

A CONTRIBUTION TO KNOWLEDGE CONCERNING THE ORTHOPTERA FAUNA OF THE SLAVONIAN RANGE (NE CROATIA) WITH THE FIRST RECORD OF SOME SPECIES IN CROATIA

GERGELY SZÖVÉNYI¹ & GELLÉRT PUSKÁS²

¹Department of Systematic Zoology & Ecology, Eötvös Loránd University, Pázmány P. sétány 1/c., H-1117 Budapest, Hungary (e-mail: szovenyig@gmail.com)

²Department of Zoology, Hungarian Natural History Museum, Baross u. 13, H-1088, Budapest, Hungary (e-mail: saksup@nhmus.hu)

Szövényi, G. & Puskás, G.: A contribution to knowledge concerning the Orthoptera fauna of the Slavonian range (NE Croatia) with the first record of some species in Croatia. *Nat. Croat.*, Vol. 21, No. 2., 403–418, 2012, Zagreb.

In the years 2007 and 2008 an orthopterological investigation was carried out in the Papuk Mountain, northeastern Croatia. We found altogether 64 species in the 81 sampling sites investigated. Five species, *Isophya modestior*, *Poecilimon affinis*, *Poecilimon fussii*, *Pseudopodisma fieberi* and *Xya pfaendleri* are new to the Croatian Orthoptera fauna.

Key words: Croatia, Orthoptera fauna, new data, Papuk Mountain

Szövényi, G. & Puskás, G.: Prilog poznavanju faune Orthoptera Slavonije (sjeveroistočna Hrvatska) s prvim nalazima pojedinih vrsta za Hrvatsku. *Nat. Croat.*, Vol. 21, No. 2., 403–418, 2012, Zagreb.

Tijekom 2007. i 2008. provedeno je istraživanje faune Orthoptera na Papuku, sjeveroistočna Hrvatska. Zabilježili smo 64 vrste na 81 istraživanom lokalitetu. Pet vrsta, *Isophya modestior*, *Poecilimon affinis*, *Poecilimon fussii*, *Pseudopodisma fieberi* i *Xya pfaendleri* nove su za hrvatsku faunu ravnokrilaca.

Gljučne riječi: Hrvatska, fauna Orthoptera, novi nalazi, Papuk

INTRODUCTION

The Orthoptera fauna of the former Yugoslavian countries is relatively well studied in general terms (e.g. US & MATVEJEV, 1967; MIKŠIĆ, 1969; ČEJCHAN, 1984; US, 1992; CHOBANOV & MIHAJLOVA, 2010). However, the northern parts of these territories are less known or even absolutely unknown from this point of view. The situation in Croatia is similar. Most of the previous works focussed on the Adriatic coast and islands (e.g. KARNY, 1907; ADAMOVIĆ, 1964), and even if taking into consideration the very few recent studies as well (NAGY, 2006; TVRTKOVIĆ & VEEN, 2006; SOMBKE & SCHLEGEL, 2007), only old and scarcely published Orthoptera data can be found from the continental part (north from the Sava river) and generally without exact locations.

The Slavonian Range forms an island-like mountainous area in the southern, mostly plain part of the Carpathian Basin, at the meeting zone of sub-Mediterranean and continental influences. Some invertebrate groups show relatively high

species richness here with endemic taxa as well (CSUZDI & POP, 2007; UJVÁRI, 2008), thus the faunistical investigation of this area seemed to be promising.

The aim of this research was to acquire some basic knowledge of the Orthoptera fauna and assemblages of the Slavonian Range, mainly of Papuk Mountain and its surroundings. We sampled a wide variety of habitats suitable for orthopteran insects, and geographically more or less covered the studied area.

MATERIAL AND METHODS

Study area

The Papuk Mountain is situated in the northern chain of the Slavonian Range, at the south western edge of the Pannonian Plain between the Drava and Sava rivers. Its highest peak is at 954 m a.s.l. The bedrock of the area is very diverse, from limestone and sandstone to andesite, basalt and granite basement rocks as well. The

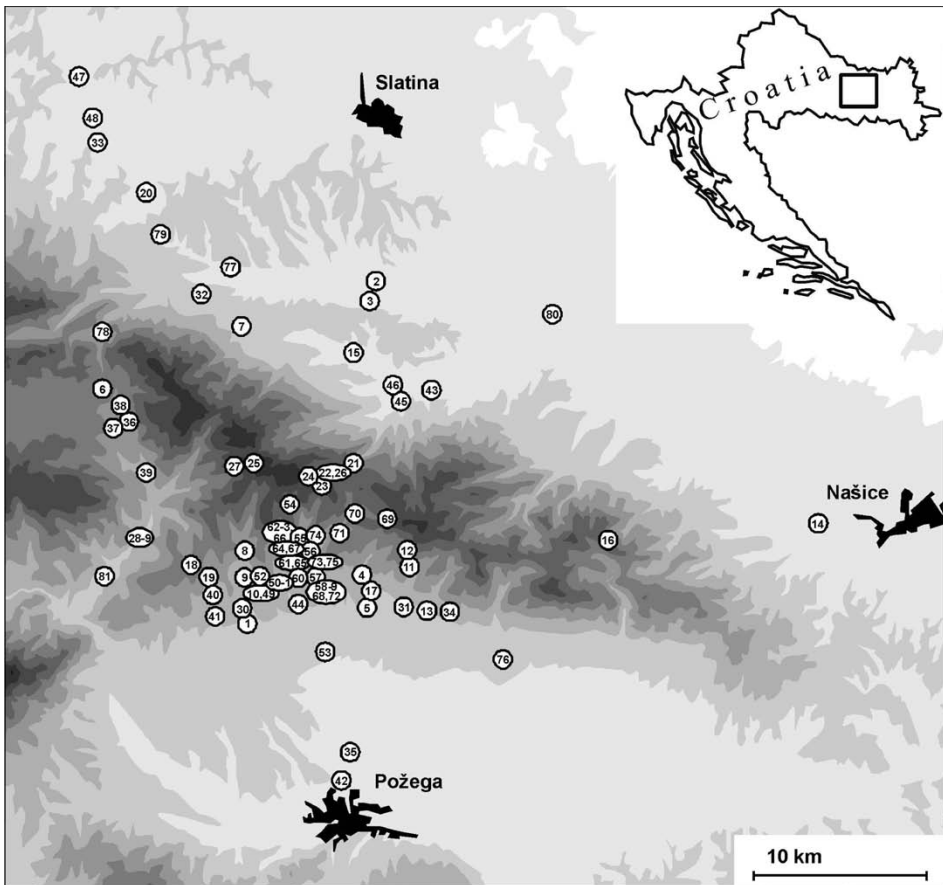


Fig. 1. The studied area in the Slavonian Range (NE Croatia) with the Orthopterological sampling sites in 2007-08. (Numbers see in appendix 1).

mountainous parts and the foothills are both predominantly forested by different cultivated, mainly deciduous forest associations. At higher elevations there are very few grassland habitats, however, mainly in the vicinity of settlements a wide variety of them can be found. The climate is continental with sub-Atlantic and sub-Mediterranean influences: moderately warm and relatively rainy.

Sampling methods

We collected Orthoptera individuals using different methods. Besides the most common sweep netting we used visual searching and for the purpose of exact acoustic detection an ultrasound detector (NHBS – Mini-3 Bat Detector) was used as well. Individuals easy to determine were identified and partly released in the field, especially in protected areas. Others were preserved and identified in the laboratory. Some species detected without any doubt by their species-specific sounds were also added to the results. Specimens were determined using the taxonomic keys of HARZ (1969; 1975), VEDENINA & HELVERSEN (2009) and INGRISCH & PAVIČEVIĆ (2010). The nomenclature of EADES *et al.* (2011) was used. The collected materials are located in the zoological collections of the Department of Systematic Zoology and Ecology, Eötvös Loránd University in Budapest, and in the Orthoptera collection of the Hungarian Natural History Museum, Budapest, Hungary.

Sampling sites

Orthopterans were sampled in 2007 and 2008 in the surroundings of the following settlements (see also Fig. 1): Biškupci, Čeralije, Češljakovci, Đedovica, Doljanci, Doljanovci, Dobrić, Donja Motičina, Đuričić, Duzluk, Golo Brdo, Gornji Vrhovci, Hum, Jankovac, Kamenski Vučjak, Kantrovci, Kaptol, Kometnik-Zubići, Levinovac, Mešinci, Mihaljevci, Novo Zvečevo, Poljanska, Požega, Pušina, Radovanci, Slatinski Drenovac, Slavonska Pivnica, Stražeman, Trenkovo, Velika, Vetovo, Voćin, Vojlovica and Vučjak. Sampling sites with short descriptions and geographical positions are listed in Appendix 1.

RESULTS AND DISCUSSION

List of species

The list contains sampling sites for each species grouped by settlements. Numbers denote sites (see above). Species are listed in the systematic order of the European Orthoptera checklist of Heller *et al.* (1998).

Ensifera *Tettigoniodea*

Tettigoniidae

Bradyporinae

Ephippiger ephippiger (Fiebig, 1784): Doljanci 10, Golo Brdo 17, Gornji Vrhovci 18, Jankovac 27, Poljanska 40, Stražeman 50, 51, 52, Velika 59, 60, 61, 64, 65, Voćin 78, 79, Vučjak 81;

Conocephalinae

Conocephalus fuscus (Fabricius, 1793): Biškupci 1, Čeralije 2, 3, Češljakovci 4, 5, Doljanci 10, Donja Motičina 14, Golo Brdo 17, Kamenski Vučjak 28, Kantrovci 30,

- Mihaljevci 35, Novo Zvečevo 38, Požega 42, Radovanci 44, Slatinski Drenovac 45, 46, Stražeman 49, 50, 51, 52, Velika 56, 57, 58, 60, 69, Voćin 77, 79;
- Ruspolia nitidula* (Scopoli, 1786): Biškupci 1, Čeralije 2, 3, Češljakovci 4, 5, Doljanci 10, Donja Motičina 14, Kometnik-Zubići 32, Mihaljevci 35, Poljanska 41, Radovanci 44, Slatinski Drenovac 45, Velika 56, 58, 68, 69, Voćin 77, 78;
- Meconematinae*
- Meconema meridionale* Costa, 1860: Donja Motičina 14, Velika 69;
- Meconema thalassinum* (De Geer, 1773): Gornji Vrhovci 18, Jankovac 27, Velika 75;
- Meconema* sp. (nymphs): Stražeman 52;
- Phaneropterinae*
- Barbitistes serricauda* (Fabricius, 1798): Velika 64, 67;
- Isophya modestior* Brunner von Wattenwyl, 1882: Dobrić 7, Doljanci 8, 9, Đuričić 15, Gornji Vrhovci 18, Jankovac 21, 27, Kamenski Vučjak 28, Kantrovci 30, Levinovac 33, Novo Zvečevo 36, 37, 38, 39, Poljanska 40, 41, Radovanci 44, Slavonska Pivnica 47, Stražeman 50, 51, 52, Trenkovo 53, Velika 57, 60, 61, 64, 65, 67, Voćin 79, Vučjak 81;
- Leptophyes albovittata* (Kollar, 1833): Čeralije 3, Doljanci 8, 9, Donja Motičina 14, Golo Brdo 17, Gornji Vrhovci 18, Kamenski Vučjak 28, Kantrovci 30, Novo Zvečevo 37, 38, 39, Poljanska 41, Radovanci 44, Slatinski Drenovac 45, 46, Slavonska Pivnica 48, Stražeman 50, 51, 52, Trenkovo 53, Velika 56, 59, 60, 61, 63, 64, Voćin 79;
- Leptophyes boscii* Fieber, 1853: Čeralije 3, Đedovica 6, Doljanci 8, Donja Motičina 14, Duzluk 16, Gornji Vrhovci 18, Jankovac 22, 25, 27, Kamenski Vučjak 28, Kantrovci 30, Kometnik-Zubići 32, Novo Zvečevo 36, 37, 38, Poljanska 41, Radovanci 44, Slatinski Drenovac 45, 46, Slavonska Pivnica 47, 48, Stražeman 51, Velika 55, 56, 57, 58, 59, 60, 64, 65, 66, 67, 69, Voćin 77, 78, 79;
- Phaneroptera falcata* (Poda, 1761): Biškupci 1, Čeralije 3, Češljakovci 5, Doljanci 10, Donja Motičina 14, Duzluk 16, Golo Brdo 17, Gornji Vrhovci 18, Jankovac 27, Mihaljevci 35, Poljanska 41, Radovanci 44, Slatinski Drenovac 45, Stražeman 50, Velika 57, 58, 60, 65, 66, 69, 70, Vojlovica 80;
- Phaneroptera nana* Fieber, 1853: Čeralije 3, Golo Brdo 17, Mešinci 34, Mihaljevci 35, Velika 58, 60, 70;
- Phaneroptera* sp. (nymphs): Čeralije 2, Doljanci 8, Donja Motičina 14, Gornji Vrhovci 18, Kamenski Vučjak 28, Kantrovci 30, Novo Zvečevo 36, 37, 38, 39, Stražeman 51, 52, Velika 54, 56, 59, 60, 61, 63, 71, Voćin 77, 78, Vučjak 81;
- Poecilimon affinis* (Frivaldszky, 1867): Đedovica 6, Doljanci 8, Jankovac 24, 25, 26, Velika 63, 64;
- Poecilimon fussii* Brunner von Wattenwyl, 1878: Doljanci 9, Gornji Vrhovci 18, Stražeman 52;
- Poecilimon gracilis* (Fieber, 1853): Doljanci 8, Jankovac 24, 25, 27, Velika 54;
- Poecilimon schmidtii* (Fieber, 1853): Đedovica 6, Doljanci 8, Jankovac 21, 22, 24, 25, 26, 27, Kantrovci 30, Novo Zvečevo 37, 39, Poljanska 40, Stražeman 51, 52, Velika 55, 60, 61, 62, 63, 64, Voćin 77;
- Tettigoniinae*
- Decticus verrucivorus* (Linnaeus, 1758): Čeralije 3, Doljanci 9, Gornji Vrhovci 18, Jankovac 27, Novo Zvečevo 37, Stražeman 50, 52;

- Eupholidoptera chabrieri* (Charpentier, 1825): Doljanci 8, Stražeman 50, 51, Velika 56, 60, 61, 63, 64, 65, 67, 73;
- Metrioptera bicolor* (Philippi, 1830): Donja Motičina 14, Golo Brdo 17, Gornji Vrhovci 18, Stražeman 50, 51, Velika 60, Voćin 78;
- Metrioptera roeselii* (Hagenbach, 1822): Biškupci 1, Čeralije 3, Češljakovci 4, Đedovica 6, Doljanci 8, 9, Donja Motičina 14, Gornji Vrhovci 18, Jankovac 25, 27, Kamenski Vučjak 28, Kantrovci 30, Mihaljevci 35, Novo Zvečevo 36, 37, 38, 39, Poljanska 40, 41, Požega 42, Radovanci 44, Slatinski Drenovac 46, Slavonska Pivnica 47, Stražeman 51, Trenkovo 53, Velika 56, 57, 58, 60, Voćin 77, 79, Vojlovica 80, Vučjak 81;
- Pachytrachis gracilis* (Brunner von Wattenwyl, 1861): Čeralije 3, Češljakovci 4, 5, Doljanci 8, 9, Doljanovci 12, Duzluk 16, Gornji Vrhovci 18, 19, Jankovac 25, 27, Kamenski Vučjak 28, Kantrovci 30, Kometnik-Zubići 32, Novo Zvečevo 39, Poljanska 40, 41, Radovanci 44, Slatinski Drenovac 45, 46, Slavonska Pivnica 47, 48, Stražeman 50, 51, 52, Velika 54, 55, 56, 57, 58, 59, 60, 61, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 74, Voćin 77, 79, Vojlovica 80, Vučjak 81;
- Pholidoptera aptera* (Fabricius, 1793): Đedovica 6, Doljanci 8, Jankovac 25, 27, Kamenski Vučjak 29, Velika 61, 63, 64, 65, 66, 67, 71;
- Pholidoptera fallax* (Fischer, 1853): Biškupci 1, Češljakovci 4, 5, Doljanci 8, 9, 10, Golo Brdo 17, Gornji Vrhovci 18, Jankovac 25, 27, Kamenski Vučjak 28, Kometnik-Zubići 32, Mihaljevci 35, Novo Zvečevo 37, 39, Poljanska 40, 41, Radovanci 44, Stražeman 49, 50, 51, 52, Trenkovo 53, Velika 56, 57, 58, 59, 60, 61, 64, 65, 67, 68, 72, Voćin 77, 79;
- Pholidoptera griseoptera* (De Geer, 1773): Češljakovci 5, Đedovica 6, Doljanci 8, Doljanovci 11, 12, Golo Brdo 17, Jankovac 21, 22, 23, 24, 25, 26, 27, Kantrovci 30, Kometnik-Zubići 32, Mihaljevci 35, Novo Zvečevo 36, 37, 38, 39, Slatinski Drenovac 45, 46, Stražeman 51, 52, Velika 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 69, 70, 71, 73, 74, Voćin 79;
- Platycleis albopunctata grisea* (Fabricius, 1781): Doljanci 10, Duzluk 16, Golo Brdo 17, Gornji Vrhovci 19, Jankovac 25, Stražeman 50, Velika 56, 60, 61, 63, 64, 66, 67, 73, Voćin 78;
- Rhacocleis germanica* (Herrich-Schäffer, 1840): Doljanci 10, Golo Brdo 17, Gornji Vrhovci 19, Stražeman 50, 51, Velika 60, 64, 65, 67, 73;
- Tettigonia cantans* (Füssli, 1775): Čeralije 3, Češljakovci 4, Đedovica 6, Gornji Vrhovci 18, Jankovac 23, 25, 27, Kamenski Vučjak 28, Pušina 43, Velika 55, 56, 68, 69, 70, 71, Voćin 77, 78;
- Tettigonia viridissima* Linnaeus, 1758: Čeralije 3, Gornji Vrhovci 18, Jankovac 21, Stražeman 50, 51, Trenkovo 53, Velika 56, 68, Voćin 77, 78;
- Tettigonia* sp. (nymphs): Doljanci 8, 9, Gornji Vrhovci 18, Kometnik-Zubići 32, Novo Zvečevo 38, 39, Stražeman 49, 52, Velika 60, 61, 64, Voćin 79;

Grylloidea

Gryllidae

Gryllinae

Acheta domesticus (Linnaeus, 1758): Velika 68, Voćin 77;

Gryllus campestris Linnaeus, 1758: Biškupci 1, Češljakovci 5, Doljanci 8, 9, 10, Doljanovci 13, Đuričić 15, Golo Brdo 17, Kometnik-Zubići 32, Mešinci 34, Mihaljevci

35, Požega 42, Slavonska Pivnica 47, Stražeman 50, 51, 52, Velika 58, 60, 61, Vetovo 76, Voćin 77, Vučjak 81;

Melanogryllus desertus (Pallas, 1771): Kometnik-Zubići 32, Stražeman 50, 51;

Modicogryllus frontalis (Fieber, 1844): Kometnik-Zubići 32;

Nemobiinae

Pteronemobius heydenii (Fischer, 1853): Čeralije 3, Donja Motičina 14, Jankovac 21, 24, Kometnik-Zubići 32, Novo Zvečevo 37, 38, Slatinski Drenovac 45, Slavonska Pivnica 47, Stražeman 49, 51, 52, Vučjak 81;

Oecanthinae

Oecanthus pellucens (Scopoli, 1763): Češljakovci 5, Doljanci 10, Donja Motičina 14, Duzluk 16, Golo Brdo 17, Gornji Vrhovci 18, Jankovac 27, Kaptol 31, Mihaljevci 35, Poljanska 41, Radovanci 44, Slatinski Drenovac 45, Stražeman 50, Trenkovo 53, Velika 56, 58, 59, 60, 65, 66, 69, 70, Vetovo 76, Voćin 77, Vojlovica 80;

Caelifera

Tetrigoidea

Tetrigidae

Tetrix bipunctata (Linnaeus, 1758): Doljanovci 11, 12, Velika 62, 63, 64, 65;

Tetrix bolivari Saulcy, 1901: Donja Motičina 14;

Tetrix subulata (Linnaeus, 1758): Čeralije 3, Đedovica 6, Doljanci 8, Doljanovci 13, Donja Motičina 14, Mihaljevci 35, Požega 42, Velika 60, 70;

Tetrix tenuicornis Sahlberg, 1893: Doljanci 10, Doljanovci 13, Donja Motičina 14, Golo Brdo 17, Novo Zvečevo 38, Stražeman 50, Velika 60, Vetovo 76;

Tetrix sp. (nymphs): Čeralije 3, Donja Motičina 14, Gornji Vrhovci 18, Jankovac 23, Kometnik-Zubići 32, Velika 69, Voćin 77, 78;

Acridioidea

Acrididae

Calliptaminae

Calliptamus italicus (Linnaeus, 1758): Doljanci 10, Duzluk 16, Golo Brdo 17, Gornji Vrhovci 19, Stražeman 51, Velika 60, 61, 64, 65, 66, 67, 69, 70, Voćin 78;

Catantopinae

Micropodisma salamandra (Fischer 1853): Čeralije 3, Đuričić 15, Hum 20, Kometnik-Zubići 32, Slatinski Drenovac 45, 46, Slavonska Pivnica 47, 48, Voćin 77, 79;

Miramella irena (Fruhstorfer, 1921): Hum 20, Voćin 77;

Odontopodisma decipiens Ramme, 1951: Duzluk 16, Jankovac 22, 25, 27, Stražeman 51, Velika 54, 55, 56, 60, 61, 63, 65, 66, 67, 69, 70, 71;

Odontopodisma schmidtii (Fieber, 1853): Čeralije 2, 3, Češljakovci 5, Đedovica 6, Doljanci 8, 10, Gornji Vrhovci 18, Kantrovci 30, Mihaljevci 35, Novo Zvečevo 36, 37, 38, Poljanska 40, 41, Radovanci 44, Slatinski Drenovac 45, 46, Stražeman 50, Trenkovo 53, Velika 57, 58, 60, 65, Voćin 77, 78, Vojlovica 80, Vučjak 81;

Odontopodisma sp.(nymphs): Doljanci 9, Novo Zvečevo 39, Slavonska Pivnica 47, Stražeman 49, 52, Velika 64, Voćin 79;

- Pezotettix giornae* (Rossi, 1794): Biškupci 1, Čeralije 2, Češljakovci 5, Doljanci 10, Doljanovci 13, Donja Motičina 14, Duzluk 16, Golo Brdo 17, Kantrovci 30, Kaptol 31, Mešinci 34, Mihaljevci 35, Poljanska 40, 41, Požega 42, Radovanci 44, Stražeman 50, 51, Trenkovo 53, Velika 56, 57, 58, 59, 60, 61, 64, 65, 69, 72, 73, Vetovo 76, Vojlovica 80;
- Pseudopodisma fieberi* (Scudder, 1897): Čeralije 3, Đedovica 6, Đuričić 15, Gornji Vrhovci 18, Jankovac 22, 25, 27, Kometnik-Zubići 32, Novo Zvečevo 36, 37, 39, Slatinski Drenovac 45, 46, Slavonska Pivnica 48, Stražeman 50, 51, Voćin 77, 79, Vojlovica 80, Vučjak 81;
- Gomphocerinae*
- Chorthippus biguttulus* (Linnaeus, 1758): Biškupci 1, Češljakovci 5, Duzluk 16, Golo Brdo 17, Jankovac 27, Mihaljevci 35, Poljanska 41, Požega 42, Stražeman 50, Velika 60, 64, 65, 66, 67, 69, 70, 71, 72, 73, Voćin 78;
- Chorthippus brunneus* (Thunberg, 1815): Čeralije 3, Doljanci 10, Doljanovci 13, Donja Motičina 14, Duzluk 16, Gornji Vrhovci 18, 19, Jankovac 21, 22, 23, 24, 25, 27, Mihaljevci 35, Slatinski Drenovac 45, Slavonska Pivnica 47, Stražeman 50, Velika 54, 56, 57, 58, 60, 61, 63, 64, 66, 67, 69, 70, 71, 73, Voćin 78, Vojlovica 80;
- Chorthippus dorsatus* (Zetterstedt, 1821): Biškupci 1, Češljakovci 4, 5, Doljanci 10, Doljanovci 13, Donja Motičina 14, Golo Brdo 17, Gornji Vrhovci 18, Kaptol 31, Mešinci 34, Mihaljevci 35, Poljanska 41, Požega 42, Stražeman 50, Velika 60, 72, Vetovo 76;
- Chorthippus mollis* (Charpentier, 1825): Biškupci 1, Češljakovci 5, Doljanci 10, Doljanovci 13, Golo Brdo 17, Jankovac 27, Kaptol 31, Mešinci 34, Mihaljevci 35, Poljanska 41, Požega 42, Stražeman 50, Velika 60, 73, Vetovo 76;
- Chorthippus oschei* Helversen, 1986: Biškupci 1, Doljanci 10, Donja Motičina 14, Golo Brdo 17, Gornji Vrhovci 18, Mihaljevci 35, Požega 42, Stražeman 50, Velika 60, 72, Voćin 77, 78;
- Chorthippus parallelus* (Zetterstedt, 1821): Biškupci 1, Čeralije 2, 3, Češljakovci 4, 5, Đedovica 6, Doljanci 8, 9, 10, Donja Motičina 14, Đuričić 15, Duzluk 16, Golo Brdo 17, Gornji Vrhovci 18, Jankovac 21, 22, 23, 24, 25, 27, Kantrovci 30, Mihaljevci 35, Novo Zvečevo 36, 37, 38, 39, Poljanska 40, 41, Požega 42, Radovanci 44, Slatinski Drenovac 45, Slavonska Pivnica 47, Stražeman 49, 50, 51, 52, Trenkovo 53, Velika 56, 57, 58, 59, 60, 64, 66, 69, 70, 71, 72, Voćin 77, Vojlovica 80, Vučjak 81;
- Chorthippus* (*Chorthippus*) sp. (nymphs): Velika 61, 64;
- Chorthippus* (*Glyptobothrus*) sp. (nymphs): Biškupci 1, Velika 64.
- Chrysochraon dispar* (Germar, 1834): Čeralije 3, Češljakovci 4, Đedovica 6, Doljanci 8, Donja Motičina 14, Gornji Vrhovci 18, Jankovac 21, 22, 25, Kantrovci 30, Novo Zvečevo 36, 37, 38, 39, Radovanci 44, Slatinski Drenovac 46, Stražeman 50, Trenkovo 53, Velika 54, 56, 57, 58, 60, 69, Voćin 77, 79, Vojlovica 80, Vučjak 81;
- Euchorthippus declivus* (Brisout de Barneville, 1849): Biškupci 1, Češljakovci 5, Doljanci 10, Doljanovci 13, Donja Motičina 14, Golo Brdo 17, Gornji Vrhovci 18, Mihaljevci 35, Požega 42, Stražeman 50, 51, 52, Velika 58, 59, 60, 61;
- Euthystira brachyptera* (Ocskay, 1826): Đedovica 6, Doljanci 8, Gornji Vrhovci 18, Jankovac 22, 25, 27, Novo Zvečevo 36, 37, 38, 39, Radovanci 44, Slatinski Drenovac 46, Stražeman 50, 51, 52, Trenkovo 53, Velika 55, 56, 57, 60, 63, 64, 65, 67, 69, 70, Voćin 77;

- Gomphocerippus rufus* (Linnaeus, 1758): Biškupci 1, Doljanovci 11, 12, Golo Brdo 17, Mešinci 34, Mihaljevci 35, Stražeman 50, Velika 57, 58, 64, 65, 67, 73, Vojlovica 80;
- Omocestus rufipes* (Zetterstedt, 1821): Biškupci 1, Češljakovci 4, 5, Doljanci 10, Donja Motičina 14, Golo Brdo 17, Kometnik-Zubići 32, Mešinci 34, Novo Zvečevo 39, Požega 42, Slatinski Drenovac 45, Stražeman 49, 50, 51, 52, Velika 60, 67, Vetovo 76, Voćin 77;
- Stenobothrus lineatus* (Panzer, 1796): Doljanci 10, Gornji Vrhovci 18, Novo Zvečevo 37, 38, 39, Radovanci 44, Stražeman 50, 51, Velika 60, 63, 64, 65, 66;
- Stenobothrus stigmaticus* (Rambur, 1838): Golo Brdo 17;
- Oedipodinae*
- Aiolopus strepens* (Latreille, 1804): Doljanci 8, Doljanovci 12, Golo Brdo 17, Gornji Vrhovci 19, Mihaljevci 35, Stražeman 50, Velika 60, 65, 73, 74;
- Aiolopus thalassinus* (Fabricius, 1781): Donja Motičina 14;
- Mecostethus parapleurus* (Hagenbach, 1822): Čeralije 3, Voćin 77;
- Oedipoda caerulescens* (Linnaeus, 1758): Doljanci 10, Duzluk 16, Golo Brdo 17, Gornji Vrhovci 19, Mešinci 34, Novo Zvečevo 38, Stražeman 50, Velika 60, 61, 64, 65, 66, 67, 69, 70, 73, Vetovo 76, Voćin 78;
- Psophus stridulus* (Linnaeus, 1758): Velika 64, 65;
- Stethophyma grossum* (Linnaeus, 1758): Čeralije 3, Mihaljevci 35;

Tridactyloidea

Tridacylidae

- Xya pfaendleri* Harz, 1970: Donja Motičina 14;

In 2007 and 2008 we sampled 81 plots, some of them two or three times. Altogether 64 Orthoptera species were detected (33 Ensifera and 31 Caelifera) (see Tab. 1), which is about 40% of the formerly known Croatian Orthoptera fauna (US & MATVEJEV, 1967; NAGY, 2006; MILOŠEVIĆ, 2004; TVRTKOVIĆ & VEEN, 2006; HELLER & WILLEMSE, 2011). Most species are more or less widespread in different parts of the country (US & MATVEJEV, 1967), but five of them have proven to be new to the Croatian Orthoptera fauna.

Isophya modestior Brunner von Wattenwyl, 1882 is distributed from north eastern Italy, Slovenia, eastern Austria and Hungary to Bulgaria and SW Romania (HELLER & WILLEMSE, 2011). This short winged, herbivorous bush cricket lives in bushy meadows, forest edges rich in dicotyledonous plants, from low altitudes to higher mountains. Its occurrence in Croatia is not surprising and fills a gap in its known range. We found it generally distributed in the suitable habitats in the studied area.

Poecilimon affinis (Frivaldszky, 1867) belongs to the *Poecilimon ornatus* species group, which was under revision recently (INGRISCH & PAVIĆEVIĆ, 2010; CHOBANOV & HELLER, 2010). According to these new results, the individuals found in Papuk, which live in bushy forest edges and road sides on higher elevations, belong to *Poecilimon affinis affinis* (Frivaldszky, 1867). An old data of *P. affinis* can be found in PUNGUR (1899) under the locality name „Károlyváros“ (=Karlovac). The specimen was presumably destroyed, together with the majority of the Orthoptera collection of the Hungarian Natural History Museum, in the 1956 revolution. We believe this datum to be dubious, because the very similar *P. ornatus* (Schmidt, 1849) is said by

Tab. 1. Katydids, crickets (Ensifera) and grasshoppers (Caelifera) of the Papuk region, based on samplings in 2007-2008 in order of their percentage occurrence in sampling sites. Species new for Croatia are in bold (Fr.: Frequency of occurrence).

Ensifera species	Fr. (%)	Caelifera species	Fr. (%)
<i>Pachytrachis gracilis</i>	59.3	<i>Chorthippus parallelus</i>	63.0
<i>Pholidoptera griseoaptera</i>	54.3	<i>Chorthippus brunneus</i>	40.7
<i>Leptophyes boscii</i>	44.4	<i>Pezotettix giornae</i>	39.5
<i>Pholidoptera fallax</i>	44.4	<i>Chrysochraon dispar</i>	34.6
<i>Metrioptera roeselii</i>	40.7	<i>Euthystira brachyptera</i>	33.3
<i>Isophya modestior</i>	37.0	<i>Odontopodisma schmidtii</i>	33.3
<i>Conocephalus fuscus</i>	33.3	<i>Chorthippus biguttulus</i>	24.7
<i>Leptophyes albovittata</i>	33.3	<i>Pseudopodisma fieberi</i>	24.7
<i>Oecanthus pellucens</i>	30.9	<i>Omocestus rufipes</i>	23.5
<i>Gryllus campestris</i>	27.2	<i>Oedipoda caerulea</i>	22.2
<i>Phaneroptera falcata</i>	27.2	<i>Chorthippus dorsatus</i>	21.0
<i>Poecilimon schmidtii</i>	25.9	<i>Odontopodisma decipiens</i>	21.0
<i>Ruspolia nitidula</i>	22.2	<i>Euchorthippus declivus</i>	19.8
<i>Tettigonia cantans</i>	21.0	<i>Chorthippus mollis</i>	18.5
<i>Ephippiger ephippiger</i>	19.7	<i>Calliptamus italicus</i>	17.3
<i>Platyleis albopunctata grisea</i>	18.5	<i>Gomphocerippus rufus</i>	17.3
<i>Pteronemobius heydenii</i>	16.0	<i>Stenobothrus lineatus</i>	16.0
<i>Pholidoptera aptera</i>	14.8	<i>Chorthippus oschei</i>	14.8
<i>Eupholidoptera chabrieri</i>	13.6	<i>Aiolopus strepens</i>	12.3
<i>Rhacocleis germanica</i>	12.3	<i>Micropodisma salamandra</i>	12.3
<i>Tettigonia viridissima</i>	12.3	<i>Tetrix subulata</i>	11.1
<i>Decticus verrucivorus</i>	8.6	<i>Tetrix tenuicornis</i>	9.9
<i>Metrioptera bicolor</i>	8.6	<i>Tetrix bipunctata</i>	7.4
<i>Phaneroptera nana</i>	8.6	<i>Mecostethus parapleurus</i>	2.4
<i>Poecilimon affinis</i>	8.6	<i>Miramella irena</i>	2.4
<i>Poecilimon gracilis</i>	6.2	<i>Psophus stridulus</i>	2.4
<i>Meconema thalassinum</i>	3.7	<i>Stethophyma grossum</i>	2.4
<i>Melanogryllus desertus</i>	3.7	<i>Aiolopus thalassinus</i>	1.2
<i>Poecilimon fussii</i>	3.7	<i>Stenobothrus stigmaticus</i>	1.2
<i>Meconema meridionale</i>	2.5	<i>Tetrix bolivari</i>	1.2
<i>Barbitistes serricauda</i>	2.5	<i>Xya pfaendleri</i>	1.2
<i>Acheta domesticus</i>	2.5		
<i>Modicogryllus frontalis</i>	1.2		

US & MATVEJEV (1967) to be distributed in Croatia unlike *P. affinis*, and according to CHOBANOV & HELLER (2010) it can be found not far from Karlovac as well. The new occurrence of this species in Croatia in the Papuk Mountain is the northwesternmost point of its south-eastern European distribution (see CHOBANOV & HELLER, 2010).

Poecilimon fussii Brunner von Wattenwyl, 1878 is much smaller than the previous congeneric species and it prefers rather mesic and xeric steppe grasslands. It is distributed from Slovakia and South Poland to Romania and Bulgaria (HELLER & WILLEMSE, 2011; EADES *et al.*, 2011).

Tab. 2. Differential species between the Orthoptera fauna of the Papuk and the Mecsek regions listed in taxonomic order. Species not occurring in the other country at all are in bold.

Papuk (NE Croatia)	Mecsek (SW Hungary)
<i>Poecilimon affinis</i> (Frivaldszky, 1867)	<i>Isophya camptoxypha</i> Bunner von Wattenwyll, 1878
<i>P. gracilis</i> (Fieber, 1853)	<i>I. modesta</i> (Frivaldszky, 1867)
<i>Eupholidoptera chabrieri</i> (Charpentier, 1825)	<i>I. costata</i> Bunner von Wattenwyll, 1878
<i>Acheta domesticus</i> (Linnaeus, 1758)	<i>Leptophyes punctatissima</i> (Bosc, 1792)
<i>Tetrix bolivari</i> Saulcy, 1901	<i>Poecilimon intermedius</i> (Fieber, 1852)
<i>Micropodisma salamandra</i> (Fischer, 1853)	<i>Saga pedo</i> (Pallas, 1771)
<i>Miramella irena</i> (Fruhstorfer, 1921)	<i>Platycleis affinis</i> Fieber, 1853
<i>Pseudopodisma fieberi</i> (Scudder, 1897)	<i>Tachycines asynamoros</i> Adelung, 1902
<i>Stenobothrus stigmaticus</i> (Rambur, 1838)	<i>Myrmecophilus acervorum</i> (Panzer, 1799)
<i>Aiolopus thalassinus</i> (Fabricius, 1781)	<i>Gryllotalpa gryllotalpa</i> (Linnaeus, 1758)
<i>Psophus stridulus</i> (Linnaeus, 1758)	<i>Acrida ungarica</i> (Herbst, 1786)
<i>Xya pfaendleri</i> Harz, 1970	<i>Chorthippus montanus</i> (Charpentier, 1825)
	<i>Omocestus haemorrhoidalis</i> (Charpentier, 1825)
	<i>O. petraeus</i> (Brisout de Barneville, 1856)
	<i>Myrmeleotettix maculatus</i> (Thunberg, 1815)
	<i>Stenobothrus crassipes</i> (Charpentier, 1825)
	<i>S. eurasius</i> (Zubowsky, 1898)
	<i>Acrotylus insubricus</i> (Scopoli, 1786)
	<i>Oedaleus decorus</i> (Germar, 1826)

Pseudopodisma is a short winged grasshopper species complex of three closely related species. The originally described *Pseudopodisma fieberi* (Scudder, 1897) inhabits the southern part of the whole distribution of the genus (from Italy to the Carpathians and Balkan Mountains). Its discovery in Croatia, like that of *Isophya modestior*, fills a gap between the eastern and western parts of its known range. We found it to be relatively widespread in the hilly and mountainous parts of the study area in mesic hayfields and sometimes in bushy habitats.

Xya pfaendleri Harz, 1970 was separated from the similar *Xya variegata* Latreille, 1809 only in 1970. Thus older data of *X. variegata* must also contain *X. pfaendleri* through Europe. Both species show a relatively wide, middle and southern European distribution (HELLER & WILLEMSE, 2011), with considerable gaps in the latter species, presumably at least partly due to data deficiency rather than real range disjunctions. Thus possibly the material of former Croatian *X. variegata* (see e.g. data in US & MATVEJEV, 1967) needs re-examination in order to clarify the situation. *Xya pfaendleri* was found at the northern surround of the Papuk, in a riparian habitat of lowland characters, typical for *Xya* species.

In addition to species new for the Croatian fauna, the presence of the bush cricket *Eupholidoptera chabrieri* in the Papuk Mountains represents its first occurrence inside the Carpathian Basin, drawing its new northwestern border of areal (see ÇIPLAK *et al.*, 2007), whereas it was already known from the Dinaric and Adriatic regions of Croatia (e.g. NAGY, 2006). The occurrence of the grasshopper *Miramella*

irena here is also valuable. This species is listed in the IUCN Red Data Book as vulnerable (IUCN, 2011), and beside the data published by GALVAGNI (1987) /Plitvička Jezera, 4–500 m/ and BAUR & CORAY (2004) /Zoological Museum, Berlin, coll. W. Ramme: Croatia, 07.1929, Plitvička Jezera, 4–500 m, 2♀/, which seem to be the same specimens, this is its second exactly known occurrence in Croatia. We found strong populations at the northern foothills of the Papuk Mountain (Voćin and Hum), in humid roadside and bankside habitats with tall, bushy vegetation. Another interesting species is *Chorthippus oschei* Helversen, 1986 which was recently separated from the similar *Chorthippus albomarginatus* (De Geer, 1773). In the former works this latter species can be found (see US & MATVEJEV, 1967 for Croatia), but the revision of VEDENINA & HELVERSEN (2009) showed their real distribution on the basis of a re-examination of specimen from different parts of central and eastern Europe. According to this revision *Chorthippus oschei puzshtaensis* Vedenina & Helversen, 2009 occurs in the territories of Croatia /Croatian data in the type material: Kutina, 150 m, 29.07.1963, 3♂, 1♀ leg. F. Willemse/, and was detected by us in the Papuk region in several plots of different grassland habitats as well.

The most widespread orthopteran species in the Papuk region, which were present at more than 50% of sampling sites (see Tab. 1), are *Chorthippus parallelus* (63%), a grasshopper very common over all of temperate Europe, *Pachytachis gracilis* (59%), a middle and southeastern European, sub/Mediterranean element, which prefers rather mesic, mesoxeric grasslands rich in dicotyledonous plants, and forest ecotones, and *Pholidoptera griseoaptera* (54%), a bush cricket common in deciduous forests and in their edges, clearings and clear cuts in Europe. Most other common species (occurring on more than 30% of sampling sites) prefer mainly mesic to hygic habitats, partly with bushy and ecotone vegetation (e.g. *Conocephalus fuscus*, *Leptophyes albivittata*, *Odontopodisma schmidtii*, *Euthystira brachyptera*, *Chrysochraon dispar*, *Metrioptera roeselii*, *Isophya modestior*, *Leptophyes boscii*), and only few of them are rather mesoxerophilous and xerophilous (*Oecanthus pellucens*, *Pezotettix giornae*, *Chorthippus brunneus*, *Pholidoptera fallax*). The preferences of these species shows well that different mesic and hygic grasslands, often close to forests or bushy vegetation are the characteristic habitats in this region.

The Orthoptera fauna of Papuk region can be compared with a similar, relatively close mountain range, the orthopterologically well documented Mecsek Mountains (SW-Hungary). These are situated about 80 km northward, on the northern side of the Drava River and are less humid and lower (682 m a.s.l.) than Papuk. In the Mecsek region, according to the recent comprehensive work of SZÖVÉNYI *et al.* (2007) modified with the notes on *Pseudopodisma fieberi* in NAGY *et al.* (2010) and completed by some new, unpublished data of the authors (*Meconema meridionale*, *Platycleis affinis* Fieber, 1853 and *Stenobothrus crassipes* (Charpentier, 1825)), 71 Orthoptera species are known. The overlap is about 63% /52 species/ and the species causing the difference are listed in Tab. 2. Apart from the special cases of the species living in human environments (*Acheta domestica* and *Tachycines asynamoros*) the main difference on the one hand is that in the Papuk region there are several meso- or hygrophilous, mainly mountain (e.g. *Miramella irena*, *Micropodisma salamandra*, *Pseudopodisma fieberi*, *Poecilimon affinis*, *P. gracilis*, *Psophus stridulus*) or Mediterranean (*Eupholidoptera chabrieri*) species, which are missing from the rather hilly and submontane Mecsek and some of them from Hungary in general. On the other hand, in the Mecsek region several xerophilous species mostly with a steppic character (e.g. *Isophya costata*, *I. modesta*,

Poecilimon intermedius, *Saga pedo*, *Stenobothrus eurasius*, *S. crassipes*, *Omocestus petraeus*, *Acrida ungarica*, *Oedaleus decorus*) can be found, and they are partly absent from Croatia. This pattern of differences in the Orthoptera fauna is partly due to the climatic differences between these mountains and presumably to the barrier effect caused by the River Drava and its wide and flat valley between them, drawing the northern or southern border of the whole distribution of several species in the southwestern Carpathian Basin.

ACKNOWLEDGEMENTS

We thank the Directorate of Papuk Nature Park, especially Vlatka Dumbović and Branko Štivić for their active help during the field works. The first author was Bolyai research fellow of the Hungarian Academy of Sciences.

Received September 17, 2011

REFERENCES

- ADAMOVIĆ, Z. R. 1964: Orthopteroids collected in Dubrovnik District, Jugoslavia. *Bull. Mus. Hist. Nat.* **19**, 155–188.
- BAUR, H. & CORAY, A., 2004: The status of some taxa related to *Miramella irena* (Fruhstorfer) and the type of *Kisella Harz* (Caelifera: Acrididae: Melanoplinae). *Revue Suisse de Zoologie* **111** (3), 631–642.
- ČEJCHAN, A. 1981: Catalogue of orthopteroid insects (s.l.) of Montenegro (Dermaptera, Dictyoptera, Cheleutoptera, Grylloptera, Orthoptera s. str.). *Acta Entomologica Musei Nationalis Pragae* **17**, 9–25.
- CHOBANOV, D. & HELLER, K-G., 2010: Revision of the *Poecilimon ornatus* group (Orthoptera: Phaneropteridae) with particular reference to the taxa in Bulgaria and Macedonia. *European Journal of Entomology* **107**, 647–672.
- CHOBANOV D.P. & MIHAJLOVA B., 2010: Orthoptera and Mantodea in the collection of the Macedonian Museum of Natural History (Skopje) with an annotated check-list of the groups in Macedonia. *Articulata* **25**(1), 73–107
- ÇIPLAK, B., WILLEMSE, F., CHOBANOV, D. & HELLER, K-G., 2007: Systematic status and distribution of *Eupholiidoptera* (Orthoptera: Tettigoniidae) in the Balkans (north of Central Greece). *Articulata* **22** (1), 33–46.
- CSUZDI, Cs & POP, V., 2007: A Kárpát-medence földigilisztái (The earthworms of the Carpathian Basin.) in: FORRÓ, L. ed.: A Kárpát-medence állatvilágának kialakulása. Hungarian Natural History Museum, Budapest. p. 13–21.
- EADES, D.C., OTTE, D., CIGLIANO, M.M & BRAUN, H. 2011: Orthoptera Species File Online. Version 2.0/4.1. <<http://Orthoptera.SpeciesFile.org>>. Downloaded on May 2011.
- GALVAGNI, A., 1987: The genus *Miramella* Dovnar-Zapolskij, 1933, in the Balkan and the Carpathian regions In: BACCETTI, B. M. (ed.). *Evolutionary biology of orthopteroid insects*. Ellis Horwood, Chichester, 208–218.
- HARZ, K., 1969: *The Orthoptera of Europe I*. W. Junk, The Hague 749 pp.
- HARZ, K., 1975: *The Orthoptera of Europe II*. W. Junk, The Hague 929 pp.
- HELLER, K-G., KORSUNOVSKAYA, O., RAGGE, D.R., VEDENINA, V., WILLEMSE, F., ZHANTIEV, R.D. & FRANTSEVICH, L., 1998: Check-List of European Orthoptera. *Articulata*, Beiheft **7**, 1–61.
- HELLER, KG. & WILLEMSE, F. (eds.), 2011: Orthoptera. Fauna Europaea version 2.4, <<http://www.fauna-eur.org>>
- INGRISCH, S. & PAVIĆEVIĆ, D., 2010: Seven new Tettigoniidae (Orthoptera) and a new Blattellidae (Blattodea) from the Durmitor area of Montenegro with notes on previously known taxa. *Zootaxa* **2565**, 1–41.

- IUCN, 2011: IUCN Red List of Threatened Species. Version 2011.1. <<http://www.iucnredlist.org>>. Downloaded on June 2011.
- KARNY, H., 1907: Die Orthopterenfauna des Küstengebietes von Österreich-Ungarn. – Entomologische Zeitschrift **52**, 17–52.
- MIKŠIĆ, S., 1969: Fauna Orthoptera Bosne i Hercegovine. I Dio – Tettigonioida. Glasnik Zemaljskog Muzeja Bosne i Hercegovine, Sarajevo **6**, 97–124.
- MILOŠEVIĆ, B., 2004: Hrvatsko entomološko društvo – Inventar entomofaune Hrvatske, Insecta – Orthoptera, Popis vrsta. <<http://www.agr.hr/hed/hrv/ento/inventar/liste/orthoptera.htm>> Downloaded on August 2010.
- NAGY, A., 2006: Preliminary data on the Orthoptera-assemblages of the Žumberak and Samobor Mountains (Northwest Croatia). *Articulata* **21**(1), 77–84.
- NAGY A., KISFALI M., SZÖVÉNYI G., PUSKÁS G. & RÁCZ I. A., 2010: Distribution of Catantopinae species (Orthoptera: Acrididae) in Hungary. *Articulata* **25**(2), 221–237.
- NAGY, B., 2005: Orthoptera Fauna of the Carpathian Basin – Recent Status of knowledge and a revised check-list. *Entomofauna Carpathica* **17**, 14–22.
- PUNGUR, GY., 1899 (1918): Ordo Orthoptera. In: Fauna Regni Hungariae, Reg. Soc. Sci. Nat. Hung., Budapest, 1–16.
- SOMBKE, A. & SCHLEGEL, M., 2007: Orthoptera and Mantodea of Istria and the Croatian Island Šipan. *Rostocker Meeresbiologische Beiträge* **18**, 137–143.
- SZÖVÉNYI, G., NAGY, B. & PUSKÁS, G., 2007: A Mecsek egyenesszárnyú rovar (Orthoptera) faunája és együttese. (The Orthoptera fauna and assemblages of Mecsek Mountains (SW Hungary).) In: FAZEKAS, I. (ed.) *A Mecsek Állatvilága 2*, Pécs, Regiografo, 73–106.
- UJVÁRI, ZS., 2008: New records of zirconid mites (Acari: Mesostigmata) from Mts. Papuk, Croatia, with description of *Zercon kontschani* sp. n. *Opuscula Zoologica Budapest* **37**, 63–70.
- Us, A.P., 1992: Favna ortopteroidnih insektov Slovenije. *Biološki inštitut ZRC Academia Scientiarum et Artium Slovenica, Dela* **32**, Ljubljana 314 pp.
- Us, P. & MATVEJEV, S., 1967: Catalogus Faunae Jugoslaviae III/6: Orthopteroidea. *Academia Scientiarum et Artium Slovenica, Ljubljana*, 47 pp.
- TVRTKOVIĆ, N. & VEEN, P. (eds.), 2006: The Dinaric Alps – Rare Habitats and Species. A Nature Conservation Project in Croatia. Part A. Hrvatski Prirodoslovni Muzej, Zagreb, Royal Dutch Society for Nature Conservation <<http://www.veenecology.nl/data/CroatiaDinaricAlpspartA.PDF>> Downloaded on May 2010.
- VEDENINA, V. YU. & HELVERSEN, O., 2009: A re-examination of the taxonomy of the *Chorthippus albomarginatus* group in Europe on the basis of song and morphology (Orthoptera: Acrididae). *Tijdschrift voor Entomologie* **152**, 65–97.

SUMMARY

A contribution to knowledge concerning the Orthoptera fauna of the Slavonian range (NE Croatia) with the first record of some species in Croatia

G. Szövényi & G. Puskás

In the years 2007 and 2008 an orthopterological investigation was carried out in the Papuk Mountain and its surroundings, in northeastern Croatia. Altogether 64 Orthoptera species (33 Ensifera and 31 Caelifera) were found in 81 sampling sites. This is about 40% of the formerly known Orthoptera fauna of Croatia. Five species, *Isophya modestior*, *Poecilimon affinis*, *Poecilimon fussii*, *Pseudopodisma fieberi* and *Xya pfaendleri* proved to be new to the Croatian Orthoptera fauna. Some others are

significant for different reasons ; *Eupholidoptera chabrieri* was formerly not known in the Carpathian Basin, while *Miramella irena* and *Chorthippus oschei* were published from only one locality in Croatia before. The composition of the Orthoptera fauna, and the frequency of species in the studied localities shows the dominance of mesophilous species connected partly to forest habitats and mountain environment.

Appendix 1. Short descriptions, elevations and geocoordinates of sampling sites.

- 1) Biškupci, orchard with mowed grassland, 280 m a.s.l., N45 26.344 E17 36.376;
- 2) Čeralije, xeromesic grassland plot and football ground, 140 m a.s.l., N45 37.032 E17 42.054;
- 3) Čeralije, swamp meadow (hayfield) and *Magnocaricetum*, 140 m a.s.l., N45 36.410 E17 41.835;
- 4) Češljakovci, humid hayfields and *Caricetum* along the stream, 280-330 m a.s.l., N45 27.892 E17 41.533;
- 5) Češljakovci, xeromesic hayfield, 270 m a.s.l., N45 26.893 E17 41.716;
- 6) Đedovica, humid grassland near a spruce forest, 520 m a.s.l., N45 33.696 E17 29.983;
- 7) Dobrić, bushy grassland on forest edge, 250 m a.s.l., N45 35.661 E17 36.107;
- 8) Doljanci, forest edge bushes and grassland along a stream between Skok and Grabovac, 380 m a.s.l., N45 28.649 E17 36.320;
- 9) Doljanci, mesic hayfields, 330 m a.s.l., N45 27.785 E17 36.322;
- 10) Doljanci, xeric grasslands and pastures, 370 m a.s.l., N45 27.288 E17 36.993;
- 11) Doljanovci, beech forest edge, 440 m a.s.l., N45 28.202 E17 43.556;
- 12) Doljanovci, south-facing oak forest clearing, 540 m a.s.l., N45 28.516 E17 43.535;
- 13) Doljanovci, xeric mowed grassland patch near the village, 285 m a.s.l., N45 26.797 E17 44.348;
- 14) Donja Motičina, pasture with bushes and small pond, 140 m a.s.l., N45 29.458 E18 01.748;
- 15) Đuričić, pasture with *Solidago*, 160 m a.s.l., N45 34.832 E17 41.117;
- 16) Duzluk, ruderal bushy grassland at a quarry, 610 m a.s.l., N45 28.966 E17 52.365;
- 17) Golo Brdo, xeromesic, acidophilous grassland plots, 310 m a.s.l., N45 27.388 E17 41.895;
- 18) Gornji Vrhovci, huge bushy steppic hayfields, 520-580 m a.s.l., N45 28.212 E17 33.939;
- 19) Gornji Vrhovci, xeric grassland near the road at the geological monument, 430 m a.s.l., N45 27.796 E17 34.670;
- 20) Hum, humid bushy grassland, 160 m a.s.l., N45 39.765 E17 31.942;
- 21) Jankovac, grassland and forest edge, 480 m a.s.l., N45 31.345 E17 41.016;
- 22) Jankovac, bushy clearing like grassland plots near the road in the northern side of Ivačka glava, 540 m a.s.l., N45 31.145 E17 40.230;
- 23) Jankovac, degraded grassland plots at the forest edge near the road in the northern side of Ivačka glava, 740 m a.s.l., N45 30.693 E17 39.743;
- 24) Jankovac, bushy forest edge stripe near the road in the northern side of Ivačka glava, 770 m a.s.l., N45 30.901 E17 39.165;
- 25) Jankovac, grassland plots near the road in the northern side of Ivačka glava, 860 m a.s.l., N45 31.357 E17 36.676;
- 26) Jankovac, tall grassland near the road, 520 m a.s.l., N45 31.177 E17 40.407;

- 27) Jankovac, Mala Papuk, steep rocky grassland, 800-870 m a.s.l., N45 31.284 E17 35.829;
- 28) Kamenski Vučjak, tall humid grassland, 300 m a.s.l., N45 29.075 E17 31.606;
- 29) Kamenski Vučjak, road, 300 m a.s.l., N45 29.075 E17 31.606;
- 30) Kantrovi, *Urtica* sp. and *Sambucus ebulus* bush, 300 m a.s.l., N45 26.851 E17 36.217;
- 31) Kaptol, small ruderal xeric grassland plot, 295 m a.s.l., N45 26.902 E17 43.302;
- 32) Kometnik-Zubići, bushy, mesic pasture, 240 m a.s.l., N45 36.633 E17 34.347;
- 33) Levinovac, mesic grasslands, 180 m a.s.l., N45 41.347 E17 29.753;
- 34) Mešinci, abandoned orchard, 345 m a.s.l., N45 26.767 E17 45.372;
- 35) Mihaljevci, humid hayfields, 155 m a.s.l., N45 22.365 E17 40.858;
- 36) Novo Zvečevo, *Carex* dominated stripe along a stream, 440 m a.s.l., N45 32.574 E17 30.764;
- 37) Novo Zvečevo, humid and mesic hayfield, 440 m a.s.l., N45 32.544 E17 30.626;
- 38) Novo Zvečevo, bushes and humid grasslands on the lakeside, 460 m a.s.l., N45 32.968 E17 30.911;
- 39) Novo Zvečevo, disturbed bushy humid grassland, 360 m a.s.l., N45 31.090 E17 31.883;
- 40) Poljanska, grassland covered forest edge, 340 m a.s.l., N45 27.301 E17 34.840;
- 41) Poljanska, xeromesic hayfield, 310 m a.s.l., N45 26.626 E17 34.971;
- 42) Požega, mesic and humid hayfields, 150 m a.s.l., N45 21.494 E17 40.549;
- 43) Pušina, roadside bushes in the village, 155 m a.s.l., N45 33.656 E17 44.581;
- 44) Radovanci, xeromesic mowed hillsides, 280 m a.s.l., N45 26.988 E17 38.657;
- 45) Slatinski Drenovac, stream bank and mesic hayfield near the road, 180 m a.s.l., N45 33.314 E17 43.228;
- 46) Slatinski Drenovac, old field with *Solidago*, 160 m a.s.l., N45 33.821 E17 42.847;
- 47) Slavonska Pivnica, flat humid grassland area between the road and railway, 140 m a.s.l., N45 43.385 E17 28.905;
- 48) Slavonska Pivnica, mesic grassland covered hillside, 140 m a.s.l., N45 42.058 E17 29.473;
- 49) Stražeman, pasture with small pond, 370 m a.s.l., N45 27.385 E17 37.052;
- 50) Stražeman, pasture in a southern slope, 400 m a.s.l., N45 27.670 E17 37.558;
- 51) Stražeman, Mekotica, clearing-like mesic grassland with wet patches, 400 m a.s.l., N45 27.670 E17 37.558;
- 52) Stražeman, Pasjače, degraded mesic grassland, 400 m a.s.l., N45 27.827 E17 36.951;
- 53) Trenkovo, ditch near the road with *Rubus* bushes, 200 m a.s.l., N45 25.506 E17 39.888;
- 54) Velika, Krečana, forest clearcut, 625 m a.s.l., N45 30.082 E17 38.272;
- 55) Velika, Smeća, stream valley and forest edge, 400 m a.s.l., N45 29.043 E17 38.825;
- 56) Velika, bushy spoil near the quarry, 340 m a.s.l., N45 28.597 E17 38.972;
- 57) Velika, mesic hayfield along the main street, 280 m a.s.l., N45 27.835 E17 39.419;
- 58) Velika, hayfield and football ground, 260 m a.s.l., N45 27.346 E17 39.693;
- 59) Velika, abandoned vineyard on a steep slope near the PNP centre, 280 m a.s.l., N45 27.445 E17 39.807;
- 60) Velika, Poljanice, car parking place, degraded xeric and mesic grasslands, forest edge and bushes, 360 m a.s.l., N45 27.764 E17 38.603;
- 61) Velika, Pliš, south faced Orno-Quercetum clearings, 480 m a.s.l., N45 28.331 E17 38.643;
- 62) Velika, small clearings on the southern slope of Mališćak, 690 m a.s.l., N45 28.929 E17 38.072;
- 63) Velika, clearing with xeric grassland, and bush on the ridge of Mališćak, 720 m a.s.l., N45 29.102 E17 38.108;

- 64) Velika, opening grassland covered clearings on the ridge of Turjak, 620 m a.s.l., N45 28.687 E17 38.050;
- 65) Velika, xeric bushy forest clearings on the Turjak, 490 m a.s.l., N45 28.242 E17 38.376;
- 66) Velika, small grassland plots of the peak Mališčak, 720 m a.s.l., N45 29.016 E17 38.068;
- 67) Velika, bushy forest clearings in the SW side of Mališčak, 570 m a.s.l., N45 28.663 E17 38.302;
- 68) Velika, village gardens and streets, 260 m a.s.l., N45 27.404 E17 39.676;
- 69) Velika, clearcuts, degraded grasslands near the forestry road at Duboka, 620 m a.s.l., N45 29.658 E17 42.555;
- 70) Velika, acidophilous beech forest clearcut near Duboka, 550 m a.s.l., N45 29.777 E17 41.113;
- 71) Velika, opening beech forest with *Vaccinium* near Duboka, 460 m a.s.l., N45 29.189 E17 40.478;
- 72) Velika, garden of the Papuk Nature Park office, 270 m a.s.l., N45 27.453 E17 39.707;
- 73) Velika, Stari grad, xeric, degraded clearing, 420 m a.s.l., N45 28.263 E17 39.232;
- 74) Velika, oak forest clearing with *Vaccinium* near the summit of Lapjak, 645 m a.s.l., N45 29.086 E17 39.242;
- 75) Velika, roadside bushes and trees near the swimming pool, 295 m a.s.l., N45 28.078 E17 39.461;
- 76) Vetovo, grazed *Festucetum* in the village, 250 m a.s.l., N45 25.288 E17 47.754;
- 77) Voćin, bushy tall humid grassland near the Vocinska stream, 180 m a.s.l., N45 37.454 E17 35.661;
- 78) Voćin, Jabuka, open dry grassland near a quarry, 380 m a.s.l., N45 35.441 E17 29.943;
- 79) Voćin, mesic, *Solidago* dominated vegetation, 200 m a.s.l., N45 38.487 E17 32.567;
- 80) Vojlovica, mesic grasslands and forest edge, 115 m a.s.l., N45 35.993 E17 49.980;
- 81) Vučjak, humid grasslands and bushes, 260 m a.s.l., N45 27.881 E17 30.080.