

**FAUNA OF THE BROWN LACEWINGS OF SERBIA
(INSECTA: NEUROPTERA: HEMEROBIIDAE)**

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Abstract - The hemerobiid fauna of Serbia was studied during two collecting trips in the years 2015 and 2016. Prior to the present study the hemerobiids in this Balkan country were insufficiently explored. According to literature data and collected material, twenty-three species are listed for the country, of which six are recorded for the first time for Serbia.

KEY WORDS: hemerobiid fauna, lacewings, Balkan Peninsula

Izvleček - FAVNA RJAVIH MREŽEKRIKCEV REPUBLIKE SRBIJE (INSECTA: NEUROPTERA: HEMEROBIIDAE)

Tekom dveh terenskih odprav v Srbijo smo v letih 2015 in 2016 raziskovali favno rjavih mrežekrilcev. Pred aktualno raziskavo so bili hemerobiidi tega območja zelo slabo poznani. Po analizi literaturnih podatkov in nabranega materiala predstavljamo seznam 23 vrst za Republiko Srbijo, od katerih je šest novih najdb za to balkansko državo.

KLJUČNE BESEDE: favna hemerobiidov, mrežekrilci, balkanski polotok

Introduction

Hemerobiidae is one of the largest families of the order Neuroptera. It contains more than 550 known species of small to medium sized insects, distributed all around

the world (Monserrat 1990, Oswald 1993, Aspöck *et al.* 2001). Brown lacewings are predaceous insects in both adult and larval stages. This is why they are suggested as potential control agents in greenhouses, field crops and orchards, where they could prey on aphids (New 1975, Stelzl 1991, Canard 2001, Devetak & Klokočovnik 2016). Although they appear to be bound to certain habitats (Monserrat & Marin 1996), like conifers or broad-leaved trees, they can produce eggs in lower aphid density because they do not rely on honeydew as a food source, which is the case in most Chrysopidae adults (Neuenschwander *et al.* 1975). Also, many hemerobiids have very low temperature thresholds, which could give them an advantage in using these predators in cool periods in temperate climates (Neuenschwander 1975, 1976, New 1975).

Neuropteran fauna of Serbia was poorly studied and authors report sporadic information on species occurrence in this Balkan country (Pančić 1863, Frivaldsky 1877, Biró 1885, Mocsáry 1899, Olasz 1906, Pongrácz 1914, Živojinović 1950, Petrik 1958, Grozdanić & Stevanović 1969, Aspöck *et al.* 1980, 2001, Mitić & Gradojević 1983, Stevanović & Bjelić 1985, Devetak 1992, Devetak & Jakšić 2003, Devetak *et al.* 2015, Petrović 2013, Marković *et al.* 2016).

Even though brown lacewings have the potential of becoming economically important group, in the past, their fauna on the Balkan Peninsula was studied very poorly and only sporadic data exist so far. Because of that, species distribution for different Balkan countries is still lacking. Popov & Letardi (2010) in their review summarizing information on the Neuropterida of the Balkan Peninsula report 44 brown lacewing species for the peninsula. However, in recent times, no information about their presence in different Balkan countries is given, except from Albania (Klokočovnik *et al.* 2014, Devetak & Rausch 2016). For Serbia, only a part of the country was studied, namely Kosovo and Metohija, and 15 brown lacewing species were reported for this part (Devetak & Jakšić 2003). In older literature (Mocsáry 1899, Pongrácz 1914), only two hemerobiid species were reported in Vojvodina.

In July 2015 and June 2016, zoologists from the Department of Biology of the University of Maribor (Slovenia) organized two neuropterological collecting trips to different parts of Serbia. In 2015 neuropterans were collected in south-eastern and western Serbia, with special focus on the Pirot district with foothills of the Stara planina mountain and the Tara National Park, while in 2016 in the north-eastern and in south-eastern part of the country – in the Deliblato sands and the Stara planina mountain. The aim of this paper is to present new faunistical data on the basis of those recent field trips, and to compile literature records.

Material and methods

The survey of brown lacewings was carried out during two collecting trips in the years 2015 and 2016. Additionally, some material was obtained from previous collecting trips not focused on Hemerobiidae. Also, literature data is presented.

During the collecting trips, animals were collected using an insect net. Collected specimens were preserved in ethanol and deposited in the last author's collection. Nomenclature and taxonomy has been used in accordance with Oswald (2017). We

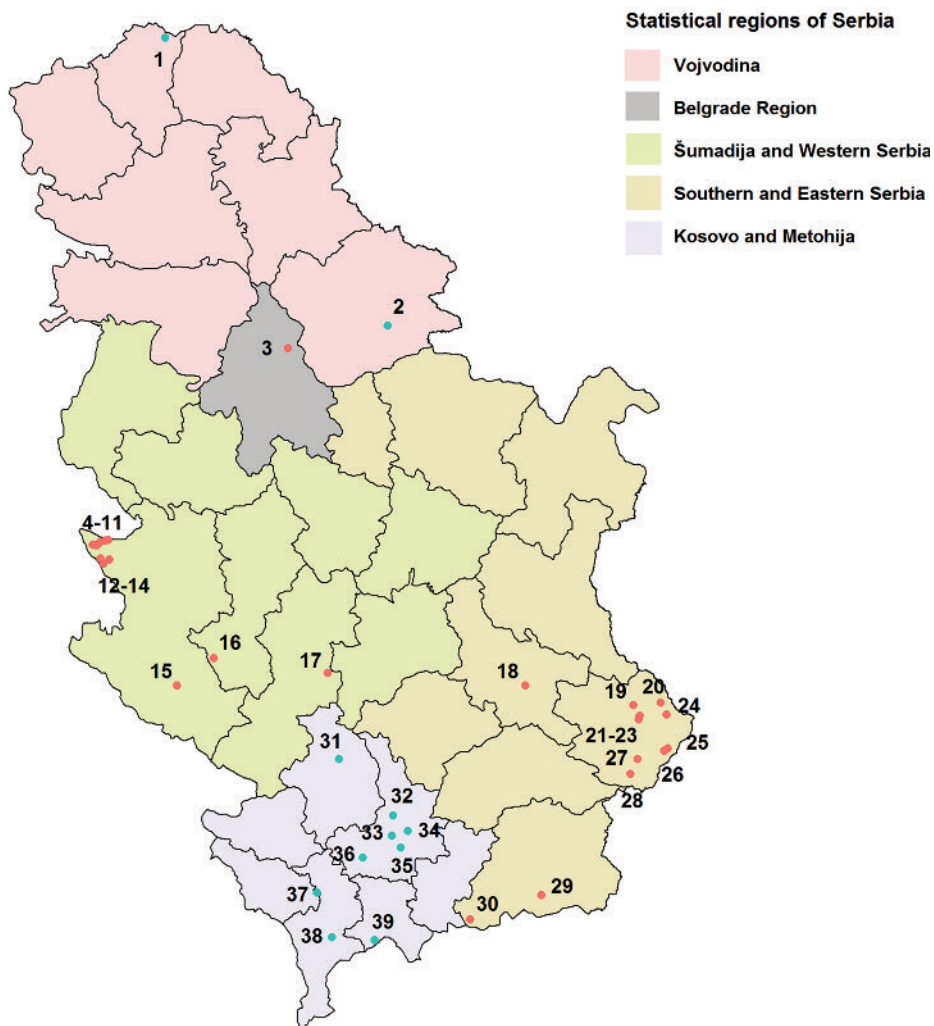


Fig. 1: Statistical regions of Serbia with collection sites of collected material (red dots) and literature records (blue dots) (collection sites with numbers are listed in material and methods).

followed zoogeographical categorization of Neuropterid fauna of the Balkan Peninsula proposed by Aspöck et al. (2001) and Popov & Letardi (2010). The map of Serbia was created with ggmap and ggplot2 packages for R Statistics (Kahle & Wickham 2013).

Most of the material was collected in the periods 21-28 June 2015 and 3-10 July 2016. Thirty-nine collecting sites were included in the survey (with details of geographic position, altitude, and type of the habitat, where information was available) (Tab. 1, Fig. 1).

Table 1: List of collecting sites in Serbia.

Statistical region	Collecting site #	Collecting site information / date	Habitat	Collector(s)
Vojvodina – literature records				
	1	Palić (MOCSÁRY 1899, PONGRÁCZ 1914)		
	2	Deliblato (MOCSÁRY 1899, PONGRÁCZ 1914)		
Belgrade Region				
	3	Beograd, Zvezdara; 185 m; 44° 47.883' N 20° 30.300' E; 25. VII. 2015	vicinity of the park	Jakšić leg.
Šumadija and Western Serbia				
	4	Zlatibor District: river Drina: lake Perućaćko jezero, near Perućac; 300-315 m; 43° 57.563' N 19° 23.572' E; 25. VI. 2015	shore of the lake	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
	5	Zlatibor District: river Drina: lake Perućaćko jezero, Perućac: Hotel Jezero; 320 m; 43° 57.733' N 19° 24.483'; 27. VI. 2015	surroundings of the hotel	Devetak leg.
	6	Zlatibor District: National Park Tara: Gorge of the Derвента river; 430 m; 43° 57.087' N 19° 21.451' E; 25. VI. 2015	mixed forest	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
	7	Zlatibor District: National Park Tara: Gorge of the Derвента river, Predo Krst; 610 m; 43° 56.518' N 19° 20.723' E; 25. VI. 2015	mixed forest	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
	8	Zlatibor District: National Park Tara: Križevac near Predov Krst; 755 m; 43° 56.521' N 19° 20.165' E; 27. VI. 2015	mixed forest: <i>Acer campestre</i>	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
	9	Zlatibor District: National Park Tara: Križevac near Predov Krst; 724 m; 43° 56.415' N 19° 20.163' E; 27. VI. 2015	<i>Quercus</i> forest	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
	10	Zlatibor District: National Park Tara: Križevac near Predov Krst; 755 m; 43° 56.521' N 19° 20.165' E; 27. VI. 2015	mixed forest	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
	11	Zlatibor District: National Park Tara: Predov Krst; 997 m; 43° 56.460' N 19° 18.899' E; 27. VI. 2015	meadow with <i>Juniperus</i> , <i>Pinus</i> , <i>Picea</i> <i>Acer</i> , <i>Salix</i>	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
	12	Zlatibor District: National Park Tara: Vasilići–Filipovići; 1105 m; 43° 51.514' N 19° 22.910' E; 27. VI. 2015	meadow with <i>Juniperus</i> , <i>Pinus</i> , <i>Picea</i>	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.

13	Zlatibor District: National Park Tara: Jezero Zaovine; 935 m; 43° 52.633' N 19° 24.972' E; 27. VI. 2015	<i>Pinus, Picea</i>	Klokočovník, Klenovšek, Podlesnik, Janžeković, Devetak leg.
14	Zlatibor District: National Park Tara: Jezero Zaovine: Bjeluša brook; 885 m; 43° 52.988' N 19° 21.707' E; 27. VI. 2015	hygrophilous forest	Klokočovník, Klenovšek, Podlesnik, Janžeković, Devetak leg.
15	Zlatibor District: Četnica Mt. plateau: near Karaula village; 1355 m; 43° 19.217' N 19° 49.783' E; 04. VIII. 2015		Nahirnić, Beshkov leg.
16	Moravica District: Javor Mt., Vasilin vrh peak; 1489 m; 43° 26.467' N 20° 03.100' E; 12. VII. 2015		Nahirnić, Beshkov leg.
17	Raška District: Kopaonik, Jošanička Banja; 623 m; 43° 22.678' N 20° 44.805' E; 06. VIII. 1986		Jakšić leg.
Southern and Eastern Serbia			
18	Nišava district: Niš, east, Nišava river; 199 m; 43° 19.235' N 21° 57.098' E; 23. VI. 2015	river bank	Klokočovník, Klenovšek, Podlesnik, Janžeković, Devetak leg.
19	Pirot district: Mt. Vidlič, Srednja Glama near Koprivštica; 995 m; 43° 14.083' N 22° 36.617' E; 14. VI. 2015	<i>Carpinus orientalis</i> thickets	Nahirnić leg.
20	Pirot district: Balkan (Stara planina), Dojkinci: along river Dojkinačka reka; 920 m; 43° 14.750' N 22° 46.583' E; 05. VII. 2016	vegetation along the river	Jakšić, Klenovšek, Janžeković, Devetak leg.
21	Pirot district: Vidlič Mt.: north east of Pirot; 725 m; 43° 10.317' N 22° 38.583' E; 06. VII. 2016	<i>Pinus nigra</i> forest	Jakšić, Klenovšek, Janžeković, Devetak leg.
22	Pirot district: Mt. Vidlič, Crni Vrh; 1016-1115 m; 43° 11.217' N 22° 39.050' E; 15. VI. 2015	mixed deciduous forest	Nahirnić, Beshkov leg.
23	Pirot district: Mt. Vidlič, Crni Vrh; 1016-1115 m; UV trap; 43° 10.850' N 22° 38.867' E; 29. VIII. 2015	mixed deciduous forest	Nahirnić, Beshkov leg.
24	Pirot district: south of Dojkinci; 770 m; 43° 11.600' N 22° 48.900' E; 05. VII. 2016	forest with <i>Pinus</i>	Jakšić, Klenovšek, Janžeković, Devetak leg.
25	Pirot district: Dimitrovgrad: Mt Vidlič, south slope, 650 m; 43° 02.517' N 22° 49.267' E; 22. VI. 2015	<i>Pinus nigra</i>	Klokočovník, Klenovšek, Podlesnik, Janžeković, Devetak leg.
26	Pirot district: Dimitrovgrad: Mt Vidlič, south slope; 630 m; 43° 01.806' N 22° 47.917' E; 22. VI. 2015	mixed forest and meadows	Klokočovník, Klenovšek, Podlesnik, Janžeković, Devetak leg.

27	Pirot district: Kanjon Jerme: Vlasi; 491 m; 42° 59.672' N 22° 38.230' E; 22. VI. 2015	deciduous forest	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
28	Pirot district: Zvanačka Banja; 690 m; 42° 55.740' N 22° 35.558' E; 22. VI. 2015	hygrophilous forest and vegetation along a rivulet	Klokočovnik, Klenovšek, Podlesnik, Janžekovič, Devetak leg.
29	Pčinja District: Pčinja river Valley: Trgovište, Vražji kamen; 663 m; 42° 23.100' N 22° 03.100' E; 21. IX. 2015	<i>Carpino orientalis</i> - <i>Quercetum mixtum</i>	Nahirnić, Beshkov leg.
30	Pčinja District: Preševo town, 2 km W Trnava village; 696 m; 42° 16.550' N 21° 36.950' E; 18. IX. 2015	<i>Quercus pubescens</i> , <i>Q. petraea</i> , steppe-like grasslands	Nahirnić, Beshkov leg.
Kosovo and Metohija – literature records			
31	Ibarska Klisura: Košutovac, Košutovački potok; 42° 59.667' N, 20° 48.983' E; 13. VIII. 1985, 24.VII. 1987 (DEVETAK & JAKŠIĆ 2003)		Jakšić leg.
32	Lebane; 42° 44.492' N, 21° 08.787' E; 9. VI. 1979 (DEVETAK & JAKŠIĆ 2003)		Devetak leg.
33	Priština; 42° 39.090' N, 21° 08.415' E; IV.–X. 1979 (DEVETAK & JAKŠIĆ 2003)	<i>Acer platanoides</i> , <i>Pinus nigra</i> ;	Devetak leg.
34	Mt. Grmija; 42° 40.325' N, 21° 14.155' E; 4. VIII. 1978, 16. VII. 1979, 22. VII. 1979 (DEVETAK & JAKŠIĆ 2003)	forest/thicket with <i>Quercus</i> spp., <i>Fagus</i> , <i>Acer</i> ;	Devetak & Jakšić leg.
35	Gračanica; 42° 35.938' N, 21° 11.617' E; 5. V. 1979, 26. VII. 1979 (DEVETAK & JAKŠIĆ 2003)		Devetak leg.
36	Mt. Goleš; 42° 33.202' N, 20° 57.688' E; VI. – VII. 1979 (DEVETAK & JAKŠIĆ 2003)	thicket/forest with <i>Quercus</i> spp.;	Devetak leg.
37	Orahovac; 42° 23.753' N, 20° 40.987' E; 15. IV. 1979 (DEVETAK & JAKŠIĆ 2003)		Devetak leg.
38	Mt. Šar planina: Prizrenska Bistrica; 42° 11.663' N, 20° 46.363' E; 22. VII. 1986 (DEVETAK & JAKŠIĆ 2003)		Jakšić leg.
39	Mt. Šar planina: Brezovica, Stojkova kuća, 1750 m; 42° 10.852' N, 21° 01.985' E; 19. VII. 1986 (DEVETAK & JAKŠIĆ 2003)		Jakšić leg.

Results

A total of 23 hemerobiid species were found. They belong to 6 subfamilies and 7 genera. The list of species with data about the localities is given below.

Hemerobiidae Latreille, 1802

Hemerobiinae Latreille, 1802

Hemerobius humulinus Linnaeus, 1758

Literature records:

Kosovo and Metohija: 32, 33, 34, 36 (Devetak & Jakšić 2003)

Material:

Belgrade Region: 3

Šumadija and Western Serbia: 4, 5, 6, 7, 8, 9, 10, 11, 12

Southern and Eastern Serbia: 20, 24, 27, 28

Zoogeographical element: Holarctic.

Hemerobius simulans Walker, 1853

Literature records:

Kosovo and Metohija: 33 (Devetak & Jakšić 2003)

Material:

Southern and Eastern Serbia: 22

Zoogeographical element: Holarctic.

Hemerobius stigma Stephens, 1836

Literature records:

Kosovo and Metohija: 33 (Devetak & Jakšić 2003)

Zoogeographical element: Holarctic.

Hemerobius pini Stephens, 1836

Material:

Šumadija and Western Serbia: 11

First record for Serbia.

Zoogeographical element: Siberian.

Hemerobius contumax Tjeder, 1932

Material:

Šumadija and Western Serbia: 16

First record for Serbia.

Zoogeographical element: Central European–Mediterranean.

Hemerobius handschini Tjeder, 1957

Literature records:

Kosovo and Metohija: 33 (Devetak & Jakšić 2003)

Material:

Šumadija and Western Serbia: 4, 5, 7, 10, 12, 13

Southern and Eastern Serbia: 21, 24, 25, 26, 29

Zoogeographical element: Holomediterranean (expansive northwards).

***Hemerobius micans* Olivier, 1793**

Literature records:

Kosovo and Metohija: 32, 33, 34, 35, 36, 37 (Devetak & Jakšić 2003)

Material:

Šumadija and Western Serbia: 4, 5, 6, 7, 9, 10, 11, 13, 14, 15

Southern and Eastern Serbia: 20, 24, 27, 28, 29

Zoogeographical element: Holomediterranean (expansive northwards).

***Hemerobius lutescens* Fabricius, 1793**

Literature records:

Kosovo and Metohija: 32, 33, 34 (Devetak & Jakšić 2003)

Zoogeographical element: Siberian.

***Hemerobius gilvus* Stein, 1863**

Literature records:

Kosovo and Metohija: 33, 35 (Devetak & Jakšić 2003)

Material:

Southern and Eastern Serbia: 28, 29

Zoogeographical element: Holomediterranean (expansive northwards).

***Hemerobius marginatus* Stephens, 1836**

Literature records:

Kosovo and Metohija: 33, 34, 36 (Devetak & Jakšić 2003)

Zoogeographical element: Siberian.

***Wesmaelius quadrifasciatus* (Reuter, 1894)**

Material:

Šumadija and Western Serbia: 16

First record for Serbia.

Zoogeographical element: Siberian.

***Wesmaelius subnebulosus* (Stephens, 1836)**

Literature records:

Kosovo and Metohija: 32, 33, 34, 36 (Devetak & Jakšić 2003)

Zoogeographical element: Holomediterranean (expansive northwards).

Sympheroibiinae Comstock, 1918

***Sympherobius pygmaeus* (Rambur, 1842)**

Literature records:

Kosovo and Metohija: 33 (Devetak & Jakšić 2003)

Material:

Šumadija and Western Serbia: 15

Southern and Eastern Serbia: 29, 30

Zoogeographical element: Holomediterranean (expansive northwards).

***Symphorobius elegans* (Stephens, 1836)**

Literature record:

Vojvodina: 2 (Mocsáry 1899, Pongrácz 1914)

Zoogeographical element: Holomediterranean (expansive northwards).

***Symphorobius fuscescens* (Wallengren, 1863)**

Material:

Šumadija and Western Serbia: 13

First record for Serbia.

Zoogeographical element: Siberian.

Notiobiellinae Nakahara, 1960

***Psectra diptera* (Burmeister, 1839)**

Literature records:

Vojvodina: 1 (Mocsáry 1899, Pongrácz 1914)

Zoogeographical element: Holarctic.

Megalominae Krüger, 1922

***Megalomus tortricoides* Rambur, 1842**

Literature records:

Kosovo and Metohija: 31, 32, 34 (Devetak & Jakšić 2003)

Material:

Šumadija and Western Serbia: 11, 16

Southern and Eastern Serbia: 19, 22, 23, 30

Zoogeographical element: Holomediterranean (expansive northwards).

***Megalomus tineoides* Rambur, 1842**

Material:

Southern and Eastern Serbia: 30

First record for Serbia.

Zoogeographical element: Holomediterranean (stationary).

Drepanepteryginae Krüger, 1922

***Drepanepteryx phalaenoides* (Linnaeus, 1758)**

Literature records:

Kosovo and Metohija: 34 (Devetak & Jakšić 2003)

Material:

Šumadija and Western Serbia: 17

Zoogeographical element: Siberian.

Microminae Krüger, 1922***Micromus variegatus*** (Fabricius, 1793)

Literature records:

Kosovo and Metohija: 31 (Devetak & Jakšić 2003)

Material:

Šumadija and Western Serbia: 16

Southern and Eastern Serbia: 18, 22, 30

Zoogeographical element: Siberian.

Micromus angulatus (Stephens, 1836)

Literature records:

Kosovo and Metohija: 38 (Devetak & Jakšić 2003)

Material:

Šumadija and Western Serbia: 4, 10, 15, 16

Zoogeographical element: Holarctic.

Micromus paganus (Linnaeus, 1767)

Literature records:

Kosovo and Metohija: 39 (Devetak & Jakšić 2003)

Zoogeographical element: Siberian.

Micromus lanosus (Zelený, 1962)

Material:

Šumadija and Western Serbia: 4, 8, 11, 16

Southern and Eastern Serbia: 27, 30

First record for Serbia.

Zoogeographical element: Central European.

Discussion

In our collecting trips 16 species of the Hemerobiidae family were found, six of them are new records for Serbian fauna. Together with scarce literature data, a list, with total number of 23 brown lacewing species for Serbia, is presented.

The most common species belong to the genus *Hemerobius*. Species *H. humulinus*, *H. handschini* and *H. micans* were found in high abundance and in most of visited localities. Other species, however, were not so abundant and present only locally. Two species, *Symphorobius elegans* and *Psectra diptera* are known only from old literature records (Mocsáry 1899, Pongrácz 1914) and were not found within our collecting trips.

The zoogeographical distribution of the brown lacewing species recorded in Serbia may be summarized as follows: eight species are Holomediterranean (7 expansive northwards and 1 stationary), 5 species are Holarctic (Siberian-Nearctic), 8 species

are Euro-Siberian (Siberian), one species is Central European-Mediterranean and one Central European.

The brown lacewing fauna of Serbia is far from being well explored, and further investigations should be carried out to improve our knowledge of the biodiversity and especially species distribution of the family in this country. Few species are still expected in the region.

Acknowledgements

We are grateful to the Ministry of Agriculture and Environmental Protection of the Republic of Serbia for the permission to collect insects. This research was supported partly by the Research Project Biodiversity of the green lacewings (Neuroptera: Chrysopidae) in Serbia – bilateral research Slovenia – Serbia (RP BioDiv CHRYSER 2015) and by the Slovenian Research Agency and the Research Programme Computationally Intensive Complex Systems (P1-0403).

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Received / Prejeto: 14. 3. 2019

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Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Acta Entomologica Slovenica](#)

Jahr/Year: 2019

Band/Volume: [27](#)

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