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FOURTH SLOVENIAN ENTOMOLOGICAL SYMPOSIUM WITH INTERNATIONAL ATTENDANCE

BOOK OF ABSTRACTS

MARIBOR,
9TH AND 10TH MAY 2014

ČETRTI SLOVENSKI ENTOMOLOŠKI SIMPOZIJ Z MEDNARODNO UDELEŽBO

KNJIGA POVZETKOV

MARIBOR,
9. IN 10. MAJ 2014

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Registracija na Fakulteti za naravoslovje in matematiko

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Opening words
Prof. Dr. **Nataša Vaupotič**, Dean of the Faculty of Natural Sciences and Mathematics, University of Maribor,
Prof. Dr. **Dušan Devetak**, the organizer of the Symposium,
M. Sc. **Slavko Polak**, the President of the Slovenian Entomological Society Štefan Michieli.

*Otvoritev 4. slovenskega entomološkega simpozija z mednarodno udeležbo
Nagovor prof. dr. Nataše Vaupotič, dekanice Fakultete za naravoslovje in matematiko, prof. dr. Dušana Devetaka, organizatorja simpozija in mag. Slavka Polaka, predsednika Slovenskega entomološkega društva Štefana Michielija.*

Invited lectures / *Vabljeni predavanji*

9:20 – 10:00 **Gerd LEITINGER, Stefan WERNITZNIG, Armin ZANKEL, Peter PÖLT, Dagmar KOLB, and F. Claire RIND**
Discovering an insect's neuronal wiring patterns with serial block face scanning electron microscopy

10.00 – 10.40 **Predrag JAKŠIĆ**
Aspects of butterflies zoogeography of some Pannonian „Island Mountains"

10.40 – 11.00 Poster session with coffee and tea break
Predstavitev posterjev z odmorom za kavo in čaj

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Maarten de GROOT, Primož SIMONČIČ, Urša VILHAR
Monitoring of hoverflies (Diptera; Syrphidae) in urban and peri-urban forest in Slovenia
Spremljanje muh trepetavk (Diptera; Syrphidae) v urbanem in periurbanem gozdu v Sloveniji

Davorin HORVAT
Structural complexity of the vegetation in dry and humid meadows in the Subpannonian region of Slovenia affects spider communities (Arachnida: Araneae)
Vpliv strukturne kompleksnosti vegetacije na suhih in vlažnih travnikih subpanonske regije Slovenije na združbe pajkov (Arachnida: Araneae)

Tatjana SIMČIČ, Al VREZEC
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Metabolni potencial in poraba kisika pri različnih vrstah hroščev

Martin VERNIK
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Zbiranje podatkov o razširjenosti nekaterih vrst hroščev (Coleoptera) po Natura 2000 v Sloveniji - spletni portal www.sporocivrsto.si

Martin VERNIK
Natura 2000 Management programme for the period 2014-2020 for beetles species (Coleoptera) (LIFE11 NAT/SI/880)
Operativni program upravljanja območij Natura 2000 v obdobju 2014-2020 za kvalifikacijske vrste hroščev (Coleoptera) (projekt LIFE11 NAT/SI/880)

Lectures / *Predavanja*

***Moderator*: Andrej ČOKL**

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Use of honeybees (*Apis mellifera*) to protect strawberry from grey mould (*Botrytis cinerea*)
*Uporaba medonosne čebele (*Apis mellifera*) pri zaščiti jagod pred sivo plesnijo (*Botrytis cinerea*)*

11:20 – 11:40 **Maarten de GROOT, Marijan GOVEDIČ, Nikica OGRIS, Rudi VEROVNIK**
Factors influencing beta diversity of butterflies in Slovenia
Vpliv okoljskih dejavnikov na beta diverziteto dnevnih metuljev v Sloveniji

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Populacijski trendi izbranih vrst hroščev evropskega varstvenega pomena v Sloveniji: prvi rezultati nacionalnega monitoringa hroščev

12:20 – 12:40 **Mojca HROVAT, Gorazd URBANIČ**
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Združbe ličink enodnevnic (Ephemeroptera), vrbnic (Plecoptera) in mladoletnic (Trichoptera) v povezavi z okoljskimi dejavniki v rekah bioregije Preddinarska hribovja in ravnine

12:40 – 13:00 **Tatjana ČELIK, Branko VREŠ**
Oviposition choice and larval preferences of Large Heath (*Coenonympha tullia* (Müller 1764); Lepidoptera: Satyrinae) at the southern border of its range
*Izbira ovipozicijskega habitata in ekološke preference gosenic munčevega okarčka (*Coenonympha tullia *(Müller 1764); Lepidoptera: Satyrinae) na južnem robu areala*

13.00 – 14.20 Lunch break
Odmor za kosilo

Moderator: **Al VREZEC**

14:20 – 14:40 **Barbara ZAKŠEK, Franc REBEUŠEK, Nika KOGOVŠEK, Marijan GOVEDIČ**
Contribution to the knowledge of oviposition preferences of *Eriogaster catax* in Slovenia
*Prispevek k poznavanju ovipozicijskih preferenc hromega volnoritca (*Eriogaster catax*) v Sloveniji*

14:40 – 15:00 **Andrej ČOKL, Alenka ŽUNIČ, Raul LAUMANN**
The role of interference in insect substrate-borne vibrational communication
Vloga interference v vibracijski komunikaciji žuželk preko podlage

15:00 – 15:20 **Matjaž JEŽ, Valerija ZAKŠEK, Bojan ZADRAVEC, Radovan ŠTANTA, Rudi VEROVNIK**
Effects of artificial lighting of churches on moths (Lepidoptera) in Slovenia
Vpliv osvetljevanja cerkva na nočne metulje (Lepidoptera) v Sloveniji

15:20 – 15:40 **Jernej POLAJNAR, Anna ERIKSSON, Valerio MAZZONI**
Developing an acoustic tool for mating disruption of *Scaphoideus titanus* (Hemiptera: Cicadellidae)
*Razvoj akustične metode za motenje paritvenega vedenja ameriškega škržatka (*Scaphoideus titanus*; Hemiptera: Cicadellidae)*

15:40 – 16:00 **Gregor BELUŠIČ, Kentaro ARIKAWA, Primož PIRIH**
The palm borer moth (*Paysandisia archon*, Lepidoptera:Castniidae), a sun moth with butterfly eyes
*Palmov vrtač (*Paysandisia archon*, Lepidoptera:Castniidae), sončni veščec z očmi metulja*

16:00 – 16:20 Poster session with coffee and tea break
Predstavitev posterjev z odmorom za kavo in čaj

Moderator: **Gregor BELUŠIČ**

16:20 – 16:40 **Nataša STRITIH, Alenka ŽUNIČ KOSI**
Protrusive scent organs in male cave crickets *Troglophilus neglectus* (Orthoptera: Rhaphidophoridae) serve primarily intermale agonism
Izbočljivi vonjalni organi samcev jamskih kobilic Troglophilus neglectus *(Orthoptera: Rhaphidophoridae) služijo primarno agonizmu med samci*

16:40 – 17:00 **Polona SPITAL, Dušan DEVETAK**
Morphological traits in adult lacewings of the genus *Chrysoperla* Steinmann, 1964 (Neuroptera: Chrysopidae) in Slovenia and western Balkan countries
Morfološke poteze odraslih tenčičaric iz rodu Chrysoperla *Steinmann, 1964 (Neuroptera: Chrysopidae) v Sloveniji in deželah zahodnega Balkana*

17:00 – 17:20 **Tamara MILIVOJEVIĆ, Gordana GLAVAN, Janko BOŽIČ, Tina MESARIČ, Kristina SEPČIĆ, Damjana DROBNE**
Honey bee (*Apis mellifera carnica*) as a model organism in nanotoxicology research
*Krajnska čebela (*Apis mellifera carnica*) kot modelni organizem za nanotoksikološke raziskave*

17:20 – 17:40 **Saška LIPOVŠEK, Tone NOVAK, Gerd LEITINGER**
The evidence of autophagic processes in the fat body of the diapausing cave cricket *Troglophilus cavicola* (Rhaphidophoridae, Saltatoria)
Dokaz avtofagnih struktur v maščobnem telesu jamske kobilice Troglophilus cavicola *(Rhaphidophoridae, Saltatoria) med diapavzo*

17:40 – 18:00 **Vesna KLOKOČOVNIK, Dušan DEVETAK**
Behavioural variability in pit-building antlion larvae (Neuroptera: Myrmeleontidae)
Vedenjska plastičnost predatorskega vedenja larv volkcev lijakarjev (Neuroptera: Myrmeleontidae)

SATURDAY, 10th MAY 2014 / SOBOTA, 10. MAJ 2014

8:55 – 9:00 Introduction to the second day of the Symposium
Uvod k drugemu dnevu simpozija

Invited lecture / *Vabljeno predavanje*

9:00 – 9:40 **Mirza DAUTBAŠIĆ, Osman MUJEZINOVIĆ**
Xylophagous pests of Bosnian pine (*Pinus heldreichii*) in Bosnia-Herzegovina

Moderator: **Maarten de GROOT**

9:40 – 10:00 **Kristjan MALAČIČ**
Public institution Goričko Landscape Park - meadows management
Travniki v upravljanju Javnega zavoda Krajinski park Goričko

10:00 – 10:20 **Špela AMBROŽIČ, Andrej KAPLA, Al VREZEC**
Population ecology of groups of predaceous diving-beetles (Coleoptera; Dytiscidae; Dytiscinae) in Slovenia: A preliminary study
Populacijska ekologija združbe velikih kozakov (Dytiscinae) v Sloveniji: preliminarna študija

10:20 – 10:40 **Tomi TRILAR, Matija GOGALA**
Cicadas of the genus *Pagiphora* (Hemiptera, Cicadidae) - distribution and their acoustic signals
Škržadi iz rodu Pagiphora *(Hemiptera, Cicadidae) - razširjenost in njihovi akustični signali*

10:40 – 11:00 **Dušan DEVETAK**
Biodiversity of the Neuroptera in Albania and Macedonia
Biodiverziteta mrežekrilcev (Neuroptera) v Albaniji in Makedoniji

11:00 – 11:20 **Katarina MIHELAK, Ivan KOS, Dušan DEVETAK**
Preliminary report on the gregarines (Protozoa: Apicomplexa: Gregarinida) of Myriapoda in Slovenia
Prispevek k poznavanju gregarin (Protozoa: Apicomplexa: Gregarinida) iz stonog (Myriapoda) v Sloveniji

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

Moderator: **Tomi TRILAR**

11:40 – 12:00 **Matija GOGALA, Tomi TRILAR**
Endemic mountain cicada from the southern Peloponnese and related species
Endemični gorski škržad z juga Peloponeza in njegovi sorodniki

12:00 – 12:20 **Peter KOZEL, Tone NOVAK**
First eyeless troglobitic harvestmen in Slovenia
Najdba prve brezoke troglobiontne vrste suhih južin v Sloveniji

12:20 – 12:40 **Andrej KAPLA, Špela AMBROŽIČ, Al VREZEC**
Hermit beetle (*Osmoderma eremita*) in The Tivoli Park, Ljubljana
*Puščavnik (*Osmoderma eremita*) v mestnem parku Tivoli, Ljubljana*

12:40 – 13:00 **Rudi VEROVNIK, Peter RUSSELL**
Melitaea ornata Christoph, 1893, important new butterfly record for Slovenia
Melitaea ornata *Christoph, 1893, pomembna nova najdba dnevnega metulja za Slovenijo*

13:00 – 13:20 **Slavko POLAK**
Favna hroščev (Coloptera) Naravnega rezervata Škocjanski zatok
Nature Reserve Škocjanski zatok Beetle fauna (Coleoptera)

13:20 – 13:40 **Alenka ŽUNIČ KOSI, Nataša STRITIH, Andrej ČOKL, Larry M. HANKS, Jocelyn G. MILLAR**
Sampling of cerambycid fauna of Slovenia using pheromone traps
Uporaba feromonskih pasti za vzorčenje hroščev iz družine kozličkov v Sloveniji

13:40 – 14:00 Poster session with coffee and tea break
Predstavitev posterjev z odmorom za kavo in čaj

Moderator: **Rudi VEROVNIK**

14:00 – 14:20 **Barbara ZAKŠEK, Nika KOGOVŠEK, Kristjan MALAČIČ, Franc REBEUŠEK, Marijan GOVEDIČ, Rudi VEROVNIK**
Biodiversity of butterfly fauna in Nature park Goričko
Vrstna pestrost dnevnih metuljev Krajinskega parka Goričko

14:20 – 14:40 **Jan PODLESNIK, Ljubodrag MIHAJLOVIĆ, Maja JURC**
Parasitoid complex associated with *Ips typographus* (Coleoptera, Scolyinae) in Altimontane belt of Slovenia (Pohorje)
Parazitoidni kompleks povezan z vrsto Ips typographus *(Coleoptera, Scolytinae) v altimontanskem pasu Slovenije (Pohorje)*

14:40 – 15:00 **Ignac SIVEC**
Knowledge of stoneflies (Insecta: Plecoptera) in Slovenia
Stanje poznavanja vrbnic (Insecta: Plecoptera) v Sloveniji

15:00 – 15:20 **Gregor BRAČKO, Maja ZAGMAJSTER**
Ants (Hymenoptera: Formicidae) of Submediterranean Slovenia
Mravlje (Hymenoptera: Formicidae) submediteranske Slovenije

15:20 – Closing of the Symposium
Zaključek simpozija

ABSTRACTS / *POVZETKI*

Invited lectures / *Vabljena predavanja*

Xylophagous pests of Bosnian pine (*Pinus heldreichii*) in Bosnia-Herzegovina

Mirza DAUTBAŠIĆ[1], Osman MUJEZINOVIĆ[1]

[1]Chair for the Forest Protection, Faculty of Forestry, University of Sarajevo, 71000 Sarajevo, Bosnia and Herzegovina
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Bosnian pine (*Pinus heldreichii* H. Christ, 1863) is a species of pine native in Bosnia and Herzegovina. The main native stands are on the 7 localities (Prenj, Čvrsnica, Hranisava, Rujište, Konjički Igman, Orjen i Vran).
The aim of this study was initial knowledge about xylophagous insects on the whitebark pine. For this purpose trap of trees were placed in stands of mountain of the Čvrsnica, for monitoring through the vegetation periods from 2012 to 2013.
Bosnian pine has demonstrated low susceptibility to insect attacks. However, it can be seriously damaged by *Ips sexdentatus* (Boerner) and *Pityogenes bidentatus* (Herbst).
In this respect and in consideration of the serious damages that recently occurred in several stands by forest fires, it appears to be useful to improve our knowledge concerning the insect species living on this conifer to ensure protection of these stands.

Aspects of butterflies zoogeography of some Pannonian „Island Mountains“

Predrag JAKŠIĆ

Department for Biology and Ecology, Faculty of Science, University of Niš, Višegradska Str., 33, 18000 Niš, Serbia;
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Specific geology and tectonic history of the Pannonian plain is pointed out. As specificity of the areas, lower mountains and hills are highlighted, which must have been islands in the phase of Paratethys, and Pannonian Sea: Malé Karpaty, Vertes, Bakony, Mecsek, Medvednica, Papuk, Fruška Gora and Avala. Head to head comparison was done as well as comparison with the site Mohách, typical plain habitat in Pannonian plain. There was a question asked about existence of specific elements of butterflies fauna in "island mountains''.
According to published data, the list of 163 butterflies species in explored area has been done. Degree of similarity of explored island mountains was calculated. There has been conclusion about their faunal and zoogeographical liaison.

Discovering an insect's neuronal wiring patterns with serial block face scanning electron microscopy

Gerd LEITINGER[1], Stefan WERNITZNIG[1], Armin ZANKEL[2], Peter PÖLT[2], Dagmar KOLB[1], F. Claire RIND[3]

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[2]Institute for Electron Microscopy and Nanoanalysis (FELMI), Graz University of Technology, Graz, Austria
[3]Institute of Neuroscience, School of Biology, Newcastle University, Newcastle upon Tyne, UK
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In the compound eyes of locusts, information processing starts at the synapse between photoreceptors (R-cells) and their first interneurons, the lamina monopolar cells (L-cells).
We have used serial block face scanning electron microscopy (SBEM) to discover the connectivity between these neurons. With SBEM, we automatically cut sections from a block and serially scan the block face using a backscatter electron detector. 3D-reconstruction of the two largest L neurons L1 and L2 from one cartridge in the lamina (optic neuropile) enabled us to map their synaptic connections. We localized and classified 237 synapses along the course of their neurites and found significant differences in the way L1 and L2 may operate: L1 and L2 both receive synapses from R-cells, but only L1 feeds back onto R-cells, so it may have an influence on the R-cells' sensitivity to light. L1 and L2 also differ in diameter (5.5 vs. 3.4 μm), so they conduct signals at different speeds. Their large diameter demonstrates both neurons are suited to control motion detection pathways, for which differences in illumination must rapidly be calculated.

We thank Elisabeth Bock, Elisabeth Pritz, Peter Schönbacher, and Claudia Mayrhofer for technical help. Funded by the Styrian Government (HTI SMApp programme 2012).

Oral presentations / *Predavanja*

Population ecology of groups of predaceous diving-beetles (Coleoptera; Dytiscidae; Dytiscinae) in Slovenia: A preliminary study

Špela AMBROŽIČ[1], Andrej KAPLA[1], Al VREZEC[1]

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Large predaceous diving-beetles are predators of aquatic invertebrates and small aquatic vertebrates. The beetles are good bioindicators of aquatic ecosystem state whereas species are sensitive to environmental changes, are abundant, with simple sampling methods and taxonomically relatively well known. The systematic survey of some water bodies in Slovenia took place between 2010 and 2013 using two sampling methods: netting and trapping. We compared the effectiveness of methods and calculated the relative densities of species depending on the methods used. We confirm the presence of majority of species of large predaceous diving-beetles known from Slovenia from five genera: *Acilius* (2 species), *Graphoderus* (3 species), *Cybister* (1 species), *Dytiscus* (4 species) and *Hydaticus* (2 species). During the survey the presence of some rare species in Slovenia was confirmed (*Graphoderus bilineatus*, *Dytiscus circumflexus* and *D. circumcinctus*) with a local distribution limited to larger watershed areas. Some wide distributed species, for example *Cybister laterimarginalis*, reach high densities only in such areas, e.g. in the system of oxbow lakes along the Mura river. In a preliminary study, we analyzed the impact of selected biotic and abiotic factors on the habitat selection of large predaceous diving-beetles using the relative abundance of species and the degree of co-existence between these exclusively predatory species of beetles, among which also known intraguild predation is known, which may further influence the community structure.

Populacijska ekologija združbe velikih kozakov (Coleoptera; Dytiscidae; Dytiscinae) v Sloveniji: preliminarna študija

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Veliki kozaki so plenilci vodnih nevretenčarjev in manjših vodnih vretenčarjev. Združba se je izkazala kot dober bioindikator stanja voda, ker so vrste občutljive na okoljske spremembe, so številčne, zanje so razvite enostavne metode vzorčenja in so taksonomsko dokaj dobro poznane. V letih 2010 do 2013 smo sistematično pregledali nekatera vodna telesa na območju Slovenije z uporabo dveh metod vzorčenja: mreženje in vodne pasti. Primerjali smo učinkovitost metod ter izračunali relativne gostote vrst glede na uporabljeni metodi. V našem vzorcu smo zajeli večji del pri nas pojavljajočih se vrst velikih kozakov iz petih rodov: *Acilius* (2 vrsti), *Graphoderus* (3 vrste), *Cybister* (1 vrsta), *Dytiscus* (4 vrste) in *Hydaticus* (2 vrsti). Tekom raziskave smo potrdili prisotnost nekaterih pri nas redkih vrst (*Graphoderus bilineatus*, *Dytiscus circumflexus* in *D. circumcinctus*) z izrazito lokalno omejeno razširjenostjo na večja vodnata območja. Na ta območja so vezane tudi nekatere sicer širše razširjene vrste, npr. *Cybister laterimarginalis*, ki visoke gostote dosega zgolj v sistemu mrtvic ob reki Muri. V preliminarni raziskavi smo analizirali vpliv izbranih biotskih in abiotskih dejavnikov na izbor habitata vrst velikih kozakov z upoštevanjem relativne abundance vrst in stopnje sobivanja med temi izključno plenilskimi vrstami hroščev, pri katerih je znano tudi znotajcehovsko plenjenje, ki lahko dodatno vpliva na strukturo združb.

The palm borer moth (*Paysandisia archon*, Lepidoptera: Castniidae), a sun moth with butterfly eyes

Gregor BELUŠIČ[1], Kentaro ARIKAWA[2], Primož PIRIH[3]

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The palm borer moth is a large lepidopteran from S. America. It has been recently introduced to the Mediterranean, causing significant damage in the palm orchards. The adults are active only during the day and navigate using vision. Their visual system is composed of a pair of large compound eyes (3 mm diameter) and a pair of prominent ocelli.
The spectral sensitivity of ocelli measured with ERG revealed two maxima at 360 nm and 550 nm, respectively. Intracellular measurements in the compund eye indicated that the vision of *Paysandisia* is based upon the insect trichromatic scheme (UV-blue-green, photoreceptor classes peaking at 356 nm, 454 nm and 550 nm) extended with an additional set of photoreceptors, peaking at 570 nm, representing a system probably tuned to the orange coloration on the wings. The eye is composed of two classes of differently pigmented ommatidia, one with a peculiar double rhabdom in the distal portion. The ommatidia are built of eight photoreceptors in two tiers and a smaller ninth photoreceptor at the proximal end, following a typical butterfly pattern. The finding that *Paysandisia* butterfly eyes might be important for understanding the evolution of Lepidoptera and of insect eyes.

Palmov vrtač (*Paysandisia archon*, Lepidoptera: Castniidae), sončni veščec z očmi metulja

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Palmov vrtač je relativno velik metulj iz J. Amerike. Nedavno je bil vnešen v Sredozemlje, kjer povzroča znatno škodo v palmovih nasadih. Odrasli osebki so aktivni samo podnevi in pri navigaciji uporabljajo vid. Vidni sistem tvorijo par velikih sestavljenih oči (3 mm premer) in par ocelov.
Spektralna občutljivost ocelov, izmerjena z ERG, kaže dva vrhova pri 360 in 550 nm. Znotrajcelične meritve v mrežnici sestavljenega očesa kažejo, da je vid *Paysandisia* zasnovan na žuželčji trikromatski shemi (UV-modra-zelena, vrhovi občutljivosti pri 356, 454 in 550 nm), ki je razširjena z dodatnim razredom fotoreceptorjev (vrh pri 570 nm). Domnevamo, da je tak sistem prilagojen za zaznavo oranžne obarvanosti na krilih. Oko je sestavljeno iz dveh vrst različno pigmentiranih omatidijev, od katerih ima ena vrsta posebno oblikovan, dvojni rabdom v distalnem delu. Omatidije sestavlja osem fotoreceptorjev v dveh nadstropjih in majhen deveti fotoreceptor proksimalno, kar popolnoma ustreza zasnovi omatidija pri metuljih. Ugotovitev, da ima *Paysandisia* oči metuljev, ne pa veščev, je pomembna za razumevanje evolucije reda Lepidoptera in žuželčjih oči.

Use of honeybees (*Apis mellifera*) to protect strawberry from grey mould (*Botrytis cinerea*)

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BICOPOLL is a CORE Organic II European project on protecting strawberries from its most important disease, the grey mould (*Botrytis cinerea*). Protective spores of fungi *Gliocladium catenulatum* in Prestop® Mix (PM) are delivered to the flowers of strawberry by honeybees. We assessed effectiveness of honeybees as vectors under field conditions. Flower visits of bees, and fruit yield were monitored and departing and returning bees and strawberry flowers were sampled. Bees visited strawberry flowers the whole flowering period, but more abundant were in warm weather and in the afternoon. The quantity of spores on honeybees was determined by plating on media and a new method, qPCR that we have developed specifically for the protective fungi. The highest number of spores on bees was determined directly after administration of PM followed by a steady decline during the day until stabilization at a low number. The spores could also be detected in returning bees at a relatively constant low number. PM increased proportion of healthy berries for approximately 50 %. Results of first field experiment in Slovenia confirmed effectiveness of bees as vector of PM. We suggest some changes in application of PM.

Uporaba medonosne čebele (*Apis mellifera*) pri zaščiti jagod pred sivo plesnijo (*Botrytis cinerea*)

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BICOPOLL je CORE Organic II evropski projekt o zaščiti jagod pred najpomembnejšo boleznijo, sivo plesnijo (*Botrytis cinerea*). S pomočjo medonosne čebele na cvetove jagod nanašamo zaščitne spore glive *Gliocladium catenulatum*, ki jih vsebuje pripravek Prestop® Mix (PM). V poljskem poskusu smo ocenili učinkovitost čebel kot prenašalk. Opazovali smo obiskovanje cvetov in zdravje pridelka ter vzorčili čebele, ki so panj zapuščale in vračajoče čebele. Čebele so obiskovale cvetove jagod ves čas cvetenja, najbolj številčne pa so bile v toplem vremenu in popoldne. Količino spor na čebelah smo določili z gojenjem na gojiščih in s pomočjo nove metode, qPCR, ki je bila razvita posebej za to glivo. Najvišje število spor smo določili neposredno po aplikaciji PM, nato pa se je preko dneva število zmanjšalo in ustalilo na nizki ravni. Spore so bile prisotne tudi na čebelah, ki so se vračale v panj, njihovo število pa je bilo razmeroma konstantno. PM je povečal delež zdravih jagod za približno 50 %. Rezultati prvega poljskega poskusa so potrdili učinkovitost čebel kot prenašalk PM, predlagamo pa nekaj sprememb pri načinu aplikacije

Ants (Hymenoptera: Formicidae) of Submediterranean Slovenia

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Of the six phytogeographic regions in Slovenia, ants are best studied and richest in the Submediterranean region. Here, 106 ant species were recorded, representing 77% of all species known for the country. In the last 15 years, number of registered species in Submediterranean Slovenia increased for 43 species. Altogether, ants are known from 193 localities. Some larger areas are still understudied, for example Brkini, while the coastal part of Slovenia, Karst Edge and southern part of Kras Plateau were more intensively sampled. These areas, and also Nova Gorica area, have the biggest number of species. According to species accumulation curves ants of Submediterranean region are insufficiently studied, species richness estimators predict from 10% to nearly 40% more species than presently known. Fortyfour percent of all species are known from five localities at most, and many of them reach their northern limit of distribution in this area (e.g. *Aphaenogaster epirotes*, *Temnothorax exilis*). *Camponotus piceus* is the most frequently collected species in Submediterranean Slovenia. Thirtythree species in Slovenia are known only from Submediterranean region, which occur mainly in the coastal Slovenia and the Karst Edge. About 80% of them belong to zoogeographical elements distributed mainly in Southern parts of Europe (e.g. Mediterranean, Apenino-Balkan species).

Mravlje (Hymenoptera: Formicidae) submediteranske Slovenije

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Od šestih fitogeografskih regij Slovenije so mravlje najbolje raziskane in najbolj bogato zastopane v submediteranski regiji. Tu je bilo najdenih 106 vrst mravelj, kar je 77 % vseh vrst poznanih za državo. V zadnjih 15 letih se je število registriranih vrst v submediteranski Sloveniji povečalo za 43 vrst. Podatki o mravljah so znani iz 193 lokalitet. Nekatera večja območja so še vedno zelo slabo raziskana, na primer Brkini, medtem ko je bilo vzorčenje bolj intenzivno v obalnem delu Slovenije, na Kraškem robu in južnem delu Krasa. Ta območja, kot tudi območje Nove Gorice, se ponašajo z največjim številom vrst. Krivulje kopičenja vrst kažejo, da je poznavanje mravelj v submediteranski regiji še nezadostno, različne cenilke napovedujejo od 10 % do skoraj 40 % več vrst. Štiriinštirideset odstotkov vseh vrst je znanih iz največ pet lokalitet, mnoge med njimi imajo tu severno mejo svoje razširjenosti (npr. *Aphaenogaster epirotes*, *Temnothorax exilis*). *Camponotus piceus* je najbolj pogosto najdena vrsta v submediteranski Sloveniji. Triintrideset vrst je v Sloveniji znanih le iz submediteranske regije, daleč največ jih je na območju Obale in Kraškega roba. Približno 80 % teh pripada zoogeografskim elementom, ki so razširjeni predvsem v južnih delih Evrope (npr. mediteranske, apenino-balkanske vrste).

Oviposition choice and larval preferences of Large Heath (*Coenonympha tullia* (Müller 1764); Lepidoptera: Satyrinae) at the southern border of its range

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Large Heath is classified as Vulnerable (VU) species in Europe. In Slovenia, it is considered as an endangered (EN) and protected species. Between 1962, when it was first observed in Slovenia, to 2001 (assumed as last observation), only six localities were known. After 10 years, the species was rediscovered at the historical site, in Natural Reserve Zelenci near Kranjska gora. In years 2012 and 2013, the larval preferences (April–May), the females' oviposition behaviour and oviposition site selection (June–July) were studied in the remaining population of species in Slovenia. To describe vegetation structure and microclimatic conditions of microhabitat (in a radius of 50 cm around the egg/larva), we recorded the following parameters: vegetation height, % cover of each plant species, litter, bare ground and standing water, water depth, distance of standing water from egg/larva, oviposition height, egg-laying substrat, temperature near the ground and 1 meter above it. We also calculated local estimates of temperature, soil moisture, soil nutrients and soil reaction using Ellenberg indicator values. We determined the larval host plants species. The characteristics of egg-laying microhabitat and the abundance of Slovenian population were compared with the populations in the central part of the species' range (Germany).

Izbira ovipozicijskega habitata in ekološke preference gosenic munčevega okarčka (*Coenonympha tullia* (Müller 1764); Lepidoptera: Satyrinae) na južnem robu areala

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Munčev okarček ima v Evropi status ranljive (VU), v Sloveniji prizadete (EN) in zavarovane vrste. Od leta 1962, ko je bila vrsta v Sloveniji prvič najdena, do leta 2001, ko je bila domnevno zadnjikrat opažena, je bilo zanjo znanih 6 nahajališč. Po 10 letih je bila vrsta ponovno najdena v NR Zelenci pri Kranjski gori. V letih 2012–2013 smo v edini obstoječi populaciji vrste v Sloveniji raziskovali habitatne preference gosenic (april–maj) in izbiro ovipozicijskega mikrohabitata samic ter njihovo ovipozicijsko vedenje/strategijo (junij–julij). Za opis strukture vegetacije in mikroklimatskih pogojev v larvalnem in ovipozicijskem mikrohabitatu (2r = 50 cm od jajčeca/gosenice) smo uporabili naslednje parametre: višina vegetacije, abundanca posamezne rastlinske vrste, rastlinskega opada, golih tal in stoječe vode, globina stoječe vode, oddaljenost stoječe vode od gosenice/jajčeca, ovipozicijska višina, ovipozicijski substrat, temperatura zraka pri tleh in 1 meter nad tlemi. Z uporabo Ellenbergovih indikatorskih vrednosti smo ocenili temperaturne in vlažnostne razmere ter količino nutrientov in ph tal v mikrohabitatu. Evidentirali smo rastlinske vrste, ki so hranilne rastline gosenic. Značilnosti ovipozicijskega mikrohabitata in številčnost slovenske populacije smo primerjali s populacijami v osrednjem delu areala (Nemčija).

The role of interference in insect substrate-borne vibrational communication

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Stinkbugs of the subfamily Pentatominae communicate via plants with vibratory signals of low frequency and narrow-band characteristics tuned with mechanical properties of the transmission medium. Female and male calling and courtship signals are generally exchanged within intervals between consecutive mate's emissions to avoid overlapping. An exception represents calling duetting of the brown stinkbug *Eushistus heros* (F.) (Heteroptera: Pentatomidae) characterized by fast repeated shorter female calling song (FS-1) pulses overlapping longer male calling song (MS-1) responses. Overlapping of spectrally similar vibrations causes interference that changes the amplitude modulation (AM) pattern into a sequence of fused pulses of duration increasing with the decreasing difference between frequencies of masked signals. Interference has been described also by overlapping pre-recorded and naturally produced FS-1 and MS-1 signals by continuous pure tone vibrations as well as by simultaneous vibration of the plant by two pure tones. Duetting mates avoid interference or minimize its effects by (a) changing the frequency of their signals to increase the frequency difference between masked signals, (b) changing the frequency modulation (FM) pattern and (c) by synchronizing time characteristics of their signals. Interference does not occur in overlapped narrow band FS-1 and broad band male courtship song (MS-2) signals.

Vloga interference v vibracijski komunikaciji žuželk preko podlage

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Rastlinske stenice iz poddružine Pentatominae se sporazumevajo z nizko-frekvenčnimi in ozkopasovnimi vibracijskimi signali, ki so uglašeni z mehanskimi lastnostmi medija- rastline. Pozivni signali in signali dvorjenja samcev in samic se običajno izmenjujejo v intervalih med sosednjimi signali partnerja tako, da se izognejo prekrivanju. Izjemo predstavlja alternacija pozivnih signalov rastlinske stenice vrste *Euschistus heros* (F.) (Heteroptera: Pentatomidae) za katero je značilno, da hitro ponavljajoči se kratki signali pozivnega napeva samice (FS-1) prekrivajo odgovore samca z daljšimi signali pozivnega napeva (MS-1). Prekrivanje spektralno podobnih vibracij povzroči nastanek interference, ki spremeni vzorec amplitudne modulacije (AM) v sekvenco združenih pulzov, katerih dolžina narašča s padajočo razliko med frekvencama obeh signalov. Interferenco smo opisali tudi s prekrivanjem naravno ali umetno induciranih FS-1 in MS-1 signalov z vibracijami čistih frekvenc kakor tudi z istočasnim tresenjem rastline z dvema vibracijama čistih frekvenc. Partnerja se v alternaciji izogibata interferenci oz. zmanjšujeta njene učinke (a) s spreminjanjem frekvence oddanih signalov tako, da se poveča razlika med njimi, (b) s spreminjanjem vzorca frekvenčne modulacije (FM) in (c) s časovno sinhronizacijo svojih signalov. Do interference ne pride v primeru prekrivanja ozkopasovnih FS-1 signalov s širokopasovnimi signali napeva dvorjenja samca (MS-2).

Biodiversity of the Neuroptera in Albania and Macedonia

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In the past, Balkan was because of its political instability less reachable for field research and that was the reason that the knowledge on the fauna of the region is insufficient. However, the peninsula is a "hot spot" of biodiversity. For Albania and Macedonia, only sporadic information on Neuroptera exists. Here, results of three Slovenian zoological expeditions to two Balkan countries organized by zoologists from the Department of Biology, University of Maribor are presented (2011: Macedonia; 2012 and 2013: Albania). From Macedonia, 56 species were recorded, thereof 17 species for the first time for the country. For Albania, only 36 species were listed before 2012, and the occurrence for additional 32 species is confirmed now. The zoogeographical composition of the Neuropteran fauna for both countries is discussed.

Biodiverziteta mrežekrilcev (Neuroptera) v Albaniji in Makedoniji

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Balkan je bil v preteklosti zaradi politične nestabilnosti za terenske raziskave manj dostopen, to pa je tudi razlog, da je balkanska favna razmeroma slabo poznana. Balkanski polotok je pomemben kot vroča biodiverzitetna točka. Znani so le sporadični podatki o mrežekrilcih (Neuroptera) Albanije in Makedonije. V prispevku so prikazani izsledki treh slovenskih zooloških odprav v obe državi, ki so jih izvedli zoologi z Oddelka za biologijo Univerze v Mariboru (v letu 2011 v Makedonijo, v letih 2012 in 2013 v Albanijo). Iz Makedonije smo zabeležili 56 vrst, od tega je 17 vrst za državo novih. Za Albanijo so navajali pred letom 2012 le 36 vrst, mi smo potrdili prisotnost še za 32 vrst. Navajamo tudi zoogeografsko sestavo favne obeh držav.

Endemic mountain cicada from the southern Peloponnese and related species

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Mountain cicadas *Cicadetta montana* s.lat. radiated in Palaearctis into many morphologically very similar and practically indistinguishable species, which can be easily recognized and determined by their song patterns. Most widely distributed species of the *C. montana* s.lat. complex in Greece is *C. hannekeae,* example of stenoecous taxon is *C. olympica* till now only known from Mt. Olympos. Last year we discovered on Mt. Taigethos new undescribed population of mountain cicadas with the calling song similar to the song pattern of *C. olympica*. On other mountains in the neighborhood, e.g. Mt. Parnon, Mt. Menalo, Mt. Erymanthos, Mt. Chelmos and around the village Kastanitsa we found till now only *C. hannekeae* with very different song. However, the mountain cicada with the most similar song (*C. olympica*) lives about 600 km away. After a thorough analysis and comparison of songs of both populations we found small but stable and characteristic differences which justify the differentiation between both groups. Therefore we will describe this isolated group of mountain cicadas as a distinct species.

Endemični gorski škržad z juga Peloponeza in njegovi sorodniki

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Gorski škržadi *Cicadetta montana* s. lat. so se v palearktičnem območju razvili v veliko število morfološko zelo podobnih ali celo morfološko in molekularno genetsko težko ločljivih vrst, ki pa se po svojih vrstno značilnih napevih brez težav razločujejo. V Grčiji smo v preteklih letih odkrili vrsto endemičnih taksonov tega sestrskega kompleksa vrst. Najbolj razširjen je grški gorski škržad (*Cicadetta hannekeae*), med ožje razširjenimi predstavniki pa je na primer olimpski gorski škržad (*C. olympica*), Preteklo leto smo na Peloponezu na gorovju Taigetos odkrili novo še neopisano vrsto, ki pa je po svojem napevu zelo podobna prav olimpskemu gorskemu škržadu. Sicer smo na vseh drugih raziskanih predelih Peloponeza, na gorah Parnon, Menalo, Erimantos, Helmos in v okolici Kastanice povsod odkrili le vrsto *C. hannekeae* z bistveno drugačnim napevom. Po svojem napevu gorskim škržadom s Taigetosa najbolj podobna vrsta *C. olympica* pa je oddaljena kar 600 km. Ob podrobni analizi in primerjavi napevov obeh vrst smo odkrili več manjših toda stalnih in značilnih razlik, ki utemeljujejo razlikovanje med obema populacijama gorskih škržadov. Zato bomo v kratkem opisali gorske škržade s Taigetosa kot novo vrsto.

Factors influencing beta diversity of butterflies in Slovenia

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We investigated the differences of the influence of topographical, habitat and climatical variables on species turnover and nestedness of butterflies divided in three larval host specifity classes and five mobility classes. We choose three topographical variables (altitudinal range, altitudinal average, proximity), eight land use variables (agricultural land, urban area, water, wetlands, meadows (facing south, north, east and west)) and two climate variables (average summer temperature, average winter temperature). For all mobility classes, the species turnover was affected by different topographical and land use variables. However, climatical variables affected only the species turnover of the less mobile species. For all mobility classes, the difference in meadows on the west slope influenced the nestedness. For the very sedentary and the migrant species the proximity also influenced the nestedness. For the larval specifity classes, the topographical, land use and climatical variables were influencing the species turnover. The nestedness in the polyphagous species was influenced by the surface of the water, meadows on the western slopes and the average winter temperature. In conclusion, many similar variables affect the species turnover in the mobility and larval specifity classes, while few variables affect the nestedness of the butterfly assemblages.

Vpliv okoljskih dejavnikov na beta diverziteto dnevnih metuljev v Sloveniji

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Ugotavljali smo vpliv topografskih, habitatnih in klimatskih spremenljivk na vrstni obrat in vgnezdenost združb dnevnih metuljev razvrščenih v tri razrede specifičnosti larvalnih stadijev glede hranilnih rastlin ter pet razredov mobilnosti. Izbrali smo tri topografske spremenljivke (razpon nadmorskih višin, povprečna nadmorska višina, bližina), osem spremenljivk rabe tal (kmetijske površine, urbane površine, voda, močvirja, travniki (vse štiri ekspozicije)) in dve klimatski spremenljivki (povprečna poletna temperatura, povprečna zimska temperatura). Pri vseh razredih mobilnosti so na vrstni obrat vplivale različne spremenljivke rabe tal in topografije. Klimatske spremenljivke pa so imele vpliv na vrstni obrat le pri manj mobilnih vrstah. Na vgnezditev združb je pri vseh razredih mobilnosti vplivala razlika v deležu travnikov z zahodno ekspozicijo. Pri zelo sedentarnih in najbolj mobilnih vrstah je na vgnezditev vplivala tudi bližina. Pri različnih razredih specifičnosti larvalnih stadijev so vsi trije tipi spremenljivk vplivali na vrstni obrat. Na vgnezditev združb polifagnih vrst je vplivala površina vod, travnikov z zahodno ekspozicijo in povprečna zimska temperatura. Če povzamemo: veliko podobnih spremenljivk vpliva na vrstni obrat različnih razredov mobilnosti in larvalne specifičnosti, le malo spremenljivk pa ima vpliv na vgnezditev združb dnevnih metuljev.

Mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trichoptera) larvae assemblages in relation to environmental factors in rivers of Subdinaric hills and plains bioregion

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The relationship among Ephemeroptera, Plecoptera and Trichoptera (EPT) larvae assemblages and environmental factors were studied in karst and non-karst rivers of Subdinaric hills and plains bioregion. The data on EPT larvae and 52 environmental variables were collected at 63 sampling sites during 2005-2010. Using two way permutational analysis of variance (PERMANOVA), EPT larvae taxonomic composition and abundance were explained equaly by typology and degradation level of rivers of Subdinaric hills and plains bioregion. The amount of the explained variability of EPT larvae assemblages by degradation level was lower in karst rivers than in non-karst rivers. The relationship among EPT larvae and typology, land use, water quality and microhabitat characteristics was explored using partial Canonical Corespondence Analysis (pCCA). The effect of land use, water quality and microhabitat characteristics on the EPT larvae was different in karst and non-karst rivers. In karst rivers water quality and microhabitat characteristics were more important than land use, whereas in non-karst rivers land use was equal or more important than water quality and microhabitat characteristics for EPT larvae assemblages, respectively. Due to the observed differences in the effects of environmental factors on karst and non-karst rivers, the different management of karst and non-karst rivers is reasonable.

Združbe ličink enodnevnic (Ephemeroptera), vrbnic (Plecoptera) in mladoletnic (Trichoptera) v povezavi z okoljskimi dejavniki v rekah bioregije Preddinarska hribovja in ravnine

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Povezave med združbami ličink enodnevnic, vrbnic in mladoletnic (EPT) in okoljskimi dejavniki smo ugotavljali v kraških in nekraških rekah bioregije Preddinarska hribovja in ravnine. Podatke o združbah ličink EPT in 52 okoljskih spremenljivkah smo zbrali na 63 vzorčnih mestih rek v obdobju od leta 2005 do 2010. Z dvosmerno permutacijsko multivariatno analizo variance (PERMANOVA) smo taksonomsko sestavo in številčnost ličink EPT v rekah bioregije Preddinarska hribovja in ravnine enako dobro pojasnili s tipološkimi značilnostmi kot s stopnjo obremenitve rek. S stopnjo obremenitve rek smo združbe ličink EPT v kraških rekah nekoliko slabše pojasnili kot v nekraških rekah. Povezanost vplivov dejavnikov tipologije, rabe tal, kakovosti vode in značilnosti mikrohabitata na združbe ličink EPT smo ugotavljali s parcialno kanonično korespondenčno analizo (pCCA). Med kraškimi in nekraškimi rekami smo ugotovili razlike v vplivih rabe tal, kakovosti vode in značilnosti mikrohabitata na združbe ličink EPT. V kraških rekah smo združbe ličink EPT s kakovostjo vode in značilnostmi mikrohabiata bolj pojasnili kot z rabo tal, medtem ko smo v nekraških rekah združbe ličink EPT s kakovostjo vode in značilnostmi mikrohabitata pojasnili manj oziroma enako kot z rabo tal. Zaradi ugotovljenih razlik v vplivih okoljskih dejavnikov na kraške in nekraške reke je smiselno različno upravljanje kraških in nekraških rek.

Effects of artificial lighting of churches on moths (Lepidoptera) in Slovenia

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Light pollution has been recognized as an important factor in biodiversity loss. Moths are among the most numerous and diverse group of insects attracted by lights. Effects of light pollution on moths were studied in a three year survey in LIFE+ project Life at Night (LIFE09 NAT/SI/000378), on five church triplets in different regions of Slovenia. Reflectors were modified to remove light seepage and UV/short-wavelength light emission. During the project each of the churches in a triplet was lighted by original reflectors, and modified reflectors with filter removing UV light only (blue) or filters removing blue and UV light (yellow). Altogether 614 moth species were recorded. Original reflectors attracted 75% more species and 83% more specimens than modified reflectors. There was a significant positive correlation between number of specimens and number of species with increasing light intensity and percentage of UV light. The blue modified reflectors attracted 30% more species and 40% more specimens than yellow reflectors. Thus, a removal of UV/short-wavelength light can minimize the effects of light pollution caused by artificial lighting. This goal could be achieved with minimum financial input by simple modifications of current lighting using UV/short-wavelength light filters.

Vpliv osvetljevanja cerkva na nočne metulje (Lepidoptera) v Sloveniji

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Svetlobno onesnaževanje pomembno vpliva na upadanje biotske raznovrstnosti. Nočni metulji so med vrstno najbolj pestrimi skupinami žuželk, ki jih privablja umetna svetloba. Vplive svetlobnega onesnaževanja smo proučevali v triletnem projektu LIFE + Življenje ponoči (LIFE09 NAT/SI/000378) na petih trojčkih cerkva v različnih slovenskih regijah. Uporabili smo prilagojene reflektorje brez UV/kratkovalovne svetlobe in zaslonkami, ki so preprečile sipanje svetlobe mimo objekta. Med projektom je bila vsaka izmed cerkva v trojčku izmenjaje osvetljena z originalnimi reflektorji, in z modificiranimi reflektorji s filtrom, ki je odstranil le UV (modre) ter s filtrom, ki je odstanil modro in UV svetlobo (rumena). Skupaj je bilo na vseh cerkvah zabeleženih 614 vrst nočnih metuljev. Originalni reflektorji so privabili 75% več vrst in 83% več osebkov kot modificirani. Statistično značilna je pozitivna korelacija med številom osebkov ter številom vrst s povečanjem intenzitete osvetlitve in deležem UV svetlobe. Modri modificirani reflektorji so privabili 30 % več vrst in 40% več osebkov kot rumeni. S filtriranjem UV/kratkovalovne svetlobe in zmanjšanjem intenzitete osvetlitve lahko močno omilimo negativne učinke svetlobnega onesnaževanja, ki ga povzroča javna razsvetljava. To pa lahko dosežemo že s preprostimi spremembami obstoječe razsvetljave z uporabo filtrov za UV/kratkovalovno svetlobo, kjer je tudi finančni vložek minimalen.

Hermit beetle (*Osmoderma eremita*) in The Tivoli Park, Ljubljana

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The Hermit beetle is a saproxylic species whose development is carried out in decayed wood of old deciduous trees. It is endangered in most European countries, and has been given the highest priority according to the EU's Habitats Directive. Adults have limited dispersal ability, therefore to maintain the population is extremely important preserve suitable old tree stands. The Hermit beetle was investigated in the area of the Landscape Park Tivoli, Rožnik and Šišenski hrib in Ljubljana in the years from 2010 to 2013, using the method of screening tree holes and pheromone traps. The presence of adult beetles and larvae was confirmed mostly in the city park Tivoli, especially in horse chestnut trees (*Aesculus hippocastanum*) and linden (*Tilia* sp.). The presence of adult or larvae hermit was confirmed in 16.7% of the investigated trees (N=42), which according to the present data from Slovenia indicates a fairly strong population. Based on data collected with pheromone traps in the Tivoli Park in 2013, the zonation of suitable habitat for Hermit beetle in the park was conducted to serve as a management tool for conservation of the species in the park. The Tivoli Park is a sensitive area due to the large number of people, and therefore logging of old and potentially dangerous trees poses a threat to loss of the Hermit Beetle habitat. The lecture will therefore also present some practical measures taken so far in the park.

Puščavnik (*Osmoderma eremita*) v mestnem parku Tivoli, Ljubljana

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Puščavnik je saproksilna vrsta, katere razvoj poteka v lesnem mulju dupel starih listnatih dreves. Vrsta se obravnava kot prednostno pri varstvu v okviru Natura 2000 omrežja v Evropi. Odrasli so malo mobilni ali pa letijo na zelo kratke razdalje, zato so sklenjeni sestoji ustreznih dreves za vzdrževanje populacije izjemno pomembni. Na območju krajinskega parka Tivoli, Rožnik in Šišenski hrib v Ljubljani smo puščavnika popisovali v letih od 2010 do 2013, pri čemer smo uporabili metodo pregledovanja drevesnih dupel in lov s feromonskimi pastmi. V teh popisih je bila potrjena prisotnost odraslih hroščev in ličink, predvsem v drevesih divjega kostanja *(Aesculus hippocastanum)* in lipe *(Tilia* sp.) z dupli, večinoma v drevoredih mestnega parka Tivoli. Prisotnost puščavnika, odraslih hroščev ali ličink, je bila potrjena v 16,7 % pregledanih dreves (n=42), kar glede na do sedanje najdbe iz Slovenije kaže na dokaj močno populacijo. Na podlagi podatkov zbranih s feromonskimi pastmi v mestnem parku Tivoli v letu 2013 smo območje Tivolija conirali glede na razpoložljivost habitata puščavnika. Ker gre v parku za občutljivo območje zaradi velikega števila ljudi, lahko sečnja starih in potencialno nevarnih dreves predstavlja grožnjo izgube habitata vrste. V predavanju bomo zato predstavili tudi praktične ukrepe sanacije posekanih gnezditvenih dreves.

Behavioural variability in pit-building antlion larvae (Neuroptera: Myrmeleontidae)

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Antlion larvae are so called sedentary predators. Unlike active predators, antlion larvae do not pursue prey, but stay at a fixed location for prolonged period of time and attack only when prey is within their hunting distance. In this hunting strategy no energy is expended for pursuing, larvae need only suitable place, where they wait for prey. Larvae that build pit-fall traps are considered as strict sit-and wait predators, while some authors consider non-pit-building larvae as sit-and-pursue predators, since their hunting place is often changed. When we observed predatory behavior of pit-building antlion larvae of species *Euroleon nostras*, *Myrmeleon formicarius* and *Myrmecaelurus trigrammus* no element of pursuing was noticed, but that was not the case in *Myrmeleon hyalinus*. Larvae of this species not only moved in direction of the prey inside the pit, in some cases, the larvae moved out of the pit-fall trap and pursued the prey outside the trap. We discussed whether it is justified to include all larvae of pit-building species in category "strict sedentary predators".

Vedenjska plastičnost predatorskega vedenja larv volkcev lijakarjev (Neuroptera: Myrmeleontidae)

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Larve volkcev so tako imenovani sedentarni plenilci. Za razliko od aktivnih plenilcev plena ne zasledujejo, ampak ga napadejo le, ko je ta dovolj blizu. S takim načinom lova ne porabljajo energije za zasledovanje plena, temveč le potrebujejo ustrezno mesto, kjer prežijo na plen. Medtem ko larve, ki gradijo lijake, vključujejo med striktne sedentarne predatorje (angl. *sit-and-wait predators*), nekateri avtorji larve nelijakarjev vključujejo med sedentarne predatorje z elementi zasledovanja (angl. *sit-and-pursue predators*), zaradi večkratnega prestavljanja mesta prežanja. Med opazovanjem plenilskega vedenja lijakarjev pri vrstah *Euroleon nostras*, *Myrmeleon formicarius* in *Myrmecaelurus trigrammus* nismo opazili elementov zasledovanja, vendar pa to ne drži za vrsto *Myrmeleon hyalinus*. Larve te vrste ne le, da so se pomikale proti plenu znotraj lijaka, v nekaterih primerih so larve zapustile lijak in zasledovale plen izven lijaka. Sprašujemo se, ali je upravičeno poimenovanje "striktni sedentarni predatorji" za vse vrste lijakarjev.

First eyeless troglobiotic harvestman species in Slovenia

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Although expected since 1980s, no eyeless troglobitic nemastomatid harvestman (Opiliones: Nemastomatidae) species has been known in Slovenia. Here we introduce a highly specialized, endemic troglobitic species *Hadzinia ferrani* Novak & Kozel, 2014, recently found in the cave Ferranova buža near Vrhnika to the regional entomologists. It is characterized by small, 1.1−1.4 mm long body, and very long, but slender appendages; leg II is more than 20 times as long as the body. According to some morphological features, the genus *Hadzinia* Šilhavý, 1966, populating the hypogean habitats of the Dinaric karst, is very similar to *Nemaspela* Šilhavý, 1966, populating the Caucasus. On the other hand, considering genital morphology it is most similar to *Pyza* Staręga, 1976 from the Bakans and *Vestiferum* Martens, 2006 from Caucasus. Despite opposite previous opinions, *Hadzinia* can be clearly distinguished from these genera by a distinctly truncated glans penis and a short stylus, well delimited from the glans. The external morphology of related troglobiotic species is strongly influenced by convergent adaptation to the subterranean habitat, but can diverge according to the adaptation to special microhabitats and/or a kind of food. So long, the genital morphology is probably the most appropriate morphological approach to investigate the taxonomic relationships.

Najdba prve brezoke troglobiontne vrste suhih južin v Sloveniji

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V Sloveniji doslej nismo našli nobene brezoke troglobiontne suhe južine iz družine kroglolask (Opiliones: Nemastomatidae), kljub temu da tako najdbo pričakujemo že od osemdesetih let 20. stoletja. V tem prispevku predstavljava regionalnim entomologom zelo specializirano troglobiontsko endemično vrsto *Hadzinia ferrani* Novak & Kozel, 2014 iz jame Ferranova buža v bližini Vrhnike. Osebki so gracilni, z 1,1–1,4 mm dolgim trupom in zelo dolgimi tankimi okončinami; drugi par nog je več kot 20-krat tako dolg kot trup. Rod *Hadzinia*, Šilhavý, 1966, ki poseljuje podzemeljske habitate dinarskega krasa, je po določenih morfoloških značilnostih zelo podoben rodu *Nemaspela* Šilhavý, 1966 z območja Kavkaza, po genitalni morfologijji pa je najbolj podoben rodovoma *Pyza* Staręga, 1976 z Balkana, in *Vestiferum* Martens, 2006 s Kavkaza. Kljub dosedanjemu nasprotnemu mnenju se rod *Hadzinia* jasno razlikuje od teh rodov po razločno prisekani glavi penisa in kratkem šilu, ki sta jasno razmejena. Zunanja morfologija sorodnih troglobiontnih vrst močno odraža konvergentne adaptacije na življenje v podzemeljskih habitatih, medtem ko hkrati poteka divergenten razvoj zaradi prilagoditev na specifične mikrohabitate ter vrsto hrane. Zato je obravnava genitalne morfologije verjetno najprimernejši morfološki pristop pri proučevanju sorodstvenih povezav.

The evidence of autophagic structures in the fat body of the diapausing cave cricket *Troglophilus cavicola* (Rhaphidophoridae, Saltatoria)

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The cave crickets *Troglophilus cavicola* overwinter in hypogean habitats. The presence of the autophagic structures in the fat body cells was studied during this non-feeding period. Using transmission electron microscopy (TEM), autophagic structures–phagophores, autophagosomes and autolysosomes–were not found in the fat body cells before overwintering in November, but they were present in the middle of overwintering (January) and were most abundant at the end of overwintering (March). Observations of TEM were confirmed using immunofluorescence microscopy. The results indicates that autophagic processes are induced by starvation during the overwintering.

Dokaz avtofagnih struktur v maščobnem telesu jamske kobilice *Troglophilus cavicola* (Rhaphidophoridae, Saltatoria) med diapavzo

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Jamske kobilice *Troglophilus cavicola* prezimujejo v podzemeljskih habitatih. Prisotnost avtofagnih struktur smo spremljali v času prezimovanja, ko se osebki ne prehranjujejo. Z metodo transmisijske elektronske mikroskopije (TEM) pred prezimovanjem (november) nismo opazili avtofagnih struktur – fagoforov, avtofagosomov, avtolizosomov – v celicah maščobnega telesa, medtem ko so bile prisotne sredi prezimovanja (januar) in jih je bilo največ ob koncu prezimovanja (marec). Opažanja, dobljena s TEM, smo potrdili s pomočjo imunofluorescenčne metode. Na osnovi rezultatov lahko sklepamo, da se procesi avtofagije sprožijo s stradanjem med prezimovanjem.

Public institution Goričko Landscape Park - meadows management

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Goričko Landscape Park is in the northeastern part of Slovenia, on the border with Austria and Hungary. The surface of the protected area is 462 km^2, one-third is covered by mixed forest, which surrounds a mosaic cultural landscape. The special nature value has agricultural land: dry and wet meadows, orchards of high-trunk fruit trees and hedges. Park administration pays the most attention to the different types of meadows habitats. Beside informing and educating the owners of meadows, administration park took in the past five years in the management 30 ha of meadows, with a purpose of conservation the rare and protected and Natura 2000 species.
Mowing is of course also adapted to this. On most of the meadows it is late mowing (in the second half of August, September and October), mowing is only with shear mowers, we also leave lines of unmown vegetation. On the surfaces, which were in the different successive phases, is priority partially removal of bushes and trees, but mainly supression of invasive alien species. Meadow habitats management is an important part of annual work programme and management plan of Landscape Park Goričko (in progress). The long-term goal is beside informing the local population, also to maintained a network of habitats in good condition, which will presented a population centroide of different species.

Travniki v upravljanju Javnega zavoda Krajinski park Goričko

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Krajinski park Goričko leži na skrajnem severovzhodnem delu Slovenije, na meji z Avstrijo in Madžarsko.
Površina zavarovanega območja je 462 km^2, tretjino pokriva mešan gozd, ki obdaja mozaično kulturno krajino. Posebno naravovarstveno vrednost imajo zemljišča v kmetijski rabi: suhi in mokrotni travniki, senožetni sadovnjaki z visokodebelnimi drevesi in mejice.
Uprava parka posveča največ pozornosti različnim tipom travniških habitatov. Poleg osveščanja in izobraževanja lastnikov travnikov, je uprava parka v zadnjih petih letih v upravljanje prevzela 30 ha travnikov, z namenom ohranjanja redkih, zavarovanih in Natura 2000 vrst. Temu je seveda prilagojena tudi košnja. Na večini travniških parcel se izvaja pozna košnja (v drugi polovici avgusta, septembra in oktobra), kosi se izključno s strižnimi kosilnicami, puščajo pa se tudi pasovi nepokošene vegetacije. Na površinah, ki so bile v različnih sukcesivnih fazah, je prioriteta delno odstranjevanje grmovnih in drevesnih vrst, predvsem pa zatrtje tujerodnih invazivk.
Upravljanje s travniškimi habitati je pomemben del vsakoletnega programa dela in načrta upravljanja Krajinskega parka Goričko (v nastajanju). Dolgoročni cilj je poleg spodbujanja lokalnega prebivalstva, vzpostaviti mrežo habitatov v ugodnem stanju, ki bodo predstavljali populacijske centroide različnih vrst.

Preliminary report on the gregarines (Protozoa: Apicomplexa: Gregarinida) of Myriapoda in Slovenia

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Gregarines (Gregarinida) 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 arthropods in Slovenia is poor; till now, gregarines have been reported in the country only from insects. In the period from June 2013 to January 2014 intestine of myriapods was occasionally inspected for the presence of gregarines. Chilopoda and Diplopoda were infected and the following gregarine species were recorded: *Echinomera hispida* (Schneider, 1875), *Actinocephalus dujardini* Schneider, 1875, *Stenophora julipusilli* (Leidy, 1853) and *Cnemidospora lutea* Schneider, 1882.

Prispevek k poznavanju gregarin (Protozoa: Apicomplexa: Gregarinida) iz stonog (Myriapoda) v Sloveniji

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Gregarine (Gregarinida) so razmeroma velike praživali, ki parazitirajo v prebavilih in telesnih votlinah nevretenčarjev – kolobarnikov, plaščarjev, sipunkulidov in zlasti členonožcev. Poznavanje njihovega pojavljanja pri členonožcih Slovenije je slabo, saj so bile gregarine zabeležene le v žuželkah. Od junija 2013 do januarja 2014 smo priložnostno pregledovali prebavila stonog. V strigah in dvojnonogah smo zabeležili naslednje vrste gregarin: *Echinomera hispida* (Schneider, 1875), *Actinocephalus dujardini* Schneider, 1875, *Stenophora julipusilli* (Leidy, 1853) in *Cnemidospora lutea* Schneider, 1882.

Honey bee (*Apis mellifera carnica*) as a model organism in nanotoxicology research

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The global expansion of nanotechnology and commercial use of nanoparticles (NPs) poses real concern regarding their toxic potential. NPs negative effects have already been observed in many wild and cultivated organisms. As one of the oldest domesticated subspecies, honey bees (*Apis mellifera carnica*) have already been used as bioindicators of environmental pollution. This is the first attempt to study nanotoxicity in honey bee. We used fitness parameters such as trophallaxis, feeding rate and mortality rate and activities of a stress-related enzymes glutathione *S*-transferase (GST) and catalase (CAT) and the neurotoxicity biomarker acetylcholinesterase (AChE) to study NP effect on honey bee metabolism. Chronic exposure to zinc oxide (ZnO), titanium oxide (TiO_2) and carbon black (CB) NPs induced different effects on the monitored parameters. Only chronic exposure to ZnO NPs induced elevation of AChE and GST brain activity, increased mortality, while chronic exposure to TiO_2, CB NPs or acute treatment of all NPs tested induced no significant changes in observed parameters. The data of our study showed that multibiomarker battery of tests used in nanotoxicology research on other invertebrates can be useful approach towards better understanding toxic effects of NPs on honey bee population.

Krajnska čebela (*Apis mellifera carnica*) kot modelni organizem za nanotoksikološke raziskave

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S širitvijo nanotehnologije in komercialne uporabe nanodelcev (ND) se pojavljajo vprašanja glede njihove morebitne toksičnosti. Pokazali so, da imajo lahko ND negativne učinke na številne divje in gojene vrste živali. Kranjska čebela (*Apis mellifera carnica*), ki je ena izmed najstarejših udomačenih podvrst, se že uporablja kot bioindikator onesnaženosti okolja. To je prva raziskava nanotoksičnosti na čebelah. V raziskavi smo ugotavljali vpliv ND na stopnjo trofalakse (izmenjave hrane), hranjenja in umrljivosti ter aktivnost encima glutation S- transferaze, ki je povezan s stresom živali, in encima acetilholinesteraze, ki je pokazatelj delovanja živčevja. Kranjske čebele so bile akutno in kronično izpostavljene naslednjim ND: cinkovemu oksidu (ZnO), titanovemu oksidu (TiO2) in sajam (CB). Kronična izpostavitev ZnO ND je povečala glutation S- transferazno in acetilholinesterazno možgansko aktivnost, povečano smrtnost, medtem ko kronična izpostavitev TiO2 , CB ND ter akutna izpostavitev vsem testiranim ND ni povzročila sprememb v analiziranih parametrih. Rezultati naše raziskave so pokazali, da je lahko kombinirano spremljanje omenjenih parametrov, ki so že v veljavi v nanotoksičnih raziskavah na drugih nevretenčarjih, pomemben pristop k boljšemu razumevanju toksičnih učinkov ND na populacijo kranjske čebele.

Critical values of the eutrophication pressures of Slovenian rivers – can be identified based on benthic invertebrate assemblages?

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Eutrophication is the (human induced) increase in factors that move an ecosystem toward eutrophic state. Anthropogenic nutrient inputs drive structural and functional changes in a river-ecosystem, that are often not detectable by primary producers only. Benthic invertebrate assemblages (BI) are good ecological indicators of water ecosystems. Based on BI assemblages, we determined critical values of eutrophication variables that coincide with strucural and/or functional changes of ecosystems. We used a river microhabitat type sampling protocol to take 305 samples of BI in Slovenian rivers. BI were identified to the taxonomic level used for the assessment of ecological river status in Slovenia, usually species or genus level. Regarding the river-eutrophication criteria, long eutrophication gradients were considered in our study, reaching from pristine (oligotrophic) to heavily modified (eutrophic) conditions. TITAN (Treshold Indicator Taxa Analysis) was applied to BI and eutrophication variables-data to identify the ecological thresholds and BI indicator taxa in Slovenian rivers. The identified ecological treshold-values of the eutrophication variables were relatively low, compared to the international standards. The identified threshold values are a usefull guide, when setting the water management goals.

Kritične vrednosti obremenitev evtrofikacije vodotokov – jih lahko ugotovimo na podlagi združb bentoških nevretenčajev?

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Evtrofikacija je proces, pri katerem se zaradi (antropogeno) povečanega vnosa hranil povečuje produktivnost ekosistemov. Antropogeni vnos hranil se odrazi na različnih ravneh zgradbe in delovanja rečnega ekosistema, zato ga le s primarnimi producenti pogosto ne moremo ovrednotiti. Združbe bentoških nevretenčarjev (BN) so dobri kazalci sprememb v vodnih ekosistemih. Na podlagi sprememb v združbah BN smo določili vrednosti spremenljivk evtrofikacije, ki pomembno vplivajo na spremembe v zgradbi in/ali delovanju ekosistemov. BN smo vzorčili s kvantitativno metodo vzorčenja mikrohabitatnih tipov in v 305 vzorcih iz slovenskih rek BN določili večinoma do vrste, v nekaterih primerih do rodu ali poddružine. Glede na kriterije za razvrščanje rek v razrede trofičnosti smo opisali dolge gradiente trofičnosti – od nespremenjenih (oligotrofnih) do močno spremenjenih (evtrofnih) razmer. Podatke o združbah BN v odvisnosti od spremenljivk evtrofikacije smo analizirali z metodo TITAN (Treshold Indicator Taxa Analysis) in določili vrednosti ekološkega praga in indikatorske taksone BN za vodotoke v Sloveniji. Vrednosti ekološkega praga smo ugotovili pri vrednostih spremenljivk evtrofikacije, ki so nižje od vrednosti navedenih v mednarodnih standardih. Ugotovljene vrednosti lahko uporabimo pri določitvi ciljev upravljanja voda.

Parasitoid complex associated with *Ips typographus* (Coleoptera, Scolytinae) in Altimontane belt of Slovenia (Pohorje)

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Ips typographus is one of the most important species in European spruce forests from ecological and economical point of view. Parasitoids are known to be an important factor in population density regulation of European spruce bark beetle. In our study of the parasitoid complex of the discussed species in 2011 and 2012, we collected bark samples from trees infested with *I. typographus* in spruce stands (*Picea abies* (L.) Karst.) in the alti-montane belt of Slovenia (Pohorje region). The samples were taken at different altitudes, 450, 750 and 1200 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. Total number of 12 species was found at all locations. At the location Rdeči breg the most abundant species was *Roptrocerus xylophagorum* with 218 specimen. *Tomicobia seitneri, Dinotiscus eupterus* and *Rhopalicus tutela* followed with 19, 9 and 7 specimen. In samples taken at location Josipdol *R. xylophagorum* was again the most abundant with 334 specimen shortly followed by *R. tutela* (120 specimen) and *T. seitneri* (18). At location Lavtrovo the most abundant species was again *R. xylophagorum* with 530 specimen. *R. tutela, E. arctica* and *Ropalophorus clavicornis* were found in smaller number, 5 or less. Most species belong to the Pteromalidae and Braconidae family. We compared our findings with other studys of parasitoid complex of *I. typographus* in Europe.

Parazitoidni kompleks povezan z vrsto *Ips typographus* (Coleoptera, Scolytinae) v altimontanskem pasu Slovenije (Pohorje)

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Ips typographus je zelo pomembna vrsta v smrekovih gozdovih Evrope predvsem iz ekološkega in ekonomskega vidika. Za parazitoide osmerozobega smrekovega lubadarja je znano, da lahko imajo pomembno vlogo pri regulaciji velikosti njihove populacije. V naši raziskavi v letih 2011 in 2012 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, 450, 750 in 1200 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. Na vseh lokacijah skupaj smo našli 12 vrst. Na lokaciji Rdeči breg je bila najštevilčnejša vrsta *Roptrocerus xylophagorum* z 218 osebki. *Tomicobia seitneri, Dinotiscus eupterus* in *Rhopalicus tutela* so sledili z 19, 9 in 7 osebki. V vzorcih iz lokacije Josipdol je bila vrsta *R. xylophagorum* spet naštevilčnejša, z 334 osebki. Sledili sta vrsti *R. tutela* (120 osebkov) in *T. seitneri* (18). Na lokaciji Lavtrovo je bila izrazito najštevilčnejša vrsta *R. xylophagorum* z 530 osebki. *R. tutela, E. arctica* in *Ropalophorus clavicornis* so bili najdeni v manjšem številu, 5 ali manj. Prevladovale so vrste iz družin Pteromalidae in Braconidae. Naše rezultate smo primerjali z ostalimi raziskavami parazitoidnega kompleksa vrste *I. typographus* v Evropi.

Developing an acoustic tool for mating disruption of *Scaphoideus titanus* (Hemiptera: Cicadellidae)

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Leafhoppers (Hemiptera: Cicadellidae) rely exclusively on vibrational signals to guide their mating behaviour, which opens a possibility for innovative approaches to controlling pest populations. Artificially induced mechanical vibrations are, in principle, able to prevent mating by obscuring information about the emitter's location, identity and quality, contained in vibrational signals and necessary for mating success. We developed a proof of concept, targeting an invasive leafhopper species *Scaphoideus titanus*, which acts as a vector for the phytoplasma Flavescence dorée in grapevines. We used a disturbance signal, such as it is used by males of this species in rival interactions with other males, and transmitted it into plants using a minishaker or a loudspeaker playback. We tested efficiency and limitations of the technique in laboratory and semi-natural conditions, focusing on amplitude, diel pattern of activation and method of transmitting disturbance signals to host plants of *S. titanus*. Our ultimate goal is to develop an environmentally friendly technique for insect pest control that could replace pesticide use in certain settings, such as vineyards and greenhouses.

Razvoj akustične metode za motenje paritvenega vedenja ameriškega škržatka (*Scaphoideus titanus*; Hemiptera: Cicadellidae)

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Za male škžatke (Hemiptera: Cicadellidae) je značilna popolna odvisnost od vibracijskih signalov pri paritvenem vedenju, kar predstavlja priložnost za inovativne pristope za kontrolo populacij škodljivcev. Umetno povzročene mehanske vibracije lahko načeloma zabrišejo informacije o lokaciji, vrstni pripadnosti in kvaliteti oddajnika, ki jih vsebujejo signali in so nujne za uspešno parjenje, s tem pa preprečijo parjenje. Razvili smo dokaz koncepta, ki cilja v Evropi invazivnega ameriškega škržatka, prenašalca zlate trsne rumenice, nevarne bolezni vinske trte. Uporabili smo umeten motilni signal, kakršne uporabljajo samci te vrste pri rivalnih interakcijah z drugimi samci, in ga predvajali s pomočjo miniaturnega vzbujevalnika, pritrjenega na rastlino, ali zvočnika. Preskusili smo učinkovitost in omejitve tehnike v laboratorijskih in pol-naravnih pogojih, s poudarkom na amplitudi, dnevno-nočnem vzorcu aktivacije motenja in načinu prevajanja motilnih signalov do gostiteljskih rastlin ameriškega škržatka. Cilj je na modelu te vrste razviti okolju prijazno tehniko kontrole žuželčjih škodljivcev, ki bi pomagala nadomestiti uporabo pesticidov v okoljih, kakršna so na primer vinogradi in rastlinjaki.

Nature Reserve Škocjanski zatok Beetle fauna (Coleoptera)

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With the proclamation as a nature reserve in 1998 the Škocjanski zatok at the edge of Koper was protected from destruction. It extends to 122 hectares and represents one of the largest brackish and freshwater marshes in Slovenia. In the area, fauna of beetles was intensively studied in 2010 and 2012. So far we recorded over 300 species of beetles. Among the identified species at least 5 are new to the Slovenian fauna, for many others Škocjanski zatok represents the second or third known locality in the country. A particularly rich fauna has proven to be that of aquatic beetles, such as the Diving beetles (Dytiscidae) and Water scavenger beetles (Hydrophilidae) and the fauna of Ground beetles (Carabidae), which are also linked to types of marsh and halophilic environment. About 30 of the identified species live exclusively (halobions) or only occasionally (halophilic) in brackish environments. In Slovenia these species are restricted to a narrow coastal strip. With the resumption of cattle and horse grazing within the freshwater reserve part of the coprophagus Scarab beetles (Scarabaeidae) are back on the Slovenian coast. Among the identified species, 6 are listed on the Red List of the Threatened Slovenian beetles species: one in the category of rare species (R), one in the category of insufficiently known species (K) and four in the category of endangered species (E).

Favna hroščev (Coloptera) Naravnega rezervata Škocjanski zatok

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Škocjanski zatok na robu Kopra je bil z razglasitvijo kot naravni rezervat pred uničenjem zavarovan leta 1998. Razteza se na 122 hektarjih površine in predstavlja eno največjih brakičnih in sladkovodnih močvirij v Sloveniji. V območju smo favno hroščev intenzivneje raziskovali v letih 2010 in 2012 ter doslej zabeležili prek 300 vrst hroščev. Med ugotovljenimi vrstami je vsaj 5 vrst novih za slovensko favno, za številne ostale pa je Škocjanski zatok drugo ali tretje znano nahajališče v državi. Zlasti bogata se je izkazala favna vodnih hroščev, kot so kozaki (Dytiscidae) in potapniki (Hydrophilidae) ter favna hroščev krešičev (Carabidae), med katerimi so tudi številne vrste vezane na vodna, močvirska in halofilna okolja. Približno 30 ugotovljenih vrst je takih, ki žive izključno (halobionti) ali pa le občasno (halofili) v brakičnih okoljih. Te vrste so v Sloveniji omejene le na ozek obalni pas. Z oživitvijo paše govedi in konj v sladkovodnem delu rezervata so se na slovensko obalo vrnili tudi koprofagni hrošči skarabeji (Scarabaeidae). Med ugotovljenimi vrstami je 6 vrst uvrščenih na rdeči seznam ogroženih vrst hroščev Slovenije, od tega ena v kategorijo redkih vrst (R), ena v kategoriji premalo poznanih vrst (K) in štiri v kategoriji prizadetih vrst (E).

Knowledge of stoneflies (Insecta Plecoptera) in Slovenia

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First records and descriptions of stoneflies (Insecta: Plecoptera) we can find in Entomologia Carniolica from Scopoli published in 1763. Unfortunately only one species of Scopoli is still valid today, as his collection was destroyed by fire. For long time nobody worked on this group in the territory of Slovenia. Intense studies started again 35 years ago, what resulted in one of the largest European collection of stoneflies that we have in Slovenian Museum of Natural History in Ljubljana. Presently we have 123 species of stoneflies in the territory of Slovenia. This makes Slovenia one of the real hot spots for the diversity of this group of aquatic insects in Europe.

Stanje poznavanja vrbnic (Insecta Plecoptera) v Sloveniji

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Prve podatke in opise novih vrst vrbnic na ozemlju Slovenije najdemo v Entomologiji Carniolici, Scopolija iz leta 1763. Na žalost je danes veljavna le še ena vrsta, saj se njegova zbirka ni ohranila. Potem se dolga leta s to skupino žuželk v Sloveniji ni ukvarjal nihče. Intenzivne raziskave vrbnic v Sloveniji so potekale v zadnjih 35 letih. Kot rezultat je enanajvečjih zbirk vrbnic v Evropi, ki jo hrani Prirodoslovni muzej Slovenije v Ljubljani. Do sedaj smo na območju Slovenije ugotovili prisotnost 123 vrst vrbnic, kar uvršča Slovenijo med vroče točke biotske raznovrstnosti te skupine vodnih žuželk v Evropi.

Morphological traits in adult lacewings of the genus *Chrysoperla* Steinmann, 1964 (Neuroptera: Chrysopidae) in Slovenia and western Balkan countries

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The European sibling species of the green lacewing genus *Chrysoperla* Steinmann, 1964 are well defined by vibrational courtship songs but insufficiently distinguished by morphological traits. In Slovenia and western Balkan countries the following species were confirmed: *Chrysoperla carnea* (Stephens, 1836) sensu stricto, *Ch. lucasina* (Lacroix, 1912), *Ch. pallida* Henry, Brooks, Duelli & Johnson, 2002, *Ch. agilis* Henry, Brooks, Duelli & Johnson, 2003 and *Ch. mediterranea* (Hölzel, 1972). To distinguish the species certain morphological features were evaluated using statistical morphometric methods. The following characters were chosen: extent of dark brown stripe on maxillar stipes, proportion of black and blonde setae on pronotum, length of costal setae, black markings on wing veins, length of setae on abdominal sternites and others.

Morfološke poteze odraslih tenčičaric iz rodu *Chrysoperla* Steinmann, 1964 (Neuroptera: Chrysopidae) v Sloveniji in deželah zahodnega Balkana

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Evropske vrste dvojčice med tenčičaricami iz rodu *Chrysoperla* Steinmann, 1964 so dobro opredeljene po svojih vibracijskih snubitvenih napevih, toda po morfoloških znakih jih slabo razlikujemo. V Sloveniji in državah zahodnega Balkana smo potrdili pojavljanje naslednjih vrst: *Chrysoperla carnea* (Stephens, 1836) sensu stricto, *Ch. lucasina* (Lacroix, 1912), *Ch. pallida* Henry, Brooks, Duelli & Johnson, 2002, *Ch. agilis* Henry, Brooks, Duelli & Johnson, 2003 in *Ch. mediterranea* (Hölzel, 1972). Za lažje razlikovanje vrst smo določene morfološke značilnosti ovrednotili s pomočjo statističnih morfometričnih metod. Upoštevali smo naslednje znake: velikost temne proge na maksilarnem stipesu, razmerje med temnimi in svetlimi dlačicami na pronotumu, dolžino kostalnih dlačic, temno obarvane dele žil v krilih, dolžino dlačic na abdominalnih sternitih in druge.

Protrusive scent organs in male cave crickets *Troglophilus neglectus* (Orthoptera: Rhaphidophoridae) serve primarily intermale agonism

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Males of *Troglophilus neglectus* cave crickets possess protrusive abdominal scent glands, which were generally presumed to influence female behaviour before mating. The validity of this hypothesis, as well as of the alternative possibility of the signal being designed for the rivals, was tested first by describing the detailed context and consequences of such signalling by gland protrusion in the species' mating period. Data were obtained in two seasons, by interval and focal behavioural sampling over small groups of males and females, observed for long periods under naturalistic conditions. Males protruded the glands in different behavioural contexts, including interactions with both mates and rivals. Such signalling, however, did not constitute an obligatory part of courtship and pre-mating in general, and caused neither female attraction not influenced courtship success. Gland protrusion was expressed significantly more often during the male contacts with another male than during contacts with a female. Of the different behaviours expressed during male-male encounters, aggressiveness was significantly correlated with gland protrusion in the respective individuals. These data strongly imply the primary function of the male scent as an agonistic signal, influencing the outcome of male-male contests. This was confirmed in another set of experiment, in which the males reared individually were first put together with a male or a female as adults. By interactions with the rivals, these males expressed a high level of aggressiveness associated by gland protrusion. The preliminary data of the influence of the presence and the intensity of such signalling on winning or losing a fight is presented.

Izbočljivi vonjalni organi samcev jamskih kobilic *Troglophilus neglectus* (Orthoptera: Rhaphidophoridae) služijo primarno agonizmu med samci

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Samci jamskih kobilic *Troglophilus neglectus* imajo na zadku izbočljive vonjalne organe, ki naj bi služili privabljanju oz. spolni stimulaciji samic. Veljavnost te predpostavke oz. njene alternativne možnosti, da je signal namenjen rivalu, smo testirali najprej prek opisa natančnega konteksta in posledic izbočanja žlez pri samcih v obdobju parjenja. Vedenjski podatki so iz dveh sezon, pridobljeni z intervalnim in tarčnim snemanjem majhnih skupin samcev in samic, opazovanih prek daljših obdobij v naturalističnih pogojih. Samci so izbočali žleze v različnih vedenjskih kontekstih, vključujoč tako interakcije z rivali kot potencialnimi partnerji. Tako vedenje pa ni bilo nujen sestavni del dvorjenja oz. vedenja pred parjenjem na sploh, in ni vplivalo niti na privabljanje samic niti na uspeh dvorjenja. Izbočanje žlez se je značilno pogosteje pojavljalo ob kontaktih samca z drugim samcem kot med kontakti s samico. Izmed različnih tipov vedenj, ki so spremljali kontakte med samci, je bilo agresivno vedenje statistično značilno povezano z izbočanjem žlez pri dotičnih osebkih. Ti podatki jasno kažejo na primarno vlogo vonjav samčevih žlez v okviru agonističnega vedenja, oz. vpliva na izid bojev med samci. To tezo smo potrdili z nadaljnjim setom poizkusov, v katerih smo ovrednotili vedenje samcev, ki smo jih gojili posamič in jih prvič združili s samcem oz. samico v okviru poizkusa. Pri interakcijah z rivalom so ti samci izrazili visok nivo agresije v tesni povezavi z izbočanjem žlez. Predstavljamo preliminarne podatke o vplivu prisotnosti oz. intenzitete njihovega signaliziranja z izbočanjem žlez na zmago oz. poraz v boju.

Cicadas of the genus *Pagiphora* (Hemiptera, Cicadidae) - distribution and their acoustic signals

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The cicada genus *Pagiphora* Horváth 1912 consists of five species: *P. annulata* (Brullé 1832) distributed in South-East Europe and Asia Minor, *P. aschei* Kartal 1978 from Crete, *P. hauptosa* Boulard 1981 from Antalya, *P. yanni* Boulard 1992 from Anatolia and *P. maghrebensis* Boulard 1981 from North Africa.
Acoustic signals of *P. yanni* were described by Boulard (1992), *P. aschei* by Gogala & Trilar (2012) and of *P. annulata* by Gogala & Trilar (2000), who described in this species also the wing clicking involved in sound production (Gogala & Trilar 2003). We give for the first time the song description of *P. hauptosa*. The song of *P. maghrebensis* is not described yet.
To all species of this genus is common a surprisingly low frequency band for relatively small animals. The spectral range for *P. yanni* is between 6.2 and 6.6 kHz and for tymbal parts of the song of *P. annulata* the main energy even at frequencies between 3 and 5 kHz. The main energy for *P. aschei* is at frequencies between 5.2 and 7.3 kHz and for *P. hauptosa* between 5.7 and 6.6 kHz. According to Bennet-Clark & Young (1994) the emitted frequency of such small cicada should be around 12 kHz.

Škržadi iz rodu *Pagiphora* (Hemiptera, Cicadidae) - razširjenost in njihovi akustični signali

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V škržadji rod *Pagiphora* Horváth 1912 uvrščamo pet vrst: nizkospevnega škržada (*P. annulata* (Brullé 1832)) iz JV Evrope in Male Azije, kretskega nizkospevnega škržada (*P. aschei* Kartal 1978) iz otoka Kreta, antalskega nizkospevnega škržada (*P. hauptosa* Boulard 1981) iz Antalije, anatolskega nizkospevnega škržada (*P. yanni* Boulard 1992) iz Anatolije in afriškega nizkospevnega škržada (*P. maghrebensis* Boulard 1981), ki je razširjen v severni Afriki.
Leta 1992 je Boulard opisal akustične signale *P. yanni*, Gogala in Trilar pa leta 2012 *P. aschei*. Tudi napev *P. annulata* sta opisala Gogala in Trilar (2000), ki sta pri tej vrsti istočasno opisala tudi pokanje s krili, ki spremlja običajne akustične signale (Gogala in Trilar 2003). V tem prispevku prvič opisujeva petje *P. hauptosa*. Pri vrstah *P. aschei*, *P. yanni* in *P. hauptosa* pokanja s krili nismo opazili. Napev vrste *P. maghrebensis* še ni opisan.
Vsem štirim vrstam z znanim napevom je skupno, da napevi vsebujejo presenetljivo nizke frekvence za tako majhne živali. Pri *P. hauptosa* je spektralno območje med 5,7 in 6,6 kHz (Boulard 1992) in pri *P. yanni* med 4 in 9 kHz (Boulard 1992). Pri *P. annulata* je glavnina energije za del napeva proizvedenega s timbalom še nižje, med 3 in 5 kHz (Gogala in Trilar 2003) in za *P. aschei* med 5 in 8 kHz (Gogala in Trilar 2012). Glede na delo Bennet-Clark in Young (1994) bi morala biti frekvenca oglašanja pri tako majhnih škržadih okoli 12 kHz.

Melitaea ornata Christoph, 1893, important new butterfly record for Slovenia

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Melitaea ornata is an enigmatic cryptic species closely resembling the widespread close relative *M. phoebe*. Therefore its range and ecology in the western part of its range in Europe have been insufficiently studied. In 2011 two females of *M. ornata*-like butterflies were sampled for a rearing experiment from a location near Rakitovec in south-western Slovenia. The habitat at the site is partially overgrown calcareous dry grassland with many small dolinas. Ova obtained from a single female suffered unusually heavy mortality and only few larvae, which had black heads, survived to produce adults. A possible explanation is that *M. ornata* female was fertilised by male *M. phoebe* producing less viable hybrid offspring. In 2012 rearing was repeated and larvae with red-brown heads were obtained unambiguously confirming the presence of *M. ornata* in Slovenia. The larvae of *M. ornata* are oligophagous feeding on many different species of Asteraceae, particularly of the genus *Centaurea*. We found them feeding on *Carduus collinus*; this is the first record of this plant being used as a host-plant by *M. ornata*. Based on our observations we provide ideas on where to search for additional sites of this interesting species in Slovenia.

Melitaea ornata Christoph, 1893, pomembna nova najdba dnevnega metulja za Slovenijo

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Melitaea ornata je kriptična vrsta, ki je zelo podobna sorodni in pri nas pogosti *M. phoebe*. V letu 2011 sta bili v bližini vasi Rakitovec v jugozahodni Sloveniji ujeti dve samici podobni *M. ornata* za vzgojo larvalnih stadijev. Življenjski prostor na tem območju so delno zaraščena suha travišča na apnenčasti podlagi z veliko majhnimi vrtačami. Jajčeca je odložila le ene od samic in ta so imela nenavadno nizko viabilnost. Razvilo se je le nekaj gosenic s črno obarvano glavo, ki so preživele do odraslega stadija. Možna razlaga je, da je samico *M. ornata* oplodil samec *M. phoebe*, in je bila viabilnost manjša zaradi hibridizacije. V letu 2012 je bilo gojenje ponovljeno in tokrat so imele gosenice rdeče obarvane glave, kar neizpodbitno dokazuje, da je *M. ornata* prisotna tudi v Sloveniji. Gosenice *M. ornata* so oligofagne in se hranijo z različnimi vrstami košarnic, predvsem iz rodu *Centaurea*. Pri nas so bile v naravi najdene na *Carduus collinus*, kar je nova potrjena hranilna rastlina gosenic za *M. ornata*. Na podlagi naših opazovanj podajava ideje za nadlajnje raziskave razširjenosti te zanimive vrste v Sloveniji.

Population trends of selected beetle species of European conservation concern in Slovenia: the first results of national monitoring scheme of beetles

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According to EU Habitat Directive member states are obliged not only to declare Natura 2000 sites for qualification species but also to assess their population status. Beetles are one of the largest groups of qualification species. It is assumed that at least 20 species are potentially occurring in Slovenia, but presence of 10 species was recently confirmed and for out of 4 species long-term monitoring scheme was established; for *Carabus variolosus* and *Lucanus cervus* from 2007 on, for *Rosalia alpine* from 2008 on, and for *Morimus funereus* from 2009 on. Two approaches for population assessment were applied, distribution and population monitoring, which are methodologically different. In the contribution methodological approaches of quantitative sampling will be presented including first analysis of population dynamics and up-dates of species distributions based on intensive samplings conducted in last years. Species presence depends on local environmental conditions, which are reflecting also in different abundances. One of the aims of national monitoring scheme for beetles is therefore also evaluation of species distribution patterns not only considering qualitative but also quantitative systematic samplings, i.e. relative population densities.

Populacijski trendi izbranih vrst hroščev evropskega varstvenega pomena v Sloveniji: prvi rezultati nacionalnega monitoringa hroščev

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Glede na določbe EU Habitatne direktive so države članice ne le dolžne opredeliti posebna varstvena območja v okviru omrežja Natura 2000 za kvalifikacijske vrste, pač pa tudi spremljati njihovo populacijsko stanje. Hrošči so ena najobsežnejših skupin kvalifikacijskih vrst. V Sloveniji se po oceni vsaj potencialno pojavlja 20 vrst, od tega s potrjeno recentno prisotnostjo 10 vrst, med katerimi je do sedaj bila vzpostavljena shema dolgoročnega populacijskega spremljanja za štiri vrste; za močvirskega krešiča *(Carabus variolosus)* in rogača *(Lucanus cevus)* od 2007 dalje, za alpskega kozlička *(Rosalia alpina)* od 2008 dalje in za bukovega kozlička *(Morimus funereus)* od 2009 dalje. Shema monitoringa zajema dva pristopa spremljanja populacije, monitoring razširjenosti in populacijski monitoring, ki se metodološko razlikujeta. V prispevku bodo predstavljeni metodološki pristopi kvantitativnega vzorčenja, rezultati spremljanja obravnavanih vrst s prvimi analizami populacijske dinamike in dopolnitev poznavanja razširjenosti glede na intenzivna vzorčenja v zadnjih letih, kot razkorak med sistematičnim vzorčenjem in zbiranjem naključnih najdb. Vrste se zaradi različnih okoljskih razmer pojavljajo v različnih okoljih v različni številčnosti, zato je bil namen nacionalnega monitoringa tudi ovrednotenje prostorskega razporejanja izbranih vrst v Sloveniji ne le z obzirom na kvalitativne pač pa tudi kvantitativne kazalce, npr. relativne populacijskega gostote.

Biodiversity of butterfly fauna in Nature park Goričko

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In years 2010 and 2011 intensive butterfly mapping was carried out in Goričko with the aim of producing an international butterfly atlas of Goričko Nature park (Slovenia) and National park Őrség (Hungary). A 2.5x2.5 km grid was created for this purpose. Butterflies were surveyed on at least 4 localities in one grid cell. Altogether 100 species of butterflies were detected and 25.121 records of butterflies were collated. The number of species represents 56% of all butterfly species in Slovenia. 27 species were detected in more than 90% of the squares, 15 species in less than 10 squares and of those 3 species only at one location. The highest butterfly diversity is in NE part of Goričko where 84 species in one square were found. In this part traditional extensive agriculture is still present, with well preserved dry meadows on the hills and wet meadows in the valleys. To the south and west the number of species is decreasing. In Goričko 20 threatened species were found, which represents 35% of all threatened species in Slovenia. Goričko is important refugee for those species, especially for those with their main centers of distribution in Slovenia in this region (*Phengaris teleius*, *P. nausithous*).

Vrstna pestrost dnevnih metuljev Krajinskega parka Goričko

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V letih 2010 in 2011 je potekalo intenzivno popisovanje dnevnih metuljev na Goričkem za namene priprave čezmejnega atlasa dnevnih metuljev za območje krajinskega parka Goričko in narodnega parka Őrség. Celotno območje smo razdelili na kvadrate s stranico 2,5 km, metulje pa smo znotraj vsakega kvadrata popisali na najmanj 4 lokacijah z večinoma 4 ponovitvami v sezoni. Skupno smo zbrali 25.121 podatkov in zabeležili pojavljanje 100 vrst dnevnih metuljev na Goričkem, kar predstavlja 56% v Sloveniji živečih dnevnih metuljev. 27 vrst smo zabeležili v več kot 90% kvadratov, 15 vrst pa je bilo najdenih v manj kot 10 kvadratih, od tega 3 vrste na samo 1 lokaciji v po 1 kvadratu. Največja vrstna pestrost dnevnih metuljev je v severovzhodnem delu Goričkega, kjer smo v enem kvadratu zabeležili kar 84 vrst. V tem delu se še vedno marsikje kmetuje na tradicionalen način, zato so ekstenzivni suhi travniki na pobočjih gričev in vlažni travniki v dolinah dobro ohranjeni. Proti jugu in zahodu vrstna pestrost upada. Na Goričkem smo našli tudi 20 ogroženih vrst, kar je 35% vseh v Sloveniji ogroženih vrst. Za te vrste je območje Goričkega zelo pomembno, nekatere vrste (*Phengaris teleius*, *P. nausithous*) pa imajo tukaj tudi glavne centre razširjenosti v Sloveniji.

Contribution to the knowledge of oviposition preferences of *Eriogaster catax* in Slovenia

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Erigaster catax is a moth species from the family Lasiocampidae. The species is listed on the Annexes II and IV of the Habitats Directive and the species as well as its habitat are protected in Slovenia. Searching for larvae is the most effective method for observation of this species. Caterpillars spend their first instars living together in a caterpillar tent. 174 tents were recorded between 2011 and 2014. For most, aspect, hight from the gorund and size (lenght, width) were recorded, as well as species of food plant, its hight and width at ground level. All caterpillar tents were recorded on *Prunus spinosa* and *Crataegus* spp. between March 28th and April 25th in similar ratio between both plants. 2/3 of caterpillar tents had southern aspect. Median of tent width was 5 cm (Q1–Q3: 4–6 cm, min–max: 1–10 cm) and lenght 10 cm (Q1–Q3: 8–13 cm, min–max: 3–28 cm). Median of hight from ground was 1.1 m (min–max: 0.25–2.8 m) and in positive corelation with plant's hight (min–max 0.8–4.0 m). Most caterpillar tents were found on plants with ground width between 1 and 5 cm.

Prispevek k poznavanju ovipozicijskih preferenc hromega volnoritca (*Eriogaster catax*) v Sloveniji

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Hromi volnoritec (*Eriogaster catax*) je nočni metulj iz družine kokljic (Lasiocampidae). Vrsta in njen habitat sta v Sloveniji zavarovana, saj je vrsta navedena v prilogah II in IV Direktive o habitatih. Hromega volnoritca se najlažje opazi spomladi, z iskanjem skupinsko živečih gosenic. Te si okoli izpraznjenih jajčec spletejo gnezdo, v katerem živijo v prvih razvojnih stopnjah. V letih 2011–2014 smo popisali 174 gnezd. Za večino gnezd smo zabeležili položaj glede na smer neba, višino od tal in velikost gnezda (dolžina, širina) ter vrsto hranilne rastline, njeno višino in debelino debelca tik nad tlemi. Vsa gnezda gosenic smo do sedaj našli izključno na črnem trnu (*Prunus spinosa*) ali glogu (*Crataegus* spp.) v času med 28. 3. ter 25. 4. in sicer v podobnem deležu na obeh vrstah. 2/3 gnezd je bilo usmerjenih proti JV-J-JZ. Mediana širine gnezd je bila 5 cm (Q1–Q3: 4–6 cm, min–max: 1–10 cm), dolžina pa 10 cm (Q1–Q3: 8–13 cm, min–max: 3–28 cm). Mediana višine pozicije gnezda je bila 1,1 m (min–max: 0,25–2,8 m), in v pozitivni korelaciji z višino hranilne rastline (min–max 0,8–4,0 m). Največ gnezd smo našli na grmih z debelino debelca 1–5 cm.

Sampling of cerambycid fauna of Slovenia using pheromone traps

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Recently, rapid progress has been made in identifying the pheromones that cerambycid beetles produce to attract mates. Some species rely solely on volatile pheromones to bring the sexes together, whereas others are more attracted to combinations of pheromones with host plant odours. The structures of pheromones are phylogenetically conserved, resulting in simultaneous attraction of multiple species to pheromone-baited traps. We tested 12 known cerambycid pheromone compounds, in combination with host-plant volatiles, in field trials in Slovenia. Semiochemicals were tested throughout the seasonal activity period using pheromone-baited cross-vane panel traps. Captured adult beetles were used for collection and identification of new pheromone structures. Volatile pheromones were collected on activated charcoal traps, and the resulting extracts were analyzed by coupled gas chromatography-mass spectrometry. In two years of trials, we captured 34 different species in four locations. In addition, the male-produced pheromone fuscumol was identified from the European cerambycid *Archopalus rusticus* (Spondyline). This work represents the first study that has broadly sampled the longhorn beetle fauna of Slovenia, using known cerambycid pheromone compounds and plant host volatiles. Knowledge on chemical ecology of cerambycids is invaluable basis for a wider European saproxylic beetle monitoring plans and conservation strategies to be explored, and undertaken.

Uporaba feromonskih pasti za vzorčenje hroščev iz družine kozličkov v Sloveniji

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Raziskave na področju identifikacije feromonov, ki jih kozlički oddajajo za privabljanje spolnih partnerjev so zelo napredovale. Nekatere vrste za privabljanje spolnega partnerja uporabljajo le feromone, medtem ko se druge vrste najbolje odzivajo na kombinacijo feromonov in hlapnih snovi gostiteljskih rastlin. Struktura feromonov, ki jih oddajajo kozlički je relativno konservativna; to pomeni, da številne sorodne vrste uporabljajo feromone z enako oz. podobno strukturo, kar omogoča simultano privabljanje osebkov različnih vrst. S pomočjo feromonskih pasti tipa Cross-vane smo testirali sposobnost 12 feromonov, skupaj s hlapnimi snovmi gostiteljskih rastlin, za privabljanje kozličkov skozi celotno sezono aktivnosti hroščev. Ujete, odrasle hrošče smo uporabili za ekstrakcijo in identifikacijo novih feromonskih struktur. Hlapne feromone smo ekstrahirali s pomočjo oglenih lovilcev in ekstrakte analizirali s pomočjo plinske in masne spektrometrije. Vzorčenje je potekalo 2 sezoni na 4 različnih lokacijah. V feromonske pasti smo ujeli 34 različnih vrst. Identificirali smo tudi feromon, fuskumol, ki ga oddajajo samci vrste A*rhopalus rusticus* (Spondylinae). Raziskava predstavlja prvo študijo favne kozličkov na področju Slovenije s pomočjo vrstno specifičnih feromonov in hlapnih snovi gostiteljskih rastlin. Rezultati študije predstavljajo pomembno osnovo za monitoring saproksilnih vrst tudi širše v Evropi, in za oblikovanje strategij s področja varovanja vrst in upravljanja z avtohtonimi in invazivnimi vrstami.

Poster presentations / *Posterji*

Monitoring of hoverflies (Diptera; Syrphidae) in urban and peri-urban forest in Slovenia

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In urban and suburban areas, forest habitats are often prone to habitat degradation. Hoverflies are good bio-indicators of the conservation status of the forest habitats. A monitoring of hoverflies was started in an urban forest (Rožnik, Ljubljana) and in a peri-urban floodplain forest (Gameljne, Ljubljana). One transect and one malaise trap were established in the urban forest and two transects were established in a peri-urban floodplain forest. The transects were monitored once per month and the malaise trap was sampled approximately every two weeks from April till October. The counts started in 2012 for urban and in 2013 for peri-urban floodplain forest. In urban forest in total 25 species were caught in the malaise trap and 40 species caught during the transect monitoring. From these species there were seven saproxylic species. In peri-urban floodplain forest, 21 species were recorded from which only one was saproxylic. There was a large difference in detected hoverfly species composition between methods, years and forest types. The intra annual dynamics showed that the highest peak of hoverfly species and number of individuals were in the June/July. The data is discussed in the context of the conservation status and possible changes of weather conditions.

Spremljanje muh trepetavk (Diptera; Syrphidae) v urbanem in periurbanem gozdu v Sloveniji

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V mestnem in primestnem okolju so gozdni habitati pogosto degradirani. Muhe trepetavke so dobri biološki pokazatelji stanja ohranjenosti gozdnih habitatov. Spremljanje muh trepetavk smo izvajali v mestnem gozdu (Rožnik, Ljubljana) in v primestnem poplavnem gozdu (Gameljne, Ljubljana). V mestnem gozdu smo muhe trepetavke spremljali na enem transektu in z eno malaisovo pastjo, v obmestnem poplavnem gozdu pa smo osnovali dva transekta. Vzorčenje na transektih je potekalo mesečno, v »malaise »pasti pa smo vzorčili približno vsaka dva tedna od aprila do oktobra. Spremljanje muh trepetavk v metnem gozdu se je pričelo v letu 2012, v primestnem poplavnem gozdu pa v letu 2013. V mestnem gozdu smo ugotovili skupaj 25 vrst muh trepetavk, ki so se ujele v past, 40 vrst muh trepetavk pa smo zabeležili na transketu. Od tega je bilo sedem saproksilnih?? vrst muh trepetavk. V primestnem poplavnem gozdu smo zabeležili 21 vrst, iz katerih je bila samo ena saproksilna vrsta . Ugotovili smo značilne razlike v vrstni sestavi muh trepetavk glede na uporabljeno metodo, leto vzorčenja in tipom gozdov. Glede na etno dinamiko smo ugotovili največje število vrst ter osebkov muh trepetavk v juniju/juliju. V prispevku obravnavamo pridobljene rezultate z vidika stanja ohranjenosti gozdnih habitatov ter morebitnega vpliva vremenskih razmer na spremembe.

Structural complexity of the vegetation in dry and humid meadows in the Subpannonian region of Slovenia affects spider communities (Arachnida: Araneae)

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Dynamic terrain, diverse geological, hydrological and pedological conditions include Slovenia among the countries with high biological diversity. On the surface of 20,273 km^2 many diverse habitats are found, meadows being the treasure of animal and plant diversity. The formation of dry and wet types of grassland is affected by anthropogenic and the multifaceted environmental factors.
The meadow as a complex ecosystem offers favourable living conditions for many species. The abundance of microhabitats and the availability of prey are the main reasons for the diversity of arthropods. Spiders as predators prey on insects and, consequently, control the population of grassland arthropods. They are also a good model for the study of biodiversity, but their determination is complicated.
In a survey I focused on the determination of the spiders and the incidence of found genera in connection with the structural complexity of the vegetation in four different locations of the Subpannonian region of Slovenia. Collected spiders belonged to 15 genera and 7 families, among which Thomisidae was the most abundant family. The results indicate higher abundance of spiders in the dry type of the meadows as well as in the areas of wider and higher vegetation.

Vpliv strukturne kompleksnosti vegetacije na suhih in vlažnih travnikih subpanonske regije Slovenije na združbe pajkov (Arachnida: Araneae)

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Razgiban relief, pestre geološke, hidrološke in pedološke razmere uvrščajo Slovenijo med države z visoko biotsko pestrostjo. Na površini 20,273 km^2 najdemo številne raznolike habitate, od katerih veljajo travniki za zakladnico živalske in rastlinske pestrosti. Na nastanek suhih in vlažnih tipov travnikov vplivajo antropogeni ter mnogoteri dejavniki okolja.
Travnik kot kompleksen ekosistem ponuja ugodne življenjske pogoje številnim vrstam. Številčnost mikrohabitatov in razpoložljivost plena sta poglavitna razloga za raznolikost skupine členonožcev. Pajki kot predatorji plenijo žuželke in posledično kontrolirajo populacijo travniških členonožcev. Prav tako so dober model za študije biodiverzitete, vendar je njihova determinacija zamotana.
V raziskavi sem se osredotočil na določanje pajkov in pojavnost najdenih rodov povezal s strukturno kompleksnostjo vegetacije na štirih različnih lokalitetah Subpanonske regije Slovenije. Nabrani pajki so pripadali 15 rodovom in so razvrščeni v 7 družin, med katerimi je bila najpogostejša družina Thomisidae. V prispevku prikazani rezultati kažejo na višjo številčnost osebkov pajkov na območjih suhega tipa travnika ter območjih z raznovrstnejšo in višjo vegetacijo.

Metabolic potential and oxygen consumption in different species of ground beetles

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Determination of electron transport system (ETS) activity and oxygen consumption is useful for explaining and understanding the biochemical and physiological characteristics of carabid beetles. It was shown that ETS activity and oxygen consumption differed significantly between six carabid species (*Carabus coreaceus*, *Carabus variolosus*, *Carabus catenulatus*, *Pterostichius fasciatopunctatus*, *Abax parallelepipedeus*, *Laemostenus schreibersii*). The lowest ETS activity was in *C. coreaceus* and the highest in *C. catenulatus*, *P. fasciatopunctatus* and *L. schreibersii*. Low oxygen consumption was measured in *C. coreaceus*, while other species had higher oxygen consumption. Moreover, the ratio between ETS activity (i.e. metabolic potential) and oxygen consumption (ETS/R ratio) is an important index of an organism's metabolism. As expected, ETS/R ratio differed significantly between studied species. It was low in *C. variolosus*, but high in *C. catenulatus* and *P. fasciatopunctatus*. High ETS/R ratio means less intensive exploitation of metabolic potential for basal metabolism and activity. Previous studies have shown that the ETS/R ratio differs between related species having different ecological tolerance and preference, and consequently they exploit their metabolic potential differently.

Metabolni potencial in poraba kisika pri različnih vrstah hroščev

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Določitev aktivnosti elektronskega transportnega sistema (ETS) in porabe kisika je koristna za poznavanje in pojasnitev biokemijskih in fizioloških značilnosti pri krešičih. Izkazalo se je, da sta se tako aktivnost ETS kot tudi poraba kisika značilno razlikovala pri šestih vrstah krešičev (*Carabus coreaceus*, *Carabus variolosus*, *Carabus catenulatus*, *Pterostichius fasciatopunctatus*, *Abax parallelepipedeus*, *Laemostenus schreibersii*). Najnižja aktivnost ETS je bila izmerjena pri *C. coreaceus*, najvišja pa pri *C. catenulatus*, *P. fasciatopunctatus* in *L. schreibersii*. Nizka poraba kisika je bila ugotovljena pri *C. coreaceus*, medtem ko so ostale vrste imele višjo porabo kisika. Razmerje med aktivnostjo ETS (t.j. metabolnim potencialom) in porabo kisika (razmerje ETS/R) je pomemben pokazatelj metabolizma organizmov. Po pričakovanju se je razmerje ETS/R bistveno razlikovalo med vrstami. Nizko je bilo pri *C. variolosus*, visoko pa pri *C. catenulatus* in *P. fasciatopunctatus*. Visoko razmerje ETS/R pomeni manj intenzivno izkoriščanje metabolnega potenciala za bazalni metabolizem in aktivnost. Predhodne raziskave so pokazale, da se razmerje razlikuje celo med sorodnimi vrstami, ki imajo različne ekološke tolerance in preference, kar posledično pomeni različno izkoriščenost metabolnega potenciala.

Collecting data of distribution for four Natura 2000 species of beetles (Coleoptera) in Slovenia

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Council Directive 92/43/EEC requires of each member state to report about the conservation status and effectiveness on Natura 2000 sites. For this propose Slovenia has started to research the distribution and ecology of some taxonomic groups that are listed on Annex 2 in before mentioned Directive. Knowledge about ecology and distribution of some beetles has made a significant progress that continues each year as distribution and population monitoring of selected species. From 2007 the significant part of distribution monitoring of some beetles is implemented by Institute of RS for Nature Conservation with collecting data for four beetles, that are easy to recognise: stag beetle (*Lucanus cervus*) a and three longhorn beetles (*Rosalia alpina, Morimus funereus, Cerambyx cerdo*). With the cooperation of The Urban Planning Institute of Ljubljana, Institute of RS for Nature Conservation has prepared the internet site www.sporocivrsto.si for simple and organised data collecting. Public appeals with presentation and photos of beetles are published in daily and local newspapers, radio stations and other media through the year, especially in late spring. Response has been growing and each year we collect more than 300 different data. Such and similar projects with public cooperation have exceptional value and various effects.

Zbiranje podatkov o razširjenosti nekaterih vrst hroščev (Coleoptera) po Natura 2000 v Sloveniji - spletni portal www.sporocivrsto.si

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Po letu 2004 se je zaradi zahtev Direktive o habitatih (Direktiva Sveta 92/43/EGS) začelo usmerjeno raziskovati razširjenost nekaterih taksonomskih skupin za namene poročanja o napredku in uspešnosti ohranjanja narave na Natura 2000 območjih. V teh letih je v Sloveniji poznavanje ekoloških zahtev in poznavanje razširjenosti nekaterih hroščev iz Priloge 2 Direktive doživelo bistven napredek. Od leta 2007 k poznavanju razširjenosti nekaterih vrst v Sloveniji pripomore tudi Zavod RS za varstvo narave z vsakoletno akcijo zbiranja podatkov za razmeroma dobro prepoznavne vrste hroščev: rogača (*Lucanus cervus*), alpskega kozlička (*Rosalia alpina*), bukovega kozlička (*Morimus funereus*) in hrastovega kozlička (*Cerambyx cerdo*). V sodelovanju z Ljubljanskim urbanističnim zavodom smo omogočili organizirano in enostavno zbiranje podatkov na portalu www.sporocivrsto.si. Vsako leto v sodelovanju z različnimi dnevniki in lokalnimi časopisi ter drugimi mediji objavimo prispevke s fotografijami hroščev, in javnost prosimo za podatke o opažanjih. Odziv je bil vsako leto večji in na leto zberemo okoli 300 različnih podatkov. Ta in podobne akcije s sodelovanjem javnosti imajo izjemno dodano vrednost in mnogotere učinke.

Natura 2000 Management programme for the period 2014-2020 for beetles species (Coleoptera) (LIFE11 NAT/SI/880)

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Main objective of the project is to prepare the Natura 2000 Management Programme for Slovenia for the period 2014-2020, which will be adopted by the Government. The Natura 2000 Management Programme will represent the basis to achieve favorable conservation status of Natura 2000 species and habitat types for the next multiannual financial framework.
Program will be adopted and harmonized with all competent sectors (fishery, forestry, agriculture, water management etc.) to properly manage the Natura 2000 sites, as Slovenia doesn't prepare special management plans for Natura 2000 sites.
For the beetles, listed on Annex 2 of Habitat Directive, draft objectives and measures will be formed within forestry (Slovenia forest service) and nature conservation sector (Institure of RS for Nature Conservation) and inspected by external expert for beetles. Such solution gives an opportunity to incorporate basis of different acts and implement realizable objectives into multiannual forestry plans.

Operativni program upravljanja območij Natura 2000 v obdobju 2014-2020 za kvalifikacijske vrste hroščev (Coleoptera) (projekt LIFE11 NAT/SI/880)

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Glavni cilj celotnega projekta je priprava operativnega programa upravljanja območij Natura 2000 za obdobje 2014 – 2020, ki ga bo potrdi in sprejme vlada RS. Ta program predstavlja osnovo za doseganje ugodnega ohranitvenega stanja vrst in habitatnih tipov omrežja Natura 2000 za naslednje večletno finančno obdobje.
Program bo usklajen z ostalimi kompetentnimi sektorji (gozdarstvo, ribištvo, kmetijstvo, upravljanje z vodami idr.), saj se v Sloveniji območja Natura 2000 upravljajo skozi sektorske načrte upravljanja. Za vrste hroščev, ki so navedeni v Prilogi 2 Habitatne Direktive se predlog ciljev, ukrepov in usmeritev usklajuje med gozdarskim sektorjem (Zavod za gozdove Slovenije) in sektorjem za varstvo narave (Zavod RS za varstvo narave) ter nadzorom in pomočjo zunanjega strokovnjaka za hrošče. Takšno izhodišče daje možnost uskladitve določil različnih zakonov in omogoča implementacijo izvedljivih ukrepov na Natura 2000 območjih skozi večletne gozdno gojitvene načrte.

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