PETI SLOVENSKI ENTOMOLOŠKI SIMPOZIJ Z MEDNARODNO UDELEŽBO

Posvečen 80-letnici akademika prof. dr. Matije Gogala
in 50-letnici smrti prof. dr. Štefana Michielija

KNJIGA POVZETKOV

FIFTH SLOVENIAN ENTOMOLOGICAL SYMPOSIUM WITH INTERNATIONAL ATTENDANCE

Dedicated to Academician Prof. Dr. Matija Gogala on the Occasion of his 80th Birthday
and 50th Anniversary of the Death of Prof. Dr. Štefan Michieli

BOOK OF ABSTRACTS

JAN PODLESNIK
VESNA KLOKOČOVNIK
UREDNIKA/EDITORS

Univerzitetna založba
Univerze v Mariboru

Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

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BOOK OF ABSTRACTS

Maribor,
21. in 22. september 2018 / 21st and 22nd September 2018

Urednika / Editors:

dr. Jan Podlesnik
dr. Vesna Klokočovnik

November, 2018

Naslov Peti slovenski entomološki simpozij z mednarodno udeležbo, Knjiga povzetkov

Title Fifth Slovenian Entomological Symposium with International Attendance, Book of Abstracts

Urednika *Editors*
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Tehnična podpora *Technical support*
Igor Pesek, Andreja Savič, Tjaša Kos, Mateja Kraner

Tehnična urednika *Technical editors*
Dunja Legat, Jan Perša
(Univerzitetna založba Univerze v Mariboru/University of Maribor Press)

Slika na naslovnici *Cover picture*
Nemoptera sinuata, uredili/*edited by* Dušan Devetak, Vesna Klokočovnik in Jan Podlesnik (slika/*picture* D. Devetak)

Konferenca *Conference*
Peti slovenski entomološki simpozij z mednarodno udeležbo
Fifth Slovenian Entomological Symposium with International Attendance

Datum in lokacija *Date and location*
21. - 22. September, 2018 // Maribor // Slovenija

Organizacijski odbor *Organizing committee*
Dušan Devetak, Vesna Klokočovnik, Jan Podlesnik, Mario Lešnik (Univerza v Mariboru), Tomi Trilar (Prirodoslovni muzej Slovenije), Slavko Polak (Notranjski muzej Postojna), Tina Klenovšek, Saška Lipovšek (Univerza v Mariboru)

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Oddelek za biologijo, Fakulteta za naravoslovje in matematiko, Univerza v Mariboru
Department of Biology, Facultay of Natural Sciences and Mathematics, University of Maribor

Sponzor *Sponsor*
Fakulteta za kmetijstvo in biosistemskle vede, Univerza v Mariboru
Faculty of Agriculture and Life Sciences, University of Maribor

Izdajatelj/*Co-published by*
Univerza v Mariboru, Fakulteta za naravoslovje in matematiko/
University of Maribor, Faculty of Natural Sciences and Mathematics
Koroška cesta 160, 2000 Maribor, Slovenia
http://www.fnm.um.si, dekanat.fnm@um.si

Založnik/*Published by*
Univerzitetna založba Univerze v Mariboru/
University of Maribor Press
Slomškov trg 15, 2000 Maribor, Slovenia
http://press.um.si, zalozba@um.s

Izdaja/*Edition* Prva izdaja/*1st*
Vrsta publikacije/*Publication type* E-publikacija/*E-publication*
Dostopno na/*Available at* http://press.um.si/index.php/ump/catalog/book/329
Izdano/*Published* Maribor, november 2018

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CIP - Kataložni zapis o publikaciji
Univerzitetna knjižnica Maribor

595.7(082)(048)

SLOVENSKI entomološki simpozij z mednarodno udeležbo (5 ; 2018 ; Maribor)
Knjiga povzetkov [Elektronski vir] / Peti Slovenski entomološki simpozij z mednarodno udeležbo, posvečen 80-letnici akademika prof. dr. Matije Gogala in 50-letnici smrti prof. dr. Štefana Michielija, Maribor, 21. in 22. september 2018 ; urednika Jan Podlesnik, Vesna Klokočovnik = Book of abstracts / Fifth Slovenian Entomological Symposium with International Attendance, dedicated to Academician Prof. Dr. Matija Gogala on the Occasion of his 80th Birthday and 50th Anniversary of the Death of Prof. Dr. Štefan Michieli, [Maribor], 21st and 22nd September 2018 ; editors Jan Podlesnik, Vesna Klokočovnik. - 1st ed. - El. zbornik. - Maribor : Univerzitetna založba Univerze, 2018
Način dostopa (URL): http://press.um.si/index.php/ump/catalog/book/329

ISBN 978-961-286-198-8 (pdf)

doi: 10.18690/978-961-286-198-8
1. Podlesnik, Jan
COBISS.SI-ID 95221505

ISBN 978-961-286-198-8 (PDF)
DOI https://doi.org/10.18690/978-961-286-198-8
Cena/*Price* Free copy
Za založnika/*For publisher* prof. dr. Zdravko Kačič, rektor Univerze v Mariboru

University of Maribor Press

PETI SLOVENSKI ENTOMOLOŠKI SIMPOZIJ Z MEDNARODNO UDELEŽBO

Maribor 2018

Knjiga povzetkov

JAN PODLESNIK & VESNA KLOKOČOVNIK

Povzetek Peti slovenski entomološki simpozij z mednarodno udeležbo je bil posvečen 80-letnici akademika prof. dr. Matije Gogala in 50-letnici smrti prof. dr. Štefana Michielija. Simpozija se je udeležilo 50 udeležencev. Svoje delo so predstavili znanstveniki iz desetih držav (Avstrije, Bosne in Hercegovine, Hrvaške, Francije, Kosova, Madžarske, Makedonije, Slovenije, Rusije in Združenega Kraljestva). Uradna jezika sta bila slovenščina in angleščina. Avtorji so obravnavali različne skupine žuželk: vrbnice (Plecoptera), kačji pastirji (Odonata), kobilice (Orthoptera), polkrilci (Hemiptera), velekrilci (Megaloptera), mrežekrilci (Neuroptera), hrošči (Coleoptera), kožekrilci (Hymenoptera), dvokrilci (Diptera) in metulji (Lepidoptera). Prispevki so segali na področja fiziologije, etologije, sistematike in evolucije, favnistike, ekologije, uporabna entomologije, varstva narave in zgodovine entomologije.

Ključne besede: • žuželke • entomologija • simpozij • Slovenija •

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DOI https://doi.org/10.18690/978-961-286-198-8
ISBN 978-961-286-198-8
© 2018 Univerza v Mariboru, Univerzitetna založba
Available at: http://press.um.si

PETI SLOVENSKI ENTOMOLOŠKI SIMPOZIJ Z MEDNARODNO UDELEŽBO / FIFTH SLOVENIAN ENTOMOLOGICAL SYMPOSIUM WITH INTERNATIONAL ATTENDANCE, MARIBOR 2018
J. Podlesnik, V. Klokočovnik (ur.)

University of Maribor Press

FIFTH SLOVENIAN ENTOMOLOGICAL SYMPOSIUM WITH INTERNATIONAL ATTENDANCE

Maribor 2018

Book of abstracts

JAN PODLESNIK & VESNA KLOKOČOVNIK

Abstract. The Fifth Slovenian Entomological Symposium, with International Attendance, was dedicated to the Academician Professor Matija Gogala on the occasion of his 80th birthday and to the 50th anniversary of the death of Prof. Dr. Štefan Michieli. The Symposium was attended by 50 participants. Scientists from ten countries (Austria, Bosnia and Herzegovina, Croatia, France, Kosovo, Hungary, Macedonia, Slovenia, Russia and the United Kingdom) presented their work. The official languages of the Symposium were Slovenian and English. Authors explored a range of insect groups: Plecoptera, Odonata, Orthoptera, Hemiptera, Megaloptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and Lepidoptera. Topics were presented in the fields of physiology, ethology, systematics and evolution, faunistics, ecology, applied entomology, nature conservation and history of entomology.

Keywords: • insects • entomology • symposium • Slovenia •

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DOI https://doi.org/10.18690/978-961-286-198-8 ISBN 978-961-286-198-8
© 2018 Univerza v Mariboru, Univerzitetna založba
Available at: http://press.um.si

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PETEK, 21. SEPTEMBER 2018 / FRIDAY, 21st SEPTEMBER 2018

8:00 – 9:00	Registracija na Fakulteti za naravoslovje in matematiko / Registration at the Faculty of Natural Sciences and Mathematics
9:00 – 9:20	Otvoritev 5. slovenskega entomološkega simpozija z mednarodno udeležbo / Opening of the 5th Slovenian Entomological Symposium with International Attendance Nagovor / Opening words **doc. dr. Mitja Slavinec**, dekan Fakultete za naravoslovje in matematiko Univerze v Mariboru / Dean of the Faculty of Natural Sciences and Mathematics, University of Maribor **prof. dr. Dušan Devetak**, organizator simpozija / the Organizer of the Symposium **Urška Ratajc**, mag. ekol. biod., predsednica Slovenskega entomološkega društva Štefana Michielija / the President of the Slovenian Entomological Society Štefan Michieli
9:20 – 9:40	**Matija GOGALA** **Štefan Michieli (1933-1968), slovenski entomolog in fiziolog** Štefan Michieli (1933-1968), Slovenian entomologist and physiologist
9:40 – 10.00	**Tomi Trilar** **Ob 80-letnici Matije Gogala** Matija Gogala on the Occasion of his 80th Birthday
10.00 – 10.40	Predstavitev posterjev z odmorom za kavo in čaj / Poster session with coffee and tea break

Predavanja / Lectures

Sekcija / Session: **Fiziologija in Etologija / Physiology and Ethology**
Moderator: **Tomi TRILAR**

10:40 – 11:00	**Vanessa MARTINEZ, Elise NOWBAHARI, David SILLAM-DUSSÈS, Vincent LORENT** *Pit-building antlions are sensitive to sub-nanometer amplitude vibrations of sand*
11:00 – 11:20	**Dušan DEVETAK, Jan PODLESNIK, Vesna KLOKOČOVNIK** Interakcije med predatorjem in plenom pri volkcih: prevajanje vibracijskih signalov globoko v pesek *Predator-prey interactions in antlions: transmission of vibrational signals deep into sand*
11:20 – 11:40	**Eva VELER, Dušan DEVETAK, Vesna KLOKOČOVNIK** Interakcije med ličinkami dveh simpatričnih vrst volkcev *Interactions between larvae of two sympatric antlion species*
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12:20 – 12:40	**Sándor KOCZOR, Ferenc SZENTKIRÁLYI, Miklós TÓTH** *The power of odours: the example of* Chrysoperla carnea *species complex (Neuroptera: Chrysopidae)*
12:40 – 13:00	**Matija GOGALA, Tomi TRILAR** Škržadi, ki uporabljajo dva mehanizma in dva komunikacijska kanala za akustično in vibracijsko komunikacijo *Cicadas using two mechanisms and communication channels for acoustic and vibrational communication*
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Sekcija / Session: **Favnistika / Faunistics**
Moderator: **Slavko POLAK**

14:30 – 14:50 **Matjaž BEDJANIČ**
Favna kačjih pastirjev Šri Lanke: retrospektivni pregled več kot dveh desetletij raziskav (Insecta, Odonata)
Dragonfly fauna of Sri Lanka: retrospective overview of over two decades of research (Insecta, Odonata)

14:50 – 15:10 **Matjaž BEDJANIČ**
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Monsoon aspect of the dragonfly fauna (Insecta, Odonata) of Andaman Islands, India

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Prvi seznam kačjih pastirjev Kosova
First checklist of Odonata from Kosovo

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Nova dognanja o razširjenosti koščičnega škratca *Coenagrion ornatum* (Odonata) v Sloveniji
New cognitions on distribution of Ornate Bluet Coenagrion ornatum *(Odonata) in Slovenia*

15:50 – 16:10 Predstavitev posterjev z odmorom za kavo in čaj / Poster session with coffee and tea break

Sekcija / Session: **Favnistika / Faunistics**
Moderator: **Jure JUGOVIC**

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Stonefly collection (Plecoptera, Insecta) in Slovenian Museum of Natural History

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Rechinger's line in Aegean Sea is also for Cicadas a borderline between European and Asian fauna

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SOBOTA, 22. SEPTEMBER 2018 / SATURDAY, 22nd SEPTEMBER 2018

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Predavanja / Lectures

Sekcija / Session: **Favnistika / Faunistics**
Moderator: **Al VREZEC**

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A Slovenian Lepidoptera Research Initiative

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*Seasonal patterns in Apollo (*Parnassius apollo*) (Lepidoptera: Papilionidae) abundance and flight period in Posočje region*

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*Historical aspects of ground beetles (*Carabus*) distribution in Slovenia*

11:20 – 11:40 Predstavitev posterjev z odmorom za kavo in čaj / Poster session with coffee and tea break

Sekcija / Session*:* **Favnistika / Faunistics**
Moderator: **Nataša STRITIH PELJHAN**

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Sekcija / Session: **Ecology and Applied Entomology / Ekologija in uporabna entomologija**
Moderator: **Maarten DE GROOT**

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POSTERJI / POSTERS

Špela AMBROŽIČ, Al VREZEC, Andrej KAPLA, Alenka ŽUNIČ KOSI
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NAT2CARE – Encouraging communities to maintain cross-border Natura 2000 sites or Nature knows no borders

Pajtim BYTYÇI, Ferdije ZHUSHI-ETEMI, Milaim MUSLIU, Osman FETOSHI
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Dung Beetles of the Kozjansko Regional Park

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A morphological comparison of two sympatric cave crickets Troglophilus neglectus *and* T. cavicola *(Orthoptera: Rhaphidophoridae) from Slovenia*

Nataša KOPRIVNIKAR, Jure JUGOVIC
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Composition and species richness of dung beetles (Coleoptera: Scarabaeoidea) in Kraški rob

Dejan KULIJER
The overview of the distribution of Natura 2000 beetle species in Bosnia and Herzegovina (Insecta, Coleoptera)

University of Maribor Press

Povzetki

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Predavanja

Oral Presentations

FAVNA KAČJIH PASTIRJEV ŠRI LANKE: RETROSPEKTIVNI PREGLED VEČ KOT DVEH DESETLETIJ RAZISKAV (INSECTA, ODONATA)

MATJAŽ BEDJANIČ[1]

Predstavljeni so rezultati več kot dve desetletji trajajočih raziskav, v okviru katerih smo zbrali vse razpoložljive podatke in znanje o razširjenosti, taksonomiji in biologiji kačjih pastirjev Šri Lanke. V obsežni monografiji, objavljeni leta 2014, je bila odonatne favne otoka celovito predstavljena in analizirana. Za vsako vrsto je bila orisana njena razširjenost, biologija, ekologija ter stanje ogroženosti. Ovrednotenje stopnje ogroženosti vseh dotlej znanih endemičnih vrst po kriterijih Rdečega seznama IUCN je razkrila, da sta kar dve tretjini endemitov globalno ogroženih. Naslednje monografsko delo, objavljeno leta 2016, je bilo osredotočeno na taksonomsko revizijo in molekularno filogenijo družine Platystictidae s Šri Lanke. V okviru taksonomskega dela naših raziskav smo v zadnjem desetletju opisali skupno 10 novih vrst, 1 novo podvrsto ter sinonimizirali 6 predhodno opisanih vrst. V nekaj zadnjih letih so tudi šrilanški raziskovalci prispevali pomembno novo znanje o taksonomiji, razširjenosti in biologiji nekaterih redkih in kritično ogroženih vrst. S Šri Lanke je po doslej objavljenih podatkih znanih 130 vrst kačjih pastirjev iz 12 družin. Stopnja endemizma znaša 50,8 %, skupaj je za otok endemičnih kar 58 vrst in 8 podvrst.

DRAGONFLY FAUNA OF SRI LANKA: RETROSPECTIVE OVERVIEW OF OVER TWO DECADES OF RESEARCH (INSECTA, ODONATA)

The results of over two decades of research, during which we have gathered all available data and knowledge about the distribution, taxonomy and biology of dragonflies of Sri Lanka are presented. In a comprehensive monograph published in 2014, the odonate fauna of the island has been presented and analysed. Distribution, biology, ecology and threat status of each species have been outlined. Assessment of the threat status of all hitherto known endemic species according to IUCN Red List criteria revealed that even two thirds of endemics are globally threatened. Another monographic work published in 2016, focused on taxonomic revision and molecular phylogeny of the Platystictidae of Sri Lanka. In the frame of taxonomic part our research we described a total of 10 new species, 1 new subspecies and synonymised 6 previously described species in last decade. In recent years, also Sri Lankan colleagues contributed important new knowledge about taxonomy, distribution and biology of some rare and critically endangered species. According to published data, 130 dragonfly species from 12 families are currently known from Sri Lanka. The proportion of endemism is 50.8%, with even 58 species and 8 subspecies endemic to the island.

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MONSUNSKI ASPEKT FAVNE KAČJIH PASTIRJEV (INSECTA, ODONATA) ANDAMANSKIH OTOKOV, INDIJA

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Predstavljeni so rezultati avtorjevega raziskovanja favne kačjih pastirjev Andamanskih otokov med 30. junijem in 21. julijem 2017. Na 49 lokalitetah, razpršenih po otokih South, Middle in North Andaman, Little Andaman in Havelock, je bilo opazovanih skupaj 35 vrst, 31 jih je bilo določenih do vrste, preostale štiri pa le do ravni rodu. Večina zabeleženih vrst ima široko območje razširjenosti v jugovzhodni Aziji, opaženih je bilo le malo endemitov. Najzanimivejše najdbe so podrobneje predstavljene, vključno s fotografijami nove, doslej še neopisane vrste iz družine ploščcev. V naši raziskavi smo zabeležili skoraj 60% trenutno znane odonatne favne Andamanov. Skupaj z rezultati objavljenih študij dajejo rezultati razmeroma dober vpogled v monsunski aspekt odonatne favne otokov. Priporočene so nadaljnje favnistične, taksonomske in naravovarstvene raziskave, ki bi jih bilo treba spodbujati, saj ostaja splošno poznavanje favne kačjih pastirjev Andamanskih otokov še vedno fragmentarno in nepopolno.

MONSOON ASPECTS OF THE DRAGONFLY FAUNA (INSECTA, ODONATA) OF ANDAMAN ISLANDS, INDIA

The results of author's exploration of the dragonfly fauna of Andaman Islands between 30 June and 21 July 2017 are presented. At 49 localities, scattered across South, Middle and North Andaman, Little Andaman and Havelock islands, altogether 35 species were observed, 31 could be determined to the species level, remaining four only to the genus level. Most of recorded species have wide distribution in southeast Asia, only few endemics were sighted. Most interesting records are presented in more detail, including photographs of a new hitherto undescribed libellulid species. In our research we recorded nearly 60% of currently known odonate fauna of the Andamans. Together with results of published studies, this gives fairly good insight into the monsoon aspect of islands' odonate fauna. Further faunistic, taxonomic and nature conservation research is recommended and should be facilitated as overall knowledge on the dragonfly fauna of Andaman Islands still remains fragmentary and incomplete.

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A SLOVENIAN LEPIDOPTERA RESEARCH INITIATIVE

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Between 2009 and 2012 a joint research program searched for, located and mapped 106 butterfly species across the 88,000 hectares comprising the adjacent nature parks of Örseg, in south-west Hungary, and Goričko, in north-east Slovenia. Both parks have Special Area of Conservation and Special Protection Area status. The author participated in that initiative, one of 50 individuals acknowledged in the Butterfly Atlas end-product. Until 2014, Park Goričko had no moth fauna data. In that year, the author undertook an ambitious unfunded solo initiative to quantify the moth fauna within Goričko. The project is now in its fifth year. His presentation will relate progress to date and reveal the methods used to maximise both species counts and species diversity to obtain some idea of the moth fauna of north-east Slovenia. He will touch on some surprising drawbacks encountered during his project.

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INTERAKCIJE MED PREDATORJEM IN PLENOM PRI VOLKCIH: PREVAJANJE VIBRACIJSKIH SIGNALOV GLOBOKO V PESEK

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Larve volkcev gradijo v rahli zemlji ali suhem pesku lijakaste pasti za lov plena – drobne členonožce. Plen zaznavajo na osnovi vibracij podlage, ki jih plen proizvaja med hojo po podlagi. Medtem ko se je večina raziskav osredotočala na površinske (Rayleighove) valove, pa smo mi osvetlili vlogo vibracij, ki potujejo v globlje plasti peska. Dokazali smo, da je larva celo, ko je zakopana globlje v pesku, sposobna zaznati plen in reagirati s približevanjem plenu in zagrabitvijo. Zanimalo nas je, kako se signali prevajajo globlje v pesek. S pomočjo akcelerometra, potopljenega globoko v podlago, smo merili umetne signale in signale lazenja žuželke po podlagi. Predstavljamo spektralne značilnosti vibracij, relevantnih pri interakcijah med predatorjem in plenom. Zastavili smo si vprašanje, ali imajo lastnosti peščene podlage vpliv na signal. Peščeni delci močno vplivajo na prevajanje signalov, pri čemer je pesek filter za visoke frekvence. Manjši so peščeni delci, močnejše je filtriranje. Ker je fini pesek učinkovitejši filter, se signali visokih frekvenc na določeni razdalji udušijo. Signali nizkih frekvenc pa se prevajajo še na razdaljah, pomembnih za zaznavanje plena. Medtem ko je najučinkovitejše prevajanje signalov videti v grobem pesku, pa zaradi prevelikih delcev ta ni primeren za volkce. Plenilci naredijo kompromis med finim in grobim peskom – izbirajo peske srednih granulacij.

PREDATOR-PREY INTERACTIONS IN ANTLIONS: TRANSMISSION OF VIBRATIONAL SIGNALS DEEP INTO SAND

Trap-building antlion larvae are known to dig conical pitfall traps in dry loose soil or fine sand to catch prey – small arthropods. The larvae detect them according to substrate vibrations produced during the movement of the prey on sand surface. While the most studies have been devoted to surface (Rayleigh) waves, we elucidate the role of vibrations travelling in deeper sand layers. We demonstrate that the antlion larva even when buried deep in the sand is capable to detect its prey and react with movement closer to the prey to grasp it. We addressed the question of how the signals propagate deep into the sand. We conducted measurements of artificial signals and signals produced by walking insects (prey) with accelerometer sunk deep in the sand. Here we present results of the study of the spectral characteristics of the substrate vibrations relevant for predator-prey interactions, using accelerometric methods. We addressed the following question: Do sand properties have any impact on the signals? Particle size highly affects signal transmission. Sand is a filter for higher frequencies. Smaller are the sand particles, more intense is the filtering. Fine sand is more efficient filter, consequently high frequencies are eliminated at a certain distance. However, low frequency signals are still propagated at a certain distance, biologically relevant for prey detection. While the most efficient signal propagation seems to be in coarse sand, it contains too large particles thus it is inconvenient for antlions. Predators make a compromise between finest and coarse sand choosing medium sand.

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ZGODOVINA UPRAVLJANJA Z GOZDOVI JE POMEMBEN DEJAVNIK PRI IZBRUHIH PODLUBNIKOV: LEKCIJE ZA PRIHODNOST

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Gozdovi so bili v zadnjih stoletjih močno spremenjeni; zgodovinske prakse upravljanja pa bi lahko močno vplivale na današnje stanje gozdov. Preverili smo, ali zgodovinsko načrtovanje upravljanja z gozdovi in aktivno gospodarjenje z navadno smreko vpliva na potencial izbruha lubadarjev po velikih motnjah. Poleg tega smo preverili vpliv deleža smreke v razmerah ob izbruhu in na različnih nadmorskih višinah. Zaznali smo močno povezavo med spreminjanjem naravne gozdne sestave, deležem smreke in sanitarno sečnjo zaradi podlubnikov. Zaznali smo negativen povezavo nadmorske višine in pozitiven vpliv deleža navadne smreke na sanitarno sečnjo. Skupaj z obdobjem izbruha je bila sanitarna sečnja večja na nižjih nadmorskih višinah, na območjih z višjim deležem navadne smreke in v obdobju po abiotskem stresu. Dodatno je bila zaznana negativna povezava med deležem realizirane glede na načrtovano sečnjo ter sanitarno sečnjo v obdobjih po abiotskem stresu.

FOREST MANAGEMENT HISTORY IS AN IMPORTANT FACTOR FOR BARK BEETLE OUTBREAKS: LESSONS FOR THE FUTURE

Forests were changed strongly in the last centuries; however historical management practices could have strong effect on nowadays status of the forests. We tested whether the forest management history and forest tending with Norway spruce is affecting the potential the outbreak of bark beetles after large disturbances. Furthermore, the effect of percentage of spruce under outbreak situations and different altitudes were checked. There was a strong association with the change of the naturalness of the forest composition and the percentage of Norway and sanitary felling because of spruce bark beetles. There was a negative influence of altitude and a positive influence of percentage of Norway spruce on the sanitary felling. Together with the outbreak period, the sanitary felling was amplified in lower altitude, in areas with higher percentage of Norway spruce and in periods after abiotic stress. In addition, there was a negative association between the percentage of realized cut in the planned cut and the sanitary felling in periods after abiotic stress.

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NOVOSTI V FAVNI STENIC (HETEROPTERA) IN ČEBEL (APIFORMES) V SLOVENIJI

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Kljub razmeroma dobro poznani favni stenic in čebel v Sloveniji se vrstijo najdbe vrst, ki jih tu še nismo poznali. Pomemben delež novih prišlekov so tujerodne vrste, ki se jih vedno več pojavlja v Evropi. Stenice prednjačijo z mnogimi vrstami, ki se invazivno širijo in mnoge postajajo pomembni škodljivci v kmetijstvu ali gozdarstvu. Najnovejša izmed tujerodnih vrst stenic v Sloveniji je marmorirana smrdljivka (*Halyomorpha halys*). Slovenijo je dosegla tudi prva tujerodna vrsta čebel, azijska čebela smolarka (*Megachile sculpturalis*). Območja razširjenosti povečujejo tudi mnoge sredozemske vrste stenic. Kretsko vitezovko (*Lygaeus creticus*) je leta 2016 v Kopru prvič v Sloveniji fotografirala Duša Vadnjal. Janez Kamin je pred svojim domom v Novi Gorici na zabojnikih za ločeno zbiranje odpadkov prvič v Sloveniji našel več vrst. Zabojniki so rumene, zelene, modre in bele barve in verjetno privlačijo žuželke podobno kot rumene pasti in znane rumene lepljive plošče, ki jih uporabljajo sadjarji proti škodljivcem. Nekatere vrste pa so bile morda odložene z rastlinskimi ostanki v zabojnik za organske odpadke, kjer se je verjetno zaredila plenilska vrsta *Xylocoris galactinus*, ki živi med fermentiranim rastlinjem pri visoki vlagi in temperaturi in jo je Kamin tudi našel na zabojnikih. Poleg novih metod vzorčenja so za nove najdbe pogosto ključni tudi obiski novih zanimivih lokalitet. V letu 2018 sem prvič nekajkrat obiskal mejno območje med Slovenijo in Italijo na robu kraške planote med Seli na Krasu in Jamljami z najvišjima točkama Kremenjakom in Špikom. Tu sem prvič našel dve vrsti čebel, peščinsko čebelo vrste *Andrena danuvia* in znosko *Hoplitis perezi*. Prva je še slabo poznana vrsta, ki so jo zamenjevali s sorodnimi, najdba pa je prva na Krasu. Druga je bila že znana iz okolice Trsta, medtem ko je v Sloveniji še nismo našli. Gnezda sem našel tik nad stenami kraškega roba.

NEWS IN THE FAUNA OF TRUE BUGS (HETEROPTERA) AND BEES (APIFORMES) IN SLOVENIA

In spite of relatively well known fauna of true bugs and bees in Slovenia, finds of species never recorded before are lining up. A significant proportion of new arrivals are non-native species, which are increasingly occurring in Europe. True bugs predominate with many species that are invasively expanding and many are becoming important pests in agriculture or forestry. The latest among the non-native Heteroptera species in Slovenia is brown marmorated stink bug (*Halyomorpha halys*). Slovenia has been reached also by the first alien bee species, the giant resin bee (*Megachile sculpturalis*). Areas of distribution are expanding also by many Mediterranean Heteroptera species. *Lygaeus creticus* was photographed in Koper for the first time in Slovenia in 2016 by Duša Vadnjal. Several species were found for the frst time in Slovenia by Janez Kamin in front of his home in Nova Gorica on containers for separate collection of waste. Containers are yellow, green, blue and white and probably attract insects, like yellow traps and well known yellow sticky plates used by fruit-growers against pests. Some species may have been deposited with plant residues in an organic waste container where the predatory species *Xylocoris galactinus* have probably bred as it is living among fermented plant material at high humidity and temperature, and Kamin also found it on containers. In addition to new sampling methods, visits to new interesting sites are often key to new finds. In 2018, I visited for the first time the border area between Slovenia and Italy on the edge of the Karst plateau between Sela na Krasu and Jamlje with the highest points Kremenjak and Špik. Here I found two bee species for the first time, *Andrena danuvia* and *Hoplitis perezi*. The first is still poorly known species, which was confused with related species, and the find is the first in the Karst. The other was already known from the surroundings of Trieste, while it has not yet been found in Slovenia. I found nests just above the walls of the karst edge.

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ŠKRŽADI, KI UPORABLJAJO DVA MEHANIZMA IN DVA KOMUNIKACIJSKA KANALA ZA AKUSTIČNO IN VIBRACIJSKO KOMUNIKACIJO

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Škržadi vrste *Cicadatra persica* in sorodna še neopisana vrsta z otoka Milos (GR) oddajajo kot pozivni napev kontinuirano timbalno brenčanje in fraze, ki sestojijo iz kratkih timbalnih ehemov, katerim sledi serija pokanja s krili. Druge vrste tega rodu, npr. *C. atra* in *C. platyptera* oddajajo ob dvorjenju le posamezne poke s krili med kratkimi timbalnimi ehemi. To pokanje s krili, ki ga producirajo tudi nekatere druge vrste škržadov, je precej tišje od timbalnih ehemov. Zato nas je zanimalo, kako se ti poki prevajajo po podlagi, vejah grmov in dreves kot biotremulacijski signali. Z akcelerometrom B&K 4338 smo posneli te signale in pričakovano ugotovili, da so zelo intenzivni pri nizkih frekvencah. Timbalni ehemi pa imajo tudi kot vibracijski signali povsem drugačen spekter, ki sega v visoke frekvence do 20 kHz. Te meritve si razlagamo z domnevo, da škržadi s timbalnimi zvoki komunicirajo predvsem po zraku, pokanje s krili pa deluje kot biotremulacijski signal, ki se prevaja po vejah grmov in dreves, na katerih se običajno hranijo in oglašajo.

CICADAS USING TWO MECHANISMS AND COMMUNICATION CHANNELS FOR ACOUSTIC AND VIBRATIONAL COMMUNICATION

Cicadas *Cicadatra persica* Kirkaldy, 1909 and a close related species *Cicadatra* sp. from the Greek island of Milos use for intraspecific communication continuous song produced by tymbals, and phrases comprising short echemes produced by tymbals and following series of wing clicks. Other species of this genus like *C. atra* or *C. platyptera* produce single clicks between short echemes during courtship using the same mechanism. Cicadas from other genera and families are producing similar clicks. Our question was why they use two different mechanism in acoustic communication. These clicks, recorded as airborne sound are faint broad band signals. We wanted to know how these clicks are transmitted as biotremulation signals. We used accelerometer Bruel & Kjaer 4338 for recording vibrational signals in the field. We recorded continuous song and phrases with short echemes and wing clicks as acceleration and/or velocity parameter. As expected we found that biotremulation signals of wing clicks were very intense low frequency vibrations and tymbal echemes have spectral characteristics with main energy in higher parts of spectrum up to 20 kHz. The explanation of our results is that cicadas of the genus *Cicadatra* use tymbal sounds to communicate through air and wing clicks for biotremulation through substrate, branches of bushes and trees on which they usually feed and sing.

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EKOLOŠKE RAZISKAVE IN MONITORING GLOGOVE BELINKE (*APORIA CRATAEGI*) NA KRAŠKEM ROBU (JZ SLOVENIJA)

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Od leta 2012 proučujemo ekologijo glogove belinke, *Aporia crataegi* (Lepidoptera: Pieridae). Čeprav vrsta ni na seznamu ogroženih vrst v Evropi, je njen upad v zadnjem času znaten. Da bi dobili vpogled v zahteve vrste, smo analizirali tako ekološke zahteve odraslih, kot mladostnih stadijev v mozaični pokrajini različnih habitatov. Ocenili smo spolno strukturo, sposobnost širjenja, vedenje in vpliv tipa habitatov na gostoto in razporeditev živali. Samcev je bilo v populaciji več, opazna je bila protandrija. Oba spola sta sposobna tudi daljših preletov med habitatnimi krpami. Na suhih kraških travnikih smo zabeležili najvišje gostote, na pašnikih in zaraščajočih površinah pa nižje. Odrasle živali se prehranjujejo priložnostno na različnih nektarskih rastlinah (zabeležili smo 9 različnih vrst nektarskih rastlin). Medtem, ko odrasli nektarske rastline iščejo predvsem na odprtih površinah, se gosenice zadržujejo in prehranjujejo v mejicah črnega trna in gloga (*Prunus spinosa* in *Crataegus monogyna*). Mikrohabitat gosenic se ujema s mikrohabitanimi zahtevami samic pri odlaganju jajčec. Samice v ta namen najraje izbirajo manjše in dobro osončene grme. Da bi preprečili prihodnje upadanje vrste na tem območju, predlagamo tradicionalno vzdrževanje mozaične pokrajine.

ECOLOGICAL STUDIES AND MONITORING OF THE BLACK-VEINED WHITE (*APORIA CRATAEGI*) BUTTERFLY IN KRAŠKI ROB (SW SLOVENIA)

Since 2012 we have studied ecology of Black-veined White, *Aporia crataegi* (Lepidoptera: Pieridae). Although the species is not considered to be threatened on a European level, there are reports of severe declines. To achieve a detailed insight into its ecology, we studied different ecological aspects of adult and juvenile stages in a dense network of different types of habitats. We assessed the sexual structure, dispersal ability, behaviour and influence of habitat types upon its density and distribution. In total, male to female ratio is biased toward males, with a pronounced protandry. Both sexes are highly mobile and are able to cross a few kilometres' distances between favourable habitat patches. The preferred habitats are open dry calcareous meadows where the highest densities of adults are observed, in comparison with pastures and overgrown meadows, where densities are lower. Adults are opportunistic feeders, using different nectar sources (nine plant taxa recorded). While adults seek these nectar sources in open areas, juvenile stages mainly live and feed in hedgerows of *Prunus spinosa* and *Crataegus monogyna*. We have also assessed the microhabitat preferences of the larvae and connected these with female behaviour when searching for appropriate places for laying the eggs. Females preferably select smaller plants that grow in full sun. In order to prevent declines of the species in this area, the traditional mosaic open grasslands with hedgerows should be maintained.

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INVAZIVNE VRSTE KOMARJEV V SLOVENIJI S POSEBNIM POUDARKOM NA JAPONSKEM KOMARJU, *AEDES JAPONICUS JAPONICUS* (DIPTERA: CULICIDAE)

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Invazivne vrste komarjev imajo zaradi nevarnosti prenosa različnih zoonoz izjemen pomen za javno zdravje. Zaradi nepoznavanja njihovega pojavljanja v Sloveniji smo leta 2013 in 2015 opravili popise komarjev v celotni državi. Tekom dela smo ugotovili stabilno populacijo tigrastega komarja (*Ae. albopictus*) na Primorskem, v Ljubljani in širši okolici ter na Dolenjskem. Z monitorigom smo zabeležili tudi prvo najdbo korejskega komarja, *Ae. koreicus*, ter stabilno populacijo japonskega komarja, *Ae. japonicus japonicus*. Na podlagi zbranih podatkov o razširjenosti tigrastega in japonskega komarja, bioklimatskih spremenljivk in nadmorske višine smo v računalniškem programu MaxEnt izdelali različne modele njune potencialne razširjenosti. Tigrasti komar lahko po napovedih modelov potencialno naseli še območje v severovzhodni Sloveniji, japonski komar pa lahko naseli večino države. Opravili smo tudi genetsko populacijsko študijo japonskega komarja na evropski ravni, kjer smo genotipizirali sedem jedrnih mikrosatelitnih lokusov in določili nukleotidno zaporedje mitohondrijskega gena za podenoto 4 NADH dehidrogenaze (NAD4). Izkazalo se je, da so slovenske populacije najbolj podobne populacijam iz Nemčije. S študijo smo pridobili pomembne podatke o pojavljanju treh invazivnih vrst komarjev v Sloveniji, ki bodo vsekakor uporabni za nadaljnje akcijske načrte za preprečevanje njihovega širjenja ter nadzor.

INVASIVE MOSQUITO SPECIES IN SLOVENIA (DIPTERA: CULICIDAE) WITH EMPHASIS ON *AEDES JAPONICUS JAPONICUS* (DIPTERA: CULICIDAE)

Invasive mosquito species have great impact on public health as they are vectors of various zoonoses. The lack of knowledge on mosquito fauna in Slovenia triggered mosquito samplings throughout the country in 2013 and 2015. With the monitoring we found an established population of Asian tiger mosquito (*Ae. albopictus*) in Primorska, Ljubljana with its surroundings and Dolenjska regions. We also recorded the first finding of *Ae. koreicus* and an established population of Asian bush mosquito, *Ae. japonicus japonicus*. Based on the collected presence data for Asian tiger and Asian bush mosquitoes, bioclimatic and altitude variables, we developed models of their potential distribution using MaxEnt. According to built models, Asian tiger mosquito can additionally inhabit the north-eastern Slovenia, while the Asian bush mosquito could settle in most of the country. Additionally, we conducted a genetic population study of a Asian bush mosquito at the European level. We genotyped seven nuclear microsatellite loci and determined the nucleotide sequence of the mitochondrial gene for NADH dehydrogenase subunit 4 (NAD4). Gained data showed that Slovenian populations are most similar to those from Germany. With this study we obtained important data on occurrence of mosquitoes in Slovenia and they will certainly be useful for further mosquito surveillance and control plans.

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THE POWER OF ODOURS: THE EXAMPLE OF *CHRYSOPERLA CARNEA* SPECIES COMPLEX (NEUROPTERA: CHRYSOPIDAE)

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Larvae of common green lacewings (*Chrysoperla carnea* species complex) are important predators of several soft bodied arthropods, including aphids. Nevertheless, adults of these lacewings are not predatory and feed on pollen and nectar. In accordance with the feeding habits of the adults, several plant volatile compounds have previously been suggested as attractants. A ternary combination of plant-derived compounds has been found to be highly attractive to both males and females of these lacewings. Furthermore, females were found to lay their eggs in the vicinity of the baits, thus hatching larvae would hunt for prey in the vicinity. We intend to give a brief overview of the studies conducted with the ternary attractant, including discussion of potential practical applications.

Acknowledgements: The current research was partially supported by the PD115938 NKFIH grant, the SMARTCROP project of the Research Council of Norway and the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.

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ČASOVNO IN PROSTORSKO SOBIVANJE KOPROFAGNIH PLOJKAŠEV (COLEOPTERA: SCARABAEOIDEA) NA SUBMEDITERANSKIH TRAVIŠČIH KRAŠKEGA ROBA (JZ SLOVENIJA)

NATAŠA KOPRIVNIKAR[1], JURE JUGOVIC[1]

Analizirali smo znotraj in medvrstno kompeticijo in sobivanje koprofagnih plojkašev (Coleoptera: Scarabaeoidea) na dveh vzorčnih ploskvah v submediteranu Slovenske Istre. Na vsaki vzorčni ploskvi smo vzorčili na treh habitatnih krpah (S1: aktivno pašen del pašnika, S2: del pašnika v zaraščanju, S3: travnik/gozdni rob ob pašniku). Vzorčili smo s talnimi pastmi, ki smo jim za vabo dodali goveje iztrebke. Vzorčenje je potekalo od marca do oktobra 2012 z enakim številom pasti na vsaki habitatni krpi in vsak mesec. Analiza vrstne sestave je nakazala izrazito časovno razporeditev vrst iz vseh štirih cehov (Aphodiidae – endokopridi, Scarabaeidae – parakopridi, Geotrupidae – parakopridi, Scarabaeidae – telekopridi). Časovna razporeditev je bila najbolj opazna med cehoma Aphodiidae – endokopridi, ki ki so bili najštevilčnejši ob začetku in koncu sezone, a popolnoma odsotni iz vzorcev v avgustu, ter Scarabaeidae – parakopridi, ki se pojavljajo skozi celo sezono, a so na začetku in ob koncu sezone maj številčni. Tekmovanje med cehi je bilo izrazito tudi med Aphodiidae – endokopridi in Geotrupidae – parakopridi. Opazili smo tudi pomembne razlike v sestavi združbe, diverziteti in številčnosti med obema vzorčnima ploskvama (Zazid, Hrastovlje) in njunimi habitatnimi krpami (S1, S2, S3). Najvišje število vrst smo zabeležili na S1, a je bila številčnost najvišja na S2 in S3. Predvidevamo, da izraziti časovna in prostorska razporeditev vrstam omogočata sobivanje na širšem območju Kraškega roba.

TEMPORAL AND SPATIAL COEXISTENCE OF DUNG BEETLES (COLEOPTERA: SCARABAEOIDEA) IN SUBMEDITERRANEAN GRASSLANDS IN KRAŠKI ROB (SW SLOVENIA)

We studied intra- and interspecfic competition and coexistence of dung beetles (Coleoptera: Scarabaeoidea) on two study sites in submediterranean Slovenia. Each study site was divided in three habitat patches (S1: strongly grazed pasture, S2: pasture in overgrowing stage, S3: meadows/wood edges outside pastures). We used pitfall traps and cattle excrements as a bait, and sampling was carried out from March until end of October in 2012, with equal numbers of traps per habitat patch and month. We found an evidence of a strong temporal segregation between species of all four guilds (Aphodiidae – dwellers, Scarabaeidae – tunnelers, Geotrupidae – tunnellers and Scarabaeidae – rollers). Temporal segregation was the most evident between Aphodiidae – dwellers, which were the most active at the beginning and end of season, but they were completelly absent from samples in the August, and Scarabaeoidae – tunnelers, which were present through all season, but were less active at the beggining and end of season. Interguild competition was also evident between Aphodiidae – dwellers and Geotrupidae – tunnellers. Finally, differences in species composition, species richness and abundance between both study sites (Zazid and Hrastovlje) and their habitat patches (S1, S2, S3) were detected. We noticed that S1 has the most species, and that the abundance is highest in S2 and S3. We presume that temporal and spatial segregation allow more species to coexsit.

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ECOLOGICAL REQUIREMENTS AND FEATURES ADAPTING THE ALPINE GRASSHOPPER *MIRAMELLA CARINTHIACA* TO LIVE IN SUBALPINE PASTURES

KARL KRAL[1]

The alpine grasshopper *Miramella carinthiaca* (Kollar, 1833) can be found in pastures of the Seckau Tauern mountain range, at an altitude of approximately 1600 m to 2100 m. However, a study of a pasture at the treeline (approximately 1710 m) showed that *M. carinthiaca* requires rather wetter and poorer slightly acid soils that contain certain plant species, stones and patches of bare earth. The patches of earth surrounded by evergreen plants, such as *Geum montanum* and *Vaccinium vitis-idaea*, are essential for oviposition. Leaves of these particular plants provide the first food source for the early nymphs. The isolated habitats and limited mobility of the completely flightless *M. carinthiaca* could result in extinction of the population if oviposition sites are lost due to climatic influences or being overgrown by plants. Another factor which could affect the population is changes in the vegetation. Leaves of more than thirty other plant species are also eaten if the plants preferred by *M. carinthiaca* are insufficient to meet protein (nitrogen) requirements. Sufficient nitrogen is important not only for reproduction but also for cuticle melanisation, which provides protection against pathogens and harmful radiation. Quantification of the cuticle melanisation of adult females within a single *M. carinthiaca* population showed significant variability, which may be an indicator of the fitness of the population. At the study site, it was apparent that the treeline habitat favourable to *M. carinthiaca* is also used by other grasshoppers, such as *Chorthippus* species, *Omocestus viridulus*, *Euthystira brachyptera* and *Gomphocerus sibiricus*. However, only *G. sibiricus* may occupy an ecological niche similar to that of *M. carinthiaca*.

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MREŽEKRILCI (NEUROPTERIDA) OBMOČJA NATURA 2000 V SLOVENIJI: LIČENCA PRI POLJČANAH – RIBNIKI PETELINJEK KOT PRIMER

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Mrežekrilci (Neuropterida) so v Sloveniji iz naravovarstvenega vidika slabo raziskana skupina žuželk. Zato smo se odločili, da opravimo popis mrežekrilcev na območju ribnikov Petelinjek, ki so del območja Natura 2000 Ličenca pri Poljčanah. Naš cilj je bil, da preko popisa, naravovarstveno ovrednotimo favno mrežekrilcev in sicer s pomočjo Rdečega seznama ogroženih mrežekrilcev Slovenije. Prav tako pa je bil naš cilj tudi opredeliti mrežekrilce kot bioindikatorsko skupino. Živali smo popisovali dvakrat mesečno od aprila do oktobra med letoma 2016 in 2017, in sicer na devetih lokalitetah v okolici ribnika Štepihovec in Štatenberšek. Na območju ribnikov Petelinjek smo tako našli 30 vrst mrežekrilcev: eno vrsto iz redu velekrilcev (Megaloptera), ostale vrste pa pripadajo redu pravih mrežekrilcev (Neuroptera). Vrstno najbolje zastopani sta bili družina tenčičaric (Chrysopidae) in družina rjavih mrežekrilcev (Hemerobiidae). Iz družine tenčičaric smo našli vseh pet v Sloveniji prisotnih vrst iz rodu *Chrysoperla,* med katerimi je še posebej zanimiva najdba vrste *Chrysoperla mediterranea*. Skoraj polovica najdenih vrst je bioindikatorskih in med njimi so tudi vrste, ki imajo vodne ličinke. To so: *Sialis lutaria*, *Sisyra nigra*, *Sisyra terminalis* in *Osmylus fulvicephalus*. Te štiri vrste so tudi vključene na Rdeči seznam ogroženih mrežekrilcev Slovenije, kjer so opredeljene kot ranljive vrste.

LACEWINGS (NEUROPTERIDA) OF THE NATURA 2000 PROTECTED AREA IN SLOVENIA: LIČENCA NEAR POLJČANE - PETELINJEK PONDS AS AN EXAMPLE

Lacewings (Neuropterida) in Slovenia are from a nature conservation point of view a poorly studied group of insects. For this reason, we decided to perform a lacewings census in the area of Petelinjek ponds, which are part of the Natura 2000 protected area Ličenca near Poljčane. Our aim was to evaluate the conservation status of the Neuropterids fauna with the help of the Slovenian Red List of endangered Neuroptera. Our aim was also to define Neuroptera as a bioindicator group. Animals were collected twice a month from April to October during the years 2016 and 2017, at nine collecting places in the surrounding area of the ponds Štepihovec and Štatenberšek. In the area of Petelinjek ponds, 30 species of Neuropterids have been found in two orders and 7 families. One species belongs to the order Megaloptera, while others belong to the order Neuroptera. Most abundant were species from the families Chrysopidae and Hemerobiidae. Among Chrysopidae we found all five species in the genus *Chrysoperla* that are present in Slovenia. Especially interesting was the finding of *Chrysoperla mediterranea*. Almost half of the species are bioindicators and a few of them with aquatic larvae. These are *Sialis lutaria*, *Sisyra nigra*, *Sisyra terminalis* and *Osmylus fulvicephalus*. All of the listed species are present in the Slovenian Red List of endangered Neuroptera, and they are classified as vulnerable.

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ALTERNATIVNA ZASNOVA EKOLOŠKEGA NASADA JABLAN ZA URAVNAVANJE RAZMERIJ MED POPULACIJAMI ŠKODLJIVIH IN KORISTNIH ŽUŽELK ZA VZPOSTAVITEV SAMOREGULIRANEGA SADOVNJAKA BREZ UPORABE PESTICIDOV

MARIO LEŠNIK[1], RENATA VEBER[1], STANISLAV TOJNKO[1]

Obstoječe metode nadzora škodljivcev sadnega drevja s pogosto uporabo pesticidov niso več sprejemljive zaradi škodljivih vplivov na okolje in človeka. Sodoben način zatiranja škodljivcev je sprememba zasnove sadovnjakov da bi znatno povečali populacije naravnih sovražnikov tako, da jim zagotovimo ustrezen življenjski prostor in alternativne vire hrane. Namen našega raziskovanja je bil ugotoviti, kako zasaditev zelišč in grmov med jablane vpliva na populacije škodljivcev v ekološkem sadovnjaku jablan. V prostoru med drevesi smo posadili naslednje vrste rastlin: pelin, rožmarin, ribez, lesko in bezeg. S tem smo spremenili mikro-ekosistem sadovnjaka. Rezultati kažejo, da sajenje zelišč in grmovnic med jablane vpliva na populacijsko dinamiko škodljivcev in koristnih žuželk. Ugotovili smo, da posamezne vrste posajenih rastlin lahko imajo nasproten učinek za eno vrsto koristne ali škodljive žuželke, kot za drugo.

ALTERNATIVE ORGANIC APPLE ORCHARD DESIGN TO MANIPULATE PEST-BENEFICIAL INSECT RELATIONSHIPS IN DIRECTION TO AUTO-REGULATED ORCHARD WITHOUT PESTICIDE APPLICATION

The existing methods of control of agricultural insect pests of fruit trees by frequent application of pesticides are not accepted anymore because of harmful effects to environment and human population. Modern way of pest control is to manipulate orchard design to significantly enlarge populations of naturally occurring beneficial organisms by supplying them with appropriate habitat and alternative food sources. Aim of our research was to determine how planting specific herbs and shrubs between apple trees impact the emergence of pests in an ecological apple tree orchard. In the space between the trees we had planted herbs: common wormwood and rosemary; and shrubs blackberries, hazel and elder. With this we changed the micro-ecosystem of the orchard. The results show that planting herbs and shrubs between apple trees has an impact on the population dynamics of pests and beneficial insects. It was also shown that a specific plant can have the opposite effect with one type of beneficial or harmful insect, than with the other.

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PIT-BUILDING ANTLIONS ARE SENSITIVE TO SUB-NANOMETER AMPLITUDE VIBRATIONS OF SAND

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European pit-building antlions (*Myrmeleon inconspicuus* Rambur 1842) are studied in their capacity to detect vibrations generated by the locomotion of an ant (*Cataglyphis cursor*) outside the pit. These locomotions have been recorded by laser velocimetry and replicated by micro-controllers digital outputs acting on piezoelectric transducers placed several centimeters outside the peripheries of the pits: their actions on the surface of a sand media create surface waves with particle accelerations that are 3 orders of magnitude less than g, alleviating any possibility of sand avalanche towards the bottom of the pit. Depending on the amplitude of the vibrations, the antlions answer back, generally by sand tossing. One remarkable feature is the time delay from the start of the cue and the agonistic behavior induced by this cue. This time delay is studied versus the cue amplitude. The conclusion of this work is that antlions answer back within seconds to cues with amplitudes between 20 to 50 nanometers at the level of their mechanosensors, within minutes for the same cues when they carry 1 to 2 nanometer amplitude signals and within seconds to these last cues if they are preceded by a sequence of signals at the Ångström amplitude.

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ZATIRANJE LIČINK KORUZNEGA HROŠČA *DIABROTICA V. VIRGIFERA* (COLEOPTERA, CHRYSOMELIDAE) Z ENTOMOPATOGENIMI OGORČICAMI

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Koruzni hrošč (*Diabrotica v. virgifera* LeConte, [Coleoptera, Chrysomelidae]) je nevaren škodljivec koruze v Ameriki in v Evropi. Glavno škodo povzročajo ličinke, ki živijo v tleh in se prehranjujejo na koreninah koruze (*Zea mays* L.). Pri močnem napadu ličink na korenine koruze lahko pride o večjega izpada pridelka in s tem povezane gospodarske škode. Cilj naše raziskave je bil v poljskem poskusu preučiti učinkovitost izbrane vrste entomopatogenih ogorčic (EPN) za zatiranje ličink koruznega hrošča. Za ta namen smo razvili tudi poseben prenosni sistem za vnos ogorčic v tla. V dvoletnem poljskem poskusu smo primerjali učinkovitost pripravka Dianem® na osnovi EPN vrste *Heterorhabditis bacteriophora* Poinar (Rhabditida: Heterorhabditidae) in konvencionalnih insekticidov Force 1,5 G iz skupine sintetičnih piretriodov (a.s. teflutrin) in Sonido iz skupine neonikotinoidov (a.s. tiakloprid) za zatiranje ličink koruznega hrošča. Poljski poskusi so potekali v Bučečovcih v Prlekiji in v Šmartnem pri Cerkljah na Gorenjskem. Razlike med obravnavanji so bile zelo podobne v obeh letih in na obeh lokacijah, čeprav je bila populacija hroščev na Gorenjskem približno 5-krat manjša kot v Prlekiji. Največ koruznih hroščev smo zabeležili v kontroli. Statistična analiza je pokazala, da sta obravnavanji Force in EPN značilno zmanjšali število ulovljenih hroščev glede na kontrolo in da se statistično ne razlikujeta. Sredstvo Sonido ni značilno zmanjšalo števila ulovljenih hroščev. To nakazuje možnost uporabe preizkušane vrste EPN kot nadomestilo sintetičnega talnega insekticida Force v koruzi, ob ustrezni prilagoditvi mehanizacije za vnos suspenzije EPN v tla.

CONTROLLING *DIABROTICA V. VIRGIFERA* (COLEOPTERA, CHRYSOMELIDAE) LARVAE WITH ENTOMOPATHOGENIC NEMATODE

The Western Corn Rootworm (WCR), *Diabrotica v. virgifera* LeConte, [Coleoptera, Chrysomelidae] is an important insect pest of maize Zea mays (L). in America and in Europe. The main damage is caused by larvae, which feed on maize roots. If the pressure of the pest population on corn roots is too high, economic yield losses are expected. The aim of our research was to assess entomopathogenic nematode (EPN) *Heterorhabditis bacteriophora* Poinar (Rhabditida: Heterorhabditidae) against the WCR larvae in a series of field experiments. For this purpose we have developed a special portable system for EPN application. In two years field studies we tested the product (dianem®) based on *H. bacteriophora* compared to the conventional management based on the use of synthetic insecticides Force 1.5 g (active substance tefluthrin) or Sonido (active substance thiacloprid). Field trials took place in Bučečovci (Prlekija) and Šmartno near Cerklje (Gorenjska). Differences between treatments were very similar at both locations; although the population of WCR in Gorenjska was approximately 5-x lower than in Prlekija. The highest number of beetles was caught in negative control, where no WCR management was performed. Statistical analysis showed that the treatments EPN and Force significantly reduced the number of WCR beetles caught compared to the control, and that the former two treatments are not statistically different. Product Sonido didn't significantly reduce the number of WCR beetles caught. Our results suggest the possibility of using the tested EPN as a substitute for synthetic insecticide Force in maize, with the appropriate adaptation of the machinery to introduce the EPN suspension into the soil.

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NOVE VRSTE IN REVIZIJA RODU *BATHYSCIDIUS* JEANNEL, 1910 (COLEOPTERA, LEIODIDAE, LEPTODIRINI)

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Jamski hrošči tribusa Leptodirini so največja skupina med hrošči pri katerih je večina pripadnikov prilagojena na podzemeljsko življenje. Poleg večjih in bolj troglomorfnih taksonov z podaljšanimi telesi in okončinami poznamo tudi manjše, kroglaste in večinoma edafske pripadnike. Osebke ene najmanjših znanih leptodirin iz jame na Pelješcu v Dalmaciji je Apfelbeck (1907) originalno opisal kot *Bathyscia tristicula*. Kasneje je Müller (1910) opisal ločeno podvrsto *Bathyscia t. fallaciosa* iz jame na izviru reke Omble pri Dubrovniku. Za to vrsto z dvema podvrstama je Jeannel (1910) v svoji reviziji uveljavil novo rodovno ime *Bathyscidius*. Tretjo podvrsto, *Batyscidius tristiculus tomoricensis* je Müller (1922) opisal z gore Tomor v južni Albaniji. To podvrsto je kasneje Jeannel (1924) povišal na vrstni nivo. Po tem sta bili opisani še dve vrsti in sicer *B. rambueseki* iz gore Galičica (Republika Makedonija), ki jo je opisal Knirsch (1931) in iz Bracanovića pećine na Bjelasici (Črna gora) vrsta *B. remyi*, ki jo je opisal Jeannel (1934). Nedavna raziskave jam avtorjev in sodelavcev na Hrvaškem v Črni gori in Republiki Makedonij ter nabrani številni primerki tega rodu so omogočili avtorjema taksonomsko revizijo rodu in prepoznavo treh novih vrst.

NEW SPECIES AND THE REVISION OF THE GENUS *BATHYSCIDIUS* JEANNEL, 1910 (COLEOPTERA, LEIODIDAE, LEPTODIRINI)

The cave beetle tribe Leptodirini is the largest of the beetle groups in which most members have subterranean habits. Besides bigger and more troglomorphic taxa with prolonged body and appendages, small, spherical and mostly edaphic taxa are known as well. Specimens of one of the smallest known Leptodirini collected in one cave on Pelješac peninsula in Dalmatia, were originally described by Apfelbeck (1907) as *Bathyscia tristicula*. Later on, Müller (1910) described separate subspecies *Bathyscia t. fallaciosa* from the cave on Ombla river spring near Dubrovnik. Jeannel (1910) in his revision later established a new genus *Bathyscidius* for this species with two recognized subspecies. The third subspecies *Bathyscidius tristiculus tomoricensis* was found in the Tomor Mountain in southern Albania and described by Müller (1922). This subspecies was elevated to the species level by Jeannel (1924). After that, two more species were described, *B. rambueseki* from Galičica Mountain (Republic of Macedonia) by Knirsch (1931) and *B. remyi* from Bracanovića pećina on the Bjelasica Mountain (Montenegro) by Jeannel (1934). Recent cave explorations carried out by authors and colleagues in Croatia, Montenegro and the Republic of Macedonia resulted in the collection of numerous individuals that enabled the authors to review the genus and recognize three newly discovered species.

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ZGODOVINSKI VIDIKI RAZŠIRJENOSTI VELIKIH KREŠIČEV (*CARABUS*) V SLOVENIJI

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V zadnjih desetletjih je v Evropi vse bolj opazno upadanje specializiranih in redkih vrst velikih krešičev (*Carabus*), zato je bil naš namen ugotoviti trend razširjenosti in stopnjo ogroženosti vrst tega rodu na območju Slovenije. Na podlagi zgodovinskih in recentnih podatkov smo izdelali karte zgodovinske razširjenosti posameznih vrst. Analizirali smo podatke za 25 vrst velikih krešičev. Glede na zmanjšanje območij razširjenosti smo ocenili trend upadanja posameznih vrst in jim pripisali kategorije ogroženosti. Ugotovili smo, da je velik delež vrst velikih krešičev v upadu. Najbolj izginjajo veliki krešiči, ki so vezani na negozdna okolja, na zrele, negospodarske gozdove ali na vlažne gozdove. Izoblikovali smo seznam vrst, ki bi jih morali dodatno uvrstiti na Rdeči seznam ogroženih vrst. Nekaj vrst velikih krešičev je v zadnjih desetletjih na območju Slovenije že izginilo, zato so potrebne intenzivne ekološke raziskave preostalih vrst in nujno čimprejšnje oblikovanje učinkovitih ukrepov varstva.

HISTORICAL ASPECTS OF GROUND BEETLES (*CARABUS*) DISTRIBUTION IN SLOVENIA

In the past few decades, there has been a sharp decline in specialised and rare species of ground beetles (*Carabus*) throughout Europe. Our aim was to determine the distribution trends of chosen species and their conservation status in Slovenia. Based on historical and recent data, distribution maps for each species have been made. Extensive data for 25 species of genus *Carabus* were analysed. The reduction in distribution area sizes was used to evaluate the decline of each species in Slovenia and for assigning them to different categories of threat status. Our results show that a significant number of species from genus Carabus are in decline. Open habitat species of ground beetles and ground beetles that are dependent on mature, unmanaged forests were found to be the most endangered. We suggest several species, which should be added to the Red list of threatened species in Slovenia. A few species of ground beetles have already disappeared from Slovenia in the last few decades, therefore intensive ecological studies of the remaining species and immediate effective conservation strategies are essential.

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KAJ VEMO O FAVNI ŠČITKARJEV (MOLJEVK) SLOVENIJE (HEMIPTERA, STERNORRHYNCHA, ALEYRODIDAE)?

GABRIJEL SELJAK[1]

Moljevke ali ščitkarji so zelo majhne žuželke iz reda raznokrilcev (Hemiptera). Doslej je bilo opisanih nekaj čez 1500 živečih in približno ducat fosilnih vrst. Težišče njihove razširjenosti so tropska in subtropska območja. V Evropi (skupaj s Sredozemljem) je znanih okrog 60 vrst, od katerih je precej tujerodnih, ki so bile sem zanesene v novejšem zgodovinskem obdobju. Po avtorjevem vedenju se v Sloveniji v preteklosti s to skupino žuželk ni nihče sistematično ukvarjal. Nekaj podatkov (a ne favnističnih) je le o vrstah, ki so znani kot škodljivci gojenih rastlin (npr. *Trialeurodes vaporariorum*, *Aleyrodes proletella*, *Bemisia tabaci*). Z bolj priložnostnim kot resnično sistematičnim zbiranjem teh žuželk na ozemlju Slovenije v preteklih dveh desetletjih je avtorju uspelo zbrati in dokumentirati 25 vrst. To število zajema skoraj celotno srednjeevropsko favno moljevk in tudi delček sredozemskega vrstnega bogastva. Sedem vrst je tujerodnih, pri čemer je bila vrsta *Singhiella simplex* zgolj prestrežena pri fitosanitarnem nadzoru na okrasnih fikusih v prodaji in se ni ustalila. Podatki o razširjenosti posameznih vrst v Sloveniji so še zelo skromni. Nekaj več podatkov je le za Primorsko. V predstavitvi bo slikovno prikazano in obravnavano avtorjevo trenutno poznavanje favne moljevk Slovenije.

WHAT DO WE KNOW ON THE WHITEFLY FAUNA OF SLOVENIA (HEMIPTERA, STERNORRHYNCHA, ALEYRODIDAE)?

Whiteflies are very small insects from the order Hemiptera. So far, more than 1500 living and a dozen of fossil species are described worldwide. Most of them live in tropical and subtropical regions. About 60 species occur in Europe (Mediterranean basin included), many of which are alien species which have been introduced quite recently. According to the author's knowledge, this group of insects has not been studied systematically up to now in Slovenia. There are some published data (but not faunistic) on species which are considered as pests of cultivated plants (e.g. *Trialeurodes vaporariorum*, *Aleyrodes proletella*, *Bemisia tabaci*). With occasional collecting of whiteflies in the territory of Slovenia in the last two decades, the author collected and document 25 species. This number covers almost the entire whitefly fauna of Central Europe and a part of Mediterranean species richness. Seven species are alien, with the *Singhiella simplex* being intercepted in phytosanitary surveillance on ornamental *Ficus microcarpa* and not being established. The data on the distribution of whitefly species in Slovenia are still very scarce. There is mora data for the western part of Slovenia (Primorska region). In the presentation, the author's current knowledge on the fauna of whiteflies of Slovenia will be pictorially shown and discussed.

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BIONOMIJA NAVADNE SLINARICE - *PHILAENUS SPUMARIUS* (LINNAEUS, 1758) (HEMIPTERA, CICADOMORPHA, APHROPHORIDAE) IN GOSTITELJSKE PREFERENCE NJENIH MLADOSTNIH STADIJEV

GABRIJEL SELJAK[1,3], IVAN ŽEŽLINA[2], MOJCA ROT[2], MATJAŽ JANČAR[2], MARKO DEVETAK[2], TANJA DREO[3]

Navadna slinarica (*Philaenus spumarius*) je ena najpogostejših vrst škržatkov v Evropi. V Sloveniji je splošno razširjena in pogosta od obale do nadmorske višine okoli 1800 m. V Evropi ni povzročala pomembnejše škode na gojenih rastlinah vse do vnosa nevarne rastlinske bakterije *Xylella fastidiosa* v Evropo v začetku tega desetletja. Ta bakterija povzroča obolevanje in propadanje velikega števila gojenih in samoniklih rastlin in je ena hujših bolezni kadarkoli zanesenih v Evropo. Navadna slinarica je najpomembnejši in najbolj učinkovit naravni prenašalec te bakterije na okuženih območjih v Evropi. Dobro poznavanje bionomije tega prenašalca in njegove preference glede gostiteljskih rastlin je zato ključnega pomena pri oblikovanju strategije obvladovanja bolezni v primeru morebitnega vnosa ali razširitve na ozemlje Slovenije. V prispevku bodo prikazani izsledki dveletnih raziskav bionomije navadne slinarice v okviru projekta CRP XylVec (V4-1603). Posebna obravnava je posvečena gostiteljskim rastlinam mladostnih razvojnih stopenj navadne slinarice, hraniteljskim rastlinam odraslih slinaric ter preference le-teh za različne rastlinske vrste oziroma skupine rastlinskih vrst.

BIONOMICS OF THE MEADOW SPITTLEBUG - *PHILAENUS SPUMARIUS* (LINNAEUS, 1758) (HEMIPTERA, CICADOMORPHA, APHROPHORIDAE) AND HOST PREFERENCES OF ITS IMMATURES

The meadow spittlebug (*Philaenus spumarius*) is one of the most common froghoppers in Europe. In Slovenia, it is widespread and common from the sea coast up to an altitude of 1800 m. In Europe, it did not cause significant damage to cultivated plants until the introduction of the dangerous plant bacterium *Xylella fastidios* in the beginning of this decade. This bacterium causes diseases and decay of a large number of cultivated and non-cultivated plants and is one of the most dangerous plant pathogens ever introduced to Europe. In the infected areas in Europe the meadow spittlebug is the most important and efficient natural vector of this bacterium. A good knowledge of bionomics of this vector and its preferences for host plants is therefore crucial in the development of strategies for the disease management in case of its introduction or spread into the territory of Slovenia. In the presentation, the results of two-year studies of bionomics of meadow spittlebug within the project CRP XylVec, V4-1603 will be presented. The host plants on which nymphs and adult spittlebugs occur and feed, and their preference for plant species or groups, will be discussed.

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ZBIRKA VRBNIC (PLECOPTERA, INSECTA) V PRIRODOSLOVNEM MUZEJU SLOVENIJE

IGNAC SIVEC[1], TEA KNAPIČ[2]

Prve podatke o vrbnicah na območju Slovenije zasledimo že v Skopolijevi »Entomologia Carniolica« iz leta 1763. Do leta 1977 se s to skupino vodnih žuželk pri nas ni ukvarjal nihče. S sistematičnim delom, ki je kmalu preraslo domače meje in se razširilo predvsem v JV Azijo je v muzeju nastala zbirka, ki danes sodi med 3-5 največjih zbirk te skupine žuželk na svetu. Zbirka obsega preko 16000 inventarnih enot med katerimi so tudi številni holotipi. Več kot polovica zbranega materiala je še neobdelana, med njimi tudi številne nove za znanost še neopisane vrste. Na žalost v muzeju ni prostora za nadaljevanje dela s to zbirko. Tudi v naravi bodo številne vrste izginile in izumrle preden jih bomo uspeli popisati. Danes so na razpolago milijoni za reševanje pande, tigrov in podobnih organizmov, medtem ko nihče niti ne ve za milijone majhnih organizmov, ki izginjajo za večno. Tudi to je biotska raznovrstnost.

STONEFLY COLLECTION (PLECOPTERA, INSECTA) IN SLOVENIAN MUSEUM OF NATURAL HISTORY

First records of stoneflies for the territory of Slovenia we can find in Scopoli »Entomologia Carniolica« from the year 1763. Nobody worked on stoneflies on the territory of Slovenia until 1977. Systematic work on stoneflies in Slovenia and in SE Asia resulted with a collection that is among 3-5 largest collections of these aquatic insects in the world. There are more than 16000 catalog units including many holotypes of Plecoptera. More than half of the collected material is still unstudied including many new and undescribed species. Unfortunately, there is no space nor interest for further work on this collection. Also in museums not only in nature many species will disappear before they will be discovered and described. Millions are spent today on panda and tiger rescuing, and on the other hand, nobody knows that millions of tiny organisms are disappearing forever. This also is biodiversity.

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VONJ KOT AGRESIVNI SIGNAL MED TEKMOVANJEM SAMCEV JAMSKIH KOBILIC *TROGLOPHILUS NEGLECTUS* (ORTHOPTERA: RHAPHIDOPHORIDAE)

NATAŠA STRITIH PELJHAN[1], ALENKA ŽUNIČ KOSI[1]

Samci jamskih kobilic *Troglophilus neglectus* imajo na zadku izbočljive vonjalne žleze, ki se izbočijo predvsem tekom agresivnih interakcij med samci. Funkcijo sproščenega vonja smo testirali s poskusi na parih fizično izenačenih samcev, pri katerih smo nivo vedenjsko izražene agresije in status dominance korelirali s stopnjo izbočanja žleznega tkiva kot pokazateljem količine sproščenega vonja. Ob srečanju z rivalom je stopnja izbočanja žlez pri posameznem samcu korelirala z nivojem vedenjsko izražene agresije in predvsem pojavom dvignjene telesne drže, ki se pojavi neposredno pred fizičnim napadom. Stopnja izbočanja žlez zmagovalcev interakcij je bila značilno večja od poraženčev na istem vedenjskem nivoju agresije, kar kaže na pomembno vlogo vonja pri razrešitvi konflikta. Neposredno po interakciji so žleze izbočali skoraj izključno zmagovalci, kar kaže da vonj v tem kontekstu oznanjanja dominanco. Funkcijo vonja smo testirali tudi neposredno, s preprečitvijo izbočanja žleznega tkiva pri enem oz. obeh rivalih. Tretiranje samo dominantnih samcev je povzročilo preko 60 % upad njihovih zmag ob posamičnih interakcijah, tretiranje obeh rivalov pa značilen porast pogostnosti in trajanja fizičnih spopadov. Rezultati dokazujejo, da vonj samcev *T. neglectus*, sproščen preko izbočljivih žlez, predstavlja učinkovito grožnjo rivalu, ki preprečuje maksimalno stopnjevanje agresije in zmanjšuje stroške povezane s konfliktom.

OLFACTORY SIGNALLING OF AGGRESSION DURING MALE-MALE CONTESTS OF THE CAVE CRICKET *TROGLOPHILUS NEGLECTUS* (ORTHOPTERA: RHAPHIDOPHORIDAE)

Male cave crickets *Troglophilus neglectus* possess protrusive abdominal scent glands, recently shown to protrude primarily during male-male aggression. We tested for the agonistic function of the emitted odor by staging physically matched individuals in dyadic contests and correlating the behaviorally expressed levels of aggression and dominance status of the individuals to degree of their gland tissue protrusion as an indication of the quantity of odor release. During rival encounters, gland protrusion degree correlated to the level of the signaler's aggression and especially the occurrence of the elevated body posture preceding an attack. Gland protrusion degree was significantly higher in encounter winners than losers, suggesting an important role of the released odor in contest resolution. Following encounters, glands protruded almost exclusively in winners, apparently announcing dominance. We tested for the odor function also directly, by preventing gland protrusion in one or both contestants. Treating only the dominant individuals decreased the percentage of encounters they won by over 60%, while treating both contestants elicited a significant increase in the frequency and duration of fights. Thus, the olfactory signals of *T. neglectus* males function as a highly effective threat that prevents maximal escalation of aggression and decreases the conflict-related costs.

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NOVA DOGNANJA O RAZŠIRJENOSTI KOŠČIČNEGA ŠKRATCA *COENAGRION ORNATUM* (ODONATA) V SLOVENIJI

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Koščični škratec *Coenagrion ornatum* (Sélys, 1850) (Coenagrionidae, Odonata) je vrsta počasi tekočih plitvih potokov, povirij in barij z zmerno do močno razvito vodno in obvodno vegetacijo, ki ne zasenči struge, saj ima koščični škratec rad sonce. Večinoma ga najdemo v sekundarnih habitatih, jarkih in kanalih v kulturni krajini, v katerih so se ustvarili podobni pogoji. Odrasli osebki letajo od maja do julija. Vrsta s Priloge II Direktive o Habitatih je v Sloveniji ogrožena in zavarovana. Leta 1997, ob izidu Atlasa kačjih pastirjev Slovenije, je bilo znanih 48 lokalitet. Zaradi kombinacije habitata ter časa letanja odraslih je ob splošnih odonatoloških popisih le malokrat zaznana. Po več namenskih raziskavah v zadnjih letih se je število znanih lokalitet povečalo za več kot pet krat. Največ najdb je na Ljubljanskem barju ter v Vipavski in Mirenski dolini, sledijo Goričko in vzhodni del Prekmurja. Večina najdb je izven Alpskega sveta, z ravnin pod 300 m nadmorske višine. Izjema so najdbe z Gorenjske, predvsem iz okolice Bleda, ter najdbe na Bloški planoti (okoli 750 m n.v.). Z obeh območij je podatkov malo, stari so več kot 15 let, zato je trenutno stanje neznano.

NEW COGNITIONS ON DISTRIBUTION OF ORNATE BLUET *COENAGRION ORNATUM* (ODONATA) IN SLOVENIA

Ornate Bluet *Coenagrion ornatum* (Sélys, 1850) (Coenagrionidae, Odonata) is inhabiting small and sunny streams, seepages and marshes with slow current and rich aquatic and riparian vegetation. Most often is found in secondary habitats with similar habitat conditions, drainage diches in agricultural areas. Adult flight period is from May to July. A Annex II Habitats Directive species is endangered and protected in Slovenia. In 1997, when Atlas of Dragonflies of Slovenia was published, 48 localities where known. Because of a combination of habitat preferences and flight period, the species is seldom found during general dragonfly surveys. After several species oriented surveys number of known localities increased more than five times in last years. Areas with most findings are the Ljubljana Moors and Mirna valley in Central Slovenia, Vipava valley in the West and also Goričko and Eastern Prekmurje in North East Slovenia. Majority of known localities are outside Alpine region from plains and flats below 300 m asl. Exceptions are localities in Gorenjska region in the Alps, especially around Bled, and findings from Bloke Plateau (750 m asl.). At both areas localities are few, with records over 15 years old and unknown present conditions of Ornate Bluet's populations.

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REHINGERJEVA LINIJA V EGEJSKEM MORJU TUDI PRI ŠKRŽADIH RAZMEJUJE EVROPSKO OD AZIJSKE FAVNE

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Na osnovi razširjenosti rastlin so Rechinger (1943, 1950) in Rechinger & Rechinger-Moser (1951) na sredini Egejskega morja predlagali linijo, ki deli floro zahodno Egejskih otokov od flore vzhodnih otokov, ki vsebuje večinoma anatolske in azijske floristične elemente. Tako imenovana »Rechingerjeva linija« je bila kot biogeografska meja med Evropo in Azijo mnogokrat potrjena z novejšimi botaničnimi (Strid 1996) in zoološkimi raziskavami (npr. kopenski polži, mokrice, hrošči črnivci, plazilci) (Hausdorf & Hennig 2005). Ta delitev je očitna tudi pri razširjenosti večine vrst škržadov, z različnimi, vendar sorodnimi vrstami na obeh straneh »Rechingerjeve linije«. Pari sorodnih vrst, ki podpirajo »Rechingerjevo linijo«, so: *Cicada orni* in *C. mordoganensis*, *Lyristes plebejus* in *L. gemellus*, *Cicadatra atra* in *C. icari*. Poleg tega so tudi grške endemične vrste, dve iz kompleksa *Cicadetta montana* in tesno sorodna *Euboeana castaneivaga*, razširjene le zahodno od »Rechingerjeve linije«. *Cicadetta dirfica* je endemična samo za osrednji del otoka Evia in *Cicadetta hannekeae* je endemična za večino delov kontinentalne Grčije pod 40° geografske širine in je prisotna tudi na severnem delu otoka Evia. *Euboeana castaneivaga* je endemična za otok Evia in najbližji otok Andros. Nadaljnjo potrditev smo našli tudi v dveh še neopisanih vrstah iz rodu *Cicadatra*, od katerih je bila ena najdena na otoku Milos in druga na otokih Kos in Kalimnos.

RECHINGER'S LINE IN AEGEAN SEA IS ALSO CICADAS A BORDERLINE BETWEEN EUROPEAN AND ASIAN FAUNA

Based on the distribution of plants Rechinger (1943, 1950) and Rechinger & Rechinger-Moser (1951) proposed a line in the middle of the Aegean Sea, which divides the flora of the West Aegean islands from the flora of Eastern islands which contains mainly the Anatolian or Asian floristic elements. This »Rechinger's line« has been confirmed many times as a biogeographic border between Europe and Asia by newer botanical (Strid 1996) and zological investigations (i.e. land snails, isopods, tenebrionid beetles, reptiles) (Hausdorf & Hennig 2005). This division is evident also in geographical distribution of most cicada species, with different, but closely related species on both sides of the »Rechinger's line«. The pairs of related species, which are supporting the »Rechinger's line« are *Cicada orni* and *C. mordoganensis*, *Lyristes plebejus* and *L. gemellus*, *Cicadatra atra* and *C. icari*. Beside these there exist also Greek endemic species, two from *Cicadetta montana* complex and the closely related *Euboeana castaneivaga*, which are distributed west of the »Rechinger's line« only. *Cicadetta dirfica* is endemic just to the middle part of the island Evia and *Cicadetta hannekeae* is endemic for most parts of continental Greece below 40° latitude and is also present on northern part of the island Evia. *Euboeana castaneivaga* is endemic to the island Evia and the closest island Andros. Further support we found in the two undescribed species form the genus *Cicadatra*, one found on the island Milos and the other on the islands Kos and Kalimnos.

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INTERAKCIJE MED LIČINKAMI DVEH SIMPATRIČNIH VRST VOLKCEV

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Ličinke volkcev so sedentarni plenilci, med katerimi je nekaj vrst, ki gradijo pasti v obliki lijakov. Preučevali smo interakcije med različno hranjenimi ličinkami dveh simpatričnih vrst lijakarjev, *Euroleon nostras* in *Myrmeleon formicarius*. Beležili smo prisotnost/odsotnost lijakov, njihov premer in prestavljanje ličink pri dveh različnih gostotah. Rezultate smo primerjali s kontrolno skupino, kjer smo larve namestili v posode posamično. Ličinke *E. nostras* so v prisotnosti *M. formicarius* lijake bolj povečevale kot v kontrolni skupini. Ličinke *M. formicarius* so se več prestavljale, pogosteje pa so bile tudi brez lijakov. Pri večji gostoti ličink, kjer sta bili ličinki na manjši površini, sta se obe pogosteje prestavljali, prisotno pa je bilo tudi znotrajcehovsko plenilstvo. V direktnih interakcijah smo pogosteje zabeležili zmago ličink *E. nostras*. V drugem poskusu smo larve snemali 24 ur po namestitvi in beležili vedenjske vzorce, ki se pojavljajo v interakciji. Zabeležili ter opisali smo 14 osnovnih vedenjskih vzorcev, ki so vključeni v direktne interakcije med larvami obeh vrst volkcev. Opazili smo, da se larve vedejo teritorialno.

INTERACTIONS BETWEEN LARVAE OF TWO SYMPATRIC ANTLION SPECIES

Pit-building antlion larvae are sedentary predators, which build conical pit-fall traps in sandy substrates. We studied interactions between differently fed larvae of two sympatric species, *Euroleon nostras* and *Myrmeleon formicarius*. We recorded the presence/absence of the pit-fall traps, their diameter and larval relocations at two different densities. The results were compared with the control group, where larvae were placed in the containers individually. Compared to the control group, pit diameter in *E. nostras* increased more when larvae were confronted with *M. formicarius*. In contrast, *M. formicarius* larvae relocated more frequently and were often without pits. When we increased the density (two larvae on a smaller surface), both were more likely to relocate. We also noticed the presence of intraguild predation since direct interactions were more often. In direct interactions, *E. nostras* larvae were usually the winners. In the second experiment, we observed larvae for 24-hour period after we placed them into the containers. We recorded and described 14 basic behavioral patterns that occurred in larval interactions. We also noticed the presence of territorial behavior.

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PRVI SEZNAM KAČJIH PASTIRJEV KOSOVA

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Atlas kačjih pastirjev Evrope (2015) poroča s Kosova pojavljanje 22 vrst kačjih pastirjev na podlagi manj kot 50 podatkov v večini zbranimi pred letom 1986. Slednje uvršča Kosovo glede na poznavanje kačjih pastirjev med najmanj raziskane evropske države. Obenem poseduje Oddelek za biologijo Fakultete za matematiko in naravoslovje Univerze v Prištini poseduje pregledano zbirko podatkov in/ali osebkov za 25 vrst, popisanih po letu 2003. V letu 2018 je bila opravljena prva sistematična raziskava kačjih pastirjev Kosova. V 20 terenskih dneh med aprilom in avgustom smo na več kot sto lokalitetah popisali 50 vrst kačjih pastirjev – med drugimi tudi za evropsko skupnost pomembne vrste: koščičnega škratca (*Coenagrion ornatum*), velikega studenčarja (*Cordulegaster heros*) in bledega vetrnjaka (*Caliaeschna microstigma*). 16 vrst je bilo na Kosovu prvič zabeleženih, vključno z na Balkanu redkima stasitim in pasastim kamenjakom (*Sympetrum depressiusculum*, *S. pedemontanum*). Rezultati naše raziskave skupaj s podatki iz Atlasa kačjih pastirjev Evrope in Univerze v Prištini podajajo prvi seznam kačjih pastirjev Kosova z zabeleženimi 51 vrstami. Kačji pastirji ali posamezne vrste na Kosovem niso zavarovane, v pripravi pa je Rdeča knjiga favne Kosova

FIRST CHECKLIST OF ODONATA FROM KOSOVO

For Republic of Kosovo, Atlas of the European dragonflies and damselflies (2015) reports 22 dragonfly species, with less than 50 data altogether and majority of records collected before 1986. This makes Kosovo one of the least investigated European countries considering dragonfly fauna. Department of Biology of Faculty of Mathematics and Natural Sciences, University of Prishtina holds data and/or specimen collection of 25 species from the territory of Kosovo, all collected after 2003. In 2018 first systematic dragonfly survey for Kosovo was conducted. Altogether in 20 days from April to August, 50 dragonfly species where recorded at more than 100 sites. Among others, new data for *Coenagrion ornatum*, *Cordulegaster heros* and *Caliaeschna microstigma*, species of broader European concern, was collected. 16 species were recorded for the first time in Kosovo, including *Sympetrum depressiusculum* and *S. pedemontanum* both on the Balkan Peninsula rare species. Results from this survey, records from Atlas of the European dragonflies and damselflies together with records from the collection of University of Prishtina give the first checklist of Odonata from Republic of Kosovo which consist of 51 species. For now, no dragonfly species is protected in Kosovo, while the Red book of fauna of Kosovo is in preparation.

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ZGODOVINA POJAVLJANJA, RAZŠIRJENOST IN HABITAT ŠKRLATNEGA KUKUJA (*CUCUJUS CINNABERINUS*) V SLOVENIJI

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Škrlatni kukuj (*Cucujus cinnaberinus*) je saproksilna vrsta hrošča, pri katerem se je intenzivnost raziskav v Evropi v zadnjih letih močno povečala, saj gre za kvalifikacijsko vrsto v omrežju Natura 2000. Raziskovali smo zgodovino pojavljanja vrste in vpliv abiotskih in biotskih dejavnikov na razširjenost vrste na robu areala v Sloveniji. Vrsto je prvič opisal Joannes A. Scopoli leta 1763 iz vojvodine Kranjske. Največji del populacije v Sloveniji je omejen na nižje nadmorske višine, med 100 in 300 m, vendar je bila vrsta odkrita tudi nad 1200 m n. v. s sorazmerno visoko pogostnostjo pojavljanja v mrtvih debelih stebrih v montanskih gozdovih med 700 in 1100 m n. v. Poleg nadmorske višine je v habitatu vrste pomembna tudi zastopanost listavcev in odmrle lesne mase. Ličinke se večinoma pojavljajo v listavcih, tako domorodnih (npr. *Tilia*, *Populus*, *Acer*) kot tujerodnih (*Robinia*), medtem ko je bila višja stopnja zasedenosti zabeležena v debelejših in daljših deblih. Vrsto smo našli tudi v iglavcih (*Abies*), vendar se teh večinoma izogiba

HISTORY OF OCCURRENCE, DISTRIBUTION AND HABITAT SELECTION *CUCUJAS CINNABERINUS* IN SLOVENIA

The beetle *Cucujus cinnaberinus* is one of the saproxylic species, for which research intensity in Europe was greatly intensified in recent years after its designation as qualification species within Natura 2000 network. We have investigated the history of the species and influence of abiotic and biotic variables on the distribution of *C. cinnaberinus* at the edge of its range in Slovenia. The species was first described by Joannes A. Scopoli in 1763 from the duchy of Carniola. The bulk of the species population in Slovenia is confined to lowlands, between 100 and 300 m a. s. l., but the species was found up to over 1200 m a.s.l. with relatively high frequency of occurrence in dead tree trunks in montane forests between 700 and 1100 m a. s. l. At macrohabitat scale beside altitude important habitat parameters defining species distribution were also the amount of deciduous trees and deadwood mass in forest stands. For the larval habitat, the species preferred deciduous trees, native (e.g. *Tilia*, *Populus*, *Acer*) as well as non-native (*Robinia*), while higher occupation rate was recorded in thicker and longer tree trunks. The species was found also in coniferous trees (*Abies*), but those are mostly avoided.

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TOWARDS THE PRELIMINARY CHECKLIST OF CROATIAN CERAMBYCIDAE

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The beetle fauna of Croatia is diverse, but poorly studied. The longhorn beetles are among the few families for which there exists a checklist, albeit almost 50 years old. Since then, there have been many changes in taxonomy and several previously neglected/alien species have been found for the country. Henceforth an update is needed. To do this, a review of all available literature was performed, several private and institutional entomological collections were checked, and new records were collected in the field. All collected data was pooled into a database, taxon names were updated and from this an updated preliminary checklist was created. The list was compared with the Catalogue of Palearctic Coleoptera, and with the published checklists for neighbouring countries. Several species were recorded for the first time for Croatia, and the presence of some species was reaffirmed for the country. Through recent research many species were photographed. These will be used in the creation of a digital, publicly available repository, with distribution maps – a basis for the future Atlas and red listing of Croatian Cerambycidae.

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MEDSEZONSKA NIHANJA POPULACIJ RDEČEGA APOLONA (*PARNASSIUS APOLLO*) (LEPIDOPTERA: PAPILIONIDAE) V POSOČJU

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V letih od 2013 do 2018 smo s transektno metodo popisovali tri izbrane populacije zavarovanega rdečega apolona (*Parnassius apollo*) v zahodnih Julijskih Alpah: Livške ravne (1.200 m n. v.), Polovnik (340 m n. v.) in Bavšica (680 m n. v.). Zanimalo nas je predvsem natančnejše časovno pojavljanje rdečega apolona v populacijah na različnih nadmorskih višinah. Poznavanje fenologije vrste je nujno za dolgoročno spremljanje stanja izbranih populacij, saj se apoloni pojavljajo od začetka junija do konca avgusta. Letno smo opravili od 7 do 9 popisov, od začetka junija do sredine avgusta. V povprečju so se odrasli osebki začeli pojavljati 18. 6. na Livških ravnah in Polovniku, ter teden dni kasneje (24. 6.) v Bavšici. Vrh pojavljanja so apoloni v povprečju najhitreje dosegli na Polovniku (30. 6.), nato v Bavšici (4. 7.) in nazadnje na Livških ravnah (6. 7.). Podatki kažejo, da so nihanja časa začetka pojavljanja osebkov in vrha populacije večja med sezonami kot med posameznimi lokacijami. Tako so lahko znotraj iste lokacije razlike med sezonami v vrhovih pojavljanja za več kot 30 dni, v začetkih pojavljanja pa tudi za 40 dni. Razlike med najbolj zgodnjim (2014) in najbolj poznim (2013) začetkom pojavljanja povezujemo z akumulirano toploto od začetka leta do časa izleganja odraslih osebkov. Opazna so tudi sezonska nihanja v številu osebkov pri čemer so nihanja v številčnosti osebkov med lokacijami podobna. Skupaj smo na vseh treh lokacijah največ osebkov opazili leta 2015 (316) in najmanj v letu 2013 (103). Tudi nizka številčnost je bila na vseh lokacijah v istem letu (2013).

SEASONAL PATTERNS IN APOLLO (*PARNASSIUS APOLLO*) (LEPIDOPTERA: PAPILIONIDAE) ABUNDANCE AND FLIGHT PERIOD IN POSOČJE REGION

Three populations of the Apollo (*Parnassius apollo*) were monitored from 2013 to 2018 using transect counts in northwestern part of Slovenia in Julian Alps. Selected sites are at different altitudes: Livške ravne (1.200 m a. s. l.), Polovnik (340 m a. s. l.) and Bavšica (680 m a. s. l.). Understanding the phenology of the species is a basic knowledge needed for succesful long term monitoring. According to avaliable records, *P. apollo* in Slovenia flies from beginning of June to the end of August. All transects were walked and all butterflies were counted from beginning of June until mid August, with 7 to 9 counts yearly. Average emergence of first adults was on 18 June in Livške ravne and Polovnik, and a week later (24 June) in Bavšica. Earliest average abundance peak of the flight period was in Polovnik (30 June), later in Bavšica (4 July) and the latest in Livške ravne (6 July). Fluctuations of the first emergences and peaks of flight period were higher between years than between locations. In a single location the highest difference between peaks of flight periods was more than 30 days and first occurrences were delayed for up to 40 days. These differences could be explained by accumulated temperature from the beginning of the year to the period when butterflies start to emerge. There are also fluctuations in numbers of individuals between years, but again the influence of the season was higher than of the location. Summed together for all three locations the highest number of observed individuals was in 2015 (316) and the lowest in 2013 (103).

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STANJE POPULACIJ MRAVLJIŠČARJEV V SEVEROVZHODNI SLOVENIJI: DESETLETJE SPREMLJANJA UPADA

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Glavni območji razširjenosti strašničinega (*Phengaris teleius*) in temnega mravljiščarja (*P. nausithous*) v Sloveniji sta Goričko in Slovenske gorice. Še nedavno je bila za obe območji značilna ekstenzivna kmetijska raba, a kmetijske prakse se v zadnjih letih hitro spreminjajo. Območji sta vključeni v mrežo Natura 2000, strašničin in temni mravljiščar pa sta zanju kvalifikacijski vrsti, za kateri se od leta 2009 izvaja redni državni monitoring. Za obdobje 2003–2018 smo za omenjeni območji zbrali podatke o prisotnosti in številčnosti obeh mravljiščarjev ter o velikosti in kvaliteti njunega habitata. Da bi ocenili zadostnost in učinkovitost obstoječega varstva obeh vrst, smo analizirali zbrane podatke. Iz preliminarnih rezultatov je za obe vrsti in območji razviden znaten upad populacij, ki je koreliran z zmanjšanjem površine in kvalitete primernega habitata. Ne glede na več kot desetletje trajajoče formalno varstvo obeh vrst in območij, smo torej priča hitremu upadu populacij in izginjanju habitata, ki lahko privede do izumrtja najpomembnejših populacij strašničinega in temnega mravljiščarja v Sloveniji. Če želimo vrsti v Sloveniji ohraniti in učinkovito varovati, je nujno doslednejše izvajanje obstoječe zakonodaje ter takojšnji aktivnejši in bolj ciljno naravnani varstveni ukrepi.

THE STATUS OF LARGE BLUES IN SLOVENIA: A DECADE OF MONITORED DECLINE

The Scarce Large Blue (*Phengaris teleius*) and the Dusky Large Blue (*P. nausithous*) have two main centres of distribution in Slovenia: Goričko and Slovenske gorice. Both areas are characterized by extensive small scale agriculture; however farming practices are changing rapidly in the last decade. Both areas were designated as Natura 2000 sites for the species in 2004 and 2013, respectively, and a monitoring scheme for both species was established in 2009. Consequently, relatively continuous data on their presence and abundance, as well as on habitat size and quality are available for the 2003-2018 period. We analysed these data to evaluate the adequacy of existing protection for the populations of the two Large Blues. Preliminary analyses show a significant population decline correlated to the loss of suitable habitat and its quality for both species in both areas. Thus, despite more than a decade of formal protection, we are witnessing a severe population decline and rapid loss of habitat, which can eventually lead to extinction of *P. teleius* and *P. nausithous* in their most important areas in Slovenia. We belive that the existing legislation should be followed more consistently and urge for an immediate and more proactive conservation approach in order to save both species.

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CONTRIBUTION TO THE KNOWLEDGE OF THE BUTTERFLY FAUNA (LEPIDOPTERA: PAPILIONOIDEA) OF THE NORTHEASTERN PART OF REPUBLIC OF KOSOVO

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As sensitive organisms that react to habitat and climate changes, butterflies are recognized as important indicators of environment, therefore their diversity needs to be studied in each country in order to take actions for their protection by national and international legislation. In this paper the results of the butterfly survey in the northeast part of Kosovo are presented. Altogether 57species of butterflies were recorded from April to September 2014 in two surveyed localities. From the identified butterflies, 6 species belong to Hesperiidae family, 3 to Papilionidae, 11 to Pieridae, 8 to Lycenidae, 28 to Nymphalidae family, and a single species to Riodinidae. The species registered in the Red List of European Butterflies as Near Threatened we noted *Parnassius mnemosyne* (Linnaeus, 1758) and *Hipparchia statilinus* (Hufnagel, 1766).

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FEROMONSKE PASTI UČINKOVITO ORODJE ZA RAZISKAVE S PODROČJA BIODIVERZITETE IN VARSTVENE BIOLOGIJE

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Številne raziskave so pokazale velik potencial vrstno specifičnih feromonov pri raziskavah ekologije, biodiverzitete in varstvene biologije. Velik napredek je bil dosežen pri identifikaciji feromonov hroščev iz družine kozličkov. Alpski kozliček (*Rosalia alpina*) predstavlja eno od indikatorskih in prioritetnih vrst saproksilne faune v Evropi. Raziskali smo hlapne vonjave, ki jih oddajajo samci in samice alpskega kozlička. Analize hlapnih ekstraktov so pokazale prisotnost spolno specifične vonjave iz skupine pyrolov. Biološki poizkusi na terenu so pokazali, da identificirana spojina učinkovito privablja oba spola, kar kaže na to, da deluje kot agregacijski feromon. Poleg tega smo ugotovili, da je feromon alpskega kozlička pomemben tudi pri inter-specifičnih interakcijah. Rezultati raziskave kažejo, da so pasti na osnovi feromonov lahko koristno orodje za vzorčenje saproksilne favne, za prepoznavanje vročih točk biodiverzitete in za razvoj strategij ohranjanja narave na zavarovanih območjih, kot je Natura 2000.

PHEROMONES AS MONITORING TOOLS IN BIODIVERSITY AND CONSERVATION RESEARCH

Recently, several studies have demonstrated the great potential for exploiting semiochemicals in ecology, biodiversity and conservation. Extensive progress has been made in identifying pheromones of cerambycid beetles. The Alpine longicorn (*Rosalia alpina*) represents one of the indicator species of saproxylic biodiversity in Europe. Here, we will present volatiles released by males of *R. alpina*. Analyses of the resulting extracts revealed the presence of a single male-specific compound, identified as a novel alkylated pyrone structure. Field bioassays with the synthesized pyrone captured both sexes of *R. alpina*, indicating that the pyrone functions as an aggregation pheromone. In addition, we will show that *R. alpina* pyrone had a significant effect on trapping of other rare species. The pheromone-baited traps could provide a useful tool for sampling saproxylic fauna, for identifying biodiversity hotspots, and for developing conservation strategies in protected areas, such as Natura 2000.

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Posterji

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NAT2CARE - SPODBUJANJE SKUPNOSTI ZA OHRANJANJE IN OBNAVLJANJE ČEZMEJNIH OBMOČIJ NATURA 2000 ALI "NARAVA NE POZNA MEJA"

ŠPELA AMBROŽIČ[1], AL VREZEC[1], ANDREJ KAPLA[1], ALENKA ŽUNIČ KOSI[1]

Interreg projekt Nat2Care obravnava skupni izziv preprečevanja tveganja fragmentacije, zmanjšanja in izgube biotske raznovrstnosti na območjih treh parkov: Parco Naturale delle Prealpi Giulie, Parco Naturale Dolomiti Friulane in Triglavskega narodnega parka. Naravni park Julijsko predgorje je vodilni partner projekta. Projekt bo trajal 30 mesecev, njegova vrednost znaša 1,3 milijona evrov. Pri projektu sodelujejo še Triglavski narodni park, Deželni naravni park Dolomiti Friulane, Nacionalni inštitut za biologijo, Biotehnični center Naklo in Univerza v Vidmu. Preko projektnih aktivnosti bo prišlo do utrjenega upravljanja ekosistemskih storitev in obnovitve biodiverzitete na območjih, za katera so pristojni projektni partnerji. Splošni cilj projekta je izboljšanje biodiverzitete na območjih Natura 2000 v pristojnosti treh parkov in bo dosežen s posegi v habitatih in vrstah Natura 2000, s krepitvijo celovitega upravljanja, ozaveščanjem in okoljsko vzgojo ter promocijo ekosistemskih storitev. Eden izmed ciljev projekta je zagotoviti dejanske in inovativne aktivnosti v okviru čezmejnega upravljanja habitatnih tipov in živalskih vrst, zlasti tistih, ki živijo na obeh straneh meje in jo tudi pogosto prečkajo. Mednje sodijo tudi saproksilni hrošči, ki so pomembni pokazatelji stanja gozdnih ekosistemov. Med projektom bomo vzpostavili sistem spremljanja stanja habitata in populacije alpskega kozlička (*Rosalia alpina*), kot ključnega predstavnika saproksilnih organizmov.

NAT2CARE - ENCOURAGING COMMUNITIES TO MAINTAIN CROSS-BORDER NATURA 2000 SITES OR "NATURE KNOWS NO BORDERS"

Interreg project Nat2Care addresses the preventing the fragmentation, reduction and loss of biodiversity in the areas of three parks: Parco Naturale delle Prealpi Giulie, Parco Naturale Dolomiti Friulane and Triglav National Park. Parco Naturale delle Prealpi Giulie are the leading partner of the project. The project will last 30 months, its value is 1.3 million euros. Other project partners are Triglav National Park, Dolomiti Friulane Regional Park, National Institute of Biology, Naklo Biotechnical Center and University of Udine. Through project activities, the management of ecosystem services and the restoration of biodiversity will be consolidated in the areas for which the project partners are responsible. The overall objective of the project is to improve biodiversity on the Natura 2000 sites under the jurisdiction of three parks and will be achieved through interventions involving habitat and species restoration in Natura 2000. One of the objectives of the project is to provide real and innovative activities in the context of cross-border management of habitat types and animal species, especially those living on both sides of the border. These include saproxylic beetles, which are important indicators of the state of forest ecosystems. We will establish a monitoring system for the habitat and population of the Alpine longhorn beetle (*Rosalia alpina*) as a key representative of saproxylic organisms.

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CONTRIBUTION TO THE KNOWLEDGE OF NYMPHALIDAE FAUNA (LEPIDOPTERA: RHOPALOCERA) IN THE PROTECTED AREA "MIRUSHA WATERFALLS" IN KOSOVO

PAJTIM BYTYÇI[1], FERDIJE ZHUSHI-ETEMI[1], MILAIM MUSLIU[2], OSMAN FETOSHI[3]

In this paper the results of a study on composition of butterfly fauna of the family Nymphalidae in the protected area "Mirusha Waterfalls" in Kosovo, conducted in the period April to the end of September 2016 are presented. "Mirusha Waterfalls" is a Natural Monument (III category according to IUCN) with a surface of 598.4 ha, located in the central part of Kosovo. The survey was organized in 13 sites with different types of habitats, mostly dominated by grassland, combined with rocks and shrubs. As aresult of this research 35 species of Nymphalidae butterflies have been recorded. In regard to conservation status, all the recorded species are evaluated against the regional (European) IUCN categories in the European Red list of Butterflies. Out of them 32 are classified as Least Concerned (LC), and three as Near Threatened (NT).

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MREŽEKRILCI (INSECTA: NEUROPTERIDA) V ENTOMOLOŠKI ZBIRKI ŠTEFANA MICHIELIJA

DUŠAN DEVETAK[1]

Štefana Michielija (1933-1968), slovenskega entomologa in fiziologa, ki ga najbolje poznamo po raziskavah metuljev (Lepidoptera) Slovenije in Balkana, imamo za izjemnega lepidopterologa. Slovensko entomološko društvo nosi v nazivu njegovo ime. Poleg metuljev je zbiral tudi predstavnike manjših redov žuželk – nogoprelcev (Embioptera), kljunavcev (Mecoptera) in mrežekrilcev. V devetdesetih letih 20. stoletja je akademik prof. Matija Gogala prenesel Michielijevo zbirko mrežekrilcev avtorju tega prispevka. Prav gotovo je sedanja zbirka le del nekoč večje zbirke, ki je bila deloma uničena ali so bili primerki izgubljeni. Preostanek zbirke smo restavrirali in osebke določili do vrst, kjer je bilo mogoče. Zbirka mrežekrilcev po restavriranju vključuje pribl. 160 osebkov, ki pripadajo 31 vrstam – eni vrsti velekrilcev (Megaloptera), dvema vrstama kamelovratnic (Raphidioptera) in 28 vrstam pravih mrežekrilcev (Neuroptera). Osebki izvirajo iz Slovenije, Hrvaške in Črne gore. Skupno število vrst je presenetljivo veliko, saj predstavlja pribl. 27% vrst vseh mrežekrilcev v širšem smislu (Neuropterida), ki jih danes poznamo iz Slovenije. Štefan Michieli je določil pribl. 25 osebkov, pri tem pa so njegove determinacije v veliki večini zanesljive.

LACEWINGS (INSECTA: NEUROPTERIDA) IN THE ŠTEFAN MICHIELI'S ENTOMOLOGICAL COLLECTION

Štefan Michieli (1933-1968), Slovenian entomologist and physiologist, best known after the study of butterflies and moths (Lepidoptera) in Slovenia and the Balkan countries, was an outstanding lepidopterist. Slovenian Entomological Society is bearing his name. In addition to the Lepidoptera, he also collected small insect orders – Embioptera, Mecoptera and neuropterid orders. In nineties of the 20th century, Academician Professor Matija Gogala transferred the Michieli's collection of the Neuropterida to the author of this paper. We believe that the investigated small collection is only a part of formerly larger one, which had been partially destroyed or specimens lost. The remaining collection was restored and specimens identified to species level where possible. The collection after restoration contains ca. 160 specimens belonging to 31 neuropterid species – one alderfly (Megaloptera) species, two snakefly (Raphidioptera) species, and 28 lacewing (Neuroptera) species. Collected specimens originate from Slovenia, Croatia and Montenegro. The total species number is surprisingly high and represents approx. 27% of the number of the Neuropterida species known nowadays in Slovenia. Štefan Michieli identified ca. 25 individuals and mostly his determination was made correctly.

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DIVERSITY OF GROUND BEETLES FAUNA (COLEOPTERA, CARABIDAE) OF SHAR PLANINA MT.

SLAVČO HRISTOVSKI[1], ALEKSANDRA CVETKOVSKA-GJORGIEVSKA[1]

Shar Planina Mt. is one of the largest and highest mountain massifs on the Balkan Peninsula. The fauna of ground beetles (Coleoptera, Carabidae) has been subject of numerous studies where many endemic taxa were described. Nevertheless, the diversity of ground beetle fauna is still insufficiently known. Intensive research of ground beetles was conducted in the last two years by several methods: hand-collection, pitfall traps, intercept traps, etc. Also, critical literature review was performed in order to document the ground beetles diversity of Shar Planina Mt. So far, about 200 species of ground beetles are known for Shar Planina Mt. The percentage of endemic taxa is very high. There are ten species known only from Shar Planina – local (exclusive) endemics. Furthermore, about 35 species are Balkan endemics confined to different parts of the Balkan Peninsula. If rare species for Macedonian fauna are included then the total number of significant species is 85. The latest research also pointed out to possible new species for science from genera of *Tapinopterus* and *Trechus*. Intensive and focused research suggests that the species *Carabus variolosus nodulosus* Creutzer, 1799 is probably extinct from Shar Planina.

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VARIABILNOST KRILA IN BARVNIH VZORCEV NA KRILU SPREMENLJIVEGA OVNIČA *ZYGAENA EPHIALTES* (LINNAEUS, 1767) (LEPIDOPTERA, ZYGAENIDAE): PRISTOP Z GEOMETRIJSKO MORFOMETRIJO

PREDRAG JAKŠIĆ[1], FRANC JANŽEKOVIČ[2], TINA KLENOVŠEK[2]

Metulj spremenljivi ovnič *Zygaena ephialtes* je večji predstavnik skupine ovničev, vrsta je izrazito polimorfna in nastopa v pestri paleti barvnih kombinacij in različnih barvnih morfotipih. Z metodami geometrijske morfometrije smo ovrednotili variabilnost prednjega krila. V analizo smo vključili 70 osebkov podvrst *Z. ephialtes pannonica* Holik, 1937 in *Z. ephialtes istoki* Silbernagel, 1944 s šestih lokalitet z Balkanskega polotoka (Črna gora: kanjon Tare, Plužine, Durmitor in Gusinje, Srbija: Rugovska klisura in Makedonija: Kožuf planina). Ločeno smo obravnavali obliko in velikost krila ter obliko in velikost vzorca na krilu, ki je iz petih stigem. Geografska variabilnost je bila jasno izražena v obliki ne pa tudi velikosti krila in stigem. Ena skupina je imela relativno ožje (vzorci: Kožuf planina, Rugovska klisura in kanjon Tare) druga skupina relativno širše krilo (Plužine, Durmitor in Gusinje). Analiza oblike krila ni podprla domneve o razlikovanju med podvrstama *pannonica* in *istoki*.

WING AND WINGSPOTS VARIABILITY IN *ZYGAENA EPHIALTES* (LINNAEUS, 1767) (LEPIDOPTERA, ZYGAENIDAE): GEOMETRIC MORPHOMETRIC APPROACH

Zygaena ephialtes is one of the largest species of burnet moths. The species is highly polymorphic and can be found in a wide variety of colour combinations and colour morphotypes. In this study, the variability of the fore wing has been evaluated with geometric morphometric methods. 70 specimens of two subspecies *Z. ephialtes pannonica* Holik, 1937 and *Z. ephialtes istoki* Silbernagel, 1944 from six localities in the Balkan Peninsula (Montenegro: Tara canyon, Plužine, Durmitor and Gusinje, Serbia: Rugovska canyon and Republic of Macedonia: Kožuf mountain) were considered. The size and shape of the wing and the wing pattern of five stigmas were analyzed separately. Clear geographical variability was found in the shape but not the size of the wings and stigmata. One group had a relatively narrow (samples: Kožuf mountain, Rugovska canyon and Tara canyon) and the second group wide wing (Plužine, Durmitor and Gusinje). The wing shape analysis did not support the hypothesis of the *pannonica* and *istoki* subspecies distinction.

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GOVNAČI V KOZJANSKEM PARKU

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Koprofagne žuželke, med katere spadajo tudi govnači, predstavljajo pomemben člen v dekompoziciji iztrebkov pašne živine. Nerazkrojeni iztrebki namreč zmanjšujejo aktivno površino pašnika. Za govnače iztrebki predstavljajo vir hrane in substrat za ovipozicijo ter razvoj ličink. Zaradi hitrega spreminjanja habitatov, fragmentacije gozda in ostale človekove dejavnosti pa je ogrožena številčnost in vrstna pestrost govnačev. Raziskava je potekala na območju Kozjanskega regijskega parka, za katerega je značilna heterogena struktura habitatov z različnimi deleži kmetijskih in gozdnih površin. Namen raziskave je bil, da preverimo vrstno pestrost govnačev v Kozjanskem regijskem parku. Prav tako smo ugotavljali vpliv deleža gozdne površine na številčnost in vrstno pestrost govnačev ter preferenco različnih vrst govnačev do iztrebkov izbranih vrst herbivorov. Hrošče smo ulovili s talnimi pastmi, za vabo pa uporabili iztrebke različnih vrst živali, vodnega bivola, krave, koze in konja. Ugotovili smo, da obstaja razlika v abundanci govnačev glede na delež gozdne površine na območju vzorčenja, in sicer se abundanca govnačev povečuje s povečevanjem deleža gozda na izbranih območjih. Prav tako smo ugotovili, da govnači kažejo največjo preferenco do iztrebkov vodnega bivola in krave, sledita jima koza in konj.

DUNG BEETLES OF THE KOZJANSKO REGIONAL PARK

Coprophagous insects, including dung beetles, have an important role in decomposition of dung from grazing livestock. Namely, undecomposed dung decreases the active area of a pasture. Dung beetles use dung as a food source and a substrate for oviposition and larval development. Rapid habitat destruction, forest fragmentation and other human-induced changes put abundance and species richness of dung beetles at risk. Our investigation was carried out in the Kozjansko Regional Park. The park has a heterogenic habitat structure with different shares of agricultural and forest areas. The aim of the investigation was to study the dung beetle species richness in the Kozjansko Regional Park. We also studied the dung beetles habitat and resource preferences. More precisely, we investigated the influence of forest area shares on the abundance and species richness of dung beetles. We also investigated preferences of different dung beetle species to the dung of selected herbivores. Beetles were collected using pitfall traps baited with faeces of different animals: a water buffalo, cow, goat and horse. We found out that forest area shares have an important impact on the abundance of dung beetles. The abundance of dung beetles is increasing with increasing of the forest area share. Data also showed that beetles were more attracted to the dung of water buffalos and cows than of goats and horses.

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GEOMETRIJSKA MORFOMETRIJA KOT ORODJE ZA IDENTIFIKACIJO POGOSTIH VRST KOMARJEV V SLOVENIJI

JURE JUGOVIC[1], AJA GOLOB[1], KATJA KALAN[1]

Iz Slovenije poznamo šest rodov komarjev (Diptera: Culicidae), med katerimi najdemo potencialne ali dejanske vektorje infektivnih bolezni. Natančno prepoznavanje taksonov je ključno tudi za razumevanje možnih poti prenosa bolezni in njihovo preprečevanje. Ker je prepoznavanje komarjev na morfološki osnovi za nestrokovnjake zahtevno, smo preverili, ali je prepoznavanje vrst na osnovi morfologije kril ob uporabi geometrijske morfometrije na slovenskih taksonih uspešno. V analizo smo zajeli devet vrst iz vseh šestih rodov. Vzorce smo zbrali z različnih lokacij v Sloveniji. Najprej smo taksone določili s pomočjo določevalnega ključa, nato pa na osnovi 17 merilnih točk na desnem krilu izvedli geometrijsko analizo, v katero smo zajeli analizo velikosti (velikost centroida) in oblike (kanonična analiza: CVA in diskriminantna analiza: DFA). Iskali smo razlike v morfologiji kril med i) šestimi rodovi, ii) tremi vrstami iz rodu *Aedes* in iii) dvema iz rodu *Culex*. Izkaže se, da se taksoni razlikujejo tako v velikosti kot obliki kril. Visok odstotek (brez prečnega preverjanja: 94 %; prečno preverjanje: 84 %) pravilnih napovedi kaže, da je geometrijski pristop v morfometriji uporaben pri prepoznavanju pogostih vrst slovenskih komarjev.

GEOMETRIC MORPHOMETRICS AS A TOOL FOR IDENTIFICATION OF COMMON MOSQUITO SPECIES FROM SLOVENIA

In Slovenia, six genera of mosquitoes (Diptera: Culicidae) that are actual or potential vectors of infectious diseases are recognised. Precise species recognition is crucial to understand possible pathways of disease transmission and their prevetion. As identification of mosquitoes by morphological characters can be difficult for non-experts, we tested a hypothesis that geometric morphometrics of mosquitoes' wings is a useful tool in identification of common species of mosquitoes from Slovenia. In the study we included nine mosquito species from six genera, which were caught during various mosquito samplings in Slovenia. After identifying the species by taxonomic key, we extracted and photographed right wings of female adult mosquitoes. The geometric morphometrics was based on 17 landmarks. Centroid size analysis and shape analysis were performed. The latter included Canonical Variate Analysis (CVA) and Discriminant Function Analysis (DFA). We tested the differences in morphology between i) six mosquito genera, ii) three species of *Aedes* and iii) two species of *Culex*. Our results show that studied mosquito taxa are different in both, wing size and shape. High percentage (original: 94 %, cross-validated: 84 %) of correctly classified mosquito taxa proved geometric morphometry as a useful tool in recognition of common Slovenian species and we recommend it's use in future studies.

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MORFOLOŠKA PRIMERJAVA DVEH SIMPATRIČNIH JAMSKIH KOBILIC *TROGLOPHILUS NEGLECTUS* IN *T. CAVICOLA* (ORTHOPTERA: RHAPHIDOPHORIDAE) V SLOVENIJI

JURE JUGOVIC[1], NIKA ŠUMER[1]

Dve vrsti jamskih kobilic iz rodu *Troglophilus*, *T. neglectus* Krauss 1879 in *T. cavicola* (Kollar 1833), se simpatrično in sintopično pojavljata v Sloveniji. Obe vrsti sta subtroglofila in izkoriščata jame in njihove vhodne dele kot območje refugijev, kjer prezimujeta. Raziskovali smo morfološke razlike obeh vrst (39 številskih merjenih in 7 številskih štetih znakov), skupaj s spolnim dimorfizmom in poskušali ugotoviti, ali je katerega od raziskovanih morfoloških znakov mogoče razlagati kot troglomorfoze, kljub temu, da vrsti nista prava troglobionta. Prvotno smo iskali razlike v velikosti telesa, velikosti oči in v dolžini nog I-III, saj so izguba oči in podaljšanje okončin skupaj z izgubo pigmentacije telesa (obe vrsti sta še vedno/zmeraj pigmentirani) med najpogosteje prepoznanimi morfološkimi spremembami po uspešni kolonizaciji jam. V povprečju *T. neglectus* kaže večjo variabilnost telesne velikosti (koeficient variacije, *T. neglectus*: samci = 14,9 %, samice = 10,6 %, *T. cavicola*: samci = 5,9%, samice = 7,4%) in je večji od *T. cavicola*, vendar so samci *T. cavicola* večji od samic svoje vrste, kar je v nasprotju s *T. neglectus*. Zabeležena je pozitivna vrednost indeksa spolnega dimorfizma [(povprečna velikost samice/povprečna velikost samca) - 1] pri *T. neglectus* (0,068), negativna pa pri *T. cavicola* (-0,078). Ne glede na vrsto imajo samice zmeraj relativno daljše noge (I, II in III), znotraj spola pa ima *T. neglectus* relativno daljše okončine kot *T. cavicola*. Pri obeh spolih je relativna površina oči večja pri *T. cavicola* kot pri *T. neglectus*. Za morebitne prilagoditve teh lastnostni so potrebne dodatne raziskave.

A MORPHOLOGICAL COMPARISON OF TWO SYMPATRIC CAVE CRICKETS *TROGLOPHILUS NEGLECTUS* AND *T. CAVICOLA* (ORTHOPTERA: RHAPHIDOPHORIDAE) FROM SLOVENIA

Two species of *Troglophilus* cave crickets, *T. neglectus* Krauss 1879 and *T. cavicola* (Kollar 1833) display sympatric and syntopic occurrence in Slovenia. Both species are subtroglophiles and exploit caves and their entrances as their refugees and are becoming especially abundant in caves during winter. We investigated morphological variation of both species (39 measured and 7 counted characters) along with their sexual dimorphism, and tried to establish whether any of the investigated morphological characters can be interpreted as troglomorphoses, despite the species are not true troglobionts. We primarily searched for differences in body size, and the size of the eyes and length of legs I–III, as the loss of eyes and elongation of appendages are along with the loss of the body pigmentation (both species are still pigmented) among most commonly reported morphological changes following a successful colonisation of caves. In average *T. neglectus* shows higher variation in body size (coefficient of variation; *T. neglectus:* males = 14.9 %, females = 10.6 %; *T. cavicola*: males = 5.9 %, females = 7.4 %) and is larger than *T. cavicola*, however in *T. cavicola* males are larger than females, while it is the opposite in *T. neglectus*. Positive value of sexual dimorphism index [(average female size/average male size) - 1] in *T. neglectus* (0.068) but negative in *T. cavicola* (-0.078) were recorded. Regardless the species, females have always relatively longer legs (I, II, and III) and within a single sex, *T. neglectus* has relatively longer appendages than *T. cavicola*. In both sexes, the relative surface of eyes is larger in *T. cavicola* than *T. neglectus*. The possible adaptive nature of these traits however still needs to be addressed.

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SESTAVA ZDRUŽBE IN VRSTNA PESTROST KOPROFAGNIH PLOJKAŠEV (COLEOPTERA: SCARABAEOIDEA) NA KRAŠKEM ROBU

NATAŠA KOPRIVNIKAR[1], JURE JUGOVIC[1]

Ugotavljali smo diverziteto in sestavo združbe koprofagnih plojkašev (Coleoptera: Scarabaeoidea) na dveh vzorčnih mestih (Hrastovlje, Zazid) v JZ Sloveniji. Na vsakem vzorčnem mestu smo vzorčili na treh habitatnih krpah (S1: popašen del pašnika, S2: zaraščajoči se del pašnika; S3: travnik ob gozdnem robu izven pašnika). Živali smo vzorčili od marca do novembra 2012 s talnimi pastmi, (4 pasti na vsaki habitani krpi, polvica pasti z vabo iz govejega iztrebka). Ugotovili smo (1) prisotnost 29 vrst plojkšev iz treh cehov (endokopridi, parakopridi, telekopridi), kar predstavlja približno četrtino znanih slovenskih vrst; (2)vrstno bogastvo in abundanca se med tremi habitatnimi krpami v Zazidu nista razlikovala, (3) v Hrastovljah pa smo zabeležili bistveno višje bogastvo na krpi S2 (velja za vse vrste skupaj in ločeno za endokopride ter parakopride) v primerjavi z S1 ali S3; (4) v Hrastovljah so endokopridi značilno najštevilčnejši na S1. Ker smo pokazali, da so za vzdrževanje združbe plojkašev na Kraškem robu pomembni različni habitati, predlagamo vzdrževanje mozaične pokrajine tudi v prihodnosti.

COMPOSITION AND SPECIES RICHNESS OF DUNG BEETLES (COLEOPTERA: SCARABAEOIDEA) IN KRAŠKI ROB

We have investigated a species richness and compositon of a dung beetle community (Coleoptera: Scarabaeoidea) from two different study sites (Hrastovlje, Zazid) in SW Slovenia. Each study site was divided in three different habitat patches (S1: the most grazed part of pasture, S2: overgrowing part of pasture, S3: meadow/wood edge near pasture). Animals were trapped from March until November 2012 with pitfall traps; we set four traps per each habitat patch and used a cattle dung as a bait for half of them while the other half was used as control traps. Main results were: (1) 29 species belonging to the three guilds (dwellers, tunnelers, rollers) were colllected, and that represents cca. 25% of known dung beetle fauna of Slovenia; (2) species richness and abundance were not signficantly different between the patches in Zazid while in (3) Hrastovlje, we noticed the highest species richness and abundance on habitat patch S2 (i.e. for all guilds together as well as separately for dwellers and tunnellers); (4) in Hrastovlje, dwellers differed in abundance, being most abundant on S1. Since different habitats proved to be important in sustaining a high diversity of dung beetles in the wider area of the study site, a mosaic landscape is preffered.

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THE OVERVIEW OF THE DISTRIBUTION OF NATURA 2000 BEETLE SPECIES IN BOSNIA AND HERZEGOVINA (INSECTA, COLEOPTERA)

DEJAN KULIJER[1]

This presentation summarizes the available knowledge and presents the overview of the distribution of beetles (Coleoptera) listed in the Annex II of EU Habitats Directive in Bosnia and Herzegovina. The Habitats Directive (HD) defines the establishment of the network of special conservation areas, known as Natura 2000 network, in order to ensure a long-term survival of Europe's most valuable and most threatened species and habitats. Among insects, Coleoptera are one of the most represented groups in the Directive. The Annex II of the Directive lists 38 Coleoptera species for which areas for their protection should be designated. In order to determine species occurrence and distribution in the country the records from published papers, museum collections and new data collected by the author were analyzed. In total, 16 beetle species of the Annex II of EU Habitats Directive were reported for the country. Most of identified species are insufficiently studied and known only from historical records. Voucher specimens of 12 of these species are present in the entomological collections of the National Museum of Bosnia and Herzegovina. By the number of records *Lucanus cervus*, *Morimus asper funereus* and *Rosalia alpina* are the most abundant species in the country.

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NOVE NAJDBE PARAZITOIDOV GOSENIC (HYMENOPTERA) V SLOVENIJI

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V letih 2017 in 2018 smo z vzorčenjem gosenic na gojenih rastlinah (maline, paradižnik, zelje, soja) prvič potrdili zastopanost parazitoidov: *Euplectrus flavipes* (Fonscolombe), *Euplectrus bicolor* (Swederus), *Pediobius foliorum* (Geoffroy), *Pediobius claviger* (Thomson) (Hymenoptera, Eulophidae); *Hyposoter ebeninus* (Gravenhorst), *Hyposoter didymator* (Thunberg), *Thyrateles camelinus* (Hymenoptera, Ichneumonidae), *Cotesia* sp. (Hymenoptera, Braconidae). Od teh so vrste *E. bicolor*, *H. didymator* in *Cotessia* sp. parazitirale listno sovko (*Orthosia* sp.) v nasadu malin. Najezdnik *T. camelinus* pa se je izlegel iz bube osatnika *Vanessa cardui* (Lepidoptera, Nymphalidae) v soji.

NEW RECORDS OF LARVAL PARASITOIDS (HYMENOPTERA) IN SLOVENIA

During 2017 and 2018, we sampled caterpillars on selected cultivated plants (raspberries, tomato, cabbage, and soya). Here we provide first reports for the following parasitoids species: *Euplectrus flavipes* (Fonscolombe), *Euplectrus bicolor* (Swederus), *Pediobius foliorum* (Geoffroy), *Pediobius claviger* (Thomson) (Hymenoptera, Eulophidae); *Hyposoter ebeninus* (Gravenhorst), *Hyposoter didymator* (Thunberg) *Thyrateles camelinus* (Hymenoptera, Ichneumonidae) and *Cotesia* sp. (Hymenoptera, Braconidae). In raspberry plantation species *E. bicolor*, *H. didymator* and *Cotessia* sp. parasitized leaf Noctuid *Orthosia* sp.. In soya species *T. camelinus* emerged from *Vanessa cardui* (Lepidoptera, Nymphalidae) pupae.

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CONTRIBUTION TO THE KNOWLEDGE OF THE MOSQUITOES FAUNA (CULICIDAE) IN KOSOVO

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The mosquitoes are the most important group of insects because of their impact in public health and for this they are subject for many entomological research in worldwide. A large part of the world's population lives under the risk of becoming infected by mosquitoes that carry the causative agents of diseases such as malaria, dengue, Chikungunya, West Nile fever, Japanese encephalitis or lymphatic filariasis. Data on mosquito presence in Kosovo are very poor. In this paper the results of an investigation of the mosquito fauna realized from July to November 2016 are presented.During this period mosquitoes are collected in Dukagjini Plane in west-eastern part of country in 10 provinces with 30 localities, where a total number of 1209 mosquito specimens representing 13 species belong to six genera were collected and morphologically identified. The recorded mosquito specimens belong to following species: *Anopheles claviger, Anopheles maculipenis s.l, Anopheles melanoon, Anopheles messea, Aedes caspius, Aedes pulcritarsis, Aedes vexans, Culex pipiens s.l, Culista annulata, Culista longialeorata, Coquillettidia buxtoni, Coquillettidia richiardii, Uranotenia unguiculata*. Our result show the presence of rich mosquito fauna in Dukagjini Plane which should be carefully studied and analyzed in order to prevent the public health from potential epidemic.

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