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NEW DATA ON SOME RARE AND POORLY KNOWN ODONATA SPECIES IN SERBIA

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In spite of the relatively long tradition of studies on Odonata fauna in Serbia, its territory remains a "blank space" on distribution maps of many European Odonata species. The real distribution of almost all species is poorly known, so this paper presents new data on the least known species (*Lestes viridis*, *Erythromma lindenii*, *Brachytron pratense*, *Anax parthenope*, *Anax ephippiger*, *Cordulegaster heros*, *Somatochlora flavomaculata*, *Somatochlora metallica*, *Epitheca bimaculata* and *Sympetrum vulgatum*), including overview based on modern tendencies in taxonomy. Also included is a comment on the needs and present state of conservation of certain species as natural rarities and assets of Serbia.

Key words: Odonata, Serbia.

INTRODUCTION

Serbia is the central country of the Balkan Peninsula and has no direct contact to any seas in the Mediterranean area. However, the river valleys of the Danube, Vardar, Južna Morava and Velika Morava enable the incursion of Mediterranean faunistic elements. On the other hand, the northern part of

the territory of Serbia enters the Pannonian Plain, which represents the door for incursion of "northern" and "eastern" faunistic elements. The main corridors leading through this spacious plain are the river courses of the Danube, Sava, Drava and Tisa (Jović *et al.* 2008). Another important aspect is that its territory represents a part of the Ponto-Mediterranean glacial refugium (Dévai 1976). This diversity of influences and circumstances enabled the development of fauna that is, unfortunately, still poorly studied in general (Andjus 1992). There are only single or very rare records of many species, although it may be assumed that their distribution in Serbia is much wider. This type of situation further leads to unawareness of the presence of potential local variations.

The goal of this paper is to present modern records of the least known species in the territory of Serbia.

MATERIAL AND METHODS

Material used for this contribution to the knowledge of Odonata fauna of Serbia is stored mostly at the Natural History Museum in Belgrade (collections NHM600Beo 595.7331 - 3), while there is also a number of specimens in the collection of the National Museum in Zrenjanin.

The literature data cited here within the lists of localities are chosen due to their particular importance as recent records for the territory of Serbia, published only in studies in Serbian and therefore unavailable for the wider community of readers.

Nomenclature given here follows Dijkstra & Lewington (2006).

Localities per species are given in alphabetical order, referring to geographical regions of Serbia. Belgrade (in Serbian *Beograd*) spreads over an area of about 3222.268 km^2 (Grubačević *et al.* 2006). This area includes both parts of the Pannonian Plain (in the regions of Banat and Srem) and hills of the Balkan Peninsula (in the region of Šumadija).

Naturalistic photography appears for the first time as a source of data about Odonata distribution in Serbia. The photographs used to identify Odonata to species level were found on the Internet (www.wild-serbia.com) or brought by authors personally. The photographers have shared the data concerning the sites and dates when the photographs were taken, and have given us permission to use the photographs in this article.

RESULTS AND DISCUSSION

Lestes viridis (Vander Linden, 1825)

Šumadija: Mt. Juhor, 1995-08-11, 1♂, leg. B. Ristić

The only presently known specimen of the species *Lestes viridis* from Serbia (Fig. 1a), kindly donated to the Natural History Museum in Belgrade by Prof. Predrag Jakšić and Boban Ristić, is a male collected on Mt. Juhor.

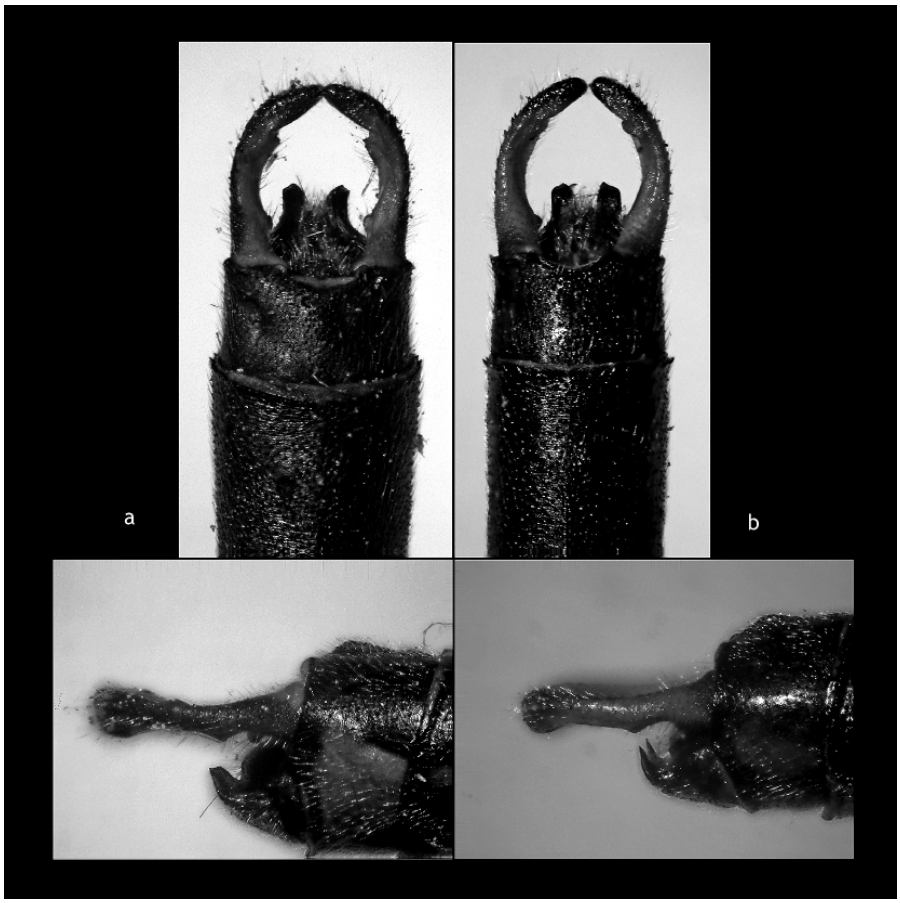

Fig. 1. - Anal appendages of a) male *Lester viridis* and b) male *L. parvidens* from Serbia (photo: Miloš Jović)

Our analysis of collected material showed that the closely related species *Lestes parvidens* Artobolevskii 1929 was "hidden" behind all the previously published data on *L. viridis* in Serbia (Adamović 1949, Tripković-Čubrilović 1960, Adamović & Andjus 1983, Andjus 1992, Santovac & Andjus 1995-98, Santovac 2002, Jović & Andjus 2003). This record partially matches the hypotheses on overlapping ranges of these two species presen-

ted by Olias *et al.* (2007). They presumed that the distribution of *L. parvidens* in Serbia is confined to northern parts of the country, northwards from the flows of the Sava and Danube Rivers, while the *L. viridis* area of distribution covers most of the country. According to our present knowledge, the dominant species of this species pair in Serbia is *L. parvidens*. Records presented by Adamović (1949) and Jović & Andjus (2003) push the limit of the *L. parvidens* area of distribution (proposed by Olias *et al.* 2007) southwards, to central Serbia (Rogot, near Kragujevac and Lake Trešnja, near Sopot, respectively). The male specimens of *L. parvidens* from Serbia (Fig. 1b) mostly match the characteristics of this species presented in modern identification keys (Marinov 2000, Askew 2004, Dijkstra & Lewington 2006, Kalkman 2006). These two species may also appear together as syntopic species. In Southern Europe this phenomenon has already been recorded for Italy (Cobolli *et al.* 1994), Greece (Olias & Günther 2005), and Bulgaria (Olias *et al.* 2007), but so far it is not recorded in Serbia.

Erythromma lindenii (Selys, 1840)

Eastern Serbia: Petrovac na Mlavi; 2003-05-12, 1♂, leg. M. Jović

This record represents a rediscovery of the species *E. lindenii* in Serbia after a century of absence. The only previous record was published by Adamović (1948), according to the material in the collection of the Zemaljski muzej in Sarajevo. We assume that those specimens from Bela Palanka in Southeastern Serbia arrived in Sarajevo in the late 19th century, when certain Austro-Hungarian researchers collected natural material in this part of Serbia (Adamović *et al.* 1992).

In Southeastern Europe this species is primarily attached to habitats with a more pronounced influence of Mediterranean climate (see the map for this species given in Boudot *et al.* 2009). The artificial lake at the confluence of Busur into Mlava (near the town Petrovac na Mlavi) is "tucked in" between Homoljske Mts. to the east and the hills of Šumadija to the west. Mlava River is a tributary of the Danube, so it is reasonable to expect a certain incursion of Mediterranean elements of entomofauna deeper into the Balkan Peninsula through this corridor.

Brachytron pratense (Müller, 1764)

Banat: Beograd: Reva; Jović *et al.* (2008)

Mačva: Zasavica; Jović *et al.* (2007)

Srem: Obedska bara; 2007-05-01, population observed by M. Jović

Šumadija: Beograd: Mala Moštanica: Žuto Brdo; 2006-05-13, 1♂, 1♀, leg. A. Stojanović

Šumadija: Kragujevac: Lake Šumarice; 2008-05-17, 1♂, leg. M. Jović

This species was previously considered rare in Serbia. In recent times very abundant populations of *B. pratense* were recorded at Obedska Bara and Zasavica. These data indicate that similar populations could be recorded at several localities along the river courses of the Danube, Sava and Tisa in the northern part of Serbia.

B. pretense was only recently recorded in the Balkan part of Serbia. The first record of *B. pratense* in Šumadija is from Mala Moštanica. The southernmost record is from the artificial lake Šumarice at Kragujevac. The characteristics of the habitat partially match the needs of this species (a dense reed belt in one part of the lake) but in contrast to the localities in the northern part of Serbia this record includes only several individuals.

There are probably several reasons for the rare recordings of this species in Serbia during the 20th century (Pongracz 1944, Tripković--Čubrilović 1960, Adamović & Andjus 1983, Andjus 1992). They include the rare study excursions to a small number of localities, performed at the time of year when the abundance of this springtime species seasonally decreases as a rule. Additional hardship is that in most habitats it is necessary to use a boat, as individuals of *B. pratense* fly at the side of the reed-mace belt facing the open water of a pond or a slowly-flowing river.

Anax parthenope Selys, 1839
Bačka: Hajdukovo & Bačka Topola; Santovac (2007)
Bačka: Palić; 2002, larvae, leg. S. Grubanov

Fig 2. - Male *Anax parthenope* photographed near Mrtva Tisa near Banatski Despotovac (photo: Katarina Paunović)

Banat: Banatski Despotovac: Mrtva Tisa; 2008-08-23, 1♂, photo K. Paunović (Fig. 2)

Banat: Zrenjanin & Kikinda; Santovac (2007)

Šumadija: Vlaški do, 2003-07-23, 1♂, leg. M. Jović

In Serbia *A. parthenope* is most commonly recorded to the north of the Sava and Danube Rivers (Franković 1990, Santovac & Andjus 1997, Santovac 2007) while the only record of this species from the Balkans part of Serbia was from the artificial lake near the village Vlaški Do in Šumadija.

Larvae of both *A. parthenope* and *Anax imperator* Leach 1815 were found in Palić in North Serbia but only *A. imperator* adults were recorded. Due to the differences in size and strength, it is possible that *A. imperator* successfully suppresses *A. parthenope* in territorial disputes so the latter species may be easily overlooked in its potential habitats in Serbia.

Anax ephippiger (Burmeister, 1839)

Banat: Vršac, fishpond, 2008-07-31, dead ♂ specimen, photo: M. Paunović

Šumadija: Lake Gružansko: Knić, 2004-04-27, 1♂, leg. A. Paunović

This "vagrant" species is not commonly recorded in Serbia (Adamović 1949, Mihajlović 1974, Andjus 1992). In addition to the mass occurrence of this species reported by Mihajlović (1974) there was another recorded

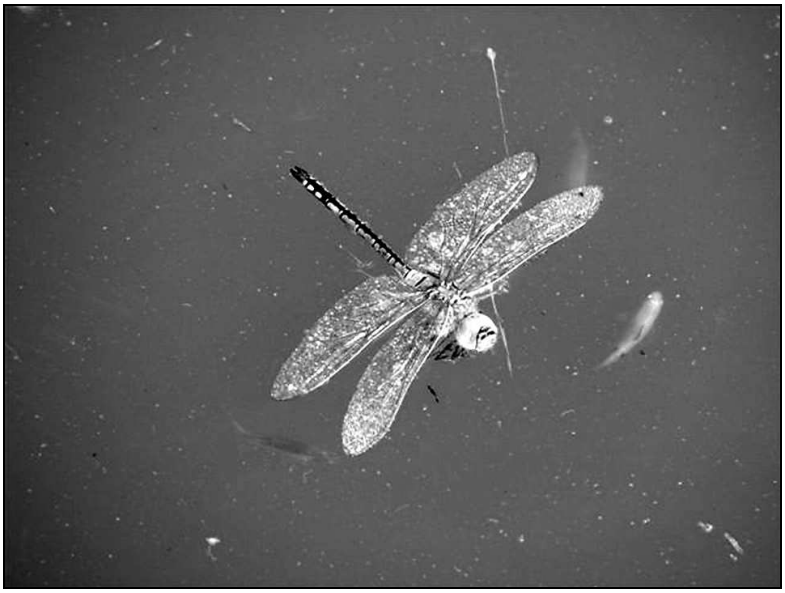

Fig. 3. - Male *Anax ephippiger*, floating on the surface of water in a fishpond (photo: Milan Paunović)

mass occurrence in Serbia in recent times. Ana Paunović, curator of the Natural History Museum in Belgrade, has observed a mass occurrence of this species at Gružansko Lake in the vicinity of the town of Knić. When the authors visited this site several days later they found only a handful of individuals flying over the shallow ponds in sand on the lake shore. The tandem flight was also recorded on this occasion.

Milan Paunović, Curator of the Natural History Museum in Belgrade, has photographed a dead male of this species at a fishpond in the vicinity of Vršac (Fig. 3).

Both recorded habitats match the habitat type preferred by this species – shallow warm bodies of standing water (Askew 2004, Dijkstra & Lewington 2006). So far, there is no evidence of the successful reproduction of this species in Serbia.

Cordulegaster heros Theischinger, 1979

Srem: Fruška Gora: Ledinački potok; Santovac (2007); 2009-07-21, 1♂, leg. M. Jović

Šumadija: Belgrade: Karagački potok; Jović (2002)

Šumadija: Dragovo; 2006-08-15, 1♂, 1♀, leg. M. Jović

Western Serbia: Petnica; Branković (1996)

This species is included in Annexes II and IV of the Habitat directive of EU (meaning that habitats of this species must be included in the national network of protected habitats and that the survival of national populations must be ensured), and therefore it is particularly important, as this document (although presently without compulsory implementation in Serbia) is relevant for species protection on a pan-European level. Therefore this is one of the species suggested for the list of legally protected species of wild fauna and flora in the Republic of Serbia. Adamović *et al.* (1992) presented a review of the known records of this species in Serbia and Macedonia at the time of publication. They also gave a description of habitats preferred by this species in Serbia and Macedonia - "Narrow and shallow, gentle streams, with pebbly, sandy and slity bottom and clean water, flowing through forests of hilly and mountainous areas appear the favorable habitats of *C. h. heros* in Serbia and Macedonia".

The record from Belgrade (Jović 2002) is interesting as it includes a special habitat of this species in Serbia – a stream flowing among the cultivated fields through a "tunnel" of bush-like vegetation, separated from the closest forest by agroecosystems. The male of species *C. heros* was using this stream at a relatively low altitude (about 100 m above sea level) as a tunnel for moving through the landscape of obviously unsuitable characteristics.

The record from Fruška Gora is the northernmost record of this species in Serbia. The stream at the locality of Ledinci is under a remarkably strong anthropogenous influence, which, due to the spread of the human settlement and the corrections being made in the stream bed, is prone to be ever increasing in the future.

Somatochlora flavomaculata (Vander Linden, 1825)

Mačva: Bitva Canal, 2008-08-08, 1♂, leg. M. Jović

This is one of the rare records of the *S. flavomaculata* in Serbia. Previously it was recorded only three times (Adamović 1949, 1993; Andjus 1992). In Southeastern Europe it is represented by a relatively small population (Dijkstra & Lewington 2006, Boudot *et al.* 2009).

Somatochlora metallica (Vander Linden, 1825)

After analysis of material published so far on the species *S. metallica* in Serbia (Adamović 1948, Andjus 1992, Santovac 2002) we concluded that it actually pertains to the species *Somatochlora meridionalis* Nielsen, 1935. The habitats matching the ecological needs of the species *S. metallica* are relatively rare in Serbia – mountain lakes (Kotarac & Bedjanič 1994, Dijkstra & Lewington 2006) and peat bogs (Adamović *et al.* 1996) (bearing in mind that Serbia is situated in Southeastern Europe). On the other hand, habitats preferred by *S. meridionalis* - running, often shaded waters (Dijkstra & Lewington 2006) are quite common in the Balkan part of Serbia. The challenges with confusing determination and differences in the ecological needs of this species were discussed in several literature sources on the Odonata of the Balkan Peninsula (Kotarac & Bedjanič 1994, Adamović *et al.* 1996, Marinov 2007, Jović *et al.* 2008).

S. metallica should be excluded from the list of Odonata species recorded in Serbia. However, *S. metallica* should be expected in Serbia in high-mountain areas as well as in the far north of the country.

Epitheca bimaculata (Charpentier, 1825)

Banat: Labudovo okno marsh, 2004-05-11, 1 exuvia, leg. A. Petrović

Banat: Koviljski rit; 2008-05-01, 1♂, photo K. Paunović (Fig. 4)

Mačva: Zasavica: Turske livade; Jović *et al.* (2007); 4 exuviae, 2008--04-26, leg. M. Stanković; 1 exuvia, 2008-05-14, leg. A. Ćetković; 1 exuvia, 2009-05-05, leg. M. Stanković

Šumadija: Kragujevac: Lake Šumarice; 2006-05-14, 1♂, photo N. Miljković (Fig. 5)

This species was rediscovered in Serbia in 2001 (Jović & Andjus 2003), but during the last few years it was recorded at several sites; it was determined according to exuvia and photographs of freshly emerged adults that confirmed successful breeding of this species in Serbia. The sites

included artificial lakes, marshes and even the banks of the slowly flowing river Zasavica (Jović *et al.* 2007).

The banks of the Zasavica River are a very interesting area where exuviae of this primarily lacustrine species (Jović & Andjus 2003) of Odonata were recorded. In this part of its flow the Zasavica is very slow, but still it is a river with a certain amount of water flow. After the initial

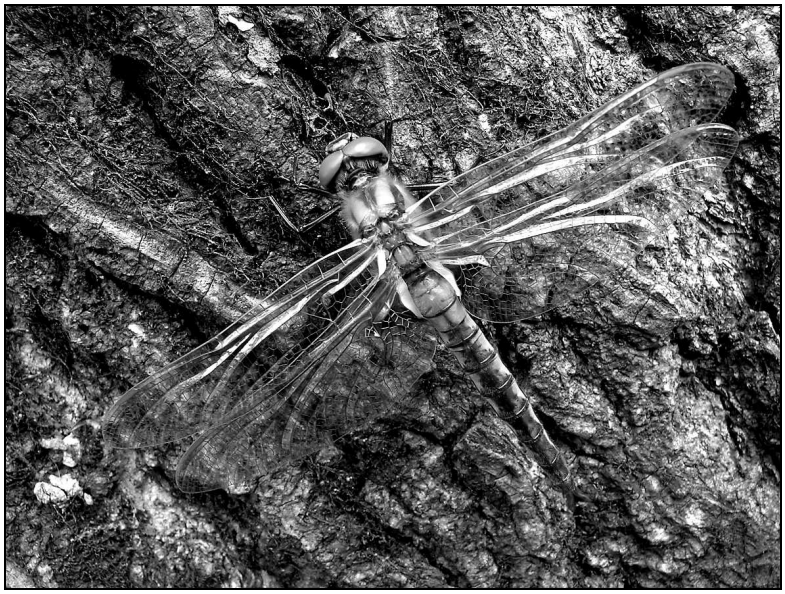

Fig. 4. - Freshly ecloded individual of species *Epitheca bimaculata*; photograph taken at Koviljski Rit (photo: Katarina Paunović)

record of *E. bimaculata* exuvia at the locality of Turske Livade on the banks of the Zasavica, new exuviae were also recorded in 2008 and 2009, indicating the continuity in the development of this species in river water.

A photograph of the teneral male specimen (Fig. 5) of *E. bimaculata* from the lake Šumarice in Kragujevac is the southernmost record of this species in Serbia and Europe (see the distribution map of this species in Boudot *et al.* 2009). Previously, the southernmost record was from Rogot, in July 1906, some 10 km northwards from Kragujevac. However, our later visit to this locality in May 2008 showed no presence of either exuviae or of adult individuals of *E. bimaculata*.

Sympetrum vulgatum (Linnaeus, 1758)

Mačva: Zasavica: Valjevac; Jović *et al.* (2007)

Southeastern Serbia: Vlasinsko jezero; 2003-08-17, 1♂, leg. M. Jović

Šumadija: Jezero Trešnja; 2005-08-14, 1♀, leg. M. Jović

Fig. 5. - Freshly ecloded individual of *Epitheca bimaculata*; photograph taken at Lake Šumarice (photo: Nikola Miljković)

This species is considered rare in Serbia. It was previously recorded only a few times (Pongracz 1944, Živojinović 1950, Adamović & Andjus 1983, Deliry & Loose 1987, Santovac & Andjus 1995-98). Although it is characteristic of various types of standing water bodies (Dijkstra & Lewington 2006), the records of this species in Southern Europe are significantly fewer in number than in Eastern, Central and the continental part of Western Europe.

CONCLUSION

Small amounts of data do not provide a basis to make some general reviews of distribution patterns or to discuss priorities in the conservation of the Odonata species in Serbia. Data presented in this study solve some problems in interpretation of previously published data (about *L. viridis* and *S. metallica*) and show that some of the species are still present in Serbia (*E. lindenii* and *E. bimaculata*). Most of the species mentioned here are threatened to some extent in Serbia, due to habitat loss induced by climate changes and human impact. However, these are not the only species that deserve special attention. Systematic and steady exploration of Odonata fauna in Serbia is urgently needed in order to make a basis for analyses and the creation of management plans.

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НОВИ ПОДАЦИ О НЕКИМ РЕТКИМ И МАЊЕ ПОЗНАТИМ ВРСТАМА ODONATA У СРБИЈИ

МИЛОШ ЈОВИЋ, ЉИЉАНА АНЂУС И СВЕТОЗАР САНТОВАЦ

Р Е З И М Е

Упркос релативно дугој традицији истраживања фауне Одоната у Србији, њена територија је остала „бела мрља" на мапама распрострањења многих врста Odonata у Европи. О стварном распрострањењу готово свих врста се мало зна. У раду су презентовани нови подаци о ретким и мање познатим врстама, то су: *Lestes viridis*, *Erythromma lindenii*, *Brachytron pratense*, *Anax parthenope*, *Anax ephippiger*, *Cordulegaster heros*, *Somatochlora flavomaculata*, *Somatochlora metallica*, *Epitheca bimaculata* и *Sympetrum vulgatum*. У разматрању су коришћене савремене тенденције у таксономији ове групе инсеката. Посебно је наглашен коментар о потреби и тренутном стању у заштити одређених врста као природних реткости и вредности у фауни Србије.