). Observations are mainly based on imagines, while exuviae and larvae were searched for only sporadically. During our survey weather was favorable for observing dragonflies at most days.

A total of 22 participants from Bosnia and Herzegovina, Macedonia, Serbia, Slovenia and Germany took part in the survey (Fig. 2). The participants were split in two to four groups on most days and every group was led by at least one experienced odonatologist. The records collected during the meeting have been inserted into the national dragonfly database, and voucher specimens were deposited in the collections of the National Museum of Bosnia and Herzegovina in Sarajevo.

Study area

Bosnia and Herzegovina is predominantly a mountainous country located in the western part of Balkan Peninsula. Karst mountains of Dinaric Alps cover the largest part, separating Mediterranean influenced southern region from the lowland continental area in the north (Fig. 1). Influences of the Dinaric Alps and the Adriatic Sea

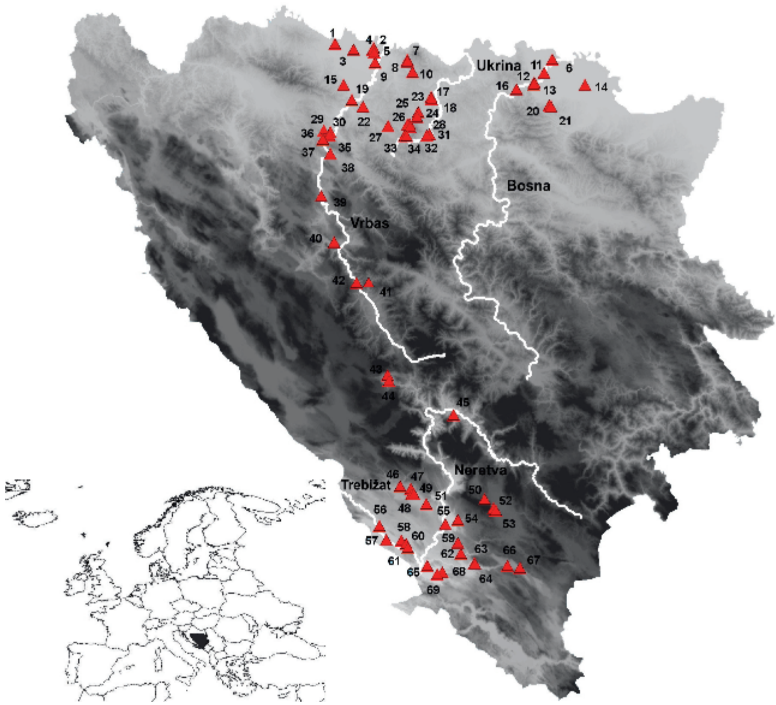

Figure 1. Geographical position of Bosnia and Herzegovina (left) and the overview of the localities investigated during this study (right). The major rivers in the study area are highlighted.

Figure 2. Participants of the IV Balkan Odonatological Meeting at Blagaj, Herzegovina (Photo: Dejan Kulijer).

are the most important factors that determine diversity and distribution of dragonfly fauna in Bosnia and Herzegovina (Kulijer et al. 2013). Karst mountains of the Dinaric Alps are extended in a northwest-southeast direction limiting the influence of the Mediterranean climate to the north. This mountain chain spreads from Slovenia to Albania, forming the largest continuous karst landscape in Europe (Mihevc & Prelovšek 2010). Karst poljes are one of the specificities of the Dinaric karst region. These are large surface karst formations characteristic for karst region from Slovenia to Montenegro. Karst poljes are large, mainly closed depression characterized by a flat floor and surrounded by steep mountain slopes (Gams 1978; Prohić et al. 1998). As many of the poljes in Bosnia and Herzegovina are rich in water they represent important wetlands and rich dragonfly habitats in dry karst region (Kulijer 2012, 2014).

Our survey included localities from all three biogeographical regions of the country (Mediterranean, Alpine and Continental), but most surveys were conducted in the Continental and Mediterranean region. The meeting started in Prnjavor (North Bosnia), continued through the central part and finished in Blagaj (Herzegovina) (Fig. 3). Continental (Posavina) region encompasses the area between the Sava River, which represents the country's northern border, and the Dinaric Alps mountain range in the south. Characteristic habitats of this lowland region are slow flowing rivers. Most of the floodplains along these rivers were destroyed through the building of embankments at the end of XIX and the beginning of XX century, leaving only small fragments. In this region, we focused our research on the Vrbas and Ukrina river valleys, but also visited several localities along the River Bosna (Fig. 1). The Vrbas River is one of the Sava's main tributaries and one of the largest rivers

Figure 3. Spring of Buna River at Blagaj (Photo: Dejan Kulijer).

Figure 4. Oxbow near the Prnjavor Fish ponds (Loc. 17) (Photo: Dejan Kulijer).

Figure 5. Oxbow near Laktaši (Loc. 19) (Photo: Iva Miljević).

Figure 6. Gravel ponds along the Vrbas River (Loc. 9) (Photo: Falk Petzold).

in Bosnia and Herzegovina. In its lower section large lowland rivers changed its course throughout history and today these old riverbeds are transformed into ponds and oxbows (locally known as "starača"), e.g. starača close to Prnjavor Fish ponds on Ukrina River (Loc. 17, Fig. 4) or starača near Laktaši on Vrbas River (Loc. 19, Fig. 5). Numerous old gravel pits were transformed into ponds along both sides of the Vrbas River (Loc. 9, Fig. 6), while a large, Bardača fishpond is located near its mouth to the Sava River (Loc. 2, 4–5, Fig. 7–8).

Field surveys continued in the alpine region and included investigations at Plivska lakes and Ramsko Lake (Loc. 43, Fig. 9). Unfortunately, in this region bad weather and even storms prevented the survey of some typical mountainous habitats.

Figure 7. Matura River at Bardača Fish ponds (Loc. 4) (Photo: Falk Petzold).

Figure 8. Bardača Fish ponds (Loc. 4) (Photo: Dejan Kulijer).

Figure 9. Mouth of Brodić Stream into the Ramsko Lake (Loc. 43) (Photo: Ana Tratnik).

Figure 10. Kravice Waterfall on Trebižat River, the largest tufa waterfall in the Herzegovina region (Photo: Ana Tratnik).

Figure 11. Karst stream at Gornji Studenci (Loc. 58) (Photo: Ana Tratnik).

Figure 12. Veleško Lake at the outskirts of Nevesinjsko polje below the Velež Mountain (Loc. 50) (Photo: Iva Miljević).

The focus of our research in the southern, Mediterranean region was the Neretva River catchment where we investigated several tributaries of the Neretva River: Trebižat, Bregava and Lištica (Loc. 58, Fig. 11). In the Trebižat River catchment we investigated several small streams and rivers and visited Kravice Waterfall, a 25 m high tufa waterfall on Trebižat River (Fig. 10). In this region, we also surveyed several karst poljes: Mostarsko blato, Nevesinjsko and Dabarsko polje. Nevesinjsko karst polje (Loc. 50, Fig. 12) is one of the poljes at higher altitude where Alpine and Mediterranean influences met.

The final part of our field trip was dedicated to Hutovo blato wetland (Loc. 69, Fig. 13) which is a Ramsar site, Nature Park and the most pristine area of the Neretva River's delta. Neretva River, Hutovo blato wetland and Trebižat River are three biodiversity hotspot of the Mediterranean region in Bosnia and Herzegovina (see www.karsthabitats.ba, access: 20 II 2016).

Results

Dragonflies were surveyed at 69 localities (Tab. I) in all three biogeographical regions of the country resulting in 496 records of 47 dragonfly species (Tab. II, in appendix). This represents 73% of known dragonfly species in the country.

Figure 13. Deransko Lake at Hutovo blato Wetland, the shallow lake surrounded by vast read beds is the habitat of *Lindenia tetraphylla* (Loc. 69) (Photo: Falk Petzold).

Table I. List of surveyed localities during the 4th Balkan Odonatological Meeting.

	Locality	Date	Latitude	Longitude	Altitude [m]
1.	Small pond near Gradiška	10.08.2014	45°07'29''	17°13'16''	89
2.	Bardača, small fishpond near motel	03.08.2014	45°06'37''	17°26'13''	91
3.	Laminci Lake	04.08.2014	45°06'12''	17°19'26''	92
4.	Bardača, fishponds	03.08.2014	45°06'08'	17°25'45''	85
5.	Bardača, small private fishpond	03.08.2014	45°05'35''	17°26'24''	90
6.	Oxbow near Donja Dubica	04.08.2014	45°03'57''	18°25'30''	83
7.	Motajica Mountain, upper part of Stojkovića rijeka Stream	04.08.2014	45°03'53''	17°37'27''	199
8.	Motajica Mountain, lower part of the Stojkovića rijeka Stream	04.08.2014	45°03'30''	17°37'21''	165
9.	Gravel ponds along the Vrbas River	04.08.2014	45°03'14''	17°26'42''	94
10.	Lepenica Stream at Gornja Lepenica	03.08.2014	45°01'00''	17°39'10''	160
11.	Ada, Bosna River	04.08.2014	45°00'47''	18°22'52''	89
12.	Modrički lug, several small waterbodies	04.08.2014	44°58'39''	18°19'28''	95
13.	Modrički lug, sunny pool in a gravel pit along the Bosna River	04.08.2014	44°58'04''	18°19'22''	98
14.	Obudovac, irrigation canal near the bridge	04.08.2014	44°57'58''	18°36'26''	86
15.	Aleksandrovac, small temporary pond by the road	01.08.2014	44°57'51''	17°16'21''	119
16.	Oxbow north of Vranjak Village	04.08.2014	44°56'59''	18°13'40''	106
17.	Oxbow and Vijaka River near Prnjavor fishponds	02.08.2014	44°55'08''	17°45'24''	124
18.	Prnjavor fishpond, canal along the large fishpond	02.08.2014	44°54'39''	17°45'26''	124
19.	Laktaši Oxbow	03.08.2014	44°54'23''	17°19'03''	120
20.	Vidara Lake, Gradačac	04.08.2014	44°53'12''	18°24'30''	132
21.	Hazna Lake, Gradačac	04.08.2014	44°52'54''	18°24'59''	138
22.	Crkvena Stream near old mill	05.08.2014	44°52'52''	17°22'46''	131
23.	Kanjska bara Pond, Prnjavor	02.08.2014	44°51'34''	17°41'05''	140
24.	Vijaka River at Žunića mill	02.08.2014	44°50'31''	17°40'40''	142
25.	Outflow from Drenova Lake (under the dam)	02.08.2014	44°48'50''	17°38'14''	165
26.	Stari majdan (old mine) – pond by the road near Drenova Lake	02.08.2014	44°48'41''	17°37'34''	175
27.	Mouth of Vijaka River into Drenova Lake	02.08.2014	44°48'21''	17°31'06''	171
28.	Drenova River	02.08.2014	44°48'09''	17°38'19''	187
29.	Lauš, garden near Crkvena Stream	09.08.2014	44°47'03''	17°09'55''	185
30.	Mladen Stojanović Park	09.08.2014	44°46'50''	17°12'02''	165
31.	Ukrina River, near the bridge	02.08.2014	44°46'27''	17°44'48''	152
32.	Ukrina River, gravel extraction site	02.08.2014	44°46'09''	17°43'59''	156
33.	Tubački Stream, near the playground	02.08.2014	44°46'01''	17°36'32''	233
34.	Sabanjska River	02.08.2014	44°46'00''	17°37'12''	234
35.	Skaut, Vrbas River	09.08.2014	44°45'58''	17°11'42''	154
36.	Suturlija River	03.08.2014	44°45'09''	17°09'40''	169
37.	Toplice, Vrbas River	03.08.2014	44°44'57''	17°09'33''	168
38.	Karanovac, gravel ponds	(a) 03.08.2014, (b) 10.08.2014	44°41'45''	17°12'03''	176
39.	Bočac, gravel ponds	05.08.2014	44°31'48''	17°09'14''	228
40.	Plivska lakes	05.08.2014	44°20'54''	17°13'40''	425
41.	Oborci, small stream	10.08.2014	44°11'30''	17°25'03''	608
42.	Small stream near Donji Vakuf	10.08.2014	44°11'24''	17°21'06''	543
43.	Ramsko Lake, at the inflow of Brodić Stream	05.08.2014	43°49'42''	17°31'26''	594
44.	Ramsko Lake, near Šćit Monastery	05.08.2014	43°48'23''	17°31'53''	583
45.	Idbar Stream	08.08.2014	43°40'28''	17°52'56''	319
46.	Spring of Lišlica River	06.08.2014	43°23'39''	17°35'44''	305
47.	Gnjilište pond, Gornji Gradac	06.08.2014	43°23'01''	17°39'11''	280
48.	Knešpolje, stream by the road	06.08.2014	43°21'58''	17°39'26''	237
49.	Dobrić, small stream	06.08.2014	43°21'49''	17°40'09''	233
50.	Veleško Lake	06.08.2014	43°20'41''	18°03'00''	1040
51.	Lišlica River, Mostarsko blato	06.08.2014	43°19'29''	17°44'09''	223
52.	Nevesinjsko polje, shallow ponds	06.08.2014	43°18'29''	18°05'56''	846
53.	Nevesinjsko polje, Nevesinjsko Lake	06.08.2014	43°18'02''	18°06'39''	843
54.	Road near Blagaj	06.08.2014	43°15'50''	17°54'24''	303
55.	Buna River in Buna Village	06.08.2014	43°14'46''	17°50'21''	33
56.	Vitina, spring of Vrioštica River	06.08.2014	43°14'16''	17°29'08''	96
57.	Trebižat River at Humac, Ljubuški	06.08.2014	43°11'01''	17°31'21''	69
58.	Spring and small stream at Gornji studenci	06.08.2014	43°10'52''	17°36'11''	67

	Locality	Date	Latitude	Longitude	Altitude [m]
56.	Vitina, spring of Vrioštica River	06.08.2014	43°14'16''	17°29'08''	96
57.	Trebižat River at Humac, Ljubuški	06.08.2014	43°11'01''	17°31'21''	69
58.	Spring and small stream at Gornji studenci	06.08.2014	43°10'52''	17°36'11''	67
59.	Rotimlja Stream	06.08.2014	43°10'26''	17°54'19''	340
60.	Spring and small stream at Donji Studenci	06.08.2014	43°10'11''	17°37'41''	47
61.	Trebižat River at the mouth of Studenčica River	06.08.2014	43°09'16''	17°38'15''	27
62.	Ljuca, two small ponds	06.08.2014	43°07'53''	17°55'17''	296
63.	Bregava River	06.08.2014	43°05'32''	17°59'42''	98
64.	Small artificial lake on Bregava River	06.08.2014	43°05'26''	17°59'52''	101
65.	Hutovo blato, Škrka Lake	07.08.2014	43°05'02''	17°44'32''	4
66.	Dabarsko polje, small ditches and channels	06.08.2014	43°05'00''	18°10'22''	489
67.	Dabarsko polje, springs of Vrijeka River	06.08.2014	43°04'27''	18°14'21''	496
68.	Hutovo blato, Drijen Lake	07.08.2014	43°03'30''	17°49'27''	3
69.	Hutovo blato, Krupa River and Deransko Lake	07.08.2014	43°02'57''	17°47'40''	1

Systematic account

Abbreviations used: ♂ - male(s), ♀ - female(s), MA - mature adult(s), AP - adults present (some participants of the mapping scheme didn't differ between mature and juvenile resp. teneral imagos), Juv/Ten - juvenile(s)/teneral(s), Lar - larva(e), Ex - exuvium(ae), Cop/Tan - copula(e)/tandem(s), Ovip - ovipositing.

CALOPTERYGIDAE

Calopteryx splendens (Harris, 1782)

Loc. 3: 1♂, 1♀, 1MA; **Loc. 4**: 2♂; **Loc. 5**: 1♂, 3♀; **Loc. 8**: 10MA; **Loc. 9**: 20MA; **Loc. 10**: 2MA; **Loc. 11**: 1♀; **Loc. 13**: 2–5MA; **Loc. 15**: 1♂; **Loc. 17**: >10MA; **Loc. 18**: 5♂; **Loc. 19**: 6–20MA; **Loc. 22**: 5♂, 3♀ Cop/Tan; **Loc. 24**: >10MA; **Loc. 25**: 6–20MA; **Loc. 28**: 2–5MA; **Loc. 30**: 1♂; **Loc. 31**: >10MA; **Loc. 32**: >10MA; **Loc. 34**: 2–5MA; **Loc. 36**: 2–5MA; **Loc. 37**: 1MA; **Loc. 38(a)**: 2–5MA, **(b)**: 1♂; **Loc. 39**: 1♂; **Loc. 40**: 2♂; **Loc. 57**: 20MA, 10Ex; **Loc. 61**: 10MA; **Loc. 64**: 2–5MA; **Loc. 69**: AP.

Calopteryx virgo (Linnaeus, 1758)

Loc. 4: 1♂; **Loc. 7**: 1♂; **Loc. 8**: 10♂; **Loc. 10**: >10MA; **Loc. 19**: 1MA; **Loc. 22**: 1♂, 1F; **Loc. 24**: 1♂; **Loc. 25**: 6–20MA; **Loc. 28**: 6–20MA; **Loc. 31**: >10MA; **Loc. 33**: 1MA; **Loc. 34**: 6–20MA; **Loc. 35**: 1♂; **Loc. 36**: 6–20MA; **Loc. 37**: 21–100MA; **Loc. 38(a)**: 6–20MA, **(b)**: 5♂; **Loc. 41**: 5♂, 1♀; **Loc. 42**: 2♂, 1♀; **Loc. 43**: 1Juv/Ten; **Loc. 45**: 5♂; **Loc. 48**: AP; **Loc. 49**: AP; **Loc. 55**: <10MA; **Loc. 57**: 1♂; **Loc. 60**: 2♀; **Loc. 61**: 5MA; **Loc. 63**: 1MA; **Loc. 64**: 21–100MA, >100Ex; **Loc. 68**: AP; **Loc. 69**: AP.

LESTIDAE

Chalcolestes parvidens (Artobolevskii, 1929)

Loc. 3: 3♂; **Loc. 4**: 2MA; **Loc. 5**: 5♂, 3♀; **Loc. 23**: 1♀; **Loc. 27**: 2–5MA; **Loc. 38(a)**: 6–20MA, 1Cop/Tan, **(b)**: 1MA; **Loc. 68**: AP.

Chalcolestes viridis (Vander Linden, 1825)

Loc. 43: 1Juv/Ten; **Loc. 59**: 1MA; **Loc. 66**: 1MA, 21–100Juv/Ten; **Loc. 67**: 1MA.

Lestes barbarus (Fabricius, 1798)

Loc. 1: 1Ovip; **Loc. 14**: 1♂,1♀; **Loc. 51**: AP; **Loc. 59**: 1MA; **Loc. 62**: 6–20MA.

Lestes dryas Kirby, 1890

Loc. 9: 1♀; **Loc. 38(a)**: 1MA; **Loc. 43**: 1MA; **Loc. 50**: 2–5MA; **Loc. 52**: 1Cop/Tan; **Loc. 53**: 1MA.

Lestes sponsa (Hansemann, 1823)

Loc. 4: 1♂; **Loc. 5**: 1♂; **Loc. 12**: 2–5MA; **Loc. 17**: 1♂; **Loc. 23**: 1MA; **Loc. 27**: 2–5MA; **Loc. 38(a)**: 6–20MA; **Loc. 50**: 6–20MA; **Loc. 52**: >10MA; **Loc. 53**: >100MA, >10Cop/Tan.

Lestes virens (Charpentier, 1825)

Loc. 12: 1MA; **Loc. 16**: 3♀; **Loc. 23**: 1♂; **Loc. 53**: 2♂; **Loc. 62**: 1MA; **Loc. 66**: 21–100MA, 1Juv/Ten.

Sympecma fusca (Vander Linden, 1820)

Loc. 43: 21–100Juv/Ten; **Loc. 47**: AP; **Loc. 53**: 5MA, 1Juv/Ten; **Loc. 66**: 1Juv/Ten; **Loc. 68**: AP; **Loc. 69**: AP.

COENAGRIONIDAE

Ceriagrion tenellum (de Villers, 1789)

Loc. 19: 1MA; **Loc. 65**: 5MA.

Coenagrion puella (Linnaeus, 1758)

Loc. 4: 3♂; **Loc. 9**: 10♂; **Loc. 25**: 1MA; **Loc. 27**: 6–20MA,2Cop/Tan; **Loc. 38(a)**: 6–20MA, 3Cop/Tan; **Loc. 39**: 10♂; **Loc. 43**: 1MA; **Loc. 50**: 2–5MA; **Loc. 52**: 10MA; **Loc. 69**: AP.

Coenagrion scitulum (Rambur, 1842)

Loc. 62: 6–20MA.

Enallagma cyathigerum (Charpentier, 1840)

Loc. 39: >10MA, 1Cop/Tan; **Loc. 40**: 1♂; **Loc. 43**: >10MA; **Loc. 50**: 2–5MA; **Loc. 52**: >10MA; **Loc. 53**: <10MA; **Loc. 62**: 6–20MA.

Erythromma lindenii (Selys, 1840)

Loc. 9: 30♂; **Loc. 18**: 2MA; **Loc. 19**: 6–20MA; **Loc. 25**: 2–5MA; **Loc. 47**: AP; **Loc. 51**: AP; **Loc. 53**: >10MA; **Loc. 69**: AP.

Erythromma najas (Hansemann, 1823)

Loc. 9: 2♂; **Loc. 19**: <10MA; **Loc. 38(a)**: 1MA.

Erythromma viridulum (Charpentier, 1840)

Loc. 2: >10MA; **Loc. 3**: 10MA; **Loc. 4**: >10MA; **Loc. 5**: 20MA; **Loc. 9**: >10MA; **Loc. 11**: 1♂; **Loc. 13**: 21–100MA; **Loc. 14**: 2♂; **Loc. 17**: 5MA; **Loc. 18**: >10MA; **Loc. 19**: 21–100MA; **Loc. 20**: 6–20MA; **Loc. 21**: 1MA; **Loc. 27**: 6–20MA; **Loc. 38(a)**: 21–100MA; **Loc. 69**: AP.

Ischnura elegans (Vander Linden, 1820)

Loc. 2: >10MA; **Loc. 3**: >10MA; **Loc. 4**: >10MA, 10Juv/Ten; **Loc. 5**: >10MA; **Loc. 9**: >10MA, 10Cop/Tan; **Loc. 12**: 21–100MA; **Loc. 13**: 2–5MA; **Loc. 14**: <10MA; **Loc. 15**: 20MA, <10Cop/Tan; **Loc. 16**: 2MA; **Loc. 17**: 20MA; **Loc. 18**: 10MA, 1Cop/Tan; **Loc. 19**: 21–100MA; **Loc. 20**: 21–100MA; **Loc. 21**: 21–100MA; **Loc. 22**: 1♂; **Loc. 23**: 10MA; **Loc. 24**: >10MA; **Loc. 25**: 21–100MA, <10Cop/Tan; **Loc. 26**: 6–20MA; **Loc. 27**: 21–100MA, 3Cop/Tan; **Loc. 38(a)**: 21–100MA, <10Juv/Ten, **(b)**: 15MA; **Loc. 39**: >10MA, 3Cop/Tan; **Loc. 40**: 2♂; **Loc. 43**: 6–20MA; **Loc. 44**: 1MA; **Loc. 47**: AP; **Loc. 50**: 2–5MA; **Loc. 51**: AP; **Loc. 52**: >10MA; **Loc. 53**: >10MA; **Loc. 56**: <10MA; **Loc. 60**: 5MA; **Loc. 61**: <10MA; **Loc. 62**: 21–100MA; **Loc. 65**: AP; **Loc. 66**: 1MA.

Ischnura pumilio (Charpentier, 1825)

Loc. 14: 1Cop/Tan; **Loc. 15**: 30MA, <10Cop/Tan; **Loc. 24**: 2♂; **Loc. 26**: 2–5MA; **Loc. 27**: 6–20MA, 1Juv/Ten; **Loc. 39**: 1Juv/Ten; **Loc. 43**: 6–20MA; **Loc. 62**: 2–5MA; **Loc. 66**: 6–20MA.

PLATYCNEMIDIDAE

Platycnemis pennipes (Pallas, 1771)

Loc. 2: 20MA; **Loc. 3**: >10MA; **Loc. 4**: 2MA; **Loc. 5**: 10MA; **Loc. 8**: 20MA; **Loc. 9**: >10MA; **Loc. 10**: 10MA; **Loc. 11**: 1MA; **Loc. 12**: 2–5MA; **Loc. 13**: 2–5MA; **Loc. 14**: >20MA; **Loc. 16**: >5MA; **Loc. 17**: >10MA, >10Cop/Tan; **Loc. 18**: 5MA; **Loc. 19**: >100MA; **Loc. 20**: 2–5MA; **Loc. 21**: 2–5MA; **Loc. 22**: 10MA; **Loc. 24**: >10MA, 1Juv/Ten; **Loc. 25**: <10MA; **Loc. 26**: 2–5MA; **Loc. 27**: 21–100MA; **Loc. 31**: 1♂; **Loc. 32**: 50MA; **Loc. 36**: 2–5MA; **Loc. 37**: 6–20MA; **Loc. 38(a)**: 6–20MA, **(b)**: 5MA; **Loc. 39**: 10MA, 2Cop/Tan; **Loc. 43**: 1MA; **Loc. 51**: AP; **Loc. 53**: 5MA, 1Cop/Tan; **Loc. 57**: 10MA; **Loc. 61**: 100MA; **Loc. 64**: 6–20MA; **Loc. 65**: AP.

AESHNIDAE

Aeshna affinis Vander Linden, 1820

Loc. 2: 5♂; **Loc. 3**: 1♂; **Loc. 5**: 3MA; **Loc. 6**: <10MA; **Loc. 7**: 10MA; **Loc. 8**: 10MA; **Loc. 9**: 7♂; **Loc. 11**: 1MA; **Loc. 12**: 21–100MA; **Loc. 17**: >10MA, 2Cop/Tan; **Loc. 23**: 1MA; **Loc. 24**: 2♂; **Loc. 27**: 6–20MA, 2Cop/Tan; **Loc. 33**: 1MA; **Loc. 61**: 1MA; **Loc. 65**: AP; **Loc. 66**: 2–5MA; **Loc. 68**: AP; **Loc. 69**: AP.

Aeshna cyanea (Müller, 1764)

Loc. 16: 1♂; **Loc. 23**: 2♂, 1♀; **Loc. 27**: 2–5MA; **Loc. 29**: 1♂; **Loc. 52**: 3♂; **Loc. 53**: 1♀.

Aeshna isoceles (Müller, 1767)

Loc. 40: 1♂ M; **Loc. 69**: AP.

Aeshna mixta Latreille, 1805

Loc. 4: 2Ex; **Loc. 5**: 10Ex; **Loc. 6**: <10MA; **Loc. 9**: 1Ex; **Loc. 14**: 1♂; **Loc. 18**: 1EX; **Loc. 64**: 1MA; **Loc. 65**: AP; **Loc. 69**: AP.

Anax ephippiger (Burmeister, 1839)

Loc. 54: 1♂.

Anax imperator Leach, 1815

Loc. 2: 4♂; **Loc. 3**: 3♂; **Loc. 4**: 10MA, 3Ex; **Loc. 8**: 1♂; **Loc. 9**: 5♂, 1Ovip; **Loc. 18**: 5♂, 15Ex; **Loc. 19**: 1MA; **Loc. 20**: 1MA; **Loc. 23**: 1MA, 1Ovip; **Loc. 25**: 2–5MA; **Loc. 27**: 2–5MA; **Loc. 38(a)**: 6–20MA, **(b)**: 2♂; **Loc. 39**: 2♂, 2♀; **Loc. 47**: AP; **Loc. 50**: 5Ex; **Loc. 51**: AP; **Loc. 52**: 5♂, 1♀; **Loc. 53**: 1Ex; **Loc. 59**: 2Ex; **Loc. 62**: 2–5MA; **Loc. 64**: 6–20MA; **Loc. 65**: AP; **Loc. 68**: AP; **Loc. 69**: AP.

Anax parthenope Selys, 1839

Loc. 9: 1♂; **Loc. 12**: 1MA; **Loc. 25**: 1MA; **Loc. 47**: AP.

GOMPHIDAE

Gomphus vulgatissimus (Linnaeus,1758)

Loc. 10: 1MA.

Lindenia tetraphylla (Vander Linden, 1825)

Loc. 69: <10MA.

Onychogomphus forcipatus (Linnaeus,1758)

Loc. 8: 1♀; **Loc. 9**: 15♂; **Loc. 10**: 10MA; **Loc. 17**: 1MA; **Loc. 25**: 2–5MA; **Loc. 28**: 2–5MA; **Loc. 31**: 1♂; **Loc. 32**: 5♂, 1♀, 1Juv/Ten; **Loc. 38(b)**: 1♂; **Loc. 59**: 2–5MA; **Loc. 61**: 1♀, 2Ex; **Loc. 63**: 1MA; **Loc. 64**: 1MA, 2Ex.

CORDULEGASTERIDAE

Cordulegaster bidentata Selys, 1843

Loc. 45: 1♂; **Loc. 46**: <10MA.

Cordulegaster heros Theischinger,1979

Loc. 7: 1♂, 1♀, 8Lar; **Loc. 33**: 1Lar; **Loc. 34**: 1Lar; **Loc. 58**: 1♂; **Loc. 60**: 1♂.

Cordulegaster sp. Leach, 1815

Loc. 29: 1MA; **Loc. 34**: 2Lar; **Loc. 42**: 1MA; **Loc. 64**: 1MA.

(At **Loc. 34** two early instar stadia of larvae were collected but could not be reliable identified)

CORDULIIDAE

Cordulia aenea (Linnaeus, 1758)

Loc. 4: 2Ex.

Somatochlora flavomaculata (Vander Linden, 1825)

Loc. 17: 1MA; **Loc. 39**: 5♂; **Loc. 46**: AP; **Loc. 65**: AP; **Loc. 68**: AP; **Loc. 69**: AP.

Somatochlora meridionalis Nielsen, 1935

Loc. 9: 1♀; **Loc. 10**: 5MA; **Loc. 17**: 2MA; **Loc. 18**: 1♂; **Loc. 22**: 2♂; **Loc. 24**: 10MA; **Loc. 25**: 2–5MA; **Loc. 43**: 1MA; **Loc. 52**: 5♂.

LIBELLULIDAE

Crocothemis erythraea (Brullé, 1832)

Loc. 2: 10♂; **Loc. 3**: >10MA; **Loc. 4**: 10MA; **Loc. 9**: 20♂, 2♀, 1Cop/Tan, 1Ovip; **Loc. 13**: 6–20MA; **Loc. 18**: 25♂, 1Ovip; **Loc. 19**: 21–100MA; **Loc. 20**: 1MA; **Loc. 25**: 1MA; **Loc. 27**: 2–5MA; **Loc. 38(a)**: 21–100MA; **Loc. 43**: 1MA; **Loc. 47**: AP; **Loc. 50**: 1MA; **Loc. 62**: >10MA; **Loc. 65**: AP; **Loc. 68**: AP; **Loc. 69**: AP.

Libellula depressa Linnaeus, 1758

Loc. 3: 1♀; **Loc. 7**: 1♀; **Loc. 39**: 4♂; **Loc. 52**: 5♂; **Loc. 53**: 1♂; **Loc. 62**: 2–5MA.

Libellula quadrimaculata Linnaeus, 1758

Loc. 53: 1Ovip.

Orthetrum albistylum (Selys, 1848)

Loc. 2: 2♂, 1♀; **Loc. 3**: >10MA; **Loc. 4**: 5♂, 1♀; **Loc. 5**: 5MA; **Loc. 9**: 10♂, 5♀, 1Cop/Tan, 1Ovip; **Loc. 12**: 6–20MA; **Loc. 13**: 2–5MA, <10Ovip; **Loc. 17**: 1♂, 1♀; **Loc. 18**: 10MA, 10Juv/Ten; **Loc. 19**: 6–20MA; **Loc. 20**: 21–100MA; **Loc. 25**: 2–5MA; **Loc. 26**: 2–5MA; **Loc. 27**: 1MA; **Loc. 38(a)**: 21–100MA, (b): 3♂, 1Cop/Tan; **Loc. 47**: AP; **Loc. 65**: AP; **Loc. 68**: AP; **Loc. 69**: AP.

Orthetrum brunneum (Fonscolombe, 1837)

Loc. 13: 2–5MA; **Loc. 18**: 1♂, 1♀, 10MA; **Loc. 39**: 10♂; **Loc. 46**: AP; **Loc. 56**: >10MA; **Loc. 57**: 1♂; **Loc. 59**: 6–20MA, <10Juv/Ten; **Loc. 62**: 1MA; **Loc. 64**: 2–5MA, 1Cop/Tan; **Loc. 66**: >10MA.

Orthetrum cancellatum (Linnaeus, 1758)

Loc. 3: 5MA, 1Cop/Tan; **Loc. 9**: 1♂; **Loc. 11**: >5MA; **Loc. 15**: 3♂, 1Ovip; **Loc. 18**: 10MA; **Loc. 21**: 6–20MA; **Loc. 25**: 2–5MA, <10Cop/Tan; **Loc. 27**: 1MA; **Loc. 38(a)**: 1MA, (b): 1♂; **Loc. 47**: AP; **Loc. 53**: 1Juv/Ten; **Loc. 62**: 6–20MA, 1Juv/Ten; **Loc. 69**: AP.

Orthetrum coerulescens (Fabricius, 1798)

Loc. 18: 1♂, 1♀; **Loc. 19**: 6–20MA; **Loc. 38(b)**: 1♂; **Loc. 39**: 2♂; **Loc. 46**: AP; **Loc. 47**: AP; **Loc. 56**: <10MA; **Loc. 57**: 10MA; **Loc. 59**: 1MA; **Loc. 60**: 1♀; **Loc. 61**: 5MA; **Loc. 66**: 2–5MA; **Loc. 68**: AP.

Selysiothemis nigra (Vander Linden, 1825)

Loc. 61: 1♀; **Loc. 62**: 1MA; **Loc. 65**: AP; **Loc. 68**: AP; **Loc. 69**: AP.

Sympetrum flaveolum (Linnaeus, 1758)

Loc. 43: 6–20MA; **Loc. 50**: 6–20MA; **Loc. 53**: >10MA.

Sympetrum fonscolombii (Selys, 1840)

Loc. 43: 2–5MA; **Loc. 44**: 2Ex; **Loc. 47**: AP; **Loc. 52**: 1♂; **Loc. 62**: 1MA, 1Ex.

Sympetrum meridionale (Selys, 1841)

Loc. 8: 1♂, 1♀; **Loc. 10**: 2♂, 3MA; **Loc. 12**: 2–5MA; **Loc. 17**: 1♂; **Loc. 27**: 1MA; **Loc. 38(b)**: 3♂; **Loc. 62**: 1MA; **Loc. 65**: AP; **Loc. 66**: 1Juv/Ten.

Sympetrum sanguineum (Müller, 1764)

Loc. 1: 1♂; **Loc. 2**: >10MA, 3Cop/Tan; **Loc. 3**: >10MA; **Loc. 4**: >10MA, 10Cop/Tan, 10Ovip; **Loc. 5**: >10MA; **Loc. 6**: <10MA; **Loc. 7**: 5MA; **Loc. 8**: 20MA; **Loc. 9**: >10MA; **Loc. 10**: 3♀; **Loc. 11**: 1♂, 2♀; **Loc. 12**: 21–100MA; **Loc. 13**: 2–5MA, <10Cop/Tan; **Loc. 14**: 3♀; **Loc. 17**: >10MA; **Loc. 18**: 10MA, 1Cop/Tan, 10Ovip; **Loc. 19**: 6–20MA; **Loc. 23**: 10MA; **Loc. 26**: 6–20MA, 1Cop/Tan; **Loc. 27**: 21–100MA, 3Cop/Tan; **Loc. 28**: 1MA; **Loc. 31**: 2♀, 1MA; **Loc. 32**: 1♀; **Loc. 33**: 2–5MA; **Loc. 38(a)**: 21–100MA, 5Cop/Tan, **(b)**: 5♂; **Loc. 39**: 1♂; **Loc. 50**: 2–5MA; **Loc. 52**: >10MA; **Loc. 53**: >10MA; **Loc. 59**: 2–5MA; **Loc. 61**: 1MA; **Loc. 62**: 6–20MA; **Loc. 64**: 6–20MA; **Loc. 65**: AP; **Loc. 69**: AP.

Sympetrum striolatum (Charpentier, 1840)

Loc. 4: 1Ex; **Loc. 25**: 2Juv/Ten; **Loc. 38(a)**: 1MA, **(b)**: 2♂; **Loc. 39**: 2♂, 1♀; **Loc. 43**: 1Juv/Ten; **Loc. 46**: AP; **Loc. 50**: 2–5MA; **Loc. 52**: 1♂; **Loc. 59**: 1MA, <10Juv/Ten; **Loc. 66**: 21–100MA, 1Juv/Ten.

Sympetrum sp. Newman, 1833

Loc. 42: 1♂.

Discussion

Until recently, dragonfly distribution in Bosnia and Herzegovina was one of the least known in Europe, but systematic investigations conducted in recent years significantly contributed and increased the dragonfly knowledge of the country. Nevertheless, many regions are still insufficiently explored. This was the reason for focusing our research on these areas, particularly on the northern, lowland region of the country.

Only one week excursion and the poor weather conditions in the Alpine region did not allow us to visit all the localities we planned, but we were able to collect large amount of species data from many different habitats. In terms of number of collected records (496) and the number of surveyed localities (69) this was by far the most successful BOOM meeting so far. Although our survey did not result in additional species for the country, many new records represent valuable contribution to the knowledge of the distribution of many species, as well as for the work on the protection of rare and threatened dragonfly species and their habitats in Bosnia and Herzegovina. The noteworthy results are new records of several nationally rare species – *Chalcolestes viridis*, *Coenagrion scitulum*, *Erythromma najas* and *Ceriagrion tenellum* – as well as new populations of *Cordulegaster heros*, species of the EU Habitats Directive.

Species notes

As the range of both ***Chalcolestes* spp.** overlaps in Bosnia and Herzegovina (Olias et al. 2007), it is interesting to have more precise data on the local distribution of both species. Particularly as until recently there was almost no reliable data on the presence of *Chalcolestes* spp. in the country (Olias et al. 2007; Kulijer et al. 2013).

The oldest known record of *Chalcolestes* spp. for Bosnia and Herzegovina is one female found in the collections of the National Museum of Bosnia and Herzegovina in Sarajevo, collected on 23 July 1888 near Stolac in South Herzegovina. This record was previously reported by Adamović (1948) as *C. viridis*, but it was found to belong to *C. parvidens* (Kulijer et al. 2013). This specimen is among the oldest known dragonfly records for the country (Kulijer et al. 2013) and possibly among the oldest confirmed *C. parvidens* from the Balkans. Only one additional literature record was published by Vukić (1992), who reported *C. viridis* for Hutovo blato wetland. This record could not be checked but we suspect that it also belongs to *C. parvidens*, as at this locality the largest population of *C. parvidens* occurs in the country (Kulijer, unpublished data) (Fig. 14).

Figure 14. Habitat of *Chalcolestes parvidens* at Hutovo blato Wetland (Photo: Dejan Kulijer).

The first reliable record of *C. viridis* for Bosnia and Herzegovina is from Plivska Lakes in the central part of Dinaric Alps and was found in 2009 (D. Kulijer, unpublished data). In addition to several new locations of *C. parvidens*, Jović et al. (2010) also reported specimens of *C. viridis* (or hybrids between *C. viridis* and *C. parvidens*).

Recent investigations confirmed the presence of both species in all three biogeographical regions (Kulijer et al. 2013). Based on the current knowledge of the species distribution (Fig. 15), *C. parvidens* is mostly found in the coastal region and along Sava River, while *C. viridis* is more common in mountain regions of the Dinaric Alps and in some cases goes further south into Mediterranean part. This roughly corresponds to the distribution of these two taxa in the Balkans as predicted by Olias et al. (2007). Yet, the number of records is still insufficient to determine their distribution more accurately.

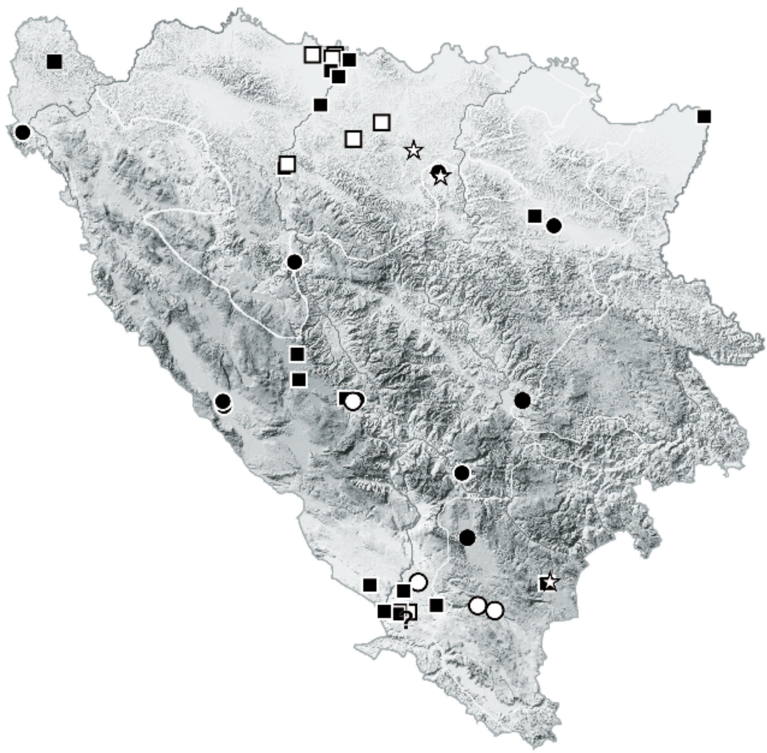

Fig 15. Distribution of *Chalcolestes* spp. in Bosnia and Herzegovina (*C. viridis* – dots, *C. parvidens* – squares; BOOM records are given in white color; Stars are locations where hybrids were observed, question mark represents the location of unchecked literature record of *C. viridis* in Hutovo blato wetland).

At several locations there were indications of hybridization, but as only one or two individuals were found at these sites, this needs further investigation. According to Olias et al. (2007) hybridization probably occurs in all contact zones where both species co-occur and the lack of evidence of hybridization is probably due to lack of research.

During the BOOM most of our observations of *C. parvidens* were made in the northern lowland region, at standing water habitats, while *C. viridis* was found only at four localities in the central and southern region, all in flowing water habitats. The observations from Rotimlja Stream (Loc. 59) and Dabarsko Polje (Loc. 66–67) are the southernmost records of *C. viridis* in the country. This finding also corresponds to the suggestion from Olias et al. (2007) that *C. viridis* prefers cooler habitats than *C. parvidens*, and that it is more restricted to streams and rivulets in the south. Specimens observed during BOOM did not have any hybrid characters.

Coenagrion scitulum is widespread species in the Balkans, although much scarcer than in most of SW Europe (Boudot & Jović 2015). In Bosnia and Herzegovina the data on this species are rare. It can be found at small sunny and shallow standing waters, particularly ponds and small ditches in Mediterranean and Alpine region (e.g. Kulijer 2012, 2014; Kulijer et al. 2013). During our survey *C. scitulum* was recorded only at two small shallow ponds (L 62) near Stolac in the southern part of the country.

Erythromma najas is much scarcer in the country than its congener, *Erythromma viridulum* (Kulijer et al. 2013). The reason therefore could be attributed to rather poor research, particularly in spring, as well as scarce investigations in the northern region. As *E. viridulum* is very common in the country and quite abundant at many habitats in summer it is easy to overlook *E. najas* that becomes much less numerous towards the end of its flying season. Although our survey took place in August, this resulted in two new localities of *E. najas* (Loc. 9, 19).

Ceriagrion tenellum is a western Mediterranean species that in the Balkans is confined to a narrow belt along the Adriatic coast and to some Greek islands (Kalkman 2005; Boudot et al. 2009). Before 2009 only a single, old record was known for Bosnia and Herzegovina, but in the last years, several new populations were discovered (Jović et al. 2010; Kulijer et al. 2012; Kulijer 2014), including the first population in the Danube River catchment in the Balkans (Kulijer & Topić 2013).

Our visit to starača near Laktaši (Loc. 19, Fig. 5) is a new location and the second for the Danube catchment. This population was discovered in June 2014 during the ongoing investigations in the Posavina region supported by IDF (unpublished data). *Ceriagrion tenellum* was further found in Hutovo blato (Loc. 65) in the Mediterranean region.

These new country records, including the finding of a population in the Danube catchment (Kulijer & Topić 2013) suggest that the knowledge of the species distribution in the region is still insufficient. It is unclear if *C. tenellum* recently expanded its range to the north in the Balkans or if the species was overlooked due to low prospections. The regional distribution of the species is discussed in Kulijer & Topić (2013).

In the western part of the Balkans, *C. tenellum* is rare and therefore of special conservation interest (Kulijer & Topić 2013). Based on current distribution and status, *C.*

tenellum has been considered as potentially threatened in Bosnia and Herzegovina (Kulijer et al. 2013). The species populations in natural habitats in the Mediterranean region of the country could be threatened in the future due to numerous

Figure 16. a) Upper part of the Stojkovića Rijeka Stream (Loc. 7) and b) some of the collected *Cordulegaster heros* larvae (Photo: Falk Petzold).

hydro power plants and other infrastructure projects. Increased water usage in combination with climate warming could cause desiccation of natural habitats (Kulijer & Topić 2013).

Cordulegaster heros was first discovered in 2007 in Bosnia and Herzegovina (Kulijer et al. 2013). Since then, several new observations were made from all parts of the country (i.e. Kulijer 2012, Kulijer et al. 2012, 2013). All of the records from the north originate from the NW region (Kulijer et al. 2013, unpublished data), while the species was not known from the Posavina region. During the BOOM, we found two adults and several larvae at a Stojkovića rijeka stream on the Motajica Mountain (Loc. 7, Fig. 16). The larvae were also found on Tubački Stream (Loc. 33) and Sabanjska River (Loc. 34) near Prnjavor. In the Mediterranean region adults were observed at two small streams in the Trebižat River valley (Loc. 58, 60). At several locations (Loc. 29, 34, 42, 64) *Cordulegaster* imagines were observed, but could not be identified to the species level. *Cordulegaster heros* is expected to be found at suitable habitats in all parts of the country, particularly along partly shaded streams or small rivers in the hilly region.

Acknowledgements

Many thanks to Sara Mandić, Radenka Đurasović, Selma Razić (Bosnia and Herzegovina), Ana Tratnik, Nina Erbida, Brina Stančič, Tajda Turk, Damjan Vinko (Slovenia), Sara Schloemer, Mélanie Turiault, Marko Olias, Oliver Brauner, Falk Petzold (Germany), Biljana Rimceska (Macedonia), Lena Kulić, Marija Gajić, Andrea Aranđelović, Katarina Erić and Saša Rajkov (Serbia), who participated in this survey and contributed with their observations. Special thanks to Ana and Nina for the help with additional cars and the transport. We would also like to thank the management of Hutovo Blato Nature Park for research permissions and assistance. We are also grateful to Martin Schorr and the reviewers for their valuable comments and suggestions, which helped to improve the manuscript.

The BOOM 2014 was supported by Critical Ecosystem Partnership Fund, Slovene Dragonfly Society, Rufford Foundation, International Dragonfly Fund as well as Student organization of University of Ljubljana, Student union of Biotechnical faculty of University of Ljubljana, Student organization of Biotechnical faculty and Društveno stičišče STIKS. We would like to express our gratitude to Klaus-Jürgen Conze for his help in the organization of the Meeting, but unfortunately was not able to join us this year.

References

Adamović, Ž.R., 1948. List of dragonflies (Odonata Fabr.) in the Biological Institute in Sarajevo. Godišnjak Biološkog Instituta u Sarajevu 1: 79–84.

Boudot, J.-P. & M. Jović, 2015. *Coenagrion scitulum* (Rambur, 1842). In: Atlas of the European dragonflies and damselflies, J.-P. Boudot, Kalkman V.J. & F. Peels (Eds.), KNNV Publishing, Zeist, the Netherlands pp. 114–116.

Boudot, J.-P., Kalkman & F. Peels (Eds.), 2015. Atlas of the European dragonflies and damselflies. KNNV Publishing, Zeist, the Netherlands.

Boudot, J.-P., V.J. Kalkman, M. Azpilicueta Amorín, T. Bogdanović, A. Cordero Rivera, G. Degabriele, J.-L. Dommanget, S. Ferreira, B. Garrigós, M. Jović, M. Kotarac, W. Lopau, M. Marinov, N. Mihoković, E. Riservato, B. Samraoui & W. Schneider, 2009. Atlas of the Odonata of the Mediterranean and North Africa. Libellula Supplement 9: 1–256.

Gams, J., 1978. The polje: the problem of definition. Zeitschrift für Geomorphologie 55: 170–181.

Jović, M., 2011. BOOM-ing. Erjavecia 26: 2–3.

Jović, M., B. Gligorović & M. Stanković, 2010. Review of faunistical data on Odonata in Bosnia and Herzegovina. Acta Entomologica Serbica 15(1): 7–27.

Kalkman, V.J., 2005. On the distribution of the genus *Ceriagrion* in the Balkans, including *C. georgifreyi*, a species new for the European fauna (Odonata: Coenagrionidae). Libellula Supplement 6: 25–32.

Kulijer, D. & M. Marinov, 2010. Odonata from Bulgaria in the collection of National Museum of Bosnia and Herzegovina. Acta Entomologica Serbica 15(2): 161–169.

Kulijer, D. & G. Topić, 2013. First record of a Balkan population of *Ceriagrion tenellum* outside the influence of the Mediterranean climate (Odonata: Coenagrionidae). Libellula 32(3/4): 193–204.

Kulijer, D., 2012. Odonata species and habitats at Livanjsko polje karst wetland area. International Dragonfly Fund-Report 48: 1–38.

Kulijer, D., 2014. Odonata fauna of karst streams and rivers of South Herzegovina (Bosnia and Herzegovina, West Balkan). International Dragonfly Fund-Report 72: 1–50.

Kulijer, D., G. De Knijf & M. Franković, 2013. Review of the Odonata of Bosnia and Herzegovina. Odonatologica 42(2): 109–123.

Kulijer, D., D. Vinko, M. Billqvist & J.J. Mekkes, 2012. Contribution to the knowledge of the Odonata fauna of Bosnia and Herzegovina – Results of the ECOO 2012. Natura Sloveniae 14(2): 23–38.

Kulijer, D., 2015. Bosnia and Herzegovina. In: Atlas of the European dragonflies and damselflies, J.-P. Boudot, Kalkman V.J. & F. Peels (Eds.), KNNV Publishing, Zeist, the Netherlands p. 38.

Kulijer, D. & I. Miljević, 2015. First record of *Leucorrhinia caudalis* for Bosnia and Herzegovina (Odonata: Libellulidae). Notulae odonatologicae 8(6): 176–183.

Mihevc, A. & M. Prelovšek, 2010. Geographical Position and General Overview. In: Mihevc, A., M. Prelovšek & N. Zupan Hajna (Eds.) Introduction to the Dinaric karst, Karst Research Institute at ZRC SAZU, Postojna, Slovenia, pp. 6–8.

Olias, M., F. Weihrauch, M. Bedjanić, N. Hacet, M. Marinov & A. Šalamun, 2007. *Lestes parvidens* and *L. viridis* in southeastern Europe: a chorological analysis (Odonata: Lestidae). Libellula 26(3/4): 243–272.

Prohić, E., Z. Peh & S. Miko, 1998. Geochemical characterization of a karst polje. An example from Sinjsko Polje, Croatia. Environmental Geology 33(4): 263–273.

Rajkov, S., D. Vinko & A. Aranđelović, 2015. Faunistic results from the 2nd Balkan OdonatOlogical Meeting – BOOM 2012, Serbia. Natura Sloveniae 17(2): 67–76.

Šácha, D. & M. Bedjanič, 2011. Rediscovery of the endangered river clubtail *Gomphus flavipes* (Charpentier, 1825) in Slovenia after half a century (Odonata: Gomphidae). Natura Sloveniae 13(2): 37–43.

Vinko, D., 2011. BOOM 2011 Faunistical review. Erjavecia 26: 7–12.

Vinko, D. & M. Vilenica, 2013. BOOM 2013, 3rd Balkan Odonatological Meeting (Third International meeting of odonatologists of the Balkans) Croatia, 01 – 07 August 2013: Results. Erjavecia 28: 10–19.

Vukić, M., 1992. Dragonflies in the entomological collection Jurečić. Student paper, Faculty of Sciences and Mathematics, University of Zagreb, 9 pp.

Appendix

Table II. List or recorded species with the reference to the specific locality (Tab. I, Fig. 1).

Locality	Date	Latitude	Longitude	Altitude [m]
Small pond near Gradiška	10.08.2014	45°07'29"	17°13'16"	89
Bardača, small fishpond near motel	03.08.2014	45°06'37"	17°26'13"	91
Laminci Lake	04.08.2014	45°06'12"	17°19'26"	92
Bardača, fishponds	03.08.2014	45°06'08'	17°25'45"	85
Bardača, small private fishpond	03.08.2014	45°05'35"	17°26'24"	90
Oxbow near Donja Dubica	04.08.2014	45°03'57"	18°25'30"	83
Motajica Mountain, upper part of Stojkovića rijeka Stream	04.08.2014	45°03'53"	17°37'27"	199
Motajica Mountain, lower part of the Stojkovića rijeka Stream	04.08.2014	45°03'30"	17°37'21"	165
Gravel ponds along the Vrbas River	04.08.2014	45°03'14"	17°26'42"	94
Lepenica Stream at Gornja Lepenica	03.08.2014	45°01'00"	17°39'10"	160
Ada, Bosna River	04.08.2014	45°00'47"	18°22'52"	89
Modrički lug, several small waterbodies	04.08.2014	44°58'39"	18°19'28"	95
Modrički lug, sunny pool in a gravel pit along the Bosna River	04.08.2014	44°58'04"	18°19'22"	98
Obudovac, irrigation canal near the bridge	04.08.2014	44°57'58"	18°36'26"	86
Aleksandrovac, small temporary pond by the road	01.08.2014	44°57'51"	17°16'21"	119
Oxbow north of Vranjak Village	04.08.2014	44°56'59"	18°13'40"	106
Oxbow and Vijaka River near Prnjavor fishponds	02.08.2014	44°55'08"	17°45'24"	124
Prnjavor fishpond, canal along the large fishpond	02.08.2014	44°54'39"	17°45'26"	124
Laklaši Oxbow	03.08.2014	44°54'23"	17°19'03"	120
Vidara Lake, Gradačac	04.08.2014	44°53'12"	18°24'30"	132
Hazna Lake, Gradačac	04.08.2014	44°52'54"	18°24'59"	138
Crkvena Stream near old mill	05.08.2014	44°52'52"	17°22'46"	131
Kanjska bara Pond, Prnjavor	02.08.2014	44°51'34"	17°41'05"	140
Vijaka River at Žunića mill	02.08.2014	44°50'31"	17°40'40"	142
Outflow from Drenova Lake (under the dam)	02.08.2014	44°48'50"	17°38'14"	165
Stari majdan (old mine) – pond by the road near Drenova Lake	02.08.2014	44°48'41"	17°37'34"	175
Mouth of Vijaka River into Drenova Lake	02.08.2014	44°48'21"	17°31'06"	171
Drenova River	02.08.2014	44°48'09"	17°38'19"	187
Lauš, garden near Crkvena Stream	09.08.2014	44°47'03"	17°09'55"	185
Mladen Stojanović Park	09.08.2014	44°46'50"	17°12'02"	165
Ukrina River, near the bridge	02.08.2014	44°46'27"	17°44'48"	152
Ukrina River, gravel extraction site	02.08.2014	44°46'09"	17°43'59"	156
Tubački Stream, near the playground	02.08.2014	44°46'01"	17°36'32"	233
Sabanjska River	02.08.2014	44°46'00"	17°37'12"	234
Skaut, Vrbas River	09.08.2014	44°45'58"	17°11'42"	154
Suturlija River	03.08.2014	44°45'09"	17°09'40"	169
Toplice, Vrbas River	03.08.2014	44°44'57"	17°09'33"	168
Karanovac, gravel ponds	(a) 03.08.2014, (b) 10.08.2014	44°41'45"	17°12'03"	176
Bočac, gravel ponds	05.08.2014	44°31'48"	17°09'14"	228
Plivska lakes	05.08.2014	44°20'54"	17°13'40"	425
Oborci, small stream	10.08.2014	44°11'30"	17°25'03"	608
Small stream near Donji Vakuf	10.08.2014	44°11'24"	17°21'06"	543
Ramsko Lake, at the inflow of Brodić Stream	05.08.2014	43°49'42"	17°31'26"	594
Ramsko Lake, near Šćit Monastery	05.08.2014	43°48'23"	17°31'53"	583
Idbar Stream	08.08.2014	43°40'28"	17°52'56"	319
Spring of Lištica River	06.08.2014	43°23'39"	17°35'44"	305
Gnjilište pond, Gornji Gradac	06.08.2014	43°23'01"	17°39'11"	280
Knešpolje, stream by the road	06.08.2014	43°21'58"	17°39'26"	237
Dobrić, small stream	06.08.2014	43°21'49"	17°40'09"	233
Veleško Lake	06.08.2014	43°20'41"	18°03'00"	1040
Lištica River, Mostarsko blato	06.08.2014	43°19'29"	17°44'09"	223
Nevesinjsko polje, shallow ponds	06.08.2014	43°18'29"	18°05'56"	846
Nevesinjsko polje, Nevesinjsko Lake	06.08.2014	43°18'02"	18°06'39"	843
Road near Blagaj	06.08.2014	43°15'50"	17°54'24"	303
Buna River in Buna Village	06.08.2014	43°14'46"	17°50'21"	33

INSTRUCTION TO AUTHORS

IDF-Report is a journal of the International Dragonfly Fund (IDF). It is referred to as the journal in the remainder of these instructions. Transfer of copyright to IDF is considered to have taken place implicitly once a paper has been published in the journal.

The journal publishes original papers only. By original is meant papers that: a) have not been published elsewhere before, and b) the scientific results of the paper have not been published in their entirety under a different title and/or with different wording elsewhere. The republishing of any part of a paper published in the journal must be negotiated with the Editorial Board and can only proceed after mutual agreement.

Papers reporting studies financially supported by the IDF will be reviewed with priority, however, authors working with Odonata from the focal area (as defined on the back page of the front cover) are encouraged to submit their manuscripts even if they have not received any funds from IDF.

Manuscripts submitted to the journal should preferably be in English; alternatively German or French will also be accepted. Every manuscript should be checked by a native speaker of the language in which it is written; if it is not possible for the authors to arrange this, they must inform the Editorial Board on submission of the paper. Authors are encouraged, if possible, to include a version of the abstract in the primary language of the country in which their study was made.

Authors can choose the best way for them to submit their manuscripts between these options: a) via e-mail to the publisher, or b) on a CD, DVD or any other IBM-compatible device. Manuscripts should be prepared in Microsoft Word for Windows.
While preparing the manuscript authors should consider that, although the journal gives some freedom in the style and arrangements of the sections, the editors would like to see the following clearly defined sections: Title (with authors names, physical and e-mail addresses), Abstract, Introduction, Material & Methods, Results, Discussion, Acknowledgments and References. This is a widely used scheme by scientists that everyone should be familiar with. No further instructions are given here, but every author should check the style of the journal.

Authors are advised to avoid any formatting of the text. The manuscripts will be stylised according to the font type and size adopted by the journal. However, check for: a) all species names must be given in italic, b) the authority and year of publication are required on the first appearance of a species name in the text, but not thereafter, and c) citations and reference list must be arranged following the format below.

Reference cited in the text should read as follows: Tillyard (1924), (Tillyard 1924), Swezey & Williams (1942).

The reference list should be prepared according to the following standard:
Swezey, O. & F. Williams, 1942. Dragonflies of Guam. Bernice P. Bishop Museum Bulletin 172: 3-6.
Tillyard, R., 1924. The dragonflies (Order Odonata) of Fiji, with special reference to a collection made by Mr. H.W. Simmonds, F.E.S., on the Island of Viti Levu. Transactions of the Entomological Society London 1923 III-IV: 305-346.

Citations of internet sources should include the date of access.

The manuscript should end with a list of captions to the figures and tables. The latter should be submitted separately from the text preferably as graphics made using one of the Microsoft Office products or as a high resolution picture saved as a .jpg .tif or .ps file. Pictures should be at least 11 cm wide and with a minimum 300 dpi resolution, better 360 dpi. Line drawings and graphics could have 1200 dpi for better details. If you compose many pictures to one figure, please submit the original files as well. Please leave some space in the upper left corner of each picture, to insert a letter (a, b, c...) later. Hand-made drawings should be scanned and submitted electronically. Printed figures sent by the post could be damaged, in which case authors will be asked to resubmit them.

Manuscripts not arranged according to these instructions may also be accepted, but in that case their publication will be delayed until the journal's standards are achieved.