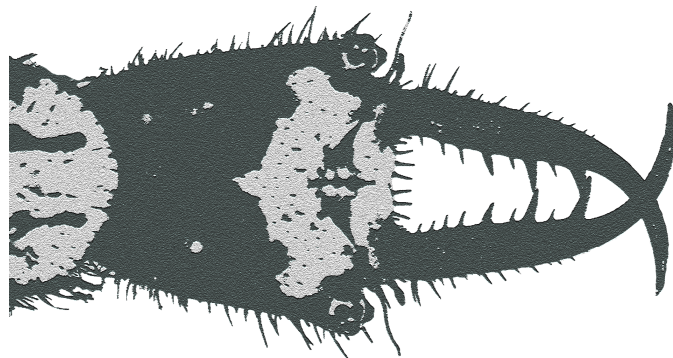


THIRD SLOVENIAN ENTOMOLOGICAL SYMPOSIUM  
WITH INTERNATIONAL ATTENDANCE

BOOK OF ABSTRACTS

MARIBOR,  
27<sup>TH</sup> AND 28<sup>TH</sup> JANUARY 2012



TRETJI SLOVENSKI ENTOMOLOŠKI SIMPOZIJ  
Z MEDNARODNO UDELEŽBO

KNJIGA POVZETKOV

MARIBOR,  
27. IN 28. JANUAR 2012



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## **Abstract book of the Third Slovenian Entomological Symposium with International Attendance**

Edited by Vesna Klokočovnik

Published by the Faculty of Natural Sciences and Mathematics, University of Maribor

Cover picture: *Neuroleon microstenus* by Vesna Klokočovnik

### Organizers

The Slovenian Entomological Society of Štefan Michieli

Faculty of Natural Sciences and Mathematics

Department of Biology, FNM

Institute for Biology, Ecology and Nature Conservation, FNM

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## SYMPOSIUM PROGRAMME / PROGRAM SIMPOZIJA

### FRIDAY, 27<sup>th</sup> JANUARY 2012 / PETEK, 27. JANUAR 2012

- 7:30 – 8:30 Registration at the Faculty of Natural Sciences and Mathematics  
*Registracija na Fakulteti za naravoslovje in matematiko*
- 8:30 – 8:40 Opening of the 3<sup>rd</sup> Slovenian Entomological Symposium with International Attendance  
Opening words of Prof. Dr. Nataša Vaupotič, Dean of the Faculty of Natural Sciences and Mathematics, University of Maribor. Opening words of Prof. Dr. Dušan Devetak.  
*Otvoritev 3. slovenskega entomološkega simpozija z mednarodno udeležbo*  
Nagovor prof. dr. Nataše Vaupotič, dekanice Fakultete za naravoslovje in matematiko in prof. dr. Dušana Devetaka.

8:40 – 9:20 **Invited lecture / Vabljeno predavanje**

**Ofer OVADIA:**

Genetic and phenotypic divergence in antlion populations along Israel's steep Mediterranean to hyper-arid climatic gradient

**Moderator: Maarten de Groot**

**Lectures / Predavanja**

- 9:20 – 9:40 **Carlos LOPEZ-VAAMONDE, Bengt Åke BENGTTSSON, Alain CAMA, Helmut DEUTSCH, Gerfried DESCHKA, Endrit KULLAJ, Ales LASTUVKA, Zdenek LASTUVKA, David LEES, Jurate De PRINS, Stanislav GOMBOC, Peter HUEMER, John LANGMAID, Marko MUTANEN, Ian SIMS, Paolo TRIBERTI, Christian WIESER, Rodolphe ROUGERIE:**  
DNA Barcoding of European Gracillariidae Leaf-Mining Moths  
*Določanje zaporedja genetskega zapisa (DNA barcoding) evropskih vrst listnih zavrtačev (Lepidoptera: Gracillariidae)*
- 9:40 – 10:00 **Matjaž BEDJANIČ:**  
Diversity, distribution and threat status of dragonflies of Sri Lanka (Insecta: Odonata)  
*Diverziteteta, razširjenost in ogroženost kačjih pastirjev Šri Lanke (Insecta: Odonata)*
- 10:00 – 10:20 **Tatjana ČELIK:**  
Characteristics of the ovipositional habitat of Fenton's Wood White (*Leptidea morsei* Fenton, 1881; Lepidoptera: Pieridae) in Slovenia  
*Značilnosti ovipozicijskega habitata velikega frfotavčka (Leptidea morsei Fenton, 1881; Lepidoptera: Pieridae) v Sloveniji*
- 10:20 – 10:40 Poster session with coffee and tea break  
*Predstavitev posterjev z odmorom za kavo in čaj*

## POSTERS / *POSTERJI*:

### **Božidar DROVENIK, Branko VREŠ:**

*Gasterocercus depressirostris* (Fabricius 1792), a weevil (Curculionidea, Coleoptera) new for the fauna in Slovenia  
*Gasterocercus depressirostris* (Fabricius 1792), nov rilčkar (Curculionidea, Coleoptera) v favni Slovenije

### **Matjaž JEŽ:**

*Cydalima perspectalis* (Walker 1859) (Lepidoptera: Crambidae), Box Tree Moth, new moth species in Slovenia  
*Cydalima perspectalis* (Walker 1859) (Lepidoptera: Crambidae), pušpanova vešča, nova vrsta metulja v Sloveniji

### **Jan PODLESNIK, Maja JURC, Ljubodrag MIHAJLOVIĆ:**

Overview of parasitoids associated with *Ips typographus* (Coleoptera, Scolytinae) in Europe and first results of parasitoid entomofauna research in Altimontane belt of Slovenia (Pohorje)  
*Pregled parazitoidov povezanih z vrsto Ips typographus* (Coleoptera, Scolytinae) v Evropi ter prvi izsledki raziskovanja parazitoidne entomofavne v altimontanskem pasu Slovenije (Pohorje)

### **Marko SAMEJA:**

Distribution and conservation of Hermit beetle *Osmoderma eremita* on study area Slovenske Gorice – (Coleoptera: Scarabaeidae)  
*Razširjenost in ohranjanje puščavnika Osmoderma eremita na primeru Slovenskih Goric-* (Coleoptera: Scarabaeidae)

### **Barbara ZAKŠEK, Nika KOGOVŠEK, Franc REBEUŠEK, Marijan GOVEDIČ:**

Brown Hairstreak (*Thecla betulae*): rare or just rarely seen butterfly?  
*Lepi brezar* (*Thecla betulae*): redki ali samo redko opažen metulj?

## **Moderator: Tomi Trilar**

- 10:40 – 11:00 **Matija GOGALA, Tomi TRILAR, Sakis DROSOPOULUS:**  
Endemic cicada species from Greek island of Evia  
*Endemični škržadi z grškega otoka Evbeje*
- 11:00 – 11:20 **Maarten de GROOT:**  
The effect of altitude on seasonal dynamics and species composition in hoverflies (Diptera: Syrphidae) in beech forest  
*Vpliv nadmorske višine na sezonsko dinamiko in vrstno sestavo muh trepetavk* (Diptera: Syrphidae) v bukovih gozdovih
- 11:20 – 11:40 **Dušan DEVETAK, Manja OMERZU:**  
Notes on the gregarines (Protozoa: Apicomplexa: Eugregarinorida) of insects in Slovenia  
*K poznavanju gregarin* (Protozoa: Apicomplexa: Eugregarinorida) v žuželkah v Sloveniji

- 11:40 – 12:00 **Michelle GADPAILLE:**  
“No place for an entomologist”: Slovenia’s karst in a 19<sup>th</sup>-century murder mystery  
*“Ni prostora za entomologa” – skrivnostni umor na slovenskem krasu v devetnajstem stoletju*
- 12:00 – 12:20 **Stanislav GOMBOC, Gregor TORKAR, Andrej SOVINČ:**  
Biodiversity of Lepidoptera fauna in the Sečovlje Salina Nature Park and its management  
*Biodiverziteteta metuljev v Krajinskem parku Sečoveljske soline in njeno upravljanje*
- 12:20 – 12:40 **Mojca HROVAT, Gorazd URBANIČ:**  
Life cycle of caddisflies *Rhyacophila fasciata* and *Hydropsyche saxonica* in karst rivers of SE Slovenia  
*Življenjski cikel mladoletnic Rhyacophila fasciata in Hydropsyche saxonica v kraških rekah JV Slovenije*
- 12:40 – 13:00 **Maja JURČ:**  
Pest status of alien insects in Slovenian forests  
*Pomen škodljivih tujerodnih žuželk v slovenskih gozdovih*
- 13:00 – 13:20 **Andrej KAPLA, Al VREZEC, Špela AMBROŽIČ:**  
Status of *Cucujus cinnaberinus* (Scopoli 1763) in Slovenia  
*Status škrlatnega kukuja, Cucujus cinnaberinus (Scopoli 1763) v Sloveniji*
- 13:20 – 14:40 Lunch break  
*Odmor za kosilo*

**Moderator: Andrej Čokl**

- 14:40 – 15:00 **Meta KOGOJ, Maarten de GROOT:**  
Factors influencing the abundance of the hoverfly *Cheilosia fasciata* (Diptera: Syrphidae) on ramson *Allium ursinum*.  
*Vpliv različnih dejavnikov na pojavljanje muhe trepetavke Cheilosia fasciata (Diptera: Syrphidae) na čemažu Allium ursinum*
- 15:00 – 15:20 **Toni KOREN:**  
New data about the distribution of some rare and interesting butterflies from Croatia  
*Novi podatki o razširjenosti redkih in zanimivih dnevnih metuljev na Hrvaškem*
- 15:20 – 15:40 **Tina KLENOVŠEK, Franc JANŽEKOVIČ, Miran ČAS, Tomi TRILAR, Tone NOVAK:**  
Arthropods in the diet of three co-existing *Sorex* shrew species in montane forests in Slovenia  
*Členonožci v prehrani treh sobivajočih vrst rovk rodu Sorex v gorskih gozdovih v Sloveniji*
- 15:40 – 16:00 **Valerija ZAKŠEK, Marijan GOVEDIČ, Rudi VEROVNIK:**  
Habitat selection of the Large Blue (*Phengaris arion*) in western Haloze  
*Izbira habitata velikega mravljiščarja (Phengaris arion) v zahodnih Halozah*
- 16:00 – 16:20 **Gregor BELUŠIČ, Primož PIRIH:**  
Physiological optics of the owlfly *Libelloides macaronius*  
*Fiziološka optika metuljčnice Libelloides macaronius*

- 16:20 – 16:40 **Nataša STRITIH, Andrej ČOKL:**  
Mating behaviour and communication in the cave crickets *Troglophilus neglectus* and *T. cavicola* (Orthoptera: Rhabdophoridae)  
*Paritveno vedenje in komunikacija jamskih kobolic* *Troglophilus neglectus* in *T. cavicola* (Orthoptera: Rhabdophoridae)
- 16:40 – 17:00 **Maja ZOROVIC:**  
Coding of Temporal Parameters of the Substrate-Borne Vibratory Songs in the CNS of the Southern Green Stinkbug *Nezara viridula* (L.)  
*Kodiranje časovnih parametrov vibracijskega napeva na nivoju centralnega živčevja pri stenici vrste* *Nezara viridula* (L.)
- 17:00 – 17:20 **Maarten de GROOT, Andrej ČOKL, Meta VIRANT-DOBERLET:**  
Influence of duration and amplitude of the female signal on the localisation by males of two hemipteran insects  
*Vpliv dolžine in amplitude samičinih vibracijskih signalov na lokalizacijo vira signalov pri samcih dveh vrst polkrilcev* (Hemiptera)
- 17:20 – 17:40 Poster session with coffee and tea break  
*Predstavitev posterjev z odmorom za kavo in čaj*

**Moderator: Matija Gogala**

- 17:40 – 18:00 **Andrej ČOKL, Raul A. LAUMANN, Meta VIRANT-DOBERLET:**  
Frequency differences of the predatory bug *Podisus nigrispinus* vibratory signals recorded on a non-resonant substrate or on a plant  
*Frekvenčne razlike med vibracijskimi signali roparske stenice* *Podisus nigrispinus* *registriranimi na neresonirajoči podlagi ali na rastlini*
- 18:00 – 18:20 **Maja DERLINK, Petra PAVLOVČIČ, Maarten de GROOT, Meta VIRANT-DOBERLET:**  
Prezygotic isolation in the genus *Aphrodes*  
*Prezigotna izolacija v rodu* *Aphrodes*
- 18:20 – 18:40 **Andreja KAVČIČ, Andrej ČOKL:**  
Recognition of Predatory Bugs in the Southern Green Stinkbug *Nezara viridula* (L.)  
*Prepoznavanje plenilcev na osnovi vibracijskih signalov pri stenici* *Nezara viridula* (L.)
- 18:40 – 19:00 **Anka KUHELJ, Maarten de GROOT, Franja PAJK, Tatjana SIMČIČ, Meta VIRANT-DOBERLET:**  
Starvation effects on reproduction in leafhopper species *Aphrodes makarovi*  
*Vpliv stradanja na razmnoževanje pri škržatku vrste* *Aphrodes makarovi*
- 19:00 – 19:20 **Primož PIRIH, Bodo D. WILTS and Doekele G. STAVENGA:**  
Combined pigmentary-iridescent colouration in the eyes of conspecific butterflies  
*Kombinirana pigmentna in strukturna obarvanost kril v očeh metuljskih sovrstnikov*



**SATURDAY, 28<sup>th</sup> JANUARY 2012 / SOBOTA, 28. JANUAR 2012**

7:55 – 8:00 Introduction to the second day of the Symposium  
*Uvod k drugemu dnevu simpozija*

**Moderator: Ignac Sivec**

8:00 – 8:40 **Invited lecture / Vabljeno predavanje**

**Karl KRAL:**

Functional significance of the peering behaviour in mantids

8:40 – 9:00 **Janez PREŠERN, Jeffrey D. TRIBLEHORN, Johannes SCHUL:**  
Cellular mechanisms of stimulus-specific adaptation in the tettigoniid TN-1 neuron  
*Celični mehanizmi od stimulusa odvisne adaptacije nevrona TN-1 dolgotipalčnih kobilic*

9:00 – 9:20 **Alenka ŽUNIČ, Ann M. RAY, Ronald L. ALTEN, J. Steven MCELDFRESH, Lawrence M. HANKS, Jocelyn G. MILLAR:**  
Chemical Communication of Longhorn Beetles, example of *Ortholepthura valida* (Cerambycidae: Lepturinae)  
*Kemična komunikacija pri kozličkih, primer Ortholepthura valida (Cerambycidae: Lepturinae)*

9:20 – 9:40 **Dušan DEVETAK, Saška LIPOVŠEK, Vesna KLOKOČOVNIK, Maria-Anna PABST, Gerd LEITINGER, Elisabeth BOCK:**  
Morphology of the sensilla in the antlion larvae (Neuroptera: Myrmeleontidae)  
*Morfologija senzil pri larvah volkcev (Neuroptera: Myrmeleontidae)*

9:40 – 10:00 **Saška LIPOVŠEK, Ilse LETOFSKY-PAPST, Ferdinand HOFER, Gerd LEITINGER, Dušan DEVETAK:**  
The degradation processes in the midgut epithelial cells of the larval antlion *Euroleon nostras* (Geoffroy in Fourcroy, 1785) (Myrmeleontidae, Neuroptera)  
*Procesi degradacije v epitelnih celicah srednjega črevesa larv volkcev Euroleon nostras (Geoffroy in Fourcroy, 1785) (Myrmeleontidae, Neuroptera)*

10:00 – 10:20 Poster session with coffee and tea break  
*Predstavitev posterjev z odmorom za kavo in čaj*

**Moderator: Rudi Verovnik**

10:20 – 10:40 **Danilo BEVK, Jasna KRALJ, Andrej ČOKL:**  
Effects of coumaphos on learning of workers of honeybee *Apis mellifera carnica*  
*Kumafos vpliva na učenje delavk medonosne čebele Apis mellifera carnica*

10:40 – 11:00 **Vesna KLOKOČOVNIK, Dušan DEVETAK:**  
Predatory behavior of the non-pit-building larvae *Neuroleon microstenus* (Neuroptera: Myrmeleontidae)  
*Predatorsko vedenje larve volkca Neuroleon microstenus (Neuroptera: Myrmeleontidae)*

- 11:00 – 11:20 **Andrej GOGALA:**  
Compiling a list of digger wasps (Hymenoptera: Ampulicidae, Sphecidae and Crabronidae) of Slovenia  
*Sestavljanje seznama os grebač (Hymenoptera: Ampulicidae, Sphecidae in Crabronidae) Slovenije*
- 11:20 – 11:40 **AI VREZEC, Špela AMBROŽIČ, Andrej KAPLA:**  
Biology and ecology of cerambycid *Morimus funereus*, species of conservation importance, in Slovenia  
*Biologija in ekologija varstveno pomembnega bukovega kozlička (Morimus funereus) v Sloveniji*
- 11:40 – 12:00 **AI VREZEC, Maarten de GROOT, Andrej KAPLA:**  
Influence of species traits on the changes of carabid (Carabidae) community structure along cave environment gradient  
*Vpliv vrstnih značilnosti na spremembe v strukturi združbe krešičev (Carabidae) prek jamskega okoljskega gradienta*
- 12:00 – 12:20 **Špela AMBROŽIČ, Andrej KAPLA, AI VREZEC:**  
Genus *Graphoderus* in Slovenia with an emphasis on *Graphoderus bilineatus*, species of European conservation importance  
*Pojavljanje rodu Graphoderus v Sloveniji s poudarkom na naravovarstveno pomembni vrsti Graphoderus bilineatus*
- 12:20 – 12:40 **Tamara MILIVOJEVIĆ, Maarten de GROOT:**  
New records for the sawfly fauna (Hymenoptera: Symphyta) of Slovenia  
*Nove najdbe rastlinskih os (Hymenoptera: Symphyta) v Sloveniji*
- 12:40 – 13:00 **Alja PIRNAT, Ivan KOS, Božidar DROVENIK:**  
Ground beetle fauna of termophilic forests of Slovenia  
*Favna krešičev termofilnih gozdov Slovenije*
- 13:00 – 13:20 Poster session with coffee and tea break  
*Predstavitve posterjev z odmorom za kavo in čaj*

**Moderator: AI Vrezec**

- 13:20 – 13:40 **Slavko POLAK:**  
Distribution, taxonomic status, conservation and monitoring of the cave slenderneck beetle (*Leptodirus hochenwartii* Schmidt, 1832)  
*Razširjenost, taksonomski status, varstvo in monitoring jamskega hrošča drobnovratnika (Leptodirus hochenwartii Schmidt, 1832)*
- 13:40 – 14:00 **Aleksandar POPIJAČ, Ignac SIVEC:**  
An endemic species of stoneflies (Insecta, Plecoptera) from NE Italy is actually widely distributed species in Slovenia  
*Endemična vrsta vrbnice (Insecta, Plecoptera) iz SV Italije je dejansko široko razprostranjena v Sloveniji*
- 14:00 – 14:20 **Ignac SIVEC:**  
Value of faunistical data in some aquatic insects  
*Pomen favnističnih podatkov nekaterih vodnih žuželk*

- 14:20 – 14:40 **Tomi TRILAR, Matija GOGALA:**  
Present status and distribution of mountain cicadas (*Cicadetta montana sensu lato*)  
in Europe  
*Poznavanje in razširjenost gorskih škržadov (Cicadetta montana sensu lato) v Evropi*
- 14:40 – 15:00 **Tone NOVAK, Christian KOMPOSCH, Ljuba SLANA NOVAK:**  
Subspecific variability in *Nemastoma bidentatum* (Arachnida, Opiliones,  
Nemastomatidae)  
*Podvrstna variabilnost suhe južine Nemastoma bidentatum (Arachnida, Opiliones, Nemastomatidae)*
- 15:00 – 15:20 **Rudi VEROVNIK, Ali ŠALAMUN:**  
The Butterfly Atlas of Slovenia – at the finish line  
*Atlas dnevnih metuljev Slovenije – na ciljni črti*
- 15:20 – Closing of the Symposium  
*Zaključek simpozija*

## ABSTRACTS / IZVLEČKI

### Oral presentations / Predavanja

#### Genus *Graphoderus* in Slovenia with an emphasis on *Graphoderus bilineatus*, species of European conservation importance

Špela AMBROŽIČ<sup>1</sup>, Andrej KAPLA<sup>1</sup>, Al VREZEC<sup>1</sup>

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*Graphoderus* is a genus of water beetles in family Dytiscidae (predaceous diving beetles) which comprises four in Slovenia relatively rare species with the most common species *Graphoderus cinereus* and *G. austriacus*. *Graphoderus bilineatus* is a species of European conservation importance. It is eurytopic species and one of the rarest European dytiscid living in acidic, rich, eutrophic and vegetated standing waters. For Slovenia, it was known until now only from Rače ponds, which is about 100 years old record, so it was presumed to be extinct in Slovenia nowadays. In years 2008, 2010 and 2011 we conducted large-scale survey of species in standing water bodies with the use of water traps and sampling with hand net. Altogether, we reviewed 51 water bodies in which we confirmed three species of the genus *Graphoderus*, but *Graphoderus bilineatus* in only one pond, what indicates great species rarity and consequent vulnerability in Slovenia.

#### Pojavljanje rodu *Graphoderus* v Sloveniji s poudarkom na naravovarstveno pomembni vrsti *Graphoderus bilineatus*

Špela AMBROŽIČ<sup>1</sup>, Andrej KAPLA<sup>1</sup>, Al VREZEC<sup>1</sup>

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Gladki plavači (*Graphoderus*) so rod kozakov (Dytiscidae), ki zajema štiri v Sloveniji relativno redke vrste z najpogostejšima vrstama *Graphoderus cinereus* in *G. austriacus*. Ovratniški plavač (*Graphoderus bilineatus*) je vrsta evropskega varstvenega pomena. Gre za evritopno vrsto in za enega najredkejših evropskih kozakov (Dytiscidae) vezanega na kisle, evtrofne in bogato zarasle stoječe vode. Za Slovenijo je bil do sedaj znan le en podatek z okolice Rač, ki pa je star okoli 100 let, zato je bila upravičena domneva, da gre danes morda za izumrlo vrsto pri nas. V letih 2008, 2010 in 2011 smo zasnovali široko-prostorsko raziskavo stoječih vodnih teles z uporabo vodnih pasti in vzorčenja z vodno mrežo. Skupno smo pregledali 51 vodnih teles, v katerih smo potrdili tri vrste rodu *Graphoderus*, ovratniškga plavača pa le v enem, kar kaže na njegovo veliko redkost in posledično tudi ranljivost pri nas.

## **Diversity, distribution and threat status of dragonflies of Sri Lanka (Insecta: Odonata)**

**Matjaž BEDJANIČ**

Kolodvorska 21b, SI-2310 Slovenska Bistrica, Slovenia  
E-mail: matjaz\_bedjanic@yahoo.com

Currently, around 125 dragonfly species are known from Sri Lanka. The level of endemism is very high – endemic are 60 taxa or 48% of the odonate fauna. Most of these species are confined to small isolated areas that harbour fragments of tropical rainforests in the central and south-western parts of the island, which together barely exceed the size of Slovenia. Of special interest are the exclusively endemic representatives of the family Platystictidae, with 20 species of the genera *Platysticta* and *Drepanosticta*. The species radiation within this family is globally remarkable and is very interesting also from the phylogenetic and phylogeographic point of view.

Unfortunately, the natural tropical rainforest is only fragmentarily preserved in Sri Lanka and as a consequence the rich endemic fauna and flora are markedly endangered in many respects. No less than 20 endemic dragonfly species from Sri Lanka are threatened with global extinction and are included on the IUCN Global Red List of Threatened Animals.

Odonatological research priorities and recommendations for future work are: (1) stimulation of taxonomic research, (2) execution of odonatological faunistic mapping, with a focus on the south-western and central parts of the island, (3) stimulation of research of biology and ecology of globally endangered species, (4) continuation of the work on the odonatological database "Distribution Atlas of the Dragonflies of Sri Lanka" and (5) raising awareness on the threat status of endemic dragonfly fauna of Sri Lanka at the relevant local and international nature conservation organizations.

## **Diverziteteta, razširjenost in ogroženost kačjih pastirjev Šri Lanke (Insecta: Odonata)**

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Za Šri Lanko je trenutno znanih okoli 125 vrst kačjih pastirjev. Endemizem je zelo visok – 60 vrst oz. kar 48 % odonatne favne. Večina teh vrst je omejena na majhna izolirana območja s fragmenti tropskih pragozdov v osrednjem in jugozahodnem delu otoka, ki je po velikosti komaj večji od Slovenije. Posebej zanimivi so izključno endemični predstavniki družine Platystictidae, z 20 vrstami iz rodov *Platysticta* in *Drepanosticta*. Radiacija vrst v tej družini je globalno skoraj brez primere in je zelo zanimiva tudi iz filogenetskega ter filogeografskega ozira.

Naravni tropski deževni gozd je na Šri Lanki žal ohranjen le še fragmentarno in posledično je bogato endemično živalstvo in rastlinstvo v več ozirih izrazito ogroženo. Kar 20 endemičnim vrstam kačjih pastirjev s Šri Lanke grozi globalno izumrtje in so uvrščene na IUCN Global Red List of Threatened Animals.

Odonatološke prioritete in priporočila za delo v prihodnosti so naslednje: (1) spodbujanje taksonomskih raziskav, (2) izvedba odonatološkega favnističnega kartiranja, s poudarkom na jugozahodnem in osrednjem delu otoka (3) spodbujanje raziskav biologije in ekologije globalno ogroženih vrst, (4) nadaljevanje dela na odonatološki podatkovni zbirki »Atlas razširjenosti kačjih pastirjev Šri Lanke« in (5) dvigovanje zavesti o ogroženosti endemične favne kačjih pastirjev Šri Lanke pri relevantnih naravovarstvenih organizacijah na lokalnem in mednarodnem nivoju.

## Physiological optics of the owlfly *Libelloides macaronius*

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The owlfly *Libelloides (Ascalaphus) macaronius* is a diurnal predatory Neuropteran, famous due to its bipartite compound eyes, sensitive exclusively to UV. The eyes possess a superposition optical apparatus. A superposition eye is highly sensitive and better suited for nocturnal lifestyle than the apposition eye. However, in full daylight, the advantages of superposition over apposition are compromised due to the optical errors which result in inferior visual acuity. High sensitivity and high resolution – two properties of eyes of a predator – are conflicting optical demands if implemented in a superposition eye. We investigated how these issues are met in the eyes of *Libelloides*. We optically measured the eye geometry, the superposition aperture, the visual fields and the interommatidial angles. Electrophysiologically, we measured the sensitivity, signal to noise ratio and the acceptance angles of single photoreceptors. We found that the two eye parts have very different radii, partially overlapping visual fields and different interommatidial angles. The photoreceptor acceptance angles are  $\geq 1.4^\circ$ , comparable to the narrowest ever observed in superposition eyes.  $\sim 100$  ommatidia contribute to superposition, ensuring high photon yield and excellent signal to noise ratio. Overall, *Libelloides*' eyes appear to be pushed to the limits of possible within the constraints of diurnal superposition.

## Fiziološka optika metuljčnice *Libelloides macaronius*

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Metuljčnica *Libelloides (Ascalaphus) macaronius* je dnevni plenilski mrežekrilec, ki slovi zaradi dvodelnih sestavljenih oči, ki so občutljive skoraj izključno na UV. Te oči so superpozicijskega tipa, torej so zelo občutljive in primernejše za nočni način življenja, kot pa apozicijske oči. V svetlobi dneva pa prednosti superpozicije pred apozicijo zbledijo zaradi optičnih napak, ki slabšajo kotno ločljivost. Visoka občutljivost in ločljivost sta zaželeni lastnosti oči plenilca, ki pa sta medsebojno izključujoči, še zlasti v superpozicijskem očesu. Zanimalo nas je, kako sta tidve zahtevi rešeni v očeh metuljčnice. Z optičnimi metodami smo merili geometrijo oči, superpozicijsko aperturo, vidna polja in interomatidialne kote. Elektrofiziološko smo izmerili občutljivost, razmerje signal-šum ter vpadne kote posameznih fotoreceptorjev. Ugotovili smo, da imata dva dela oči različne polmere, delno prekrivajoča se vidna polja, in različne interomatidialne kote. Vpadni koti so bili  $\geq 1.4^\circ$ , kar je primerljivo z najožjimi doslej izmerjenimi v superpozicijskih očeh. K superpoziciji prispeva  $\sim 100$  omatidijev, kar zagotavlja visok izplen fotonov in odlično razmerje signal-šum. Kaže, da je oko metuljčnice blizu meja možnega v okvirih superpozicijskih oči dnevnih žuželk.

## **Effects of coumaphos on learning of workers of honeybee *Apis mellifera carnica***

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Coumaphos, an organophosphate, is an active ingredient of Perizin, the medicine used to control the parasitic mite *Varroa destructor*. Perizin is applied by sprinkling over the colony. Bees spread the agent by contact, but partly ingest the emulsion and spread it by social feeding throughout the colony. We examined effects of coumaphos on associative and non-associative learning by using proboscis extension reflex (PER) where a hungry honeybee extends its proboscis reflexively when the sucrose receptors on the antennae or the mouth parts are stimulated. In all experiments forager bees of unknown age were 24 hours fed with pure or coumaphos contaminated sugar solution. Bees treated with coumaphos showed a faster habituation of PER than control bees. In conditioning learning experiments a significant reduction of PER was found for booth 1 and 12 min after a single conditioning trial when bees received coumaphos. Results showed side effects of coumaphos on learning and suggest that this substance should be applied with great care.

## **Kumafos vpliva na učenje delavk medonosne čebele *Apis mellifera carnica***

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Kumafos, organofosfat, je aktivna učinkovina Perizina, zdravila, ki se uporablja za zatiranje zajedavske pršice *Varroa destructor*. S Perizinom čebeljo družino poškopimo. Čebele emulzijo razširijo z dotikanjem, del pa jo zaužijejo in razširijo s socialnim hranjenjem. Raziskali smo vplive kumafosa na asociativno in neasociativno učenje s pomočjo refleksa iztegovanja jezička (PER) pri katerem lačna čebela ob draženju saharoznih receptorjev na tipalnicah ali obustnih delih refleksno iztegne jeziček. V vseh poskusih smo čebele neznane starosti 24 ur hranili s čisto ali s kumafosom kontaminirano sladkorno raztopino. Pri čebelah, ki so bile tretirane s kumafosom je do habituacije PER prišlo hitreje kot pri kontrolnih. Pri poskusih s pogojevanjem smo pri čebelah, ki so prejele kumafos, ugotovili zmanjšanje PER odziva tako eno minuto kakor tudi 12 minut po enojnem pogojevanju. Naši rezultati so pokazali stranske učinke kumafosa na učenje, zato je pri uporabi tega sredstva potrebna previdnost.

## **Characteristics of the ovipositional habitat of Fenton's Wood White (*Leptidea morsei* Fenton, 1881; Lepidoptera: Pieridae) in Slovenia**

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Fenton's Wood White is a species of Community interest in the European Union, listed in the Habitats Directive 92/43 EEC under Annex II. It is protected species in Slovenia. It inhabits the light deciduous and mixed woods, forest edges and coppice areas, where the oviposition and larval food plants *Lathyrus niger* are present.

In 2011, in the central part of the species distribution in Slovenia (Bela Krajina, Kolpa River valley, Posavje) the characteristics of ovipositional habitat of the females of first generation (April-May) were investigated using the following parameters: (A) macrohabitat parameters: habitat type, amount of *L. niger* at the oviposition site, aspect of oviposition site and its exposition to the sun; (B) microhabitat parameters: oviposition plant height, oviposition plant branching (number of lateral shoots), number of eggs on the plant, position of egg on the plant (height above the ground, distance from the stem) and position of egg on a leaf (upper side, underside).

## **Značilnosti ovipozicijskega habitata velikega frfotavčka (*Leptidea morsei* Fenton, 1881; Lepidoptera: Pieridae) v Sloveniji**

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Veliki frfotavček je v Evropi ogrožena vrsta, uvrščena na Dodatek II Direktive o habitatih (92/43/EEC). V Sloveniji sodi med zavarovane vrste. Poseljuje svetle listnate in mešane gozdove, gozdne robove in večje grmovnate sestoje, kjer uspeva črni grahor (*Lathyrus niger*), ki je edina znana ovipozicijska rastlina in hranilna rastlina gosenic v Sloveniji.

V letu 2011 smo v osrednjem območju razširjenosti vrste v Sloveniji (Bela Krajina, dolina Kolpe, Posavsko hribovje) raziskovali značilnosti ovipozicijskega makro- in mikrohabitata samic spomladanske generacije (april-maj). Za opis habitata smo uporabili naslednje parametre: (A) makrohabitat: tip habitata, številčnost rastlin črnega grahorja na rastišču ovipozicijske rastline ter ekspozicija in osončenost rastišča ovipozicijske rastline; (B) mikrohabitat: višina ovipozicijske rastline, razvejanost ovipozicijske rastline (število stranskih poganjkov), število jajčec na rastlini, lega jajčeca na rastlini (višina od tal, oddaljenost od stebela) in položaj jajčeca na listu (zgornja/spodnja stran).



## Frequency differences of the predatory bug *Podisus nigrispinus* vibratory signals recorded on a non-resonant substrate or on a plant

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Predatory stink bugs *Podisus nigrispinus* (Pentatomidae: Asopinae) produce vibratory communication signals by vibration of their abdomen and by tremulation. One female (FS) and two male (MS1 and MS2) songs are produced by abdomen vibration during mating, and male and female tremulatory signals were recorded when bugs touched each other or refused to mate. Vibratory signals of both origin were recorded on a non-resonant (loudspeaker membrane) and resonant (soybean plant) surface. Although signals recorded from different substrates differed significantly in their duration and spectral properties we have observed no significant difference in male-female responsiveness during different behavioural contexts. The mean dominant frequency of loudspeaker membrane recorded signals ranged from 70 to 90 Hz for FS and from 90 to 150 Hz for MS1 and MS2. The dominant frequency of tremulatory signals ranged around mean value of 156 Hz. Vibratory and tremulatory signals emitted and recorded on a soybean plant showed different spectra with the dominant frequency below 40 Hz. Frequency position of lower amplitude spectral peaks differed for signals recorded on a soybean leaf or stem. We discuss the potential role of signal low frequency spectral components in stink bug behavior on a plant.

## Frekvenčne razlike med vibracijskimi signali roparske stenice *Podisus nigrispinus* registriranimi na neresonirajoči podlagi ali na rastlini

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Roparske stenice vrste *Podisus nigrispinus* (Pentatomidae: Asopinae) proizvajajo vibracijske komunikacijske signale s tresenjem zadka in z tremulacijo. En napev samice (FS) in dva napeva samca (MS1 in MS2) oddajajo s tresenjem zadka med paritvenim vedenjem, tremulacijske signale pa smo pri samcih in samicah registrirali ob medsebojnem dotiku ali pa v primeru, ko je eden od partnerjev odklonil parjenje. Vibracijske signale proizvedena na oba načina smo registrirali na neresonirajoči (membrana zvočnika) in resonirajoči (soja) podlagi. Čeprav so imeli signali registrirani na različnih podlagah signifikantno različne časovne in frekvenčne lastnosti, pa v različnih kontekstih vedenja nismo opazili pomembnih razlik v vibracijski komunikaciji. Povprečna dominantna frekvenca signalov registriranih na membrani zvočnika se je gibala med 70 in 90 Hz za FS, med 90 in 150 Hz za MS1 in MS2 ter okrog povprečne vrednosti 156 Hz za tremulacijske signale. Vibracijski in tremulacijski signali, ki smo jih registrirali na soji, so imeli različne spektre z dominantno frekvenco pod 40 Hz. Frekvenčni položaj spektralnih vrhov z nižjo amplitudo je bil različen pri signalih registriranih na listu ali stebelu soje. V prispevku razpravljamo o potencialni vlogi nizko frekvenčnih komponent signalov pri vedenju stenic na rastlini.

### **Prezygotic isolation in the genus *Aphrodes***

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Acoustical signals are an essential element when searching and recognizing an appropriate mate. Often they have been used by researchers as an important trait in species determination. Leafhoppers of the genus *Aphrodes* (Hemiptera: Cicadellidae) are a morphologically difficult group. Currently, four species are recognized, but a recent survey of vibrational signals showed that a so far unknown signal exists in Slovenia. Furthermore, species have been shown to be sympatric and as many as three types of signals were found in one location. Different parameters of signals of these species have been compared and it has been concluded that the new type of signal is most similar to the one already described for the species *A. bicincta* (Schrank). Phylogenetic analysis of mitochondrial COI gene has not showed any difference between these two types. Preference tests for conspecific and heterospecific signals, as well as mating behavior and interspecific matings have been conducted. While no genetic differences have been found in currently examined genes, behavioral experiments showed a clear reproductive isolation.

### **Prezigotna izolacija v rodu *Aphrodes***

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Pri nekaterih težko določljivih vrstah se za prepoznavanje vrst uporabljajo akustični signali, ki jih osebki oddajajo pri iskanju in prepoznavanju partnerjev. Med težko morfološko določljive vrste spadajo škržatki rodu *Aphrodes* (Hemiptera: Cicadellidae). Mednje uvrščamo štiri vrste. Ob analizi vibracijskih signalov, ki jih te vrste uporabljajo za sporazumevanje, pa smo poleg štirih že opisanih signalov v Sloveniji našli do sedaj še neopisan tip signalov. Izkazalo se je, da se osebki z različnimi signali pojavljajo simpatrično in da se lahko na isti lokaciji nahajajo tudi do tri vrste oziroma tipi signalov. V študiji smo primerjali parametre signalov posameznih vrst in ugotovili, da je nov tip signala najbolj podoben že prepoznani vrsti *A. bicincta* (Schrank). Filogenetska analiza mitohondrijskega COI gena ni pokazala razlik med osebki z novim tipom napeva in vrsto *A. bicincta*. Vključili smo še teste preferenc samic za signale samcev istega tipa ter signale drugačnega tipa. Primerjali smo paritveno vedenje ter opravili interspecifično parjenje. Medtem ko genetskih razlik v trenutno pregledanih genih nismo našli, so vedenjske razlike pokazale jasno reproduktivno izolacijo.

## **Notes on the gregarines (Protozoa: Apicomplexa: Eugregarinorida) of insects in Slovenia**

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Gregarines (Eugregarinorida) are relatively large protozoan parasites in the guts and body cavities of several kinds of invertebrates, including annelids, tunicates, sipunculids and especially arthropods.

The knowledge of their occurrence in insects is poor; gregarines have been reported from less than one percent of named insect species. Between August and October 2011 intestine of adults and larvae of insects of 12 orders were inspected for the presence of gregarines. Hosts of the following orders were infected: Dermoptera, Ensifera, Blattaria, Neuroptera, Coleoptera and Mecoptera. During this preliminary study 14 gregarine species were recorded belonging to the following genera:

*Actinocephalus*, *Gamocystis*, *Gregarina*, *Hirmocystis*, *Hyalospora* and *Leidyana*.

## **K poznavanju gregarin (Protozoa: Apicomplexa: Eugregarinorida) v žuželkah v Sloveniji**

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Gregarine (Eugregarinorida) so razmeroma velike praživali, ki parazitirajo v prebavilih in telesnih votlinah nevretenčarjev – kolobarnikov, plaščarjev, sipunkulidov in zlasti členonožcev. Poznavanje njihovega pojavljanja pri žuželkah je slabo, saj so bile gregarine zabeležene le pri manj kot enem odstotku znanih vrst žuželk. Od avgusta do oktobra 2011 smo pregledovali prebavila ličink in odraslih osebkov iz 12 redov žuželk. Inficirani so bili gostitelji, ki so spadali v naslednje redove: Dermoptera, Ensifera, Blattaria, Neuroptera, Coleoptera in Mecoptera. V tej preliminarni študiji smo zabeležili 14 vrst gregarin, ki jih uvrščamo v naslednje rodove: *Actinocephalus*, *Gamocystis*, *Gregarina*, *Hirmocystis*, *Hyalospora* in *Leidyana*.

## **Morphology of the sensilla in the antlion larvae (Neuroptera: Myrmeleontidae)**

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The larvae of most antlion species (Neuroptera: Myrmeleontidae) are sand-dwelling insects, but only a few of them construct conical pits in dry, loose sand to capture prey. These sit-and-wait predators wait for their prey in the centre of the pitfall trap. In contrast, sit-and-pursue antlions are non-pit-builders, which bury themselves in the sand ambushing prey on the surface. We investigated sensilla in four pit-building species of antlions and in one non-pit-builder. Four types of mechanoreceptors were recognized, namely setiform hairs (sensilla trichodea), plumose hairs, bristles (sensilla chaetica) (in 3 subtypes) and campaniform sensilla. Chemoreceptors occurring in antlions were classified in three types: sensilla coeloconica, digitiform sensilla and sensilla basiconica. The types of sensilla of antlions were compared with what has been described in other insects, and their putative functions are discussed with reference to their morphology, distribution and ultrastructure.

## **Morfologija senzil pri larvah volkcev (Neuroptera: Myrmeleontidae)**

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Larve večine vrst volkcev (Neuroptera: Myrmeleontidae) živijo v pesku, le manjše število vrst gradi v suhem, rahlem substratu za lov plena lijake. Te žuželke čakajo na dnu lijaka in na tak način lovijo plen. V nasprotju z njimi pa se nelijakarji zakopavajo v podlago, kjer na plen čakajo v zasedi. Preučevali smo senzile pri štirih vrstah lijakarjev in eni vrsti nelijakarjev. Našli smo štiri vrste mehanoreceptorjev - nitaste dlake (sensilla trichodea), peresaste dlake, ščetine (sensilla chaetica) (v obliki treh podtipov) in kampaniformne senzile. Kemoreceptorje smo uvrstili v tri tipe: sensilla coeloconica, digitiformne senzile in sensilla basiconica. Senzile volkcev smo primerjali s senzilami, opisanimi pri drugih žuželkah, ter na osnovi njihove morfologije, ultrastrukture in razporeditve sklepali na funkcijo.

## **“No place for an entomologist”: Slovenia’s karst in a 19<sup>th</sup>-century murder mystery**

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When I discovered a nineteenth-century German crime novel that brought together entomology, the Slovenian karst and an exotic butterfly species, a literary detective hunt was set in motion. *The Lonely House* (original title *Das Einsame Haus*, 1888) by Adolf Streckfuss features a naturalist from Berlin who spends a summer collecting various species in the Slovenian countryside and becomes involved in a local murder.

In the course of literary research, I hypothesized that the German author must have been involved in entomology and must have visited Slovenia. Research in the *Berliner entomologische Zeitschrift* and other historical resources casts light on Streckfuss’s travel and research and allows confirmation that this early fiction has a sound basis in actual authorial experience. Further research into the geographical, botanical and entomological detail of the novel confirms the accuracy with which Streckfuss wove real phenomena into fictional clues.

The quest for Streckfuss the entomologist thus forms a modern counter-mystery to complement the fictional search for the murderer. My presentation will follow the clues, using documentary, cartographical and photographic evidence.

## **“Ni prostora za entomologa”– skrivnostni umor na slovenskem krasu v devetnajstem stoletju**

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Ko sem odkrila nemški kriminalni roman iz devetnajstega stoletja, v katerem so povezani entomologija, slovenski kras in eksotična vrsta metuljev, me je prevzela literarna detektivska sla. V *Samotni hiši* (v originalu *Das einsame Haus*, 1888) opisuje Adolf Streckfuss naravoslovca iz Berlina, ki je poleti zbiral različne vrste žuželk na slovenskem podeželju in bil tam vpleten v umor.

V literarni raziskavi sem predpostavila, da je moral biti nemški avtor entomolog in da je obiskal ozemlje Slovenije. Preiskovanje *Berliner entomologische Zeitschrift* in drugih zgodovinskih virov je osvetlilo Streckfussovo potovanje in njegove raziskave ter potrdilo domnevo, da je ta starinski roman skladen z avtorjevo osebno izkušnjo. Z nadaljnjim poglobljanjem v geografske, botanične in entomološke podrobnosti se je izkazalo, da je Streckfuss v literarni zaplet natančno vtikal resnične dogodke.

Vprašanje o Streckfussu kot entomologu predstavlja zatorej moderno, nasprotno skrivnost, kako dopolniti zgodbo in poiskati morilca. Moja predstavitev bo sledila dogajanjem na osnovi dokumentacije, kartografskega in fotografskega gradiva.

## **Compiling a list of digger wasps (Hymenoptera: Ampulicidae, Sphecidae and Crabronidae) of Slovenia**

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History of the Slovenian sphecid fauna research starts with Scopoli (1763). Records can be found also in the works by Graeffe (1911), Vogrin (1955) and several other authors. But the most important work in this regard was done by Evgen Jaeger, a physician in Podčetrtek. He published only one work with a record of a sphecid wasp species (Jaeger 1933), but his collection, preserved in the Slovenian Museum of Natural History, is a source of most records of this group of hymenopterans and gives a good picture of a local fauna that existed in his time. Vogrin's Slovenian records are also largely based on his specimens.

3 species of Ampulicidae, 18 of Sphecidae and 165 of Crabronidae, altogether 186 species of sphecid wasps are recorded for Slovenia. Some of the literature data are dubious, however. The number of species living today in the country is probably lower, as the solitary wasps are very vulnerable to changes in the environment, caused by humanity or by weather conditions. Each species has its own requirements regarding nest sites and nesting materials, specific food sources for progeny and adults, and so on. Many species live in open, scarcely overgrown land, which is scarce now. The land is used for urbanization, intensive cultivation, or left to be overgrown by forest. But Slovenian sphecid fauna is not well investigated in all regions, so new discoveries are expected. There is a phenomenon of several introduced species of Sphecidae, not native to Europe. Some rare species have been found in Slovenia.

## **Sestavljanje seznama os grebač (Hymenoptera: Ampulicidae, Sphecidae in Crabronidae) Slovenije**

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Zgodovina raziskovanj slovenske favne os grebač se začne s Scopolijem (1763). Podatke lahko najdemo tudi v delih Graeffeja (1911), Vogrina (1955) in več drugih avtorjev. Najpomembnejše delo na tem področju pa je opravil Evgen Jaeger, zdravnik v Podčetrtku. Objavil je le eno delo o najdbi vrste os grebač (Jaeger 1933), a njegova zbirka, ohranjena v Prirodoslovnem muzeju Slovenije, je vir večine podatkov o tej skupini kožekrilcev in daje dobro sliko lokalne favne, kakršna je obstajala v njegovem času. Tudi Vogrinovi podatki za Slovenijo pretežno temeljijo na njegovih primerkih.

3 vrste družine Ampulicidae, 18 družine Sphecidae in 165 družine Crabronidae, skupno 186 vrst os grebač, je zabeleženih za Slovenijo. Nekaj podatkov iz literature je vendarle dvomljivih. Število vrst, ki danes živijo v državi, je verjetno manjše, saj samotarske ose zelo ogrožajo spremembe v okolju, ki jih povzročajo človeštvo ali vremenske razmere. Vsaka vrsta ima svoje potrebe po krajih gnezdenja in snoveh, ki jih uporablja za gradnjo gnezd, določeni hrani za zarod in odrasle osebe, itd. Mnoge vrste živijo na odprtih, redko poraslih tleh, ki so sedaj redka. Zemljišča se uporabljajo za gradnjo, intenzivno pridelavo, ali pa se prepuščajo zaraščanju z gozdom. Toda slovenska favna os grebač ni dobro raziskana v vseh območjih, zato pričakujemo nova odkritja. Obstaja pojav več tujerodnih vrst družine Sphecidae, zanešenih v Evropo. V Sloveniji smo našli nekaj redkih vrst.

## Endemic cicada species from Greek island of Evia

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Recently we described two new species of singing cicadas, *Cicadetta dirfica* and *Euboeana castaneivaga* for which we established also a new genus. They are endemic for the island of Evia (Euboea). The first taxon is a member of *Cicadetta montana* complex of species. The second one is morphologically distinct but the differences are small. However, the song pattern is very different and unique compared to any other European species of Cicadidae. We monitored a distribution of endemic species of cicadas on this island acoustically and found in addition to the both species mentioned above also a third close related species *C. hannekeae*, endemic for Greek mainland and Evia. A distribution pattern of the all three species shows a surprising similarity with three centres of speciation found by botanists for endemic flora of Evia. Since cicadas are xylem feeders and therefore not bound to specific feeding plants, so the only explanation for such parallelism is the common geological history of the island.

## Endemični škržadi z grškega otoka Evbeje

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Pred kratkim smo opisali dve novi vrsti škržadov, *Cicadetta dirfica* in *Euboeana castaneivaga*, za katero smo ustanovili tudi nov rod. Ti vrsti sta endemični za grški otok Evbejo (Evia). Vrsta *C. dirfica* spada v kompleks sorodnih vrst gorskih škržadov *C. montana* sensu lato. Druga novoopisana vrsta je morfološko različna toda razlike so majhne. Nasprotno pa je napev te vrste zelo različen in edinstven v primerjavi s katerokoli vrsto evropskih škržadov (Cicadidae). Razširjenost teh endemičnih vrst smo sledili akustično in ob tem našli na enem najdišču (Kandili) še tretjo vrsto *C. hannekeae*, ki je endemična za osrednji in južni del grškega polotoka in za Evbejo. Vzorec razširjenosti teh treh vrst presenetljivo sovпада s tremi območji oz. centri endemizma, ki so jih opisali botaniki za endemično floro na otoku Evbeji. Ker se škržadi hranijo s ksilemskim sokom niso vezani na posamezne rastlinske vrste za hrano, zato je razlago za to podobnost razširjenosti treba iskati v skupni geološki preteklosti otoka.

## **Biodiversity of Lepidoptera fauna in the Sečovlje Salina Nature Park and its management**

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In Sečovlje Salina Nature Park, a total of 732 Lepidoptera species, including 50 protected species, 60 red list species and two Natura 2000 species were recorded. More than 20 species are new for Slovenian Lepidoptera fauna. Already, this indicates the importance of Sečovlje salt pans for the protection of rare and protected species, although their scope is relatively small protected area. Despite that terrestrial habitats covers only 15% of the total area, they are of the utmost importance for the conservation of biodiversity of insects. Even Shannon Biodiversity Index for Lepidoptera (5.3) is well above average and indicates a very large diversity of fauna in a such small and extreme ecological area. This is linked with the great diversity of habitats in a small area and surrounding habitats back Sečovlje salt pans that actually provide the flow of genetic material between these habitats. The most important areas for conservation of Lepidoptera are Fontannige, Stojbe and the area around the old coalmine. Freshwater and saline habitats, mounds on the outskirts of salt pans, where grow the most flowering plants are very important for adult diet as well as for the larvae host plants. Very important are also halophytic Lepidoptera species, which occurs in Slovenia only in a small endangered coastal Ares, which are under pressure from urbanization. We also recognized the pressure of non-native invasive plants that threaten native flora and fauna, therefore efficient management of habitats critical for preservation of high diversity is of high importance. In 2011, at the period of the heatwave, two non-native Lepidoptera species were also observed in the salt pans.

## **Biodiverziteteta metuljev v Krajinskem parku Sečoveljske soline in njeno upravljanje**

**Stanislav GOMBOC<sup>1</sup>, Gregor TORKAR<sup>2</sup>, Andrej SOVINC<sup>3</sup>**

V Krajinskem parku Sečoveljske soline je bilo skupno evidentiranih 732 vrst metuljev, od tega 50 zavarovanih vrst, 60 vrst z rdečega seznama ogroženih vrst in 2 vrsti s seznama Natura 2000. Več kot 20 vrst je novih za slovensko favno metuljev. Že ti podatki kažejo na pomen Sečoveljskih solin za ohranjanje redkih in zavarovanih vrst, čeprav so po obsegu razmeroma majhno zavarovano območje. Le 15 % celotne površine solin je kopenskih habitatov in ti izjemnega pomena za ohranjanje biodiverzitet žuželk. Shannonov biodiverzitetni indeks za metulje je kar 5,3 – precej nad povprečjem in kaže na zelo veliko pestrost favne majhnega in ekstremnega ekološkega območja. Poleg majhnih solinskih habitatov k pestrosti veliko prispevajo še zaledni habitati v okolici Sečoveljskih solin. Ekološko najpomembnejša območja za metulje v solinah so Fontannige, Stojbe in območje okrog starega rudnika. Poleg sladkovodnih habitatov so za ohranjanje vrst pomembni še nasipi na obrobju solin, kjer je največ cvetnic, ključnih za prehrano odraslih metuljev in gosenic. Zelo pomembne so tudi halofilne vrste, ki pri nas živijo le na majhnih arealnih obalnih slanišč, ki so ogrožena zaradi pozidave. V kopenskih habitatih je že izražen pritisk tujerodnih rastlin, ki ogrožajo avtohtono floro in favno, zato je učinkovito upravljanje območja ključnega pomena za ohranitev bogate pestrosti solin. V letu 2011, v času vročinskega vala, smo linah zabeležili tudi dve tujerodni vrsti metuljev.



## **The effect of altitude on seasonal dynamics and species composition in hoverflies (Diptera: Syrphidae) in beech forest**

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Mountains reflect a climate gradient which may simulate the effects of climate change on plants and animals. In this research the effect of altitude on hoverfly seasonal dynamics and species composition was investigated. The seasonal dynamics and species composition were investigated on several altitudes of Mt Krim. There was a drop of several centigrade in average temperature from lower to higher altitude. Three peaks of seasonal activity were found (May/June, July and August). At the lowest altitude and at the thermophilic site the activity peaks appeared earlier than at the upper two altitudes on the northern slope. At the highest altitude the greatest abundance was recorded at the end of August. The abundance was positively influenced by the average trapping period temperature. The highest number of species on the thermophilic site was found in May, while at the highest altitude the number of species was highest in July. At the thermophilic site two peaks were found (May and August) and on the northern slope revealed three peaks (May, July and August). The species composition changed gradually, but significantly from lower to higher altitudes. These results provide a basis for further research on factors influencing the assemblages and seasonal dynamics of these species.

## **Vpliv nadmorske višine na sezonsko dinamiko in vrstno sestavo muh trepetavk (Diptera: Syrphidae) v bukovih gozdovih**

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Gore predstavljajo klimatski gradient, ki lahko predstavlja simulacijo vpliva klimatskih sprememb na rastline in živali. V tej raziskavi smo proučevali vpliv nadmorske višine na sezonsko dinamiko in vrstno sestavo muh trepetavk. Sezonsko dinamiko in vrstno sestavo smo proučevali na treh različnih nadmorskih višinah na Krimu. Povprečna temperatura se je z dvigom nadmorske višine zmanjšala za nekaj stopinj Celzija. Ugotovili smo tri viške aktivnosti (maj/junij, julij in avgust). Na najnižji nadmorski višini in na termofilni legi se je višek aktivnosti pojavil prej kot na dveh višjih nadmorskih višinah na severnem pobočju. Na najvišji nadmorski višini je bilo največ osebkov ujetih konec avgusta. Povprečna temperatura obdobja lovljenja je pozitivno vplivala na število ujetih osebkov. Na termofilni legi smo največje število vrst odkrili maja, medtem ko je bilo število vrst na najvišji nadmorski višini največje julija. Na termofilni legi smo odkrili dva viška vrstne pestrosti (maj in avgust), na legah severnega pobočja pa tri (maj, julij in avgust). Vrstna sestava se je spreminjala postopno, vendar značilno od nižjih nadmorskih višin proti višjim. Ti rezultati predstavljajo osnove za nadaljnje raziskave vpliva različnih dejavnikov na združbe in sezonsko pojavljanje teh vrst.

## **Influence of duration and amplitude of the female signal on the localisation by males of two hemipteran insects**

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Localisation of the sexual partner is an important part of reproduction in insects, however, mechanisms underlying localisation in insects using vibrational communication have been poorly studied. We investigated the influence of signal duration and amplitude on the searching and localisation behaviour of the males of the southern green stinkbug *Nezara viridula* and the leafhopper *Aphrodes makarovi*. The males were positioned on the top of a bean and nettle plant, respectively and stimulated unilaterally or bilaterally with conspecific female vibrational calls of different durations and amplitudes. The results showed that the males of *N. viridula* preferred louder signals and were searching longer in the presence of signals from only one source. In contrast, *A. makarovi* males preferred calls with longer duration and also needed more time to locate the source of shorter signals. However, there was an increase in the number of males localising the shorter calls when they had higher amplitude. Our results suggest that there are different mechanisms underlying localisation in *N. viridula* and *A. makarovi*.

## **Vpliv dolžine in amplitude samičinih vibracijskih signalov na lokalizacijo vira signalov pri samcih dveh vrst polkrilcev (Hemiptera)**

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Kljub temu, da je lokalizacija spolnega partnerja pomemben del razmnoževalnega procesa, so osnovni mehanizmi lokalizacije vibracijskega vira pri žuželkah slabo raziskani. Raziskovali smo vpliv dolžine in amplitude signalov na iskanje in lokalizacijo vira pri samcih stenice *Nezara viridula* in škržatka vrste *Aphrodes makarovi*. Samce smo postavili na vrh rastline fižola oziroma koprive ter jih enostransko ali dvostransko dražili z vibracijskimi napevi samic iste vrste ter različnih dolžin in amplitud. Rezultati so pokazali, da se samci stenic orientirajo proti viru, ki oddaja signal višje amplitude, ter da za lokalizacijo porabijo več časa v prisotnosti enega samega vira. Nasprotno pa so se samci škržatka preferenčno orientirali proti viru daljših signalov. Čeprav se je število samcev, ki so lokalizirali krajši signal povečalo, ko je le-ta imel višjo amplitudo, so samci škržatkov so potrebovali dalj časa za lokalizacijo vira krajših signalov. Naši rezultati kažejo, da se osnovni mehanizmi lokalizacije vibracijskega vira pri stenicah in škržatkih razlikujejo.

## **Life cycle of caddisflies *Rhyacophila fasciata* and *Hydropsyche saxonica* in karst rivers of SE Slovenia**

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Life cycles of caddisfly species *Rhyacophila fasciata* and *Hydropsyche saxonica* were investigated in Krupa and Lahinja River in SE Slovenia, belonging to inland water ecoregion Dinarids. The aim of our study was to present the number and the duration of life stages and to explore the importance of environmental variables in determining the life cycle of these species. Larvae, pupae and adult specimens were sampled from January to December 2005 in approximate monthly intervals. Environmental variables were measured simultaneously. Larval stages were defined based on the frequency distribution of the head capsule widths measured between eyes. As only instars 2-5 were collected in the field, the head width of first instar larvae was extrapolated using Dyar's rule by plotting instar number against the logarithm of the head capsule width. For both species five life stages were defined. For *R. fasciata* extended emergence period, whereas for *H. saxonica* univoltine cycle with summer and early autumn emergence were indicated. The relationship between larval stages and recorded environmental variables was analyzed by Canonical correspondence analysis (CCA). *H. saxonica* larval stages were best related to temporal and nutrient gradient, whereas for the life stages of *R. fasciata* water depth and oxygen concentration were the most important.

## **Življenjski cikel mladoletnic *Rhyacophila fasciata* in *Hydropsyche saxonica* v kraških rekah JV Slovenije**

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Življenjska cikla vrst mladoletnic *Rhyacophila fasciata* in *Hydropsyche saxonica* smo raziskovali v rekah Krupa in Lahinja, ki pripadata hidroekoregiji Dinaridi. Ugotavljali smo število in trajanje stadijev ter pomen okoljskih spremenljivk za življenjske stadije teh vrst. Na izbranih vzorčnih mestih smo opravili vzorčenje ličink, bub in odraslih osebkov v obdobju od januarja do decembra 2005 v približno enomesečnih presledkih. Sočasno smo merili tudi okoljske spremenljivke. Življenjske stadije ličink smo določili s pomočjo frekvenčne porazdelitve širin glave, merjenih na najširšem delu glavine kapsule. Prvi stadij ličink, ki ga z vzorčenjem nismo zajeli, smo določili s pomočjo Dyar-jevega pravila, ki je logaritemska funkcija med številko stadija in širino glavine kapsule. Pri obeh vrstah je bilo določenih pet stadijev. Vrsta *R. fasciata* ima najverjetneje podaljšano obdobje izletanja, medtem ko je pri vrsti *H. saxonica* opažen univoltini cikel s poletnim ali zgodnje jesenskim izletanjem. Vpliv okoljskih spremenljivk na življenjske stadije, vključno z datumom vzorčenja, smo analizirali s pomočjo kanonične korespondenčne analize (CCA). Stadiji ličink *H. saxonica* so bili najbolj povezani s časovnim gradientom in gradientom hranil. Pri vrsti *R. fasciata* pa sta največji vpliv na življenjske stadije imeli globina vode in koncentracija v vodi raztopljenega kisika.

## Pest status of alien insects in Slovenian forests

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In Slovenia, approximately 147 species of non-native insects were detected. Up to 64% of non-native insects appear on woody plants, around 26% of non-native insect species appears on other plants, about 10% of insect species do not consume plants. Taking into consideration the cryptogenic species and non-native insect fauna, there are about 160 allochthonous species. The dominant group of alien species is Hemiptera with 47%, followed by Coleoptera with 16%, with 15% of Lepidoptera, Diptera with 10%, Thysanoptera with 6%, Hymenoptera with 5% and Blatoidea with 1% of species. Since 2006, when a European database of non-native organisms was made we have completed our alien insect fauna with a 13th new insect taxa on woody plants: we have found *Cinara curvipes*, *Dasineura gleditchiae*, *Gnathotrichus materiarius*, *Aproceros leucopoda* and other. Some of them, such as *Xylosandrus germanus* and *Phyllonoricter issikii*, are spreading in the forests or wooded landscape, and affecting multiple functions of forests. We analysed the pest status of individual non-native insects on forests. It is important to question whether the high biodiversity of flora and fauna in our forests and traditional sustainable forest management to more than 60% of our country helps to reduce the risk of naturalisation and colonisation of our forests from invasive alien insect pests.

## Pomen škodljivih tujerodnih žuželk v slovenskih gozdovih

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V Sloveniji so ugotovili približno 147 tujerodnih žuželk. Več kot 64 % tujerodnih žuželk se pojavlja na lesnih rastlinah, okoli 26 % na drugih rastlinah, okoli 10 % vrst se ne prehranjuje z rastlinami. Ob upoštevanju zakritorodnih vrst in tujerodnih vrst žuželk, je alohtonih vrst približno 160. Prevladujočo skupino predstavlja Hemiptera s 47 %, sledi Coleoptera s 16 %, s 15 % Lepidoptera, Diptera z 10 %, Thysanoptera s 6 %, Hymenoptera s 5 % in Blatoidea z 1 % vrst. Od leta 2006, ko je bila narejena evropska zbirka podatkov o tujerodnih organizmih, smo dopolnili naš seznam tujerodne entomofavne s 13. novimi taksoni na lesnih rastlinah. Ugotovili smo krivonogo jelovo uš *Cinara curvipes*, gledičevkino listno hrzico *Dasineura gleditchiae*, podlubnika *Gnathotrichus materiarius*, brestovo grilzico *Aproceros leucopoda* in druge. Nekateri od njih, kot je npr. ksilomicetofagni podlubnik *Xylosandrus germanus* in lipov listni zavrtač *Phyllonoricter issikii*, se širijo v gozdovih in gozdnatih krajinah, in vplivajo na več funkcij gozdov. Analizirali smo status škodljivosti posameznih tujerodnih žuželk v gozdovih. Pomembno je vprašanje, ali visoka biotska raznovrstnost flore in favne v naših gozdovih in tradicionalno trajnostno gospodarjenje z gozdovi na več kot 60 % naše države, prispevata k zmanjšanju tveganja za naturalizacijo in kolonizacije naših gozdov z invazivnimi tujerodnimi žuželkami.

### **Status of *Cucujus cinnaberinus* (Scopoli 1763) in Slovenia**

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The cucujid *Cucujus cinnaberinus* was first described by G. A. Scopoli after specimens from Slovenia in 1763. It is poorly known saproxylic beetle of conservation importance in Europe. Imagos and larvae are predatory and live under bark of dead standing or lying tree trunks. The relative abundances of larvae and imagos increase in tree trunks with thickness above 70 cm. First intensive studies were conducted in 2009 in lowland softwood forests by Mura and Sava river and in 2011 we sampled through all Slovenia, first with search under bark and as well with intercept traps. It appeared that the species is widely distributed at least in E part of Slovenia. We found it in lowland as well as in montane forests, although it is far more abundant in lowlands.

### **Status škrlatnega kukuja, *Cucujus cinnaberinus* (Scopoli 1763) v Sloveniji**

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Škrlatnega kukuja (*Cucujus cinnaberinus*) je leta 1763 opisal G. A. Scopoli po primerkih iz Slovenije. Gre za slabo poznano saproksilno vrsto evropskega varstvenega pomena. Odrasli hrošči in ličinke so predatorski, in živijo pod lubjem odmrlih stoječih ter padlih debel. Gostota ličink in imagov naraste v hlodih debelejših od 70 cm. Prve intenzivne raziskave so bile izvedene leta 2009 v nižinskih mehkolesnih gozdovih Mure in Save, v letu 2011 pa smo raziskave razširili po celotni Sloveniji, najprej s preučevanjem podlubne favne, kasneje pa tudi s prestreznimi pastmi. Zadnji podatki kažejo, da je vrsta dokaj razširjena vsaj v vzhodni polovici Slovenije. Našli smo jo tako v nižinskih kot gorskih gozdovih, višje gostote pa so bile zabeležene v nižinah.

## **Recognition of Predatory Bugs in the Southern Green Stinkbug *Nezara viridula* (L.)**

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Plant-dwelling phytophagous stink bug species *Nezara viridula* (Pentatomidae, Pentatominae) communicates with species and sex-specific substrate-borne vibrational communication signals which are defined by their spectral end temporal characteristics. Vibrational communication within this species during mating is well described, however, little is known about vibrational responses to vibratory signals between species.

In the present study we investigated responses of adult males of *Nezara viridula* to vibrational communication signals of selected predatory bug species (Pentatomidae, Asopinae) on different substrates. Results of the experiment show that *Nezara viridula* adult males do respond to some of the vibrational communication signals of selected predatory bugs of the subfamily Asopinae. Males responded with vibrational communication signals, but not also with searching behaviour, a stereotypical response to stimulation with *Nezara viridula* female calling song. The vibratory responses of *Nezara viridula* males were higher when we stimulated the plant leaf than when vibratory signals of selected predatory bugs were applied to the stem or the loudspeaker membrane.

## **Prepoznavanje plenilcev na osnovi vibracijskih signalov pri stenici *Nezara viridula* (L.)**

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Rastlinojede stenice vrste *Nezara viridula* (Pentatomidae, Pentatominae) za sporazumevanje uporabljajo vibracijske komunikacijske signale, ki imajo vrstno in spolno specifične frekvenčne in časovne karakteristike. Raziskana je predvsem vibracijska komunikacija znotraj vrste v času parjenja, malo pa je znanega o vibracijskih odzivih med posameznimi vrstami.

Raziskali smo odzivnost odraslih samcev vrste *Nezara viridula* na vibracijske komunikacijske signale izbranih vrst roparskih stenic (Pentatomidae, Asopinae) na različnih vrstah podlage. Rezultati so pokazali, da se samci vrste *Nezara viridula* na stimulacijo z nekaterimi vrstami vibracijskih komunikacijskih signalov izbranih plenilskih vrst iz poddružine Asopinae odzivajo s proizvodnjem vibracijskih komunikacijskih signalov, ne pa tudi z iskanjem vira, ki se stereotipno pojavi ob stimulaciji samca s pozivnim napevom samice iste vrste. Delež samcev, ki so se na stimulacijo z napevi plenilskih vrst odzvali z vibracijskimi signali, je bil večji na rastlini kot na zvočniku, na listu pa večji kot na stebelu. V primeru, ko smo izbrane vibracijske signale predvajali na listu rastline, je bila tudi pogostost oglašanja samcev večja, kot če smo stimulirali steblo ali membrano zvočnika.

## Arthropods in the diet of three co-existing *Sorex* shrew species in montane forests in Slovenia

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From May to November in 1999 and 2000, shrews and invertebrate ground fauna were pitfall trapped on Mt. Smrekovec and Mt. Peca in the Capercaillie (*Tetrao urogallus*) habitat. The content of stomachs of three co-existing *Sorex* species: *S. alpinus*, *S. araneus* and *S. minutus* was inspected. As an out-group, *S. araneus* from Mt. Snežnik was considered. Altogether, 196 shrews were investigated and 180 animal prey items of 18 taxa were identified. The most frequent prey in all the three species in both locations were Insecta (44.9%), Araneae (23.2%), Lumbricidae (18.5%) and Opiliones (8.4%). *Sorex araneus* from Snežnik fed on 15 taxa, *S. araneus* from Smrekovec and Peca on 9 and *S. alpinus* and *S. minutus* on 8 taxa each. In the three species from Mt. Smrekovec and Mt. Peca, beetles *Aptinus bombardarda* (6.5–12.5%) and *Tropiphorus elevatus* (6.5–18.8%) and dermapteran *Apterygida media* (1.6–12.5%) were the most frequent. *Amaurobius* sp. was the only identified and the most numerous spider prey of *S. minutus* (34.8%) and *S. araneus* (29.5%). The most abundant opilionid species was *Mitopus morio* (7.6%). *Sorex araneus* from Mt. Snežnik fed most frequently on a carabid beetle *Nebria dahlii* (15.9%) and on dipteran larvae of *Mikiola fagi* (19.0%). In summary, arthropods presented 80% of prey items. Despite lower taxa richness in shrews diet, the Capercaillie habitat with large microhabitat diversity and stable food supply provided the co-existence of three shrew species.

## Členonožci v prehrani treh sobivajočih vrst rovk rodu *Sorex* v gorskih gozdovih v Sloveniji

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Od maja do novembra leta 1999 in 2000 smo na rastiščih divjega petelina (*Tetrao urogallus*) na Smrekovcu in Peci lovili rovk in talne nevretenčarje. Pregledali smo vsebino želodcev treh vrst rdečezobih rovk: gorske (*S. alpinus*), gozdne (*S. araneus*) in male rovk (*S. minutus*). Kot zunanjo skupino smo vključili gozdno rovko s Snežnika. Skupno smo pregledali 196 rovk in našli ostanke 180 uplenjenih osebkov iz 18 taksonov. Najpogostejši plen vseh treh vrst v obeh območjih so bile žuželke (44,9 %), pajki (23,2 %), deževniki (18,5 %) in suhe južine (8,4 %). *Sorex araneus* s Snežnika je uplenil 15 taksonov, *S. araneus* s Smrekovca in Pece 9 ter *S. alpinus* in *S. minutus* vsak 8 taksonov. Pri vrstah s Smrekovca in Pece so bili najpogostejši plen hrošča *Tropiphorus elevatus* (6,5–18,8 %) in *Aptinus bombardarda* (6,5–12,5 %) ter strigalica *Apterygida media* (1,6–12,5 %). Edini prepoznani pajek je bil *Amaurobius* sp., ki je predstavljal velik delež plena pri *S. minutus* (34,8 %) in *S. araneus* (29,5 %). Najpogosteje uplenjena suha južina je bila *Mitopus morio*. Najštevilčnejši plen *S. araneus* s Snežnika sta bila krešič *Nebria dahlii* (15,9 %) in ličinke velike bukove listne hrčice *Mikiola fagi* (19,0 %). V prehrani rovk z obeh območij so členonožci predstavljali 80 % plena. Čeprav je bila prehrana rovk na rastiščih divjega petelina vrstno manj številčna, rastišča z veliko raznolikostjo mikrohabitatov in trajno zalogo hrane omogočajo sobivanje treh vrst rdečezobih rovk.

## **Predatory behaviour of the non-pit-building antlion larvae *Neuroleon microstenus* (Neuroptera: Myrmeleontidae)**

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Among arthropods different predatory tactics are known. Some species invest no energy or time in searching for prey and can be classified as sit-and-wait predators. Main strategy of sit-and-wait predators is capturing prey by specific traps. Such predators are antlion larvae (Neuroptera: Myrmeleontidae), however trap constructing behaviour is known only in 10% of antlion species and is limited to the tribe Myrmeleontini. Most of the antlion larvae lie just beneath the sand surface and wait for their prey. We were interested in predatory behaviour of the non-pit-building antlion larvae *Neuroleon microstenus* (McLachlan, 1898). Description of behaviour was made by means of video recording and its analysis. We observed behaviour from prey introduction to jaw set. We identified eighteen behavioural patterns with temporal structure in stereotypical manner. We made an ethogram of significant transitions. We found different behavioural patterns following prey carcass cleaning, and these patterns depended on the method of cleaning.

## **Predatorsko vedenje larve volkca nelijakarja *Neuroleon microstenus* (Neuroptera: Myrmeleontidae)**

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Med členonožci so znane različne taktike lova plena. Nekatere vrste so tako imenovani sedentarni plenilci, ki v iskanje in zasledovanje plena ne vlagajo energije, temveč je njihova glavna taktika lov plena z različnimi pastmi. Takšni plenilci so larve volkcev (Neuroptera: Myrmeleontidae), vendar med njimi le 10 % vrst gradi pasti. Gradnja pasti je pri volkcih omejena na tribus Myrmeleontini, medtem ko ostale vrste na plen prežijo tik pod površino peska. Zanimalo nas je predatorsko vedenje larve volkca *Neuroleon microstenus* (McLachlan, 1898), ki ne gradi pasti. Opis vedenja temelji na video posnetkih in njihovi analizi. Opazovali smo faze vedenja volkca od izpostavitve plena do razširitve čeljusti. Identificirali smo osemnajst vedenjskih vzorcev, ki so si v večini opazovanj stereotipno sledili, in naredili etogram. Ugotovili smo, da imajo volkci po čiščenju ostankov plena različne vedenjske vzorce, ki so odvisni od načina čiščenja ostankov plena.



## **Factors influencing the abundance of the hoverfly *Cheilosia fasciata* (Diptera: Syrphidae) on ramson *Allium ursinum***

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The global rising of mean temperature causes the distribution of plants and animals to move to the higher altitudes. Specialised species, species with isolated populations and species with low ability of dispersal are more vulnerable to extinction. The hoverfly *Cheilosia fasciata* (Diptera: Syrphidae) is a specialised host on ramson *Allium ursinum*. We studied different factors influencing distribution of *C. fasciata* on different altitudes, which enabled us to find potential effects of climate change. The sampling was carried out on different ramson fields around Slovenia. The results show that number of larvae is increasing with increasing canopy coverage, depth of humus layer and number of ramson leaves. There is no significant relation between number of larvae and altitude or between number of larvae and presence of flooding area. Number of ramson leaves is significantly decreasing with increasing canopy coverage, altitude and depth of humus layer. There is a weak relation between number of ramson leaves and presence of flooding area. The rising temperature will have a negative effect on the abundance of *C. fasciata*. However other (a-)biotic factors have a larger effect on its abundance.

## **Vpliv različnih dejavnikov na pojavljanje muhe trepetavke *Cheilosia fasciata* (Diptera: Syrphidae) na čemažu *Allium ursinum***

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Zaradi dvigovanja povprečnih temperatur v svetovnem merilu se razširjenost rastlin in živali pomika proti vse višjim nadmorskim legam. Specializirane vrste in vrste z izoliranimi populacijami ter nizko sposobnostjo disperzije so bolj podvržene izumiranju. Muha trepetavka *Cheilosia fasciata* (Diptera: Syrphidae) je specializiran gostitelj na čemažu (*Allium ursinum*). Naš namen je bil ugotoviti vpliv različnih dejavnikov na pojavljanje muhe trepetavke *C. fasciata* na različnih nadmorskih višinah, kar nam bi omogočilo vpogled v potencialne učinke klimatskih sprememb. Vzorčili smo na večih rastiščih čemaža po Sloveniji. Rezultati so pokazali, da se število larv povečuje z večanjem pokrovnosti krošenj, globine humusa in števila čemaževih listov. Med številom larv in nadmorsko višino ne obstaja odvisnosti, prav tako rezultati ne kažejo nobene odvisnosti števila larv od prisotnosti/odsotnosti poplavnega območja. Število čemaževih listov se zmanjšuje z večanjem pokrovnosti krošenj, nadmorske višine in globine humusa. Obstaja šibka pozitivna odvisnost med številom čemaževih listov in poplavnim območjem. Dvigovanje temperature bo negativno vplivalo na pojavljanje *Cheilosie fasciate*, vendar je vpliv nekaterih drugih (a-)biotskih faktorjev večji.

## **New data about the distribution of some rare and interesting butterflies from Croatia**

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As a result of more than 200-year long research of butterflies of Croatia, 194 species are currently known from the country. More than ten species were recorded for the first time in Croatia during the last two decades. Nevertheless, a notable number of species are known from Croatia from only one or a few records, some of them being highly doubtful. Also, the low number of recently published papers, leads to the large gaps between old published data and new records, rendering it difficult to comprehend the true diversity, distribution and needed protection measures for butterflies in the country. In this presentation are presented new records for some of the seemingly rarest species of butterflies of Croatia: *Polyommatus damon*, *Polyommatus ripartii*, *Brenthis ino*, *Lopinga achine* and *Pyrgus sidae*.

## **Novi podatki o razširjenosti redkih in zanimivih dnevnih metuljev na Hrvaškem**

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Na osnovi nad dve stoletji trajajočih raziskovanj favne metuljev Hrvaške danes poznamo z njenega območja 194 vrst dnevnih metuljev (Rhopalocera). V zadnjih dveh desetletjih so zabeležili nad deset vrst, novih za Hrvaško. Poleg tega pa je s hrvaškega ozemlja zabeleženih veliko vrst, ki jih poznamo le z nekaj lokalitet ali pa so podatki nezanesljivi. Med najstarejšimi in najnovejšimi favnističnimi podatki je vrzel, zaradi katere si je težko predstavljati dejansko diverzitetno in razširjenost ter predvideti naravovarstvene ukrepe za metulje v državi. Predstavljeni so novi podatki o naslednjih vrstah metuljev, za katere smo domnevali, da so izjemno redki: *Polyommatus damon*, *Polyommatus ripartii*, *Brenthis ino*, *Lopinga achine* in *Pyrgus sidae*.

**Invited lecture / Vabljeno predavanje**

**Functional significance of the peering behaviour in mantids**

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When observing the praying mantis *Mantis religiosa* during prey detection or during locomotory behaviour then its side-to-side swaying movements cannot be overlooked. The otherwise still mantid shifts its head and upper body from side to side, counter-rotating the head simultaneously so as to keep it oriented straight ahead. We have learned from experimental studies on four species of mantids (*Tenodera aridifolia sinensis*, *Polyspilota* sp., *Mantis religiosa*, *Empusa fasciata*) that in cases when the visual surroundings are stationary, the swaying movements can be an expression of active vision. The mantid makes actively use of the translational components of the so-called peering movements for range determination within the closer visual surroundings (in *M. religiosa* up to 20 - 30 cm; Kral, J. Insect Behavior, in press). Due to the translational components of the peering movements, the velocity of the image motion is inversely proportional to the distance of objects. Apart from that, extraretinal information is also necessary for range estimation. Thus, it could be shown that in addition to the velocity of image motion proprioceptive inputs from the neck hairs play an important role. When the hair plate sensilla are surgically deafferented then range information is significantly inaccurate, although linearisation of the peering movement is not affected. The last one may be controlled by inputs of cervical muscle receptors. The results suppose, that with range estimation the velocity of the head movement must be compared with the velocity of the image motion (Poteser and Kral, J. Exp. Biol. 198, 1995; Poteser et al., J. Exp. Biol. 201, 1998; Kral, Behav. Processes 64, 2003). In this way, mantids are able to pick out the nearest and most easily accessible target object. An important precondition for range determination during locomotory behaviour is a suitable contrast of the edges of the object, and the edges must have a certain extension. Thus, longer edges are preferred to shorter ones, and vertical edges are preferred to oblique or curved edges. Longer vertical edges result in simultaneous stimulation of more photoreceptor cells what should mean a greater flow of information (Hyden and Kral, Behav. Processes 70, 2005). It would explain why *M. religiosa* prefers a grass environment where straight, vertical elements with a given extension predominate (Kral and Devetak, J. Insect Behavior 12, 1999). Of course, *M. religiosa* can also be found in open grassy-shrubby areas, as can be the case around human development. But here too, when the mantids are exploring their environment during locomotory behaviour they seem to orient preferentially towards vertically aligned structures (K. Kral, unpublished observations).

### **Starvation effects on reproduction in leafhopper species *Aphrodes makarovi***

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Since reproduction is fundamental for species existence, it represents a part of necessary energy consumption for all organisms. For leafhoppers of the genus *Aphrodes* it is known that in mate finding males are the ones that start signalling. When the male – female duet is established, male begins to move and localizes the female. To determine whether poor physiological condition affects reproduction in *A. makarovi*, males were exposed to starvation. Playback of a male – female duet was used to trigger calling and afterwards we responded to each call with a pre-recorded female signal. We compared the proportion of searching males, time needed to locate the female, success in locating the female and number and length of male calls during searching for female with the results obtained in a control nonstarved group. We also measured oxygen consumption during male movement and signalling. Results showed that males in poor physiological condition were more willing to search, however they spent more time on locating the female and were less successful in finding her. Moreover, starved males were calling more, however the length of their calls did not differ from control group. According to our results, we can conclude that males that were in worse physiological condition invested more energy in increasing the possibility of mating.

### **Vpliv stradanja na razmnoževanje pri škržatku vrste *Aphrodes makarovi***

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Ker je razmnoževanje ključno za ohranjanje vrst, predstavlja za vse organizme del nujne energijske porabe. Za škržatke rodu *Aphrodes* je znano, da se v procesu iskanja spolnega partnerja najprej začnejo oglašati samci. Ko vzpostavijo duet s samico, pa jo začnejo tudi iskati. Da bi videli, če ima poslabšano fiziološko stanje vpliv na razmnoževanje škržatka vrste *A. makarovi*, smo samce stradali ter jim nato s predvajanjem dueta sprožili oglašanje, zatem pa smo jim na signale odgovarjali s posnetim signalom samice. S kontrolno skupino nestradanih samcev smo primerjali delež samcev, ki so iskali, čas, ki so ga potrebovali za lociranje samice in uspešnost pri samem lociranju, ter število klicev in njihovo dolžino med iskanjem. Izmerili smo tudi porabo kisika med gibanjem in petjem. Rezultati kažejo, da je delež samcev, ki iščejo in so v slabšem fiziološkem stanju, večji, vendar pa porabijo več časa za lociranje samice, in tudi uspešnost iskanja je manjša. Prav tako so lačni samci več peli, med tem ko se dolžina signalov ni razlikovala. Glede na rezultate lahko zaključimo, da so samci, ki so bili v slabšem fiziološkem stanju, vložili več energije v možnost, da bi se lahko parili.

## DNA Barcoding of European Gracillariidae Leaf-Mining Moths (Lepidoptera)

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Moths in the family Gracillariidae constitute one of the primary groups of plant-mining microlepidoptera. While the majority of species are leaf miners, the family shows a diversity of other life-history strategies, such as fruit mining, stem mining, leaf rolling, boring, and galling. Many species are highly invasive and serious pests of agricultural and ornamental plants. Gracillariids include 1855 described species of which 256 have been recorded in Europe. Here we present barcode data for more than 2000 specimens for 219 species representing 85.5% of the European fauna. On average seven specimens were barcoded per species. Morphology and DNA barcodes were carefully studied and compared. Preliminary results show that barcoding is capable of unambiguously discriminating ~97% of the species investigated so far, including some of closely related species notoriously difficult to identify. We highlight some interesting cases of barcode similarity, barcode sharing, and deep intraspecific splits. DNA barcoding revealed divergent clusters within several described species when extending the study area to the whole continent of Europe calling attention for closer taxonomic scrutiny. Our comprehensive DNA barcode library for Gracillariidae leaf-mining micromoths will make identification more straightforward in particular larvae and light trapped specimens for which no host plant data is known. This research highlights the importance of international cooperation among European entomologists to complete the barcoding of all the Lepidoptera of Europe.

### **Določanje zaporedja genetskega zapisa (DNA barcoding) evropskih vrst listnih zavrtačev (Lepidoptera: Gracillariidae)**

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Listni zavrtači (Gracillariidae) so najpomembnejša skupina metuljčkov, ki zavrtavajo rastline. Medtem ko večino vrst poznamo kot zavrtače listov, družina kaže tudi druge vrste prilagoditev, kot je zavrtavanje plodov, zavrtavanje stebel ali vrtanje v stebela, zvijanje listov, vzpodbujanje nastanka novotvorb - šišk. Precej vrst je invazivnih in so pomembni škodljivci sadnih in okrasnih rastlin. Na svetu je trenutno 1855 opisanih vrst listnih zavrtačev, od tega jih je 256 znanih v Evropi. V prispevku predstavljamo podatke izsekov zaporedja genetskega zapisa - barkode za več kot 2000 primerkov oz 219 vrst, ki predstavljajo 85,5 % evropskih vrst listnih zavrtačev. V povprečju smo barkodirali 7 primerkov ene vrste. Primerjali smo tudi morfologijo vrst in DNA barkod, z namenom zanesljivosti določevanja vrst s pomočjo barkod. Predhodni rezultati doslej analiziranih primerkov kažejo, da je z barkodiranjem mogoče nedvoumno določiti okrog 97 % vrst listnih zavrtačev, vključno z nekaterimi ozko sorodnimi vrstami, ki jih je sicer z morfološkiimi metodami zelo težko ločiti. Izpostaviti želimo tudi nekaj zanimivih primerov podobnosti barkod: »souple« barkod in nekaj večjih intraspecifičnih razcepitvev. DNA barkodiranje v nekaterih primerih razkriva razhajajoče genetsko zaporedje znotraj znanih opisanih evropskih vrst listnih zavrtačev, kar kaže na potrebo po podrobnejši taksonomski razčlenitvi doslej znanih vrst. Obsežna zbirka barkod evropskih vrst listnih zavrtačev, ki smo jih zbrali v okviru študije, bo prispevala k lažji identifikaciji vrst, posebno gosenic in na svetlobne vabe ujetih primerkov, pri katerih gostiteljske rastline niso znane. Raziskava poudarja še pomen mednarodnega sodelovanja med evropskimi entomologi, za dokončanje zbirke barkod vseh evropskih vrst metuljev.

## **The degradation processes in the midgut epithelial cells of the larval antlion *Euroleon nostras* (Geoffroy in Fourcroy, 1785) (Myrmeleontidae, Neuroptera)**

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Structural differences between midgut epithelial cells of fed instar antlions' larvae *Euroleon nostras* and starved ones have been analyzed. While representative control cells from fed larvae showed normal morphology without any ultrastructural changes, we found that the starvation could induce morphological changes with ultra structural features of autophagy. These results suggest that autophagy might be induced in these cells by starvation and this could be an important protective mechanism for cell survival for the periods of food deprivation. Additional structural changes in the cytoplasm were seen in the spherites. In fed first instar larvae, the spherites contained an organic matrix (C, N, O) and P, Cl, Ca, Fe. In starved first instar larvae, C, N and P were present. The spherites of fed second instar larvae were rich in organic and inorganic elements and were composed of C, N, O, Na, Mg, P, S, Cl, K, Ca, Mn, Fe and Zn. In starved second instar larvae, N, O, P, Ca and Fe were found. In fed third instar larvae, the spherites contained C, N, O, Na, Mg, P, Cl, K, Ca, Mn, Fe, Co, Zn. In starved third larvae, C, O, Si, Ca, Fe were detected. Generally, the spherites are exploited in starved larvae. These results suggest that the elemental supply of spherites may provide crucial support for physiological processes during starvation periods among *E. nostras* instar larvae.

## **Procesi degradacije v epitelnih celicah srednjega črevesa larv volkcev *Euroleon nostras* (Geoffroy in Fourcroy, 1785) (Myrmeleontidae, Neuroptera)**

Saška LIPOVŠEK<sup>1,2</sup>, Ilse LETOFSKY-PAPST<sup>3</sup>, Ferdinand HOFER<sup>3</sup>, Gerd LEITINGER<sup>4</sup>, Dušan DEVETAK<sup>2</sup>

Proučevali smo strukturo epitelnih celic srednjega črevesa hranjenih in stradanih larv volkcev *Euroleon nostras*. V reprezentativnih kontrolnih celicah hranjenih larv nismo zasledili morfoloških sprememb. V epitelnih celicah stradanih volkcev smo opazili morfološke spremembe, ki nakazujejo proces avtofagije. Na osnovi prisotnosti avtofagosomnih struktur v citoplazmi celic sklepamo, da je lahko avtofagija posledica stradanja larv volkcev in da pomembno prispeva k prilaganju epitelnih celic na stradanje ter s tem na preživetje celic v obdobju stradanja. V celicah stradanih larv smo opazili spremembe tudi v zgradbi sferitov. V hranjenih larvah prvega stadija so sferiti iz organskega matriksa (C, N, O); v slednjem smo dokazali prisotnost P, Cl, Ca in Fe. V stradanih larvah prvega stadija so bili prisotni C, N in P. V sferitih hranjenih larv drugega stadija so bili številni elementi: C, N, O, Na, Mg, P, S, Cl, K, Ca, Mn, Fe in Zn. V stradanih larvah drugega stadija je bilo prisotnih manj kemijskih elementov: N, O, P, Ca in Fe. Sferiti hranjenih larv tretjega stadija so bili zelo bogati: C, N, O, Na, Mg, P, Cl, K, Ca, Mn, Fe, Co in Zn. V sferitih stradanih larv tretjega stadija smo našli C, O, Si, Ca in Fe. Zaključimo lahko, da je v sferitih stradanih larv vseh treh stadijev prisotnih manj kemijskih elementov kot v sferitih hranjenih larv. Sklepamo, da so sferiti pomembno skladišče za organske in anorganske komponente v obdobju stradanja larv volkcev *E. nostras*.

## **New records for the sawfly fauna (Hymenoptera: Symphyta) of Slovenia**

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Since the first collected specimen in 1919, sawflies are randomly collected in Slovenia by several scientists. Most of the species were caught between 1930's and 1940's. After this period there were not many new records until last few years. During field research in the years 2009 to 2011 eight new species of sawflies (Hymenoptera: Symphyta) were found: *Tenthredopsis tischbeinii* (Frivaldszky, 1876), *Macrophya cognata* (Moscáry, 1881), *Pristiphora alnivora* (Hartig, 1840), *Tenthredo maculata* (Geoffroy, 1785), *Tenthredo livida* (Linnaeus, 1776), *Phymatocera aterrima* (Klug, 1814), *Athalia lineolata* (Lepeletier, 1823) and *Athalia glabricollis* (Thomson, 1870). We will present the list of known species of sawflies in Slovenia with new record, and discuss about their ecology and habitats in which they were found.

## **Nove najdbe rastlinskih os (Hymenoptera: Symphyta) v Sloveniji**

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Od leta 1919, ko je bil ulovljen prvi primerek, so rastlinske ose nesistematično zbirali različni raziskovalci. Največ vrst je bilo ujetih v tridesetih in štiridesetih letih prejšnjega stoletja. Od takrat pa vse do pred nekaj leti novih najdb ni bilo zabeleženih. Med terenskim delom med leti 2009 in 2011 je bilo odkritih osem novih vrst za Slovenijo: *Tenthredopsis tischbeinii* (Frivaldszky, 1876), *Macrophya cognata* (Moscáry, 1881), *Pristiphora alnivora* (Hartig, 1840), *Tenthredo maculata* (Geoffroy, 1785), *Tenthredo livida* (Linnaeus, 1776), *Phymatocera aterrima* (Klug, 1814), *Athalia lineolata* (Lepeletier, 1823) and *Athalia glabricollis* (Thomson, 1870). Predstavili bomo listo znanih vrst rastlinskih os v Sloveniji skupaj z novimi najdbami, razpravljali o ekologiji teh vrst ter o habitatih v katerih so bile te vrste najdene.



### Subspecific variability in *Nemastoma bidentatum* (Arachnida, Opiliones, Nemastomatidae)

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*Nemastoma bidentatum* Roewer, 1914, is one of the smaller representatives of the nemastomatid family, with a body measuring about 2 mm in length. Its area ranges from the Alps, over central and eastern Europe, through to northwestern Turkey. In the late 1960s the nominal species was revised and three subspecies were established: besides *Nemastoma bidentatum bidentatum*, these are *N. b. sparsum* Gruber & Martens, 1968, and *N. b. relictum* Gruber & Martens, 1968. All the three taxa live in Austria, the first two occur in Slovenia, while *N. b. sparsum* is the most widespread. Hybrids have been described as *Nemastoma bidentatum bidentatum* x *sparsum*, occurring in a “hybrid area” in Slovenia and Croatia. In southern Austria such intermediate forms are unknown. The two subspecies behave in this zone of parapatric occurrence like *bona fide* species. In the late 1970s, a new morph was alleged to occur on Mt. Snežnik in Slovenia, and was later recognized as a further new subspecies. In the meantime, *N. b. pluridentatum* Hadži, 1973, from Bosnia has been discussed as possibly representing a further valid subspecies. A few years ago, several specimens close to *N. b. bidentatum* and *N. b. sparsum* from isolated populations in Germany were studied in a radical way elucidating some new facts. Very recently, a further new subspecies was discovered in southern Slovenia. There is obviously now a need for a new revision of *Nemastoma bidentatum* in its broader sense. Here, we elucidate unresolved problems, and possible perspectives, for making progress in research about subspecific variability in *N. bidentatum* – a feature which is unique among the European harvestmen.

### Podvrstna variabilnost suhe južine *Nemastoma bidentatum* (Arachnida, Opiliones, Nemastomatidae)

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*Nemastoma bidentatum* Roewer, 1914, je ena manjših predstavnic družine Nemastomatidae, z okrog 2 mm dolgim telesom. Razširjena je od Alp ter v srednji in vzhodni Evropi do severozahodne Turčije. V poznih šestdesetih letih prejšnjega stoletja so bile ob reviziji nominalne vrste prepoznane tri podvrste. Poleg *Nemastoma bidentatum bidentatum*, sta to *N. b. sparsum* Gruber & Martens, 1968, in *N. b. relictum* Gruber & Martens, 1968. Vse tri živijo v Avstriji, prvi dve v Sloveniji, medtem ko je *N. b. sparsum* široko razširjena. Križanci so bili opisani kot *Nemastoma bidentatum bidentatum* x *sparsum* v “hibridni coni” v Sloveniji in Hrvaški. V južni Avstriji se ti parapatrični podvrsti vedeta kot samostojni vrsti, medtem ko osebki z vmesnimi značilnostmi obeh podvrst niso znani. V poznih sedemdesetih letih prejšnjega stoletja je bil omenjen poseben morfotip vrste z Notranjskega Snežnika in kasneje prepoznan kot naslednja nova podvrsta. Medtem je bila *N. b. pluridentatum* Hadži, 1973, iz Bosne omenjena kot možna naslednja veljavna podvrsta. Pred nekaj leti je bila opravljena temeljita študija na številnih osebkih, ki so po morfologiji blizu *N. b. bidentatum* in *N. b. sparsum*, iz izoliranih populacij v Nemčiji, pri čemer so bila izpostavljena nekatera nova dejstva. Pred nedavnim so v južni Sloveniji odkrili nadaljnjo novo podvrsto. Nujna je torej nova revizija vrste *Nemastoma bidentatum* v najširšem smislu. Tukaj predstavljamo nerazrešene težave in perspektive za napredek v raziskovanju podvrstne variabilnosti *N. bidentatum*, ki je edinstvena med evropskimi suhimi južinami.

*Invited lecture / Vabljeno predavanje*

**Genetic and phenotypic divergence in antlion populations along Israel's steep  
Mediterranean to hyper-arid climatic gradient**

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Representative *Myrmeleon hyalinus* populations were sampled along Israel's steep climatic gradient, from the Mediterranean coast in the north to the hyper-arid Arava valley in the south. Neutral genetic divergence was assessed using AFLP analysis and mitochondrial DNA sequence data. To evaluate phenotypic divergence, early instar larvae were raised until completing their life cycle in two environmental chambers simulating Mediterranean and desert climates. Phenotypic differentiation substantially surpassed the neutral expectations set by PhiPT values derived from the genetic analyses, suggesting a predominant role of natural selection over genetic drift as an explanation for the observed phenotypic divergence among populations. Sequence data analyses revealed significant deviations from neutrality expectations. No traces of positive selection could be detected in the sequence data, thus refuting expectations of selective sweep while supporting those of population expansion or background selection. Analysis of the species' demographic history indicated that *M. hyalinus* undergone a range expansion in the Levant within the last 100,000 years.

## Combined pigmentary-iridescent colouration in the eyes of conspecific butterflies

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The males of many pierid butterflies have iridescent wings, due to nanostructured ridges of their cover scales. Iridescence is combined with pigmentary colouration, resulting in a two-peaked reflectance spectrum, with the short-wavelength peak being angle-dependent. We have studied the iridescence in four species of Coliadae (Brimstones *Gonepteryx aspasia*, *G. cleopatra*, *G. rhamni*, the Clouded Yellow *Colias croceus*), and in two species of the Colotis group (the Great Orange Tip *Hebomoia glaucippe* and the Queen Purple Tip *Colotis regina*). Imaging scatterometry demonstrated that the pigmentary colouration is diffuse whereas the structural colouration creates a directional, line-shaped far-field radiation pattern. Angle-dependent reflectance measurements demonstrated that the directional iridescence distinctly varies among closely related species and is determined by the curvature of the scales. The double-peaked colouration with restricted spatial visibility of iridescence presumably plays a role in intraspecific signalling. We used the measured spatial reflectance spectra to model the signal of an iridescent male against the natural backgrounds and infer the visibility of this signal with the set of photoreceptor classes from *Pieris* and *Colias*. We further compare the two-peaked colouration visibility strategy with the white strategy (e.g. *Pieris*, *Curetis acuta*) and the single peak strategy (e.g. *Morpho*, *Callophrys rubi*).

## Kombinirana pigmentna in strukturna obarvanost kril v očeh metuljskih sovrstnikov

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Samci mnogih metuljev iz družine belinov (Pieridae) imajo strukturno obarvano zgornjo stran kril. Obarvanost je posledica nanostruktur – reberc v površinskih luskicah. Kombinacija strukturne in pigmentne obarvanosti se odraža v odbojnem spektru z dvema vrhovoma, pri čemer je valovna dolžina kratkovalovnega vrha odvisna od kota osvetlitve – torej je *iridiscenčna*. Izmerili smo iridiscenco štirih vrst iz poddružine Coliadae (citrončki *Gonepteryx aspasia*, *G. cleopatra* in *G. rhamni*, senožetnik *Colias croceus*) in dveh vrst iz skupine Colotis (*Hebomoia glaucippe*, *Colotis regina*). S pomočjo slikotvorne meritve svetlobnega sipanja (ang. *imaging scatterometry*) smo pokazali, da je pigmentna obarvanost difuzna, medtem ko strukturna obarvanost tvori usmerjen, v trak razpotegnjen radiacijski vzorec v daljnem polju (ang. *far-field*). Meritve kotno-odvisne odbojnosti so pokazale, da je usmerjenost iridiscenčnega vzorca različna tudi med bližnje sorodnimi vrstami. Na usmerjenost v največji meri vpliva ukrivljenost luskic. Dvojnvršna obarvanost z omejeno prostorsko vidnostjo verjetno igra vlogo v znotrajvrstnem sporazumevanju. Odbojne spektre, izmerjene v različnih delih daljnega polja, uporabimo za modeliranje signala, ki ga odboj s krila tvori nasproti naravnemu ozadju, in predpostavimo signale, ki bi jih odboji tvorili v zbiru vidnih receptorjev, kot jih imata *Pieris rapae* ali *Colias erate*. Nadalje primerjamo strategijo vidnosti preko dvovršne obarvanosti s strategijo bele obarvanosti (npr. *Pieris rapae*, *Curetis acuta*) in s strategijo enovršne obarvanosti (npr. *Morpho sp.*, *Callophrys rubi*).

## Ground beetle fauna of termophilic forests of Slovenia

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The knowledge of the distribution of beetle species in Slovenia is weak. To partly fill this gap the importance of termophilic forests on south-exposed slopes on biodiversity of ground beetles was searched. Since the beetles are mainly mesophylic animals, of which occurrence is mainly determined by microclimatic conditions, the south-exposed slopes represent their extreme environment. Seven researched localities in different biogeographic regions in Slovenia were chosen. With pit-fall traps 5214 beetles of 36 species were collected from spring 2002 till spring 2003. Most of the species belong to the European fauna, and only small percent of them have wider area of distribution. Preliminary results suggest that temperature and soil moisture are most important ecological factors that determine species composition of ground beetles. Both factors are crucial for the successful outcome of their embryonic and larval development. In thermophilic forests on southern slopes most abundant species are those with late summer or autumn reproductive period, with overwintering larvae or their reproductive period is indefinite, with slow and asynchronously larval development. Comparison with similar annual studies carried out in Slovenia and surroundings showed that the similarity of species composition is mostly dependent on geographical proximity of the survey sites.

## Favna krešičev termofilnih gozdov Slovenije

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Za boljše razumevanje prisotnosti in razširjenosti vrst krešičev na regionalni ravni, smo raziskali njihovo prisotnost v izbranem okolju, ki za obravnavano skupino predstavlja ekstremne razmere. Mesta raziskave smo izbrali v termofilnih gozdnih sestojih na južnih legah v različnih biogeografskih regijah Slovenije. Na sedmih mestih smo z metodo talnih pasti vzorčili eno leto. Od pomladi 2002 do pomladi 2003 smo ujeli 5214 osebkov 36 vrst. Med vrstami so prevladovale evropsko razširjene vrste in tiste z ožjim južno evropskim vzorcem razširjenosti, manj je bilo vrst s širšim arealom razširjenosti. Glede na številčno pa so močno prevladovali osebki vrst z evropskim vzorcem razširjenosti. Preliminarni rezultati kažejo na to, da so na južnih legah s temperaturne in vlažnostne razmere odločilne t.j. tiste, ki determinirajo favno krešičev. Oba dejavnika sta ključna za uspešen potek embrionalnega in larvalnega razvoja. Zato so tam v večjem številu prisotne vrste, ki imajo nedoločeno obdobje reprodukcije ter z asinhronim larvalnim razvojem, poleg teh pa so na južnih legah številčneje prisotne jesenske vrste, pri katerih prezimijo ličinke. Primerjava vrstne sestave krešičev s podobnimi enoletnimi študijami izvedenimi v Sloveniji in bližnji okolici je pokazala, da je podobnost sestave favne najbolj odvisna od geografske bližine raziskovanih mest.

### **Distribution, taxonomic status, conservation and monitoring of the cave slenderneck beetle (*Leptodirus hochenwartii* Schmidt, 1832)**

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The discovery of the slenderneck beetle in Postojnska jama and Schmidt's scientific description in 1832 caused the first bigger interest for searching of cave fauna. Later on, many new cave localities of this troglobiontic beetle have been found in the Notranjska region. In 1856 Victor Motschoulsky described separate subspecies *L.h. schmidti* from the Dolenjska region and Giuseppe (Josef) Müller in 1904 described the subspecies *L.h. reticulatus* from Trieste Karst. After World War 2, the enthusiastic field work and data gathering performed by Egon Pretner resulted in the description of further two subspecies from Croatia. So far 97 localities of slenderneck beetle are known in Slovenia. Its taxonomical status and the exact subspecies distribution is far from solved. At the moment molecular phylogenetic and taxonomical studies of the species are carried on. In Slovenia the slenderneck beetle is protected by law. The species is listed on the Appendix of the EU Habitat directive. Thus between 2007 and 2009 also in Slovenia we defined and conducted the monitoring of chosen populations of the slenderneck beetle. The detected and possible threats to the species populations are discussed in the paper.

### **Razširjenost, taksonomski status, varstvo in monitoring jamskega hrošča drobnovratnika (*Leptodirus hochenwartii* Schmidt, 1832)**

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Odkritje jamskega hroščka drobnovratnika v Postojnski jami in Schmidtov znanstveni opis leta 1832 je sprožilo prvo večje zanimanje za raziskovanje podzemeljskega živega sveta. Kasneje je bila ta troglobionska vrsta najdena tudi v drugih jamah po Notranjskem. Leta 1856 je Victor Motschoulsky opisal podvrsto *L.h. schmidti* po primerkih na Dolenjskem, leta 1904 pa Giuseppe (Josef) Müller podvrsto *L.h. reticulatus* po primerkih s Tržaškega krasa. V obdobju po drugi svetovni vojni je Egon Pretner požrtvovalno proučeval in zbiral podatke o jamskih hroščih Dinarskega gorstva ter opisal še dve podvrsti iz Hrvaške. V Sloveniji trenutno poznamo 97 nahajališč drobnovratnika. Taksonomski status in razširjenost podvrst pa še nista povsem razjasnjena. Trenutno potekajo molekularne taksonomske in filogenetske raziskave vrste. Drobnovratnik je v Sloveniji zavarovana vrsta. Uvrščen je tudi na prilogo Habitatne direktive EU. Iz tega razloga je bilo v Sloveniji v letih 2007 do 2009 zasnovano in izvajano tudi spremljanje stanja izbranih populacij – monitoring. V prispevku so obravnavani ugotovljeni in morebitni viri ogrožanja populacij te vrste.

## **An endemic species of stoneflies (Insecta, Plecoptera) from NE Italy is actually widely distributed species in Slovenia**

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The known geographical distribution of the stonefly species *Protonemura julia* Nicolai, 1983 (Nemouridae, Amphinemurinae) has been considerably extended with many old, but previously unidentified, records from Slovenia and with some recent records from Croatia. This so-called endemic species of the Italian Julian Alps was found at more than twenty localities in Slovenia and most recently at three karst spring areas in the north-western part of Croatia, in the mountainous region Gorski kotar. Former claims on narrow endemic status of *P. julia* in NE Italy proved to be wrong and today we can see that the geographical distribution of this species spreads from NE Italy and southern Austria through the large part of Slovenia to the northern border of Croatia.

## **Endemična vrsta vrbnice (Insecta, Plecoptera) iz SV Italije je dejansko široko razprostranjena v Sloveniji**

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Geografsko razširjenost vrbnice *Protonemura julia* Nicolai, 1983 (Nemouridae, Amphinemurinae) smo izdatno razširili s številnimi podatki do sedaj neobdelanega materiala iz Slovenije in nekaterimi recentnimi podatki iz Hrvaške. Tako imenovano endemično vrsto italijanskih Julijskih Alp smo ugotovili na več kot 20 nahajališčih v Sloveniji, v zadnjem času pa smo jo našli v treh območjih kraških izvirov na severozahodu Hrvaške v Gorskem Kotarju. Prvotno ozko endemična razširjenost vrste *P. julia* v SV Italiji se je pokazala kot napačna, saj je dejanska razširjenost te vrste od SV Italije in južne Avstrije preko večine Slovenije do severne meje Hrvaške.

## Cellular mechanisms of stimulus-specific adaptation in the tettigoniid TN-1 neuron

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TN-1 is an auditory neuron that detects changes in auditory scenes in tettigoniids. TN-1 adapts rapidly to the sound stimulation with fast pulse rates and fires only a burst of spikes at the beginning of the stimulation. The adapted state persists while such sound stimulation lasts. However, TN-1 does not respond to transient sound pulses presented during the stimulation with the fast pulse rates if the carrier frequencies are sufficiently different. The mechanism of such stimulus specific adaptation is not yet known. Pharmacology investigations along with calcium and sodium imaging revealed transient calcium-related adaptation at the beginning of the fast pulse rate stimulus and slow, tonic sodium-related adaptation. Due to the tonotopic organization of the auditory neuropile, different stimulus frequencies stimulate different dendritic regions of TN-1. Using calcium and sodium imaging we determined 1) that main mechanisms underlying TN-1 adaptation are compartmentalized in the stimulated part of the dendrite, and 2) that such dendritic compartments are dynamically formed, depending on the carrier frequency of the stimulus. This so called dynamic dendritic compartmentalization in TN-1 allows the insect to detect novel stimuli in the auditory scene (e.g. approaching predator) and to take appropriate action.

## Celični mehanizmi od stimulusa odvisne adaptacije nevrona TN-1 dolgotipalčnih kobilic

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Nevron TN-1 dolgotipalčnih kobilic zaznava spremembe v zvočni kulisi okolja. Na dražljaje z visoko ponavljalno frekvenco zvočnih pulzov, kot so npr. zlogi istovrstnega signala, se TN-1 hitro adaptira in se odzove le z nekaj akcijskimi potenciali na začetku draženja. Te dražljaje označujemo kot »adaptirajoče«. Adaptirano stanje nevrona TN-1 traja do konca stimulacije takim dražljajem. Adaptiranemu stanju navkljub, se TN-1 odziva na kratkotrajne zvočne signale, predvajane med stimulacijo z »adaptirajočim dražljajem«. Pogoji so, da se dražljaja zadostno ločita v osnovni frekvenci zvoka. Mehanizem te adaptacije, vezane na tak specifičen tip stimulusa, ni poznan.

Farmakološke preiskave in uporaba fluorescentnih kalcijevih in natrijevih indikatorjev so pokazale dva mehanizma adaptacije. Začetna, od kalcija odvisna adaptacija, je hitra in prehodne narave. Od natrija odvisna adaptacija je počasnejša in traja dokler traja stimulacija z adaptirajočim signalom.

Zaradi tonotopične organizacije avditorne nevropile, zvočni dražljaji različnih osnovnih frekvenc aktivirajo različne dendritske regije v TN-1. Z uporabo fluorescentnih kalcijevih in natrijevih indikatorjev smo ugotovili sledeče: 1) da so glavni mehanizmi adaptacije nevrona TN-1 omejeni na aktivirano dendritsko regijo in 2) da se lokacija adaptacijskih procesov v dendritskem drevesu dinamično spreminja in zavisi od zvočne frekvence dražljaja.

Ta, t.i. »dinamična dendritična kompartmentalizacija« adaptacijskih procesov v nevronu TN-1, omogoča kobilici zaznavanje novosti v okoljski zvočni kulisi (npr. približevanje plenilca).

## **Value of faunistical data in some aquatic insects**

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Faunistical data are basis for Red list of organisms, evaluations of human impacts on the environment, protection of natural environment and similar. It is easier if there is well done faunistical survey of particular area. It is quite different when we have nearly no or very scarce faunistical data of particular group of organisms. Recently, more and more intense and unpredictable changes in natural environment are bringing more complications and problems.

Situation of stoneflies (Plecoptera) here in Slovenia is presented and discussed.

## **Pomen favnističnih podatkov nekaterih vodnih žuželk**

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Favnistični podatki neke skupine organizmov so lahko osnova za izdelavo rdečih seznamov, ocene vplivov na okolje, varovanje naravnega okolja in podobno. To je mnogo lažje, če imamo na razpolago podrobne in natančne favnistične preglede nekega območja. Povsem drugače pa je kadar o neki skupini organizmov nimamo na razpolago skoraj nobenih ali zelo skromne in nepopolne favnistične podatke. Vse bolj intenzivne in nepredvidljive spremembe naravnega okolja v zadnjem času predstavljajo le še dodatne zaplete in probleme.

Predstavljamo in diskutiramo o stanju vrbnic (Plecoptera) pri nas v Sloveniji.



## **Mating behaviour and communication in the cave crickets *Troglophilus neglectus* and *T. cavicola* (Orthoptera: Rhabdophoridae)**

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Cave crickets (Rhabdophoridae) are presumably the most primitive Ensifera, with so far unknown process of mating communication. We have described and compared mating behaviour and signalling in *Troglophilus neglectus* and *T. cavicola*, which occur syntopically in Slovenian caves. In pre mating we observed protrusion of abdominal scent glands in *T. neglectus*, but not in *T. cavicola*. In the former, gland protrusion did not obligatorily precede courtship and did not influence mating success. A high coincidence of such signalling among the neighbouring males, while in isolation or in the contact, suggests the function of excretions in mate calling and in agonistic interactions. Using laser vibrometry we further demonstrated that males of both species produce vibratory signals by tremulation, which constitutes an obligatory part of courtship in *T. neglectus* and of post-copulatory behaviour in both species. Carrier frequencies of these signals are extremely low, ranging in both species from 16–60 Hz when recorded from bark. Temporal characteristic of post-copulation signals are similar among the species. Duration of the whole mating process is about five-times longer in *T. cavicola* compared to *T. neglectus*. Differences in signalling and mating duration among the species can be explained by their ecological differences.

## **Paritveno vedenje in komunikacija jamskih kobilic *Troglophilus neglectus* in *T. cavicola* (Orthoptera: Rhabdophoridae)**

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Jamske kobilice (Rhabdophoridae) so domnevno najprimitivnejše dolgotipalčnice s še nepoznanim načinom komunikacije. Opisali in primerjali smo potek parjenja in način signalizacije pri vrstah *Troglophilus neglectus* in *T. cavicola*, ki se pojavljata sintopično v slovenskih jamah. Pred parjenjem so samci vrste *T. neglectus* izbočali vonjalne žleze na zadku, česar pri *T. cavicola* nismo opazili. Pri prvih se to vedenje pred dvorjenjem ni pojavilo vedno in ni vplivalo na paritveni uspeh. Visok delež sočasnega izbočanja žlez med pari samcev, ki so bili v izolaciji oz. v medsebojnem kontaktu, nakazuje funkcijo izločkov pri privabljanju samic oz. tekmovalnih interakcijah. Z lasersko vibrometrijo smo nadalje dokazali, da samci obeh vrst oddajajo vibracijske signale s tremulacijo, ki je sestavni del dvorjenja pri vrsti *T. neglectus* oz. post-kopulacijskega vedenja obeh vrst. Nosilne frekvence teh signalov, posnetih z lubja, so izjemno nizke in pri obeh vrstah v območju med 16–60 Hz. Časovne značilnosti post-kopulacijskih signalov so med vrstama podobne. Trajanje celotnega paritvenega procesa je pri vrsti *T. cavicola* okrog petkrat daljše kot pri vrsti *T. neglectus*. Razlike v načinu signalizacije in trajanju parjenja med vrstama so razložljive z njunimi ekološkimi razlikami.

## **Present status and distribution of mountain cicadas (*Cicadetta montana sensu lato*) in Europe**

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The Palaearctic mountain cicadas were considered as one and the same species, *Cicadetta montana* Scopoli, 1772. Small differences in the form of the wings, the colour of venation and patterns on the thorax were considered to be characteristics of local forms or subspecies. Bioacoustic investigations during the last fifteen years have shown that this taxon is actually a complex of sibling species, which can be best distinguished by their calling song structures. At present time 12 species are described from Europe and there is enough material and recordings for at least two more. These bioacoustic data are supported also by molecular analysis. Therefore a distribution of various species of this complex should be determined again. This has been done till now for some regions or countries like Slovenia, France, Switzerland, Austria (partly), Italy (partly), Poland, Montenegro, Romania, Macedonia, Bulgaria and Greece. A good example for this is a distribution of species of this complex in S.E. Europe, where the usual sympatric occurrence suddenly changes to aloptry in other endemic species.

## **Poznavanje in razširjenost gorskih škržadov (*Cicadetta montana sensu lato*) v Evropi**

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Palearktični gorski škržadi so do nedavna veljali za eno samo vrsto, *Cicadetta montana* Scopoli, 1772. Majhne razlike v obliki kril, obarvanosti žil na krilih in vzorcih na oprsju so veljali za razlikovalne znake le med lokalnimi formami ali podvrstami. Bioakustične raziskave v zadnjih petnajstih letih pa so pokazale, da so gorski škržadi kompleks sestrskih vrst, ki jih med seboj razlikujemo po strukturi napeva. Trenutno je iz Evrope opisanih 12 vrst, obstaja pa dovolj gradiva (akustično preverjenih primerkov in zvočnih posnetkov napevov) za opis še najmanj dveh vrst. Bioakustični podatki sovpadajo tudi z rezultati molekularno filogenetskih raziskav. Iz navedenih razlogov je potrebno ponovno določiti geografsko razširjenost različnih vrst gorskih škržadov, kar smo že naredili za Slovenijo, Francijo, Švico, Avstrijo (delno), Italijo (delno), Poljsko, Črno goro, Romunijo, Makedonijo, Bolgarijo in Grčijo. V jugovzhodni Evropi opazimo nenaden preskok iz običajne simpatrične razširjenosti večih vrst v alopatričnost endemičnih vrst.

## **The Butterfly Atlas of Slovenia – at the finish line**

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The Atlas project started in 2001 by the Society for research and conservation of Lepidoptera in Slovenia in cooperation with Centre for Cartography of Fauna and Flora. Data collation covered literature records, butterfly collections, and unpublished observations. In the last decade active surveys directed towards less studied regions were organized to achieve wider coverage. In total more than 200.000 records were collated, mostly from field observations (77%). Literature data covered 408 bibliographic units and 30.585 records. Major collection of the Slovenian Natural History Museum and several private collections added 15.636 records. As spatially broad sampling was a priority, and also due to limited number of active observers, the coverage is far from uniform with several regions under- or over-studied. Thus the main 'grey' areas are in Kočevska region and parts of Dolenjska and Štajerska. However, only 3% of all UTM 5x5 km squares were not surveyed, mostly marginal squares with less than 20% of the area in Slovenia. The Primorska region, Kraški rob and Vipava valley in particular, remain to be the hot spot of butterfly diversity in Slovenia. Additionally the predominantly low intensity agricultural regions like Haloze and Goričko proved to be important centers of butterfly diversity and core distribution areas of many threatened species. The Atlas provides a good overview of the recent distribution of the butterflies in Slovenia and should be considered as a powerful tool for nature conservation.

## **Atlas dnevnih metuljev Slovenije – na ciljni črti**

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Projekt atlasa dnevnih metuljev se je začel v letu 2001 na pobudo Društva za proučevanje in ohranjanje metuljev Slovenije v sodelovanju s Centrom za kartografijo favne in flore. Viri podatkov so literaturne navedbe, entomološke zbirke in terenska opažanja. V zadnjem desetletju so bile terenske raziskave usmerjene predvsem v slabše raziskana regije, da bi dosegli večjo pokritost Slovenije. Skupaj je bilo zbranih več kot 200.000 podatkov, od tega 77 % iz terenskih opažanj. Pregled literature vsebuje 408 bibliografskih enot in 30.585 podatkov, zbirke pa dodajo še 15.636 podatkov predvsem iz centralne zbirke v Prirodoslovnem muzeju Slovenije. Ker je bila prioriteta popisovanj predvsem čim širše pokrivanje slabo raziskanih območij, ter tudi zaradi malega števila aktivnih popisovalcev, razporeditev podatkov ni enakomerna. Tako med slabše raziskanimi območji velja izpostaviti Kočevsko, pa tudi nekateri predeli Štajerske in Dolenjske. Skupno so zbrani podatki kar za 97 % UTM 5x5 km kvadratov, manjkajo predvsem iz robnih kvadratov kjer je delež teritorija Slovenije manjši od 20 %. Glavna vroča točka diverzitete metuljev ostaja Primorska, še posebej Kraški rob in Vipavska dolina. Poleg tega izstopajo tudi regije s pretežno tradicionalno kulturno krajino, kot sta Haloze in Goričko, ki sta ključna tudi kot glavni območji razširjenosti nekaterih ogroženih vrst. Ta atlas podaja dober pregled sedanje razširjenosti dnevnih metuljev v Sloveniji in ga zato lahko smatramo kot enega ključnih naravovarstvenih orodij.

## **Influence of species traits on the changes of carabid (Carabidae) community structure along cave environment gradient**

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We investigated change of carabid beetle community structure along surface-cave gradient in respect to species traits due to species size and eye reduction. Larger beetles were in general more abundant outside or at the entrance of the caves, while smaller beetles in the caves, but all were positively affected by prey abundance. Larger species were also positively affected by organic matter, while smaller carabids negatively by predator abundance. Reduced eyes were present only in medium and small sized species. These species were negatively associated with the amount of organic matter and predator abundance, but positively with prey abundance. It appeared that species traits have large influence on the carabid community structure in specific cave environment due to differential species response to mainly biotic environmental conditions.

## **Vpliv vrstnih značilnosti na spremembe v strukturi združbe krešičev (Carabidae) prek jamskega okoljskega gradienta**

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Glede na vrstne značilnosti, to je velikost in redukcija oči, smo preučevali spremembo združbe krešičev v okoljskem gradientu med površino in jamo. V splošnem so bili večji krešiči številnejši na površini in ob jamskem vhodu, majhne vrste pa v jami. Pri vseh vrstah pa se je pokazala pozitivna povezava s številčnostjo plena. Večje vrste so kazale tudi pozitivno povezavo z vsebnostjo organske mase v tleh, na male vrste pa je negativno vplivala večja številčnost vsaj potencialnih plenilcev. Vrste z reduciranimi očmi so se pojavljale le v srednjem in majhnem velikostnem razredu. Številčnost teh vrst je bila v negativni povezavi z vsebnostjo organske mase v tleh in številom plenilcev, pozitiven odnos pa se je pokazal glede na številčnost plena. Kot kaže imajo vrstne značilnosti velik vpliv na sestav združbe krešičev v specifičnem jamskem okolju zaradi različnega odziva vrst na pretežno biotske razmere v okolju.

## **Biology and ecology of cerambycid *Morimus funereus*, species of conservation importance, in Slovenia**

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The cerambycid *Morimus funereus* is a polyphagous, flightless and saproxylic beetle typical for lowland and montane forests of E and SE Europe. It is included to EU Habitat Directive. In general it was known as daytime active animal attracted to freshly cut down wood. The adults can hibernate with two years of life-span. In 2008 and 2009 we conduct large-scale survey of species on freshly cut down wood, predominantly stumps, within known distribution range in Slovenia. In laboratory we measured species diurnal activity and food preferences of imagos according to consumed amount of tree bark. Our results indicate that *Morimus funereus* is predominantly nocturnal animal. We have found two peaks of seasonal activity: in the first half of May, and in the second half of June. Proportionally the species selected significantly more frequently stumps or wood of *Quercus* and *Abies*, but less *Fagus* and *Picea*. Also in the laboratory the species showed significant food preferences with exceedingly consumed tree species being *Sambucus*, *Juglans*, *Quercus*, *Alnus*, *Populus* and *Tilia*. The species was found from 150 to 1240 m asl. For the purpose of monitoring survey method we tested the efficiency of two methods in the field, survey of freshly cut wood and trapping method.

## **Biologija in ekologija varstveno pomembnega bukovega kozlička (*Morimus funereus*) v Sloveniji**

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Bukov kozliček (*Morimus funereus*) je polifagna, neleteča in saproksilna vrsta nižinskih in gorskih gozdov vzhodne in jugovzhodne Evrope. Vrsta je navedena na prilogi Direktive o habitatih. V splošnem je vrsta poznana kot dnevno aktivna, ki jo privlači sveže požagan les. Odrasli hrošči so dolgoživi, saj živijo dve leti z vmesnim obdobjem hibernacije. V letih 2008 in 2009 smo izvedli širokoprostorski popis vrste na sveže požaganem lesu, pretežno štorih, znotraj znanega območja razširjenosti vrste v Sloveniji. Dodatno smo v laboratoriju opazovali dnevno-nočno aktivnost osebkov in preference odraslih pri prehranjevanju s primerjavo relativne obžrtosti drevesnega lubja različnih drevesnih vrst. Rezultati kažejo, da je bukov kozliček pretežno nočno aktivna vrsta. V sezonski aktivnosti smo ugotovili dva vrhova: v prvi polovici maja in v drugi polovici junija. Glede na razmerja drevesnih vrst pregledanih lesnih enot, vrsta značilno v večjem deležu izbira hrast in jelko, manj pa bukev in smreko. Značilne preference so odrasli hrošči kazali tudi v laboratorijskih prehranskih poskusih, kjer so se v večjem deležu prehranjevali z lubjem bezga, oreha, hrasta, jelše, topola in lipe. Višinska razširjenost bukovega kozlička v Sloveniji se razteza med 150 in 1240 m n.v. Za namene razvoja metode monitoringa smo na terenu testirali učinkovitost dveh metod vzorčenja: popis sveže posekanega lesa in lov s pastmi.

## Habitat selection of the Large Blue (*Phengaris arion*) in western Haloze

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The Large Blue (*Phengaris arion*) is highly ecologically specialized butterfly species, whose development is restricted to the larval host plant *Thymus* spp. or *Origanum vulgare* and the specific species of red ants of the genus *Myrmica*. It's distributed from Julian Alps on the west, over Kamniško Savinjske Alps, Posavje hills, Haloze, Pohorje and Kozjak to Goričko in the north east. In the east its range extends towards south through Kozjansko hills to Bela krajina. In years 2010 and 2011 the western part of Haloze was surveyed during establishing of the monitoring of the Large Blue. Two hundred and sixty seven plots of potential habitat were visited, and at least one of larval food plant was found on 100 sampling plots. The large blue was found on 61 plots, sometimes in large numbers, up to 21 individuals per sampling plot. For the species, which is usually found in low densities, this is a very high density. It turned out, that *Origanum vulgare* is particularly important as a larval food plant in Haloze and oviposition on it was observed on several occasions. Analyses of sampling plots and habitat types have shown that the habitat type of dry and semi-dry grasslands with *Bromus erectus* most frequently occupied by the Large Blue. Due to the Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (6210(\*)) Haloze are designated as a Natura 2000 site. Thus, by maintaining the qualifying habitat type in good condition will provide long term protection of the Large Blue in this region.

## Izbira habitata velikega mravljiščarja (*Phengaris arion*) v zahodnih Halozah

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Veliki mravljiščar (*Phengaris arion*) je ozko ekološko specializirana vrsta dnevnega metulja, katere razvoj je vezan na hranilno rastlino materino dušico (*Thymus* spp.) ali navadno dobro misel (*Origanum vulgare*) ter določene vrste rdečih mravelj iz rodu *Myrmica*. Pri nas je razširjen od Julijskih Alp na zahodu, preko Kamniško Savinjskih Alp, Posavskega hribovja, Haloz, Pohorja in Kozjaka do Goriškega na severovzhodu, na vzhodu države pa sega preko Kozjanskega še na jug do Bele krajine. V letih 2010 in 2011 smo za namen vzpostavitve monitoringa za to vrstoraziskali območje zahodnih Haloz. Pregledali smo 267 ploskev s potencialnih habitatom in vsaj eno od hranilnih rastlin našli na 100 vzorčnih ploskvah. Velikega mravljiščarja smo našli na 61 ploskvah, ponekod tudi v velikem številu, največ 21 osebkov na ploskev. To je za vrsto, ki se večinoma pojavlja v nizkih gostah, izjemno velika številčnost. Izkazalo se je, da je v Halozah kot hranilna rastlina pomembna predvsem navadna dobra misel, na kateri je bila tudi večkrat opazovana ovipozicija. Analiza vzorčnih ploskev in habitatnih tipov je pokazala, da vrstava Halozah poseljuje predvsem habitatni tip srednjeevropskih zmerno suhih travnišč s prevladujočo stoklaso. Zaradi polnaravnih suhih travnišč in grmiščne faze na karbonatnih tleh (Festuco-Brometalia) (6210(\*)) so Haloze med drugim opredeljene kot Natura 2000 območje. Tako bo z ohranjanjem kvalifikacijskega habitatnega tipa v ugodnem stanju omogočena tudi trajna zaščita velikega mravljiščarja na tem območju.

## **Coding of Temporal Parameters of the Substrate-Borne Vibratory Songs in the CNS of the Southern Green Stinkbug *Nezara viridula* (L.)**

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Substrate-borne vibratory communication plays an important role during long-range calling and short-range courtship communication in many small plant dwelling insects. During mating, males and females of *N. viridula* produce sex- and species-specific vibratory songs. We examined their temporal processing by first order vibratory interneurons. The stimulus sequence consisted of 30 pulse duration/interval duration (PD/ID) combinations. Four sine wave pulses of 105 Hz were played for each PD/ID combination. The neurons' responses to these vibratory stimuli were analyzed and two response arrays were created for each neuron, showing the intensity of the response either as mean or as peak instantaneous spike rate.

Mean spike rate response arrays mostly showed selectivity for short pulse durations (below 500 ms) and no selectivity towards interval durations, while the peak spike rate response arrays exhibited either short PD/long ID selectivity or no selectivity at all. The long PD/short ID stimulus combinations elicited the weakest responses in all neurons tested. No response arrays showed receiver preference for either constant period or duty cycle. The data gathered so far matches the temporal characteristics of *N. viridula* male calling songs and points to temporal filtering of the vibratory signals already at lower levels of signal processing.

## **Kodiranje časovnih parametrov vibracijskega napeva na nivoju centralnega živčevja pri stenici vrste *Nezara viridula* (L.)**

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Komunikacija z vibracijskimi signali po rastlinah ima velik pomen za številne žuželke; zlasti so pomembni vrstno- in spolno-specifični signali, združeni v napeve, ki jih žuželke oddajajo v času parjenja. Pri zeleni smrdljivki (*N. viridula*), smo raziskali procesiranje časovnih parametrov vibracijskih signalov na nivoju vzpenjajočih nevronov, ki prevajajo informacijo o dražljaju s periferije proti možganom. Zaporedje dražljajev smo sestavili iz 30 kombinacij pulz/interval z različnimi dolžinami obeh parametrov (*pulse duration/interval duration* (PD/ID) combinations). Rezultate smo predstavili v obliki dveh tipov matrik; jakost odziva nevronov smo predstavili s povprečno frekvenco akcijskih potencialov ter z njihovo maksimalno frekvenco.

Matrike prvega tipa so pokazale selektivnost nevronov za kratke pulze (pod 500 ms) in nobene selektivnosti glede dolžine intervalov, medtem ko so matrike drugega tipa pokazale ali selektivnost za kombinacijo kratek PD/dolg ID ali pa nobene selektivnosti. Najmanjši odziv pri vseh nevronih so sprožile kombinacije dolg PD/kratek ID. Nobena od matrik ni pokazala preference za konstantno periodo ali pa razmerje med pulzom in ponavljalnim intervalom. Selektivnost raziskanih vzpenjajočih nevronov se ujema s časovnimi parametri nekaterih napevov samcev pri *N. viridula*, kar kaže, da prihaja do filtriranja intraspecifičnih vibracijskih napevov že na nivoju vzpenjajočih nevronov in da razpoznavanje napeva iste vrste ni omejeno zgolj na možganski ganglij.

## **Chemical Communication of Longhorn Beetles, example of *Ortholeptura valida* (Cerambycidae: Lepturinae)**

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Chemical signals are likely the oldest, most widespread means of animal communication especially among insects. Insects use semiochemicals to find food and suitable hosts, for species and gender recognition, for mediating reproduction, and social organization. The longhorn beetles (Cerambycidae) are one of the most charismatic families of insects. Because many species feed on dead or dying wood, they play a fundamental role in the forest ecosystem and initiate the biodeterioration of woody tissue. However, some species are among the most important insect pests worldwide. The pheromones that mediate their intra-specific communication and reproductive behaviours received little attention. Some species rely solely on volatile pheromones to bring the sexes together, whereas others are most attracted to combinations of pheromones with host plant odours. The long-term goal of the project is to identify and elucidate patterns in the use of pheromones within the family, and to understand the chemistry of the bioactive compounds. Identifying and determining the functions of pheromones provides the foundation for efficient, selective, and environmentally friendly methods of detecting, monitoring, and controlling longhorn beetles. Here, we report structure and field-bioassays of a female-produced sex attractant pheromone component of the cerambycid beetle *Ortholeptura valida* (subfamily Lepturinae).

## **Kemična komunikacija pri kozličkih, primer *Ortholeptura valida* (Cerambycidae: Lepturinae)**

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Komunikacija s pomočjo kemičnih signalov je ena najstarejših in najbolj razširjenih oblik sporazumevanja v živalskem svetu. Kemični signali žuželkam služijo pri iskanju hrane, za medsebojno prepoznavanje, privabljanje osebkov iste vrste in nasprotnega spola, so pomemben element paritvenega vedenja ter omogočajo socialno organiziranost. Hrošči iz družine kozličkov (Cerambycidae) predstavljajo eno najbolj karizmatičnih in najštevilčnejših skupin žuželk. Številne vrste se prehranjujejo in reciklirajo odmrle lesne ostanke in so kot take izredno pomemben člen gozdnega ekosistema. Po drugi strani, so številne vrste prepoznane kot nevarni škodljivci. Kemični signali, ki so pomembni za znotrajvrstno komunikacijo in paritveno vedenje so pri kozličkih še slabo raziskani. Nekatere vrste za privabljanje in prepoznavanje spolnega partnerja uporabljajo zgolj feromone, medtem ko se nekatere druge vrste najbolje odzivajo na kombinacijo feromonov in hlapljivih snovi gostiteljskih rastlin. Dolgoročni cilj projekta je ugotoviti vzorce uporabe feromonov in identificirati njihovo strukturo za celotno družino kozličkov. Poznavanje funkcije feromonov je pomembno za nadaljnje študije in razvoj učinkovitih in okolju prijaznih metod za detekcijo, monitoring in kontrolo kozličkov. Predstavili bomo strukturo in biološko funkcijo spolno specifične sestavine feromona pri vrsti *Ortholeptura valida* (podružina Lepturinae).



## Poster presentations / Posterji

### ***Gasterocercus depressirostris* (Fabricius 1792), a weevil (Curculionidea, Coleoptera) new for the fauna in Slovenia**

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The weevil fauna (Curculionidea, Coleoptera) of Slovenia has counted around 830 species, however, the more likely number of species according to our recent surveys is over 900 species. This reflects our poor knowledge of this beetle group diversity in Slovenia.

While sampling with light traps the beetles of the village Police near Gornja Radgona in 2004, a new species of weevils *Gasterocercus depressirostris* (Fabricius 1792) for the fauna of Slovenia was found. This weevil is a rare and endangered relict European species that lives in the primary beech and oak stands (*Quercus-Carpinetum* s. lat.). It is known from certain areas in France, Switzerland (doubtful), Germany, Czech Republic, Slovakia, Austria, Italy, Hungary, Moldova, Poland, Romania, Bulgaria, Ukraine and south Russia. Some countries (Austria, Germany, Hungary and Poland) included the species on their red lists.

We believe that *G. depressirostris* is a rare and endangered species in Slovenia. It lives in oak-hornbeam stands only in north-eastern part of Štajerska. We suggest its inclusion in the Red list of endangered beetles of Slovenia. So far, we only managed to find three specimens of this species despite numerous samplings over the last 10 years. The examined material is deposited at the Jovan Hadži Institute of Biology SRC SASA, Ljubljana.

### ***Gasterocercus depressirostris* (Fabricius 1792), nov rilčkar (Curculionidea, Coleoptera) v favni Slovenije**

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V favni rilčkarjev (Curculionidea, Coleoptera) Slovenije je bilo doslej znanih okrog 830 vrst. Favniščne raziskave hroščev rilčkarjev v zadnjih dveh desetletjih kažejo, da živi v Sloveniji več kot 900 vrst rilčkarjev. Doslej je bila ta skupina hroščev še slabo raziskana, medtem ko je gradivo raziskav zadnjih let še v obdelavi. Med vzorčenjem favne okolice kraja Police pri Gornji Radgoni v letu 2004 smo s pomočjo svetlobnih pasti ujeli za Slovenijo novo vrsto in hkrati nov rod rilčkarja *Gasterocercus depressirostris* (Fabricius 1792). Ta rilčkar je redka in ogrožena reliktna evropska vrsta, ki živi v primarnih hrastovo gabrovih gozdovih (*Quercus-Carpinetum* s.lat.). Poznana je iz nekaterih območij v Franciji, Švici (dvomeče prisotni), Nemčiji, Češki, Slovaški, Avstriji, Italiji, Madžarski, Moldaviji, Poljski, Romuniji, Bolgariji, Ukrajini in južni Rusiji. V nekaterih državah (Avstrija, Nemčija, Madžarska in Poljska) je vključena v Rdeči seznam ogroženih vrst.

*G. depressirostris* je v Sloveniji prav tako zelo redka in ogrožena vrsta, saj živi le v hrastovo gabrovih sestojih v severovzhodni Štajerski, zato predlagamo njeno uvrstitev v rdeči seznam ogroženih hroščev Slovenije. Doslej so bili ujeti le 3 primerki te vrste, kljub številnim vzorčenjem s svetlobnimi pastmi ali z lovom z entomološkimi pripomočki (npr. mrežami) v obdobju zadnjih 10 let. Primerki so shranjeni v koleopterološki zbirki Biološkega inštituta Jovana Hadžija ZRC SAZU v Ljubljani.

***Cydalima perspectalis* (Walker 1859) (Lepidoptera: Crambidae),  
Box Tree Moth, new moth species in Slovenia**

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*Cydalima perspectalis* (Walker, 1859), Box Tree Moth, is known in Europe as allochthonous and invasive moth species (Crambidae). In Slovenia, its presence was first confirmed in August 2011 in Ključarovci (Eastern Slovenia). Moths are large 3 to 4 cm and usually white - black colored. They are good fliers and active during the day and night. Caterpillars are fed mainly on leaves of boxwood (*Buxus sempervirens*) and can cause great damage. The expected spread of *Cydalima perspectalis* through Slovenia could affect the plant nurseries, as well the historical and decorative gardens where the boxwood is an important design component. It could also threaten the native boxwood habitats. Natural prevalence of *Cydalima perspectalis* is Eastern Asia. In Europe it was first observed in Germany in 2007, came with the remote transportation of boxwood seedlings. In the following years it has spread to Belgium, the Netherlands, Great Britain, France, Switzerland and Lichtenstein. Since 2009 the moth is also known from the vicinity of Graz in Austria from where it is likely to expand into Slovenia. In autumn 2011 the *Cydalima perspectalis* has also been observed in Hungary.

***Cydalima perspectalis* (Walker 1859) (Lepidoptera: Crambidae),  
pušpanova vešča, nova vrsta metulja v Sloveniji**

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Pušpanova vešča (*Cydalima perspectalis*) je v Evropi znana kot alohtona in invazivna vrsta metulja iz družine Crambidae. V Sloveniji je bila njena prisotnost prvič potrjena avgusta 2011 v Ključarovcih v Pomurju. Metulji so veliki 3 do 4 cm in navadno belo - črno obarvani. So dobri letalci ter aktivni podnevi in ponoči. Gosenice se hranijo predvsem z listi pušpana (*Buxus sempervirens*) in lahko povzročajo veliko škodo. Pričakovano širjenje pušpanove vešče po Sloveniji bi lahko ogrozilo drevesnice za vzgojo okrasnih rastlin ter okrasne in zgodovinske vrtove v katerih je pušpan pomembna oblikovalska komponenta. Lahko bi prišlo tudi do ogrožanja rastišč pušpana v naravi. Naravna razširjenost *Cydalime perspectalis* je vzhodna Azija. V Evropi se je najprej pojavila v Nemčiji leta 2007 kamor je prišla z daljinskim transportom sadik pušpana. V naslednjih letih se je razširila v Belgijo, Nizozemsko, Veliko Britanijo, Francijo, Švico in Lichtenstein. Od leta 2009 je znana tudi iz okolice Gradca v Avstriji od koder se je verjetno razširila v Slovenijo. Jeseni 2011 je bila ugotovljena tudi na Madžarskem.

## **Overview of parasitoids associated with *Ips typographus* (Coleoptera, Scolytinae) in Europe and first results of parasitoid entomofauna research in Altimontane belt of Slovenia (Pohorje)**

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*Ips typographus* is ecologically and economically a very important species for European spruce forests. Parasitoids are known to be an important factor in population density regulation of European spruce bark beetle. In certain parts of Europe the parasitoid complex associated with *Ips typographus* has already been studied. We reviewed the confirmed parasitoids of *I. typographus* in Europe. In our preliminary study of the parasitoid complex of the discussed species in 2011, we collected bark samples from trees infested with *I. typographus* in spruce stands (*Picea abies* (L.) Karst.) in the altimontane belt of Slovenia (Pohorje region). The samples were taken at different altitudes, 500, 800 and 1000 m above sea level. All bark samples from the same location were reared in laboratory conditions in rearing cages. After 3 months of rearing the gathered material was processed. Hymenopteran parasitoids of bark beetles were determined to species level and a list of species for each location was made. Species diversity of each sampling site was calculated. As predicted, greater species diversity was found at lower elevations. Most species belonged to the Pteromalidae and Braconidae family.

## **Pregled parazitoidov povezanih z vrsto *Ips typographus* (Coleoptera, Scolytinae) v Evropi ter prvi izsledki raziskovanja parazitoidne entomofavne v altimontanskem pasu Slovenije (Pohorje)**

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*Ips typographus* je ekološko in gospodarsko zelo pomembna vrsta v smrekovih gozdovih Evrope. Za parazitoide osmerozobega smrekovega lubadarja je znano, da lahko imajo pomembno vlogo pri regulaciji velikosti njegove populacije. V nekaterih predelih Evrope so že raziskovali z njim povezan parazitoidni kompleks. Naredili smo pregled potrjenih parazitoidov za *I. typographus* v Evropi. V preliminarni raziskavi parazitoidnega kompleksa obravnavane vrste v letu 2011 smo zbrali vzorce skorje smrek, napadenih z vrsto *I. typographus* v altimontanskem pasu Slovenije (Pohorje) v sestojih navadne smreke (*Picea abies* (L.) Karst.). Vzorci so bili odvzeti na različnih nadmorskih višinah, 500, 800 in 1000 m. Vse vzorce skorje iz iste lokacije smo gojili v laboratorijskih razmerah v entomoloških zabojih. Po 3. mesecih smo obdelali material. Parazitoide podlubnikov, ki pripadajo redu Hymenoptera, smo določili do ravni vrste in naredili seznam vrst za vsako lokacijo. Za vsako vzorčno mesto smo izračunali vrstno pestrost. Po pričakovanjih je bila vrstna pestrost nižje ležečih lokacij višja. Prevladovale so vrste iz družin Pteromalidae in Braconidae.

## **Distribution and conservation of Hermit beetle *Osmoderma eremita* on study area Slovenske Gorice (Coleoptera: Scarabaeidae)**

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The researched area comprises more than 11.000 hectares between 230 and 570 m. a.s.l. in forest and cultural landscape of north-western part of Slovenske Gorice. Hermit beetle from the family Scarabaeidae is protected by Berne Convention and FFH Directive of the European Council. According to the last it is declared as a priority species of special conservation concern. At the moment is Hermit beetle *Osmoderma eremita* in Slovenia highly endangered and only poorly known saproxylic beetle species. Data have been collected by observations and measurements in the period 2005-2010. The presence of hermit beetle has been confirmed in 33 trees. Considering limited radius of its dispersal, which amounts to maximally 200 meters, 10 new localities were discovered. In the given period altogether 41 adults, 43 larvae and 18 different remains of dead adult animals were found. According to the hereto proposed network of Natura 2000 sites in Slovenia, which are still considered as insufficient in the context of beetles, the hermit beetle is proposed as a qualifying species for only two pSCI areas. In the frame of biogeographic seminars for alpine and continental region on the EU level, these proposals were judged as very deficient, what means a clear demand for detailed research of the species and its habitat as well as demand for additional conservation sites proclamations. New data on the distribution of species in NW part of Slovenske Gorice will be an important foundation for a new pSCI proposal for hermit beetle in north-eastern Slovenia.

## **Razširjenost in ohranjanje puščavnika *Osmoderma eremita* na primeru Slovenskih Goric (Coleoptera: Scarabaeidae)**

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Območje raziskave obsega več kot 11.000 hektarjev med 230 in 570 metri nadmorske višine v gozdni in kulturni krajini severozahodnega dela Slovenskih Goric. Iz družine hroščev Scarabaeidae je puščavnik *Osmoderma eremita* zavarovan z Bernsko konvencijo in FFH Direktivo Sveta Evrope – slednja ga opredeljuje kot varstveno prioriteto oz. prednostno vrsto. Trenutno velja da je v Sloveniji puščavnik močno ogrožena in slabo poznana saproksilna vrsta hrošča. Podatke smo pridobili z opazovanji in meritvami na terenu v obdobju 2005-2010. Prisotnost puščavnika smo potrdili na 33 drevesih. Z upoštevanjem maksimalnega radija leta puščavnika, ki znaša največ 200 metrov, gre za 10 novih lokacij. V tem obdobju smo našli skupno 41 odraslih primerkov, 43 ličink in 18 različnih ostankov poginulih odraslih živali. Po doslej predlaganem omrežju Natura 2000 območij v Sloveniji, ki je v kontekstu hroščev ocenjeno kot še vedno nezadostno, je puščavnik kot kvalifikacijska vrsta predlagan le za dve pSCI območji. V okviru biogeografskih seminarjev za celinsko in alpinsko regijo so bili ti predlogi ocenjeni kot zelo pomanjkljivi, kar pomeni jasno obvezo, da je treba vrsto in njen habitat podrobneje raziskati in razglasiti dodatna varstvena območja. Novi podatki o razširjenosti vrste v SZ delu Slovenskih Goric bodo pomembna podlaga za predlog novega pSCI območja za to vrsto v severovzhodni Sloveniji.

### **Brown Hairstreak (*Thecla betulae*): rare or just rarely seen butterfly?**

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Less than 80 localities of Brown Hairstreak were known in Slovenia till the survey of butterfly fauna of the Goričko landscape park in 2011. Most observations in whole Slovenia were of imagoes, which are on the wing from July to September. In that time females lay eggs on young branches of blackthorn where the eggs overwinter. Butterflies spend their lifetime mainly in the treetops, that is why the species is rarely seen during usual recording. During the 2011 survey at Goričko we compared effectiveness of two different methods of recording – searching for eggs and searching for adults. Searching for eggs on blackthorn in hedgerows and forest edges was carried out in March and beginning of April, and for imagoes during their flight-period. Laid eggs were recorded on 95 localities, evenly spread all over Goričko. Eggs were found also in hedgerows more than 500 m from the nearest forest.

Between July 15<sup>th</sup> and September 1<sup>st</sup> 770 recordings of butterflies were carried out on 450 localities. 15 recordings of Brown Hairstreak on as many different localities were made. According to observed egg distribution imagoes were expected to be present on most localities, with actual detectibility much lower. Probability to spot the adult specimens during species flight-period is only 2%.

Based on results we conclude that for recording of Brown Hairstreak egg searching is much more effective than recording of imagoes, as a common method for majority of butterflies. It is expected that this method can drastically change the knowledge on distribution of the species in Slovenia.

### **Lepi brezar (*Thecla betulae*): redek ali samo redko opažen metulj?**

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Do raziskave favne metuljev v Krajinskem parku Goričko v letu 2011 je bilo v Sloveniji manj kot 80 najdišč lepega brezarja (*Thecla betulae*). Daleč največ opažanj iz celotne Slovenije se je nanašalo na odrasle osebkke, ki letajo od julija do septembra. V tem času samice odložijo jajca na vejice črnega trna, kjer jajca prezimijo. Metulji se zadržujejo predvsem v krošnjah dreves, zato jih ob običajnem popisovanju redko opazimo. V okviru navedene raziskave smo primerjali rezultate dveh različnih metod popisovanja lepega brezarja – iskanje jajc in iskanje odraslih osebkov. V marcu in začetku aprila smo na črnem trnu v mejicah in gozdnih robovih iskali jajca, odrasle pa popisovali od julija do septembra. Jajca smo registrirali na 95 lokalitetah, enakomerno razporejenih po celotnem Goričkem. Našli smo jih celo v mejicah oddaljenih od sklenjenega gozda več kot 500 m.

Med 15. 7. in 1. 9. smo opravili 770 popisov dnevnih metuljev na 450 lokalitetah. Lepega brezarja smo popisali 15-krat na prav toliko različnih lokalitetah. Glede na ugotovljeno razširjenost jajc smo odrasle osebkke pričakovali na večini popisnih ploskev, vendar je njihova zaznavnost neprimerno nižja. Tako je verjetnost, da naletimo na to vrsto med popisovanjem dnevnih metuljev v primernem času zgolj 2 %. Ugotavljamo, da je za popisovanje lepega brezarja najbolj primerna metoda iskanja jajc in ne odraslih osebkov, kot velja za večino ostalih dnevnih metuljev. Ocenjujemo, da lahko s spremembo metode popisovanja pričakujemo zelo drugačno sliko razširjenosti te vrste v Sloveniji.

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