ISSN 1849-5702

Hrvatsko ekološko društvo
Croatian Ecological Society

2. HRVATSKI SIMPOZIJ O INVAZIVNIM VRSTAMA
s međunarodnim sudjelovanjem

2nd CROATIAN SYMPOSIUM ON INVASIVE SPECIES
with International Participation

21-22. XI 2016 .
Zagreb, Hrvatska

ZBORNIK SAŽETAKA
BOOK OF ABSTRACTS

Fotografije na naslovnici / Photos on cover:

ambrozija / ragweed (*Ambrosia artemisiifolia)* – Božena Mitić
tigrasti komarac / tiger mosquito (*Aedes albopictus)* – Lana Schmidt
signalni rak / signal crayfish (*Pacifastacus leniusculus)* – Ivana Maguire
grozdasta kaulerpa / seaweed (*Caulerpa cylindracea)* – Ante Žuljević

Hrvatsko ekološko društvo
Croatian Ecological Society

2. HRVATSKI SIMPOZIJ O INVAZIVNIM VRSTAMA

s međunarodnim sudjelovanjem
21-22. Studeni 2016.
Zagreb, Hrvatska

2nd CROATIAN SYMPOSIUM ON INVASIVE SPECIES

With International Participation
21-22 November 2016
Zagreb, Croatia

ZBORNIK SAŽETAKA

BOOK OF ABSTRACTS

Zagreb, 2016.

ZBORNIK SAŽETAKA
2. HRVATSKOG SIMPOZIJA O INVAZIVNIM VRSTAMA

BOOK OF ABSTRACTS
OF THE 2nd CROATIAN SYMPOSIUM ON INVASIVE SPECIES

Urednik / Editor

Sven D. Jelaska

Odgovorni tehnički urednik / Technical Editor in Chief

Sven D. Jelaska

Hrvatsko ekološko društvo
Croatian Ecological Society

Zagreb, 2016.

ISSN 1849-5702
Ključni naslov: Zbornik sažetaka (Hrvatski simpozij o invazivnim vrstama s međunarodnim sudjelovanjem)
Skraćeni ključni naslov: Zb. sažet. (Hrvat. simp. invazivnim vrstama međunar. sudjelov.)

Organizator kongresa i izdavač zbornika / Organiser of the Congress and Publisher of the Proceeding

Hrvatsko ekološko društvo
Croatian Ecological Society
Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska
Tel: +385 (0)1 4877700; Fax: +385 (0)1 4826260
e-mail: hed@ekolosko-drustvo.hr
URL: http://www.ekolosko-drustvo.hr/

Suorganizatori kongresa / Co-organiser of the Congress

Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu / Faculty of Science, University of Zagreb
Horvatovac 102a, HR-10000 Zagreb
URL: http://www.pmf.hr , http://www.biol.pmf.hr

Hrvatski šumarski institut / State Institute for Nature Protection
Cvjetno naselje 41, HR-10450 Jastrebarsko
URL: http://www.sumins.hr

Javna ustanova „Maksimir“ / Public Institution „Maksimir“
Maksimirski perivoj bb, HR-10000 Zagreb
URL: http://www.park-maksimir.hr/

Organizacijski i programski odbor / Organizing and Program Committee:

Izv.Prof.dr.sc. Sven Jelaska
Dr.sc. Dinka Matošević
Dr.sc. Lucija Šerić Jelaska
Dr.sc. Biljana Janev Hutinec
Dr.sc. Nina Vuković

Znanstveni odbor / Scientific Committee:

Sven Bacher (University of Fribourg, CH)
Nenad Jasprica (University of Dubrovnik, HR)
Sven Jelaska (University of Zagreb, HR)
Mitja Kaligarič (University of Maribor, SI)
Dinka Matošević (Croatian Forest Research Institute, HR)
Enrih Merdić (University of Osijek, HR)
Wolfgang Rabitsch (Environment Agency Austria, AT)
Elena Tricarico (University of Florence, IT)
Teodora Trichkova (IBER, BG)
Krešimir Žganec (University of Zadar, HR)
Ante Žuljević (IZOR Split, HR)

Pod pokroviteljstvom / Under Patronage of:

Gradonačelnik Zagreba / Major of Zagreb Milan Bandić

Donatori / Donors:

Ministarstvo znanosti i obrazovanja / Ministry of Science and Education
Hrvatska akademija znanosti i umjetnosti / Croatian Academy of Sciences and Arts
Hrvatska komora inženjera šumarstva i drvne tehnologije
Hrvatske vode

Poštovane kolegice i kolege!

Hrvatsko ekološko društvo već 47 godina okuplja različite struke sa ciljem što cjelovitijeg sagledavanja i razumijevanja složenih procesa koji se odvijaju u okolišu. Invazivne vrste su postale jedan od vrlo bitnih čimbenika u tim procesima, koji itekako utječu na okoliš u svim njegovim segmentima – od kvalitete života pojedinaca pa do strukturalnih promjena u samim ekosustavima i njihovoj biološkoj raznolikosti koje se odražavaju direktno i/ili indirektno na svim razinama ljudskog življenja (zdravstveno, ekonomski, sociološki i dr.). Skoro da i ne postoji područje ljudske aktivnosti koje nije na neki način povezano s invazivnim vrstama (da navedemo samo neke: transport, turizam, trgovina, hortikultura, zdravstvo, poljoprivreda, šumarstvo, zaštita okoliša i prirode, itd.).

Kada smo prije dvije godine organizirali „1. Hrvatski simpozij o invazivnim vrstama“ bili smo ugodno iznenađeni odazivom svih zainteresiranih, te se predviđeni jedan dan trajanja pokazao nedovoljnim za invaziju svih zainteresiranih sudionika. Stoga smo ove godine predvidjeli dva dana, koja su ponovno u potpunosti ispunjena vrlo zanimljivim priopćenjima, sa značajnim udjelom sudionika izvan Hrvatske. S obzirom da invazivne vrste ne mare za političke granice, posebno nas veseli takav sastav sudionika, jer je razmjena znanja i iskustava, te zajedničko djelovanje jedini način da se učinkovito suočimo s problematikom invazivnih vrsta. Posljedica velikog broja sudionika iz inozemstva jest i da je ova knjiga sažetaka priopćenja samo na engleskom jeziku, jer smo smatrali neprikladnim da dio sažetaka bude dvojezičan, a dio samo na engleskom jeziku, kao i da mi prevodimo sažetke na hrvatski jezik bez da njihovi autori imaju mogućnost provjere da li su njihove riječi prevedene na odgovarajući način. Hrvatsko ekološko društvo će se drugim putovima truditi sačuvati i razvijati hrvatsko strukovno nazivlje. Kao što će se i dalje truditi doprinijeti našem razumijevanju mehanizama i procesa koji potpomažu širenju invazivnih vrsta, te spoznavanju naših mogućnosti u usporavanju, zaustavljanju i/ili sprječavanju istih, sa ciljem boljitka prirode i ljudi.

Sven Jelaska
Predsjednik Hrvatskog ekološkog društva

Honourable colleagues!

Croatian Ecological Society for 47 years now is gathering various experts, with the aim of enabling us to comprehend and understand complex processes taking place in the environment. Invasive species has become one of the significant factor in these processes, that has impact on the environment in all of its aspects – influencing personal quality of life as well as structural changes in the ecosystems and its biodiversity, both reflecting on every aspects of everyday life (health, economy, social etc.). Almost there is no area of human activities that cannot be connected to invasive species (to list just few of them: transport, tourism, trade, horticulture, health care, agriculture, forestry, nature protection, etc.).

When we have organised the "1st Croatian symposium on invasive species" we were very pleased with the level of interest we aroused, and one day of Symposium turned out to be insufficient for the invasion of all of the interested participants. This year we have allocated two days for the Symposium which are again completely filled with plenty of extremely interesting contributions, with significant share of participants from abroad. Given the fact that invasive species doesn't care about the political borders, we as organisers are particular happy with such assemblage of the participants because we firmly believe that exchange of knowledge and experience is the only way we can cope with the problem of the invasive species. As a consequence of large proportion of foreign participants, unlike last book of abstracts, this one is only in English because we felt it will be inconvenient to have part of the abstract bilingual in Croatian and English, and part only in English. Either, we didn't feel comfortable about translating abstracts to Croatian knowing that foreign colleagues cannot check whether their ideas and statements are formulated in a way they wanted. However, Croatian Ecological Society will continue to develop and preserve Croatian expert terminology by other means. As we will continue to strive to contribute to our understanding of the mechanisms and processes that promote the spread of the invasive species, and learning about our opportunities to slow them down, stop and / or prevent them, with the aim of improving well-being of nature and humans.

Sven Jelaska
President of the Croatian Ecological Society

SADRŽAJ / CONTENT

PROGRAM SIMPOZIJA

PROGRAMME OF THE SYMPOSIUM

Programme of the 2nd Croatian Symposium on Invasive Species

Monday 21st November

08:30 – 09:30	Registration and poster setup
09:30 – 10:00	Opening of the Symposium
10:00 – 10:40	Keynote lecture Ingolf Kühn INVASIVE PLANT SPECIES: JACKS-OF-ALL-TRAITS?
10:40 – 11:10	Coffe Break
11:10 – 12:40	Chairperson: Nenad Jasprica 11:10 Ahmet Uludag, Teodora Trichkova, Milica Rat, Rumen Tomov, Giuseppe Brundu, Vladimir Vladimirov, Riccardo Scalera, Quentin Groom, Piero Genovesi, Sven Bacher, Aljosa Duplic, Dan Cogalniceanu, Argyro Zenetos, Marc Kenis, Rob Tanner EUROPEAN UNION INVASIVE ALIEN SPECIES REGULATION AND THE POSSIBLE ROLE OF ESENIAS FOR IMPLEMENTATION IN THE REGION 11:25 Sonja Desnica, Vesna Vrdoljak, Igor Boršić, Petra Kutleša, Martina Cigrovski Mustafić, Sandra Slivar EU REGULATION ON INVASIVE ALIEN SPECIES – CROATIAN PERSPECTIVE 11:40 Andrej Verlič, Jana Kus-Veenvliet, Maarten de Groot LIFE ARTEMIS – Awareness Raising, Training and Measures on Invasive Alien Species in forests 11:55 Jana Kus Veenvliet, Paul Veenvliet, Nejc Jogan DETECTING THE INVASIVE GIANT HOGWEED (*Heracleum mantegazzianum*) THROUGH MEDIA ALERTS 12:10 Ivana Maguire, Mišel Jelić, Göran I. V. Klobučar, Andreja Lucić, Krešimir Žganec, Matej Faller, Gordan Hudina, Sandra Hudina HISTORY OF THE ALIEN INVASIVE FRESHATER CRAYFISH IN CROATIA 12:25 Božena Mitić, Igor Boršić, Toni Nikolić A DECADE OF AWARENESS OF REALITY: INVADERS IN CROATIAN FLORA
12:40 – 14:30	Lunch Break
14:30 – 15:45	Chairperson: Ivana Maguire 14:30 Sven D. Jelaska, Toni Nikolić ANALYSING THE DISTRIBUTION OF INVASIVE PLANTS IN CROATIA – DO WE NEED MORE OR (JUST) BETTER DATA?

	14:45 Manuela Giovanetti, Claudia Giuliani, Nina Vuković, Sven D. Jelaska, Marta Mariotti Lippi, Bruno Foggi, Cristina Máguas HOW DO ACACIAS MATCH WITH NATIVE POLLINATORS IN INVADED AREAS? DIFFERENCES AND SIMILARITIES AMONG ITALY, CROATIA AND PORTUGAL 15:00 Dinka Matošević, George Melika, Katarina Kos, Mojca Rot, Nikola Lacković, Eva Kriston, Miklos Boszo HOW TO CONTROL AN INVASIVE FOREST PEST? BIOLOGICAL CONTROL OF INVASIVE *Dryocosmus kuriphilus* WITH INTRODUCED PARASITOID *Torymus sinensis* IN CROATIA, SLOVENIA AND HUNGARY 15:15 Ante Žuljević, Boris Antolić, Marija Despalatović, Ivan Cvitković, Petra Lučić HOT-SPOT AREAS OF BENTHIC NONINDIGENOUS SPECIES IN THE ADRIATIC SEA (CROATIA) 15:30 Jakov Dulčić, Branko Dragičević THE CURRENT STATUS OF THE ADRIATIC AND MEDITERRANEAN FISH BIODIVERSITY
15:45 – 16:45	Poster Session & Coffe Break
16:45 – 18:15	Chairperson: Ante Žuljević 16:45 Nina Sajna, Tamara Karlo TESTING THE DIVERSITY RESISTANCE HYPOTHESIS – STABILITY OF UNDERSTOREY BIODIVERSITY AFTER MAJOR DISTURBANCE 17:00 Marcela van Loo, Renata Milcevicova, Michael Barfuss GEOGRAPHIC ORIGIN AND GENETIC STRUCTURE OF PLANTED *Ailanthus* IN VIENNA (AUSTRIA) 17:15 Andraž Čarni, Nina Juvan Mastnak, Igor Dakskobler, Lado Kutnar, Aleksander Marinšek, Urban Šilc PREDICTION OF THE APPEARANCE OF TREE OF HEAVEN IN FOREST COMMUNITIES IN WESTERN SLOVENIA 17:30 Igor Boršić, Petra Kutleša, Sonja Desnica, Sandra Slivar INVASIVE POTENTIAL OF GOLDENRAIN TREE (*Koelreuteria paniculata* Laxm., Sapindaceae) - A CASE STUDY FROM THE CITY OF ZAGREB 17:45 Ana Ostojić, Nela Jantol, Zrinka Mesić, Tena Birov, Ana Selak, Davor Korman, Vladimir Kušan *Paulownia tomentosa* - THE QUIET INVADER? 18:00 Antun Alegro, Vedran Šegota, Nina Vuković DIVERSITY OF INVASIVE PLANTS ON MEDVEDNICA Mt (CROATIA)
19:30 - 22:00	Beervasive evening

Tuesday 22nd November

08:30 – 09:00	Registration
09:00 – 09:40	Keynote lecture Franz Essl THE MACROECOLOGY OF BIOLOGICAL INVASIONS: WHAT GLOBAL DATABASES TELL US?
09:40 – 10:25	Chairperson: Sven Jelaska 09:40 Krešimir Žganec, Renata Ćuk, Svjetlana Dekić ALIEN FRESHWATER CRUSTACEANS (PERACARIDA: MALACOSTRACA) IN CROATIA – CHECKLIST, DISTRIBUTION AND PRELIMINARY IMPACT ASSESSMENT 09:55 Sandra Hudina, Nika Galić, Petra Kutleša, Sonja Desnica POTENTIAL FOR CONTROL OF THE INVASIVE SIGNAL CRAYFISH (*Pacifastacus leniusculus*) IN A RECENTLY INVADED REGION IN CROATIA 10:10 Lana Jelić, Biljana Janev Hutinec, Dušan Jelić REPRODUCTIVE BIOLOGY OF *Trachemys scripta* (Schoepff, 1792) IN CONTINENTAL CROATIA
10:25 – 10:55	Coffe Break
10:55 – 12:10	Chairperson: Mitja Kaligarič 10:55 Tina Fazinić, Željko Tomić, Zdravka Sever, Tihomir Miličević, Dario Ivić JUMPING ACROSS ATLANTIC OCEAN - NORTH AMERICAN PLANT PATHOGENIC FUNGI INVADING CROATIA 11:10 Nataša Janev Holcer, Pavle Jeličić, Krunoslav Capak, Ana Klobučar, Nediljko Landeka, Toni Žitko, Enrih Merdić, Ivana Vrućina, Nataša Turić, Marko Klemenčić, Magdalena Sikora, Ivan Trumbetić IMPLEMENTATION OF THE NATIONAL MONITORING OF INVASIVE MOSQUITOE SPECIES IN CROATIA 11:25 V. Rakoš, Maja Šćepanović, A. Pintar, Klara Barić QUANTITATIVE ANALYSIS OF *Abutilon theophrasti* Medik. EMERGENCE FROM BURIED SEED WITH INCREASING SOIL DEPTH 11:40 Valentina Šoštarčić, Maja Šćepanović, Dario Magosso, Roberta Masin, Klara Barić ESTIMATION OF BIOLOGICAL PARAMETERS FOR GERMINATION OF *Abutilon theophrasti* Medik. 11:55 Gábor Vétek, Dávid Korányi SEVERE DAMAGE TO VEGETABLES BY THE BROWN MARMORATED STINK BUG (*Halyomorpha halys*) IN HUNGARY

12:10 – 14:00	Lunch Break
14:00 – 15:00	Chairperson: Biljana Janev Hutinec 14:00 Gábor Vétek, Ágnes Kákai, Mária Szántóné Veszelka, Zsolt Kárpáti, Béla Péter Molnár, Balázs Kiss SEVERE DAMAGE TO RASPBERRY CAUSED BY DROSOPHILA SUZUKII IN HUNGARY IN 2016 14:15 Pavao Gančević, Klemen Jerina, Toni Safner, Nikica Šprem SPACE USE AND ACTIVITY PATTERNS OF BARBARY SHEEP IN MOSOR MOUNTAIN 14:30 Aleksander Marinšek, Lado Kutnar INVASIVE ALIEN PLANT SPECIES IN NATURAL HABITATS IN THE RIPARIAN FORESTS ALONG MURA RIVER 14:45 Najla Baković, Roman Ozimec, K. Vugrek Petljak, T. Ban Ćurić LAMPENFLORA REMOVAL AND APPLIED CONSERVATION METHODS IN VETERNICA CAVE (NATURE PARK MEDVEDNICA, CROATIA
15:00 – 15:45	Poster Session & Coffe Break
15:45 – 17:00	Chairperson: Dinka Matošević 15:45 Ivan Kurtek, Željko Zahirović, Nataša Turić, Ivana Vrućina, Goran Vignjević, Enrih Merdić, Mirta Sudarić Bogojević INVASIVE ASIAN SEED BEETLE *Megabruchidius tonkineus* (Coleoptera, Chrysomelidae, Bruchinae) FIRST RECORD IN CROATIA 16:00 Ana Klobučar, Sunčica Petrinić, Vanja Tešić, Ivan Lipovac, Sanja Mitrović-Hamzić, Vanja Slavić-Vrzić, Snježana Čopor, Biserka Hranilović, Nediljko Landeka, Tatjana Vilibić-Čavlek, Enrih Merdić *Aedes japonicus* - THE NEW INVASIVE MOSQUITO SPECIES SPREADING IN CROATIA 16:15 Milivoj Franjević, Milan Pernek, Darko Posarić, Dina Banović, Boris Hrašovec RAPID SPREAD AND FIRST DATA ON DAMAGE LEVELS AND LIFE CYCLE OF *Corythucha arcuata* (Heteroptera, Tingidae) IN CROATIA 16:30 Necmi AKSOY, Ahmet ULUDAĞ NEW RECORDS AND DISTRIBUTION OF VASCULAR PLANTS ALIEN TO NORTHERN REGIONS OF TURKEY 16:45 Aljoša Duplić, Vedran Slijepčević, Nina Popović, Paul Jedriško FIRST RECORD OF THE RACCOON DOG (*Nyctereutes procyonoides*) IN THE CROATIAN PARTS OF DINARIDES
17:00 - 17:15	Closing of the Symposium

POSTERI / POSTERS

Marina Škunca, Luka Škunca, Hrvoje Peternel
INVASIVE ALIEN SPECIES IN ENVIRONMENTAL IMPACT ASSESSMENTS: A PRELIMINARY ANALYSIS OF THE ENTANGLED RELATIONSHIP

Marijeta Čalić, Stijepo Ljubimir, Sunčica Bosak
UNUSUAL OCCURENCE OF TROPICAL PLANKTONIC DIATOM SPECIES OF THE GENUS *Chaetoceros* IN THE SOUTH ADRIATIC SEA

Ana Car, Andrzej Witkowski, Nenad Jasprica
TAXONOMIC COMPOSITION OF EPIPHYTIC DIATOMS FROM AREAS AFFECTED BY INVASIVE *MACROALGAE Caulerpa taxifolia* AND *Caulerpa cylindracea* (ADRIATIC SEA, CROATIA)

Rade Garić, Mirna Batistić
FIRST RECORD OF *Fritillaria helenae* IN THE MEDITERRANEAN SEA

Tatjana Bakran-Petricioli, Ante Žuljević, Donat Petricioli, Silvija Kipson
TWO ALIEN BENTHIC INVERTEBRATES IN THE CENTRAL ADRIATIC SEA - ARE THEY INVASIVE?

Jasna Lajtner, Petar Crnčan, Renata Ćuk, Svjetlana Dekić, Sanja Gottstein, Sandra Hudina, Simona Kovačević, Andreja Lucić, Momir Paunović, Vladica Simić, Jelena Tomović, Krešimir Žganec
DISTRIBUTION OF THE INVASIVE ALIEN BIVALVE *Corbicula fluminea* (Müller, 1774) IN CROATIA

Lea Ljubej, Ivana Maguire, Sandra Hudina, Emina Horvat Velić, Ana Bielen
DEVELOPMENT OF A NONINVASIVE METHOD FOR DETECTION OF *Aphanomyces astaci*, THE CAUSATIVE AGENT OF CRAYFISH PLAGUE

Ivana Šarić, Sven Kapelj, Ivan Katanović, Sandra Hudina
MONITORING AND CONTROL OF THE INVASIVE SIGNAL CRAYFISH (*Pacifastacus leniusculus*) IN THE KORANA RIVER

Marina Piria, Divna Lukić, Tatjana Boroša-Pecigoš
FRESHWATER ALIEN FISH SPECIES INTRODUCED INTO CROATIA FOR AQUACULTURE AND CONSEQUENCES OF THEIR ESCAPES AND RELEASES IN INLAND WATERS

Paolo Pastorino, Elisabetta Pizzul, Erika Astrid Virginie Burioli, Marzia Righetti, Antonia Concetta Elia, Gilberto Forneris, Roberto Sindaco, Marino Prearo
THE INTRODUCTION OF SALMONIDS IN SOME ALPINE LAKES OF PIEDMONT (ITALY): A SERIOUS THREAT TO AQUATIC BIODIVERSITY

Mimi Kratovalieva-Stanikevska, Stoe Smiljkov, Suzana Kratovalieva
MONITORING OF SAN JOSE SCALE (*Quadraspidiotus perniciosus*) OCCURRENCE IN REPUBLIC OF MACEDONIA

Gábor Vétek, Dénes Bartha, Richárd Oláh
OCCURRENCE OF THE INVASIVE ZIGZAG ELM SAWFLY (*Aproceros leucopoda*) IN ARBORETUMS AND BOTANICAL GARDENS OF HUNGARY

George Melika, Dinka Matošević, Eva Kriston, Nikola Lacković, Katarina Kos, Gabrijel Seljak, Mojca Rot, Laszlo Krizbai, Miklos Bozsó
NATIVE PARASITOID ASSEMBLAGES OF AN INVASIVE PEST, *Dryocosmus kuriphilus* (HYMENOPTERA: CYNIPIDAE), IN SLOVENIA, CROATIA AND HUNGARY

Ivan Lukić, Dinka Matošević, Nikola Lacković, Sanja Mrmić, Milan Pernek
BOX TREE MOTH (*Cydalima perspectalis*) BIOLOGY AND INFLUENCE OF DIFFERENT FOOD TYPE ON DEVELOPMENTAL CHARACTERISTICS

Maja Pintar, Mladen Šimala, Tatjana Masten Milek, Vjekoslav Markotić
MORPHOLOGY AND DISTRIBUTION OF INVASIVE *Acizzia jamatonica* (KUWAYAMA, 1908) IN CROATIA

Mojca Rot, Ivan Žežlina, Gabrijel Seljak
POPULATION DYNAMICS OF SPOTTED WING DROSOPHILA (*Drosophila suzukii*) IN SLOVENIA IN THE PERIOD OF 2011-2016

Ivana Pajač Živković, Božena Barić, Milorad Šubić, Aleksandar Mešić
THE SPREAD OF *Drosophila suzukii* (MATSUMURA, 1931) IN NORTHWESTERN CROATIA

Nenad Jasprica, Katija Dolina
THE INVASION OF THE EUROPEAN RABBIT (*Oryctolagus cuniculus* L., 1758) ON THE LOKRUM ISLAND – AN EXAMPLE OF POOR MANAGEMENT OF THE PROTECTED AREA

Katija Dolina, Nenad Jasprica
IS THERE RELATIONSHIP BETWEEN ANTHROPOGENIC INFLUENCE AND PRESENCE OF ALIEN PLANT TAXA ON THE ISLAND OF LOKRUM?

Nina Sajna, Kristijan Adamlje, Mitja Kaligarič
Dittrichia graveolens – HOW DOES SOIL SALINITY DETERMINE DISTRIBUTION, MORPHOLOGY, AND REPRODUCTIVE POTENTIAL?

Dmytro Iakushenko, Alla Tokaryuk, Izolda Matchutadze
INVASIVE BEACH VITEX (*Vitex rotundifolia*) ON COASTAL DUNES OF KOLKHETI LOWLAND (GEORGIA)

Stešević Danijela, Milica Luković, Caković Danka, Nemanja Ružić, Bubanja Nada, Šilc Urban
ALIEN SPECIES IN SAND DUNE PLANT COMMUNITIES ON VELIKA PLAŽA IN ULCINJ (MONTENEGRO)

Urban Šilc, Filip Küzmič
ALIEN SPECIES INVASION IN DIFFERENT HABITATS: THE CASE OF SLOVENIA

Jasna Razlog-Grlica, Božena Mitić, Nataša Kletečki, I Grlica
INVASIVE FLORA OF RIVER AND STREAM BANKS IN CONTINENTAL CROATIA

Marko Ožura, Lucija Vargović, Gordana Purgar
OVERVIEW OF INVASIVE WOODY SPECIES IN HORTICULTURAL AREAS OF KARLOVAC

Valentina Borak Martan, Renata Šoštarić
INVASIVE FLORA OF THE CITY OF VARAŽDIN

Emina Ademović, Senka Barudanović, Samir Đug, Arnela Selimić, Merima Imamović, Alma Avdibašić, Ajla Podrug, Aldin Boškailo, Ermin Mašić
INVASIVE FLORA IN THE WIDER AREA OF THE TOWN OF STOLAC (BOSNIA AND HERZEGOVINA)

Senka Barudanović, Emina Ademović, Merima Imamović, Alma Avdibašić, Arnela Selimić, Ajla Podrug, Ermin Mašić, Aldin Boškailo, Armin Macanović
DISTRIBUTION OF INVASIVE ALIEN SPECIES *Reynoutria japonica* HOUTT. IN BOSNIA AND HERZEGOVINA

Diana Vlahović, Božena Mitić
THE SPREAD OF THE INVASIVE SPECIES *Helianthus tuberosus* L. IN THE URBAN AREAS OF SAMOBOR

Milena Popov, Bojan Konstantinović., Milan Blagojević, Nataša Samardžić
SPREAD OF INVASIVE WEED SPECIES *Asclepias syriaca* L. IN VOJVODINA

Renata Ćušterevska
NEW LOCALITY OF *Azolla filiculoides* IN REPUBLIC OF MACEDONIA

Ahmet Ilcim, Ahmet Uludag, Ilhan Uremis
NEW RECORDS OF *Solanum elaeagnifolium* Cav. FROM TURKEY

Jelena Knežević, Boris Radak, Milica Rat
Sigesbeckia orientalis L. (ASTERACEAE) - NEW ALIEN PLANT SPECIES IN THE LOWER SAVA BASIN

Dario Hruševar, Dalibor Vladović, Božena Mitić, Nediljko Ževrnja
Convolvulus sabatius – JUST A CASUAL ALIEN PLANT IN DALMATIA OR…?

Boris Radak, Nikola Todorović, Bojana Bokić, Milica Rat, Goran Anačkov
Impatiens balfourii HOOK. F. 1903 (BALSAMINACEAE) IN SERBIA

Boris Radak, Milica Rat, Slobodan Bojčić, Bojana Bokić, Goran Anačkov
CONTRIBUTION TO THE ALIEN FLORA OF MONTENEGRO

Sava Vrbničanin, Dragana Božić, Danijela Pavlović, Ana Anđelković
INVASIVE WEED SPECIES IN THE TERRITORY OF SERBIA

PLENARNA PREDAVANJA

KEYNOTE LECTURES

INVASIVE PLANT SPECIES: JACKS-OF-ALL-TRAITS?

Ingolf Kühn

Helmholtz Centre for Environmental Research – UFZ, Theodor-Lieser-Str. 4, 06120 Halle, Germany, ingolf.kuehn@ufz.de

One of the oldest, and still not satisfactorily answered, questions in invasion biology is: which species get invasive? Additionally, we know that some habitats are more prone to invasions and others not. Still, the exact relationship remains unknown. Using several of our studies from Central Europe and beyond, I will review the major findings. Most importantly, species biological or ecological traits considered in isolation do not have much explanatory power. This increases largely, though, when their interactions and phylogenetic signal is included. And these traits are different for successful alien invaders than for successful, wide-spread native species, e.g. in terms of the flowering phenology, habitat versatility pollination vectors or storage organs. Most important though, are combinations with habitat information and socioeconomic factors. Especially variable related to human behaviour such cultivation and time of introduction are more important than ecological traits.

In addition, I will also focus on the habitats invaded. Invasive species are not invasive in all habitats. They are more frequent in (human) disturbed habitats and rare in almost natural habitats. This also translates into spatial patterns of invasions at European scale, mainly with larger agricultural regions being more invaded and forested regions less. Surprisingly, though, Mediterranean regions are comparably little invaded. Applying scenarios of land use changes, it became evident that even under the most sustainable scenario assumptions, the number of invasive species increased, because no specific measures against invasive species were taken into account.

Hence, the combination of traits and other factors is crucial and differs among successful alien species.

THE MACROECOLOGY OF BIOLOGICAL INVASIONS: WHAT GLOBAL DATABASES TELL US?

Franz Essl[1], Wayne Dawson[2], Holger Kreft[2], Petr Pyšek[4,5], Jan Pergl[5], Mark van Kleunen[6], Patrick Weigelt[3], Bernd Lenzner[1], Thomas Mang[1], Dietmar Moser[1], Stefan Dullinger[1], GloNAF Data Providers & Collaborators & Marten Winter[7]

[1]Division of Conservation, Vegetation and Landscape Ecology, University Vienna, 1030 Wien, Austria, franz.essl@univie.ac.at
[2]School of Biological and Biomedical Sciences, Durham University, South Road, Durham, DH1 2LF, United Kingdom
[3]Biodiversity, Macroecology & Conservation Biogeography, University of Göttingen, Büsgenweg 1, D-37077 Göttingen, Germany
[4]Institute of Botany, Department of Invasion Ecology, The Czech Academy of Sciences, CZ-252 43 Průhonice, Czech Republic
[5]Department of Ecology, Faculty of Science, Charles University in Prague, Viničná 7, CZ-128 44 Prague, Czech Republic
[6]Department of Biology, University of Konstanz, Universitätsstrasse 10, D-78464 Konstanz, Germany
[7]German Centre for Integrative Biodiversity Research (iDiv), Halle-Jena-Leipzig, Germany

Biological invasions have become a defining feature of global environmental change. However, the global patterns and underlying factors that determine variation in invasions world-wide are still insufficiently understood.

However, in the last years, the substantial increase in global distribution data on alien species of several taxonomic groups has for the first time allowed to compile databases which provide accurate and exhaustive information on the global richness, flows between regions, taxonomic composition and temporal accumulation of alien species. In addition, data on anthropogenic pressures, on the exchange routes of goods and people, and on a large range of environmental factors have increasingly become available for islands. Combined, this data allow for robust analyses of the patterns and processes of island invasions world-wide.

In this talk, we will present key insights that have emerged recently from these global databases. Further, we will highlight the likely future consequences of biological invasions for island biota, and identify gaps in knowledge which have to be addressed as a priority.

USMENA PRIOPĆENJA

ORAL PRESENTATIONS

EUROPEAN UNION INVASIVE ALIEN SPECIES REGULATION AND THE POSSIBLE ROLE OF ESENIAS FOR IMPLEMENTATION IN THE REGION

Ahmet Uludağ[1,2], Teodora Trichkova[3], Milica Rat[4], Rumen Tomov[3], Giuseppe Brundu[5], Vladimir Vladimirov[3], Riccardo Scalera[6], Quentin Groom[7], Piero Genovesi[8], Sven Bacher[9], Aljoša Duplić[10], Dan Cogalniceanu[11], Argyro Zenetos[12], Marc Kenis[13], Rob Tanner[14]

[1] Faculty of Agriculture, Canakkale Onsekiz Mart University, Canakkale, Turkey (ahuludag@yahoo.com)
[2] Faculty of Agriculture and Nature Science, Duzce University, Duzce, Turkey
[3] Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Science, Sofia, Bulgaria
[4] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad, Serbia
[5] Department of Agriculture, University of Sassari, Italy
[6] IUCN-ISSG Rome, Italy
[7] Botanic Garden Meise, Meise, Belgium
[8] Piero Genovesi, Institute for Environmental Protection and Research, and Chair IUCN SSC Invasive Species Specialist Group, Rome, Italy
[9] Department of Biology, Ecology & Evolution Unit, University of Fribourg, Fribourg, Switzerland
[10] Karlovac University of Applied Sciences, Karlovac, Croatia
[11] Faculty of Natural Sciences and Agricultural Sciences, University Ovidius Constanta, Constanta, Romania
[12] Hellenic Center for Marine Research, Athens, Greece
[13] Risk Analysis and Invasion Ecology, CABI, Delémont, Switzerland
[14] EPPO, Paris, France

An important European initiative to save biological diversity is the ‘European Union Regulation on invasive alien species’ which has applied since January 2015. It is well designed to cover all issues related to alien species and not to overlap with any other legislation. It defines alien and invasive alien species (IAS), and creates new terms such as IAS of Union concern', 'IAS of Member State concern' and 'IAS of regional concern'. Having different habitat types and zones in Europe and neighboring regions, it is not easy to create a one-size-fits-all legislation which is necessary for the high impact species. Furthermore, it should be noted that there is large variation in awareness, attitudes and capacity among Member States to tackle IAS. Also, considering the continuity of the European Union region with eastern and southern Europe, in order to ensure effective prevention and management actions toward invasive species, it would be important to promote an implementation of consistent policies also in these regions. ESENIAS was established in 2010 as a European network on IAS, mainly centred on the Balkans with EU member countries, candidate countries and potential candidate countries. One of the main impetuses was that these countries have similar environmental problems and

awareness, and shared the same geographical position, and regional cultural and industrial development for centuries. The ESENIAS-TOOLS project "East and South European Network for Invasive Alien Species – a tool to support the management of alien species in Bulgaria" funded under the Programme BG03 "Biodiversity and Ecosystem Services" within the EEA FM (2009-2014)*, started just after the EU legislation came into force. The project aims to prioritize action on alien species at a regional level, collect data and publish fact sheets for the priority species, fill gaps on IAS throughout the ESENIAS region, and help to harmonise the work done by ESENIAS with the standards of the EU acquis and EASIN as well as with definitions and tools from the CBD and other globally recognised bodies e.g. in relations to pathways and categorisation of impacts although the project focuses on Bulgaria. Owing to the dynamic nature of biological systems, activities need to be perpetuated to ensure the continuation of the database and networking both at the national and regional level, as well as continental and global ones. The EU commission regulation currently names 37 IAS of Union concern. This paper will focus on these species from the regional viewpoint.

EU REGULATION ON INVASIVE ALIEN SPECIES – CROATIAN PERSPECTIVE

Sonja Desnica[1], Vesna Vrdoljak[2], Igor Boršić[1], Petra Kutleša[1], Martina Cigrovski Mustafić[1], Sandra Slivar[1]

[1]Croatian Agency for the Environment and Nature, Radnička cesta 80/7, 10000 Zagreb, Croatia (sonja.desnica@dzzp.hr, igor.borsic@dzzp.hr, petra.kutlesa@dzzp.hr, martina.cigrovski-mustafic@azo.hr, sandra.slivar@dzzp.hr)
[2]Ministry of Environmental and Nature Protection, Radnička cesta 80/3, 10000 Zagreb, Croatia (vesna.vrdoljak@mzoip.hr)

On 1 January 2015 the EU Regulation 1143/2014 on invasive alien species entered into force. The Regulation is binding in its entirety and directly applicable in Croatia as one of the EU Member States. At the core of the Regulation there is a list of invasive alien species of Union concern (the Union list). The first Union list was adopted in July 2016 (Commission Implementing Regulation (EU) 2016/1141). The list contains 14 plant and 23 animal species. Nine species from the list are considered to be present in Croatia, either in established populations or occasionally recorded. The Regulation foresees three types of intervention that every Member State has to apply in relation to the species on the Union list: (1) prevention, (2) early detection and rapid eradication of new IAS, and (3) management of IAS that are already widely spread. Each type of intervention requires specific actions to be taken by the Member States (analysis of introduction pathways, establishment of action plan(s) addressing priority pathways, establishment of the surveillance system, putting in place management measures for widespread species etc.) and for every action the timeframe is given. The Regulation also foresees the continuous updating of the Union list as well as the possibility of establishment of national and regional lists (IAS of regional and national concern). Given all the possibilities and obligations set out in the Regulation, it is clear that concerted action of all relevant sectors at the national level is necessary to fulfil all the requirements and to successfully combat IAS.

Keywords: the Union list, prevention of introduction, introduction pathway, early detection, management measures

LIFE ARTEMIS – AWARENESS RAISING, TRAINING AND MEASURES ON INVASIVE ALIEN SPECIES IN FORESTS

Andrej Verlič[1], Jana Kus Veenvliet[2] & Maarten de Groot[3]

[1] Slovenian Forestry Institute, Večna pot 2, 1000 Ljubljana, Slovenia, (andrej.velič@gozdis.si)
[2] Zavod Symbiosis, Metulje 9, 1385 Nova vas, Slovenia, (jana.kus@zavod-symbiosis.si
[3] Slovenian Forestry Institute, Večna pot 2, 1000 Ljubljana, Slovenia, (maarten.degroot@gozdis.si)

The project LIFE ARTEMIS – Awareness Raising, Training and Measures on Invasive alien Species in forests started in June 2016 and will be active till 2020. The goal of the project is to contribute to the reduction of the harmful impacts of invasive alien species on biodiversity by increasing public awareness and by setting up an efficient early warning and rapid response framework for invasive alien species in forests. The project will increase awareness of the general public, in particularly of private forest owners, of threats caused by invasive alien species to forests, establish an efficient national institutional framework for early detection and rapid response for alien species in forests, and improve the national capacity for early detection of alien species in forests by mobilising and training professionals and volunteers. In order to achieve these results, the following actions will be conducted: 1) a general awareness campaign about IAS, 2) an area-based campaign in an urban protected area will work towards engaging volunteers in IAS surveying and eradicating alien plants, 3) a species-based campaign will mobilise forest owners to detect the alien canker of maple. Furthermore, the capacity of national institutions and members of civil society will be assessed to establish a national institutional framework for early warning and rapid response (EWRR). To support the EWRR, specific training for professionals and volunteers will be held and a national information system for alien species will be developed to document and share information on alien species.

Keywords: early warning and rapid response, citizen science, eradication, institutional framework

DETECTING THE INVASIVE GIANT HOGWEED (*Heracleum mantegazzianum*) THROUGH MEDIA ALERTS

Jana Kus Veenvliet[1], Paul Veenvliet[1], Nejc Jogan[2]

[1] Institute Symbiosis, so.e., Metulje 9, 1385 Nova vas, Slovenia, (jana.kus@zavod-symbiosis.si)
[2] University of Ljubljana, Department of Biology, Večna pot 111, Ljubljana, Slovenia, (nejc.jogan@bf.uni-lj.si)

Due to its impressive size Giant Hogweed (*Heracleum mantegazzianum*) was introduced to many botanical gardens and occasionally also to private gardens across Europe. It is a known invasive plant, which outcompetes native flora and, due to its phototoxic juice, also poses a serious health risk to humans. In Slovenia, this species was until 2015 known from only 16 localities, most with only single plants in gardens or smaller stands. In June 2015, several plants were found in the forest on the outskirts of Ljubljana. This finding triggered a high interest of media: many on-line, digital and printed media wrote about Giant Hogweed, calling the public to report any new findings. Between mid-June and August 2015, more than 120 people reported seeing Giant Hogweed. The identity of these plants was verified by asking additional questions or by checking photographs. Despite that some media published our photos on the identification of Giant Hogweed, it turned out that people have often mistaken it for native species, in particular for *Heracleum sphondylium*, and occasionally also for *Peucedanum verticillare* and even for various species of thistles (*Cirsium* spp.). However, in a few cases, the identity was confirmed, which subsequently lead to the discovery of six new localities of Giant Hogweed. Most of the new localities are far from those previously known, and we would not be able to find them without the assistance of the public. Our case shows that the public can play a significant role in detecting invasive alien species, but systematic verification of sightings is needed to avoid misidentified records.

Keywords: early detection, citizen science, media campaign, invasive alien species

HISTORY OF THE ALIEN INVASIVE FRESHATER CRAYFISH IN CROATIA

Ivana Maguire[1], Mišel Jelić, Göran I. V. Klobučar[1], Andreja Lucić[1], Krešimir Žganec[2], Matej Faller[3], Gordan Hudina[4], Sandra Hudina[1]

[1]University of Zagreb, Faculty of Science, Department of Biology, Rooseveltov trg 6, Zagreb, Croatia (imaguire@biol.pmf.hr, mjelic@biol.pmf.hr, gklobuca@biol.pmf.hr, alucic@biol.pmf.hr, shudina@biol.pmf.hr)
[2]University of Zadar, Department of Teacher's Education Gospić, Croatia (kzganec@unizd.hr)
[3]Queen Mary University of London, School of Geography, London, UK (m.faller@qmul.ac.uk)
[4]Čalogovićeva 1, Zagreb, Croatia (ghudina@gmail.com)

Until recently Croatian freshwater ecosystems harboured only indigenous European crayfish species (ICS). The first appearance of the non-indigenous crayfish species (NICS), the invasive spiny-cheek crayfish *Orconectes limosus*, was recorded in Kopački rit in 2003 where it has spread naturally through the Danube River from Hungary. In 2008, another invasive species, the signal crayfish *Pacifastacus leniusculus*, was recorded in the Mura River, because of natural spread from Slovenia. Since that time, we are witnessing continuous NICS spread via natural or human-mediated ways throughout Croatian freshwaters. Due to their biological and ecological characteristics, they have severe adverse impacts on ICS. Moreover, they are latent carriers of the pathogen *Aphanomyces astaci*, causative agent of the disease crayfish plague that is lethal for ICS. The aim of this presentation is to give an overview on the NICS invasion in Croatia and their impact on ICS. Today, NICS comprise 43% of the total number of crayfish species present in Croatia. Since 2003, NICS have occupied 30 out of 327 10x10km grid cells of Continental Croatia. At least in two localities, they have displaced ICS in a short period of time (1-3 years), and their dispersal speed ranges between 24 km/year (downstream) and 2.5 km/year (upstream). In contact areas between ICS and NICS, transmission of *A. astaci* was recorded.

Keywords: signal crayfish, marbled crayfish, spiny-cheek crayfish, astacofauna

A DECADE OF AWARENESS OF REALITY: INVADERS IN CROATIAN FLORA

Božena Mitić[1], Igor Boršić[2], Toni Nikolić[1]

[1] University of Zagreb, Faculty of Science, Department of Biology, Marulićev trg 9a, 10000 Zagreb, Croatia (bozena.mitic@biol.pmf.hr; toni.nikolic@biol.pmf.hr)
[2] Croatian Environment Agency, Radnička cesta 80/7, 10 000 Zagreb, Croatia (igor.borsic@dzzp.hr)

Awareness raising regarding the problem of invasive plants in Croatia began to stir up only a decade ago. The first national project on invasive flora, performed in 2006, marked the beginning of more organized work on this issue. The outputs of this project were: (a) adoption of national standards, criteria, and terminology for alien flora treatment; (b) creation of the preliminary list of 64 invasive alien plant taxa in Croatia; and (c) developing of the database of Croatian alien / invasive flora. Consequently, within the well-known Flora Croatica Database, the new module "Allochthonous Plants" was developed (http://hirc.botanic.hr/fcd/InvazivneVrste/Search.aspx), and permanently upgraded during the last ten years. According to this platform, aimed to map and build up the national inventory of invasive plants, they are detected on one half of Croatian territory, mainly in urban centres, but the most endangered are the Adriatic coast and islands. Currently, 74 invasive alien, mainly terrestrial, plants are recorded in Croatia. The distribution, impacts and other related remarks are briefly discussed for some of the most important invasive plants. Data from our database should provide a reliable national and regional framework for strategic planning regarding the IAS monitoring and management. A decade of more or less intensive work on invasive alien plants in Croatia is reflected in better collaboration between all interested experts and the public. However, there are still a lot of disadvantages, e.g. no documented and organised monitoring, eradication actions, prevention measures etc.

Keywords: Croatia, invasive alien plants, Flora Croatica Database, module "Allochthonous Plants"

ANALYSING THE DISTRIBUTION OF THE INVASIVE PLANTS IN CROATIA – DO WE NEED MORE OR (JUST) BETTER DATA?

Sven D. Jelaska, Toni Nikolić

Department of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia, e-mail: sven.jelaska@biol.pmf.hr

Here, we have analysed to what extent spatial accuracy of data affects our perception and knowledge on the ecological, and hence distributional, patterns of the invasive plants in Croatia. Chorological data were divided and grouped according to their spatial accuracy in distinct and cumulative groups. There wasn't unique trend belonging to specific group with respect to observed differences across different species. This could be partly attributed to the ecology of the particular species (e.g. for some species disturbance proxies will be more important then climatic data, and for some vice versa). Bigger differences were present when less precise data were used solely, then when they were used in bulk (with data of higher precision). Furthermore, we have compared impact of three groups of the environmental variables in explaining distribution of invasive plants in Croatia, i.e. climate data (presented with seasonal precipitation and mean temperature), basic topographical variables (slope, and sine and cosine of aspect) and proxies for disturbance (human population density, distance from the settlements and distance from the traffic infrastructure i.e. roads and railways). While topography variables seems to be almost irrelevant, those serving as proxies for disturbance turns out to be more important than climatic ones for significant share of the invasive plant species, with the particular emphasis on the human population density. To better understand pattern of distribution of the invasive plants it is crucial to improve not only spatial, but thematic resolution of the data as well. Latter goes particularly for the description of the microhabitats of the species that cannot be properly attributed to the chorological data of the species, regardless of their spatial precision, if detailed notes in the field hasn't been recorded.

Keywords: spatial precision; climate; disturbance; modelling

HOW DO ACACIAS MATCH WITH NATIVE POLLINATORS IN INVADED AREAS? DIFFERENCES AND SIMILARITIES AMONG ITALY, CROATIA AND PORTUGAL.

Manuela Giovanetti[1], Claudia Giuliani[2], Nina Vuković[3], Sven D. Jelaska[3], Marta Mariotti Lippi[1], Bruno Foggi[1], Cristina Máguas[4]

[1]University of Florence, Biology Department, via Giorgio La Pira 4, I-50121 Florence, Italy
Email: manuela.giovanetti@gmail.com
[2] Department of Pharmaceutical Sciences, University of Milan, Via Mangiagalli 25, I-20133 Milan, Italy
[3]Department of Botany, Division of Biology, Faculty of Science, University of Zagreb. Marulićev trg 20/II, HR-10000 Zagreb, Croatia
[4]Faculdade de Ciencias da Universidade de Lisboa, Centre for Ecology, Evolution and Environmental Changes, Campo Grande, C2, 1749-016 Lisbon, Portugal

Australian acacias are popularly known as plants showing beautiful flowers, but they have also been introduced to Europe for reforestation purposes in areas suffering frequent fires or in sand dunes. Unfortunately they turned out to be aggressive invaders and are today the subject of different lines of research. One involve their reproduction: Acacias are full or partial self-incompatible, the result of self-pollination often showing deleterious recessive genes in the population and a decrease in fertility and in general vigour. Cross-pollination is the rule: at their home range, cross-pollination is ascribed to the activity of birds, attracted by extrafloral nectar, and, to a smaller extent, to rare bee visits to inflorescences. A project, involving different research groups, started back in 2012 to address the above question and deepen the understanding of how these species establish a functional relationship with the pollinators needed for their successful reproduction. Data have been collected in three countries so far, on different species: *Acacia dealbata*, *A. pycnantha*, and *A. longifolia.* Field observations have been conducted to identify potential pollinators and their activity on flowers. Results indicate that the honeybee is the main pollinator attracted by these species, and that in certain circumstances it already developed a precise strategy to exploit all the resources offered by the alien plant. A special role is played by extrafloral nectaries (EFN), usually known as related to mutualisms with ants. EFN evolution and role need to be discussed further. Understanding plant-pollinator interactions is crucial when addressed to alien invasive species: indeed, the presence of attractive exotic plants may turn the interest of pollinators away from native plants. Moreover, we have to take into account actual pollinator decline, climate change scenarios and influence and pressure of economic processes.

Keywords: plant-pollinator interaction, EFN, pollinator attraction, coast vulnerability

HOW TO CONTROL AN INVASIVE FOREST PEST? BIOLOGICAL CONTROL OF INVASIVE *Dryocosmus kuriphilus* WITH INTRODUCED PARASITOID *Torymus sinensis* IN CROATIA, SLOVENIA AND HUNGARY

Dinka Matošević[1], George Melika[2], Katarina Kos[3], Mojca Rot[4], Nikola Lacković[1], Eva Kriston[2], Miklos Boszo[2]

[1]Croatian Forest Research Institute Cvjetno naselje 42, Jastrebarsko, Croatia(dinkam@sumins.hr)
[2] Plant Health and Molecular Biology Laboratory Directorate of Plant Protection, Soil Conservation and Agri-environment National Food Chain Safety Office, Budaörsi u. 141-145, 1118 Budapest, Hungary (melikageorge@gmail.com)
[3] Department of Agronomy, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia; e-mail: katarina.kos@bf.uni-lj.si
[4] Kmetijsko gozdarski zavod Nova Gorica, Pri Hrastu 18, 5000 Nova Gorica, Slovenia, email: mojca.rot@go.kgzs.si

Dryocosmus kuriphilus is considered as one of the major pests of sweet chestnut (*Castanea*) and the effective method of controlling its populations and damage is biological control with its introduced parasitoid *Torymus sinensis. T. sinensis* is a univoltine, host specific parasitoid, phenologically synchronized and morphologically adapted to *D. kuriphilus*, it has good dispersal ability, builds up populations quickly and effectively controls the pest already few years after release. Withered *D. kuriphilus* galls with *T. sinensis* larvae were collected in Torino vicinities, Italy in March 2014 and 2015. After emergence, males and females were put together, kept at 14°C and fed with liquid honey until release. To confirm the establishment of population of *T. sinensis* on release sites in Croatia, Slovenia and Hungary morphological and DNA identification were used. In total 10,590 females and 5,295 males of *T. sinensis* were released in sweet chestnut forests across Croatia, Hungary and Slovenia in 2014 and 2015. Subsequent releases of females resulted in rapid establishment of population of *T. sinensis* and parasitism rates of 76 % only one year after the first release was achieved. High levels of genetic diversity indices showed that populations of *T. sinensis* did not suffer from bottleneck-induced founder effect phenomenon. Prior to release of *T. sinensis* all advantages and disadvantages of introduction of this alien biocontrol species into natural stands in Croatia, Hungary and Slovenia have been considered.

Keywords: Hymenoptera, raising and release, parasitism rates, alien species

HOT-SPOT AREAS OF BENTHIC NONINDIGENOUS SPECIES IN THE ADRIATIC SEA (CROATIA)

Ante Žuljević[1], Boris Antolić[2], Marija Despalatović[3], Ivan Cvitković[4], Petra Lučić[5]

Institute of Oceanography and Fisheries, I. Meštrovića 63, Split, Croatia
[1] zuljevic@izor.hr; [2] antolic@izor.hr; [3] mare@izor.hr; [4] cvite@izor.hr; [5] lucic@izor.hr;

Number of marine benthic NonIndigenous Species (NIS) in the Adriatic Sea (Croatia) is constantly increasing. Some areas stand out by higher number of recorded NIS. Such HOT-SPOT areas are the southern part of the Croatian coast, wider area of Split and tuna fish farms on Brač Island. By analysing biological features of the recorded NIS, possible vectors of introduction and secondary spreading and ecological features of the invaded areas, we attempt to answer the following question: is elevated number of NIS in some areas a result of: 1) spreading of NIS by currents; 2) transport by shipping; 3) susceptibility of the area for NIS establishing; 4) level of area surveillance; 5) combination of different factors. We speculate how the majority of NIS are introduced in Croatian by currents (by the main Adriatic current from the Ionian Sea) and by shipping. Secondary spread through the Croatian coast is dominantly a result of propagule spreading by currents. Establishment of NIS is in many situations result of some form of ecological disturbance, like pollution and eutrophication such as area of tuna-fish farms or sewage outfall.

Keywords: spreading, current, shipping, eutrophication

THE CURRENT STATUS OF THE ADRIATIC AND MEDITERRANEAN FISH BIODIVERSITY

Jakov Dulčić, Branko Dragičević

IOF, Šetalište Ivana Meštrovića 63, HR-21000 Split, Croatia (dulcic@izor.hr)

The marine biodiversity of the Mediterranean Sea is nowadays facing substantial the structural changes in flora and fauna. Such changes were recorded in the Adriatic Sea, as well. During the last few decades, various factors including climate change, anthropogenic activity and lessepsian migration have altered the composition of Adriatic ichthyofauna. These changes are reflected in the number of species quoted in the checklist of Adriatic fishes, from 407 in 1996 to 440 in 2010. Since 2010, 12 new species were recorded, which raised the number to 452 species and 139 families (457 species and 140 families). Of the 14 Lessepsian migrants that were recorded in the Adriatic, *Fistularia commersonii* and *Siganus luridus* proved to be successful invaders for its southern part. Several checklists for the Mediterranean Sea in the last 14 years quote how number of fish species ranged from 648 to 664. Until to 2014, 151 of non-indigenous fish species were observed in the Mediterranean Sea (34 in the last 5 years, at least 36 species from the Red Sea since 2000). A significant increase of Lessepsian migrants is partly associated with the expansion and deepening of the Suez Canal. Some of them established populations very quickly in the Mediterranean and some have positive economic significance and some species exhibit negative impacts on marine fisheries and biodiversity.

Keywords: Adriatic Sea, Mediterranean Sea, Fish, Biodiversity, Changes

TESTING THE DIVERSITY RESISTANCE HYPOTHESIS – STABILITY OF UNDERSTOREY BIODIVERSITY AFTER MAJOR DISTURBANCE

Nina Sajna[1], Tamara Karlo[2]

[1]Faculty of Natural Sciences and Mathematics University of Maribor, Koroška 160, Maribor, Slovenia (nina.sajna@um.si)
[2]Ministry of Agriculture, Forestry and Food, Dunajska 22, Ljubljana, Slovenia

Biodiversity conservation recognizes a possible link between ecosystem biodiversity and ecosystem invasion resistance when an ecosystem experiences a disturbance event. Predicting the impact of such events on biodiversity is difficult because these can generate novel outcomes and because pre-disturbance data is rarely available. We had established the baseline data of understorey of two forest types: a late successional and old peri-urban forest, which both experienced the impact of a 100-year recurring flood 1 year later. The pre-flood understorey differed in species richness, in biodiversity indicators (e.g. H'), and in community quality (e.g. the presence of ancient forest species). Using permanent plots, we were able to compare the baseline data with the altered species composition after the flood. We analyzed changes in the understorey post-flood by calculating species turnover (Sørensen pairwise dissimilarity index) and investigated differences in species survival and post-flood occurrence changes. Recovery was slower in the species-poor understorey, with more new species entering the existing species composition, among them alien invasives. Results suggest that high initial biodiversity in the understorey forms the basis for better disturbance resilience, with lower mortality and a higher nestedness component of recovery in such an understorey. Our results demonstrate how important it is to maintain high biodiversity in order to sustain the ecological resilience of even small and urban forests.

Keywords: resilience, catastrophic event, flood, old forest, late successional forest

GEOGRAPHIC ORIGIN AND GENETIC STRUCTURE OF PLANTED *AILANTHUS* IN VIENNA (AUSTRIA)

Marcela van Loo[1], Renata Milcevicova[2], Michael Barfuss[3]

[1]Department of Botany and Biodiversity Research, Rennweg 14, 1030 Vienna (marcela.van.loo@univie.ac.at)
[2]Institute of Silviculture, University of Natural Resources and Life Sciences, Peter Jordan Strasse 82, A-1190, Vienna, Austria (renata.milcevicova@boku.ac.at)
[3]Department of Botany and Biodiversity Research, Rennweg 14, A-1030 Vienna, Austria (michael.barfuss@univie.ac.at)

Ailanthus altissima (Mill.) Swingle, tree of heaven, was intentionally introduced from China to Austria before 1856, where it got successfully established and naturalised in the Eastern part of the country. Based on the introduction and invasion history, we assume that capital cities represent the primary supply of genetic variation in *Ailanthus* and the place where the naturalisation started. In Vienna, being planted as wild silkworm forage and for the most part as an ornamental tree, naturalised *A. altissima* can be found throughout the entire city. Here, we focussed on planted *A. altissima* trees in Vienna in which we analysed patterns of genetic variation and structure in order to infer the geographic origin and dispersal patterns of these trees. Both nuclear DNA (nuclear microsatellites) and plastid DNA (psbA-trnH, trnL-trnH, trnD-trnT regions) were genotyped in 96 trees planted approximately between 1852-1958 along roads and in urban parks. Analyses of nuclear DNA revealed 89 distinct nuclear genotypes among which, five were identified in more than one tree. Most of the trees were assigned to three genetic clusters, although the analyses of genetic structure showed 15 in total. Analyses of plastid haplotypes are currently on the way in order to estimate the geographic region of China from which Austrian *Ailanthus* was introduced. Nevertheless, the majority of analysed trees so far contain plastid haplotype 7, which is present in the Eastern China. Final results will be discussed i) with respect to geographic origin, plantation versus naturalisation, asexual versus sexual reproduction and ii) in comparison to studies on *Ailanthus* in Japan and the USA.

Keywords: nuclear DNA, plastid DNA, planted trees, sexual and asexual reproduction

PREDICTION OF THE APPEARANCE OF TREE OF HEAVEN IN FOREST COMMUNITIES IN WESTERN SLOVENIA

Andraž Čarni[1], Nina Juvan Mastnak[2], Igor Dakskobler[3], Lado Kutnar[4], Aleksander Marinšek[5], Urban Šilc[6]

[1] Research Centre of the Slovenian Academy of Sciences and Arts, Institute of Biology, Novi trg 2, 1000 Ljubljana, Slovenia, University of Nova Gorica, Vipavska 13, 5000 Nova Gorica, Slovenia, [1]e-mail: carni@zrc-sazu.si, [2]e-mail: nina.juvan@zrc-sazu.si
[3] Research Centre of the Slovenian Academy of Sciences and Arts, Institute of Biology, Novi trg 2, 1000 Ljubljana, Slovenia University of Ljubljana, Biotechnical Faculty, Department of Forestry and Renewable Forest Resources, Večna pot 83, 1000 Ljubljana, Slovenia, e-mail: igor.dakskobler@zrc-sazu.si
[4] Slovenian Forestry Institute, Večna pot 2, 1000 Ljubljana, Slovenia, e-mail: lado.kutnar@gozdis.si
[5] Slovenian Forestry Institute, Večna pot 2, 1000 Ljubljana, Slovenia Higher Vocational College for Forestry and Hunting, Ljubljanska 3, 6230 Postojna, Slovenia, e-mail: aleksander.marinsek@gozdis.si
[7] Research Centre of the Slovenian Academy of Sciences and Arts, Institute of Biology, Novi trg 2, 1000 Ljubljana, Slovenia, Biotechnical Centre Naklo, Strahinj 99, 4202 Naklo, Slovenia, e-mail: urban@zrc-sazu.si

Tree of heaven (*Ailanthus altissima*) is one of the most invasive tree species in Slovenia. Since its invasion into forests is expected, we must raise public awareness and prepare guidelines for forest management in the presence of invasive species. The aim of the research was to predict the potential distribution of tree of heaven, to detect the most endangered forest communities and to discover what characteristics of forest stands make them susceptible. From databases, literature sources and field observations, we collected all localities in which tree of heaven appears. We assigned to these localities geological, geomorphological, soil and climatic data. We then built an ecological model and prepared a map of potential distribution. Based on the modelled future distribution of tree of heaven, we randomly selected and sampled 50 plots in the area in which invasion is expected and beyond this area. We analyzed their morphological and ecological strategies, ecological condition, origin and social behavior spectrum. We found that it has the largest invasive potential in western Slovenia. The model showed that the most susceptible forest communities appear in warm areas with pronounced climatic seasonality. Many differences occur in floristics and plant traits of forest communities in extreme positions, in terms of susceptibility to invasion, but in transitional areas, these differences are not so obvious, only a higher pH of soil and absence of species characteristic of acidophilus communities are an indicator of vulnerability. Susceptibility to invasion by tree of heaven is mainly influenced by macro-climatic conditions; in the transitional zone, communities thriving on shallow soils over carbonate bedrock are more vulnerable.

Keywords: *Ailanthus altissima*; invasive species; distribution model; traits

INVASIVE POTENTIAL OF GOLDENRAIN TREE (*Koelreuteria paniculata* Laxm., Sapindaceae) - A CASE STUDY FROM THE CITY OF ZAGREB

Igor Boršić, Petra Kutleša, Sonja Desnica, Sandra Slivar

Croatian Agency for the Environment and Nature, Radnička cesta 80/7, 10000 Zagreb, Croatia (igor.borsic@dzzp.hr, petra.kutlesa@dzzp.hr, sonja.desnica@dzzp.hr, sandra.slivar@dzzp.hr)

Goldenrain tree (*Koelreuteria paniculata* Laxm., Sapindaceae) is a neophyte deliberately introduced to Europe from eastern Asia. It has been used as ornamental tree in urban parks in Croatia for several decades. Due to the fact that its invasiveness was observed in several European countries (e.g. FYR Macedonia, Bulgaria) its invasive potential was studied in the City of Zagreb. More than 10 different localities with almost 70 cultivated goldenrain trees were visited during July, August and September of 2016, the diameter at breast height (DBH) of recorded trees was determined and it was noted if they fructified. The number of seedlings and their height (< 10 cm, 10-50 cm, 50-100 cm, 100-200 cm and > 200 cm) was determined at different distances (< 5 m, 5-10 m, > 10 m) from each planted tree. Furthermore, occupied habitat of seedlings was also noted (lawn, hedges/bushes, crevices/edges). The results have shown that goldenrain trees produce seedlings which grow at different distances from parent trees and in all observed habitats. However, the most numerous seedlings were recorded in hedges/bushes if this habitat was present in the vicinity of goldenrain tree. All these results imply that goldenrain tree is potentially invasive species.

Keywords: alien plant species, escape from cultivation, horticulture, naturalization, potentially invasive species

Paulownia tomentosa - THE QUIET INVADER?

Ana Ostojić, Nela Jantol, Zrinka Mesić, Tena Birov, Ana Selak, Davor Korman, Vladimir Kušan

Oikon d.o.o., Institute of applied Ecology, Trg senjskih uskoka 1-2, Zagreb, Hrvatska, (aostojic@oikon.hr, njantol@oikon.hr, zmesic@oikon.hr, tbirov@oikon.hr, aselak@oikon.hr, dkorman@oikon.hr, vkusan@oikon.hr)

Paulownia species are becoming increasingly popular in Croatia because of their ability to grow rapidly and create large biomass in a short period of time which makes them lucrative, attracting attention of landowners. While Paulownia wood has been used for a wide variety of purposes in China for more than 2500 years, in Europe more people are interested in growing these trees only in the last decades. *Sterile*, fast growing *paulownia hybrids are* widely held plantation types in Europe. *Paulownia tomentosa* commonly known as princess tree is a deciduous tree native to China. It was introduced into Europe as an ornamental plant in 1834. The species is a prolific seed producer, with millions of seeds produced per individual tree. Most *P. tomentosa* specimens reported in Europe have been planted in parks or they typically occur in urban areas or near-natural habitats mainly as a single tree and so far have not demonstrated naturalization. Since there are no formal risk and invasion potential assessments *P. tomentosa* is considered *potentially invasive*. Invasive potential was analyzed in the case study of the planned plantation (1.1 ha) neighboring forest, near town of Našice in Slavonia (NE Croatia) using risk screening tools (Harmonia^{+}). Taking into account the biology of *P. tomentosa* as well as the lack of targeted research on the invasiveness of the species in the wild, the results of the risk screening tools suggest that this species has high invasion potential hence the future spread of this species should be closely monitored.

Keywords: princess tree, *paulownia hybrids,* Europe, plant invasion, urban vegetation risk screening tools, monitoring

DIVERSITY OF INVASIVE PLANTS ON MEDVEDNICA Mt (CROATIA)

Antun Alegro, Vedran Šegota, Nina Vuković

Division of Botany, Department of Biology, Faculty of Science, University of Zagreb, Marulićevtrg 20/II, HR-10000 Zagreb, Croatia
antun.alegro@biol.pmf.hr

Medvednica Mt (1,035 m) is situated in north-western Croatia, near the capital city, Zagreb. Due to the well preserved forest vegetation and overall great biological value, the massive is legally protected as a Nature Park since 1981. Here, beech forests (*Fagion sylvaticae*) in upper and sessile oak forests (*Carpinion betuli* and *Quercion robori-petreae*) in lower zones predominate. Even though being a subject of interest to Croatian botanists for several decades, the invasive flora of the mountain has never been properly studied. Thus, the aim of this study was to gain information about invasive plant species, their distribution and invaded habitats, in the zones of the most severe utilization of the Park. Those lower parts of the mountain have been under the strong anthropogenic influence for centuries, thus creating a range of secondary habitats suitable for colonization of alien plants. In total, 33 invasive plants were recorded, which is one half of all invasive species recognized in Croatia. As much as one third of recorded specieswas noticed for the first time on the mountain (*Abutilon theophrasti*, *Amaranthus hybridus*, *Bidens frondosa*, *Conyza bonariensis*, *Duchesnea indica*, *Euphorbia maculata*, *Euphorbia prostrata*, *Lepidium virginicum*, *Reynoutria × bohemica*, *Reynoutria sachalinensis*, *Rudbeckia laciniata*). Several of them were most probably misidentified with similar species in previous studies. The species are significantly differing in their distribution and invasion potential. Regarding invaded habitats, in total 14 types were distinguished, with the largest number of species occurring in edges of paths and roads, followed by abandoned fields and grasslands. Invasive plants were mostly found in ruderal habitats, and were especially numerous on abandoned agricultural land. The latter, overgrowing by perennial herbaceous (*Solidago gigantea*, *S. canadensis*, *Artemisia verlotiorum*) and woody (*Robinia pseudoacacia*) species, were recognized as the main threat for biodiversity of the area. It is worth mentioning that *Reynoutria sachalinensis* is extremely rare in Croatia and does not show serious invasive behaviour.

Keywords: invasive plants, Nature Park Medvednica, invasive flora mapping, habitat preference

ALIEN FRESHWATER CRUSTACEANS (PERACARIDA: MALACOSTRACA) IN CROATIA – CHECKLIST, DISTRIBUTION AND PRELIMINARY IMPACT ASSESSMENT

Krešimir Žganec[1], Renata Ćuk[2], Svjetlana Dekić[3]

[1] University of Zadar, Department of Teacher Education Studies in Gospić, dr. Ante Starčevića 12, 53000 Gospić, Croatia (kzganec@unizd.hr)
[2] Hrvatske Vode, Central Water Management Laboratory, Ulica grada Vukovara 220, 10000 Zagreb, Croatia (Renata.Cuk@voda.hr)
[3] Jurja Križanića 10, 44000 Sisak, Croatia (svjetlana.dekic@gmail.com)

Peracarid crustaceans (Amphipoda, Isopoda, Mysida) are one of the most successful group of invertebrate invaders in inland waters. However, little is known about this group in Croatian freshwaters. Based on extensive studies conducted from 2004 to 2015 in five large rivers of Croatia, the aim of this work is to present checklist, distribution and rates of spread of alien peracarid crustaceans as well as preliminary impact assessment. Their contribution to abundance and richness biocontamination of macroinvertebrate assemblages was also assessed. Altogether, 11 alien species, including six invasive, were recorded (8 Amphipoda, 1 Isopoda, 2 Mysida). Danube has the highest number of recorded species (9), followed by Drava and Sava with six species, and Mura and Kupa with only one species. The invasive amphipods *Chelicorophium curvispinum* and *Dikerogammarus villosus* and the isopod *Jaera istri* have the most widespread distribution. Three new species of Amphipoda were found and their distribution was mapped. Peracarida contribution to abundance contamination of benthic macroinvertebrates widely varied (0.3-89.5%, sites without aliens were not considered) and the highest levels were between 70-90% (Danube-1 site, Sava-2, Drava-4). Richness contamination (5.7-47.4%) reached the highest value in Danube (47.4%), while it was around 20% in Middle Sava, and increased downstream (5.7-30.0%) in Drava. These data represent baseline for future studies, which should examine further spread and impact of the most important crustacean invaders of freshwaters in Croatia.

Keywords: invasive, Amphipoda, Isopoda, Mysida, biocontamination

POTENTIAL FOR CONTROL OF THE INVASIVE SIGNAL CRAYFISH (*Pacifastacus leniusculus*) IN A RECENTLY INVADED REGION IN CROATIA

Sandra Hudina [1], Nika Galić [2], Petra Kutleša [3], Sonja Desnica [3]

[1]Faculty of Science, University of Zagreb, Rooseveltov trg 6, Zagreb, Croatia (shudina@biol.pmf.hr)
[2]College of Biological Sciences, University of Minnesota, 1475 Gortner Ave, Minnesota, US (ngalic@umn.edu)
[3]Croatian Agency for Environment and Nature, Radnička cesta 80/7, Zagreb, Croatia (petra.kutlesa@dzzp.hr; sonja.desnica@dzzp.hr)

Signal crayfish is one of the 37 species on the List of invasive alien species of Union concern according to EU Regulation 1143/2014 on invasive species. The regulation calls for efficient and cost-effective management of listed species. The aim of this study was to explore the effectiveness of different options for management of the signal crayfish population in a recently invaded region in Croatia. We developed an individual-based model (IBM) to represent signal crayfish population and tested 13 different scenarios, entirely based on manual removal by crayfish traps. Tested scenarios were all based on a fixed number of traps (200), and fixed trapping period (7 trapping days, once a month). Simulations were run for 8 years of management. Scenarios differed in the trapping frequency (every vs. every second year), spatial extent (trapping targeted at invasion core, front or combination of both) and the start of management actions (4 or 6 years since invasion). The most effective scenario, which resulted in 65-74% reduction from the baseline of population abundance and colonisation distance, was the one performed over the largest spatial extent. Scenarios targeting invasion fronts were also among the most effective. The model demonstrated striking differences in the effectiveness of the same scenario, depending on the start of the management actions. The delay of only 2 years in the start of management leads to 2-3.5 times decrease in efficiency of the most effective scenario. The results are discussed in the context of the EU regulation requirements.

Keywords: signal crayfish, individual-based model, optimal management scenario, manual removal

REPRODUCTIVE BIOLOGY OF *Trachemys scripta* (Schoepff, 1792) IN CONTINENTAL CROATIA

Lana Jelić[1], Biljana Janev Hutinec[1], Dušan Jelić[2]

[1]Javna Ustanova „Maksimir“, Maksimirski perivoj 1, 10000 Zagreb, Hrvatska, *(lanamalovic@yahoo.com), (ravnatelj@park-maksimir.hr)
[2]Hrvatski institut za biološku raznolikost, Lipovac I. br 7, 10000 Zagreb, Hrvatska (jelic.dusan@gmail.com)

The presence of pond slider, *Trachemys scripta,* in Croatia is known since 1999 and the largest single population (Maksimir Park, Zagreb) is continuously monitored since 2006. Former research estimated the population size of Maksimir Park to be 863 individuals and suggested that most of these turtles originated from the intentional pet release. Reproductive activity of *Trachemys* was first recorded in 2013 in Maksimir but previous studies haven't confirmed full egg incubation and hatching in nature, therefore leaving opened question if continental climate of Central Croatia is favourable for this species. The goal of this study was to quantify the success of reproduction and egg incubation of slider turtle in Maksimir. By field survey 21 adult female in reproductive migration have been observed in period from June to August 2016. 12 nests were laid with 105 eggs in total. Eggs were always laid in single-hole nest, on depth of 5-10 cm under the ground, on open grassy areas 100-200 m from the lake coast. From all observed nests, three were destroyed by predators (30%), one was destroyed during manipulation, one was dig out and placed into the incubator as referent nest, and last six nests were monitored trough incubation. Average incubation time was 93.2 days and in total 27 hatchlings (26 %) managed to fully develop. These results are confirming successful incubation and low predator pressure on nests in Maksimir Park and we can conclude that environmental conditions in Croatia are favourable for successful reproduction of *Trachemys scripta*.

Keywords: incubation, successful reproduction, invasion

JUMPING ACROSS ATLANTIC OCEAN - NORTH AMERICAN PLANT PATHOGENIC FUNGI INVADING CROATIA

Tina Fazinić[1], Željko Tomić[1], Zdravka Sever[1], Tihomir Miličević[2], Dario Ivić[1]

[1] Croatian Centre for Agriculture, Food and Rural Affairs - Institute for Plant Protection, Gorice 68b, Zagreb, Croatia (tina.fazinic@hcphs.hr)
[2] University of Zagreb, Faculty of Agriculture, Svetošimunska cesta 25, Zagreb, Croatia

During the last twenty years global trade with plants and plant products lead to the invasion of numerous plant pathogenic fungi and oomycetes into new areas. Following their establishment, these invasive microorganisms are causing economic damage in agriculture, forestry and horticulture. *Monilinia fructicola* (G. Winter) Honey, *Eutypella parasitica* R. W. Davidson & R. C. Lorenz and *Phytophthora lateralis* Tucker & Milbrath are examples of plant pathogens which have spread into new areas during the last two decades. Until the beginning of 20th century, the natural range of *M. fructicola*, *E. parasitica* and *P. lateralis* was the North American continent. From 2007 to 2015, these species were found for the first time in Croatia, within the official surveys in national plant quarantine activities. *P. lateralis* was found in 2015 on *Chamaecyparis lawsoniana* in Koprivnica-Križevci County. *E. parasitica* was recorded in Croatia in 2007, in forests near Slovenia, but in 2015 it was found for the first time on maples (*Acer* spp.) in the city of Zagreb, in an urban environment. *M. fructicola* was found for the first time on peaches and nectarines in 2012 in Split-Dalmatia County, but the subsequent surveys revealed the presence of this fungus in other parts of Croatia as well. The pathway of *M. fructicola*, *E. parasitica* and *P. lateralis* introduction into Croatia is not known. Invasion and establishment of these fungi and oomycetes are showing some limitations of todays' plant quarantine system, offering insufficient protection from such types of biological invasions.

Keywords: *Monilinia fructicola*, *Eutypella parasitica*, *Phytophthora lateralis*

IMPLEMENTATION OF THE NATIONAL MONITORING OF INVASIVE MOSQUITOE SPECIES IN CROATIA

Nataša Janev Holcer[1,2], Pavle Jeličić[1], Krunoslav Capak[1], Ana Klobučar[3], Nediljko Landeka[4], Toni Žitko[5], Enrih Merdić[6], Ivana Vrućina[6], Nataša Turić[6], Marko Klemenčić[7], Magdalena Sikora[8], Ivan Trumbetić[1]

[1]Croatian Institute of Public Health, Rockefellerova 7, Zagreb, Croatia, (natasa.janev@hzjz.hr; pavle.jelicic@hzjz.hr; krunoslav.capak@hzjz.hr; ivantrumbetic@gmail.com)
[2]Faculty of Medicine of the University of Rijeka, Braće Branchetta 20/1, Rijeka, Croatia,
[3]Andrija Stampar Teaching Institute of Public Health, Mirogojska 16, Zagreb, Croatia, (ana.klobucar@stampar.hr)
[4]Istria County Institute of Public Health, Nazorova 23, Pula, Croatia, (3kazuna@gmail.com)
[5]Teaching Public Health Institute of Split-Dalmatia County, Vukovarska 46, Split, Croatia, (zitko.t@gmail.com)
[6]Department of Biology University of Osijek, Ulica cara Hadrijana 8/A, Osijek, Croatia, (enrih@biologija.unios.hr; ivrucina@biologija.unios.hr; nturic@biologija.unios.hr)
[7]Institute of Public Health of Međimurje County, I.G. Kovačića 1E, Čakovec, Croatia, (marko.klemencic@zzjz-ck.hr)
[8] Institute of Public Health Osijek-Baranja County (magdalena.sikora9@gmail.com)

In relation to human's health, mosquitoes are of public health importance as infectious disease vectors or as a nuisance. From 2010 and first appearance of indigenous dengue fever and in 2012 with indigenous cases of neuroinvasive disease caused by West Nile virus, mosquitoes are playing a role of infectious diseases vectors. Given that Croatia has a long history of monitoring and control of mosquitoes, with the well-regulated underlying legislation, the above situations are managed in a timely manner and according to the rules of the profession. Monitoring was conducted by Croatian Institute of Public Health through the network of county public health institutes and in cooperation with Department of Biology University of Osijek in Croatia. Determination was performed in Zagreb, Pula, Split and Osijek.

Ovitrap breeding data were collected weekly from May to October 2016 for detecting invasive *Aedes* species in areas where no data is available and in risk areas when there is a danger of high mosquito density. The ovitraps are relatively simple and inexpensive method for surveillance and early detecting of introduction of invasive mosquito species at points of entry. Data will be used for vector surveillance and risk assessment of the disease. Locations of the ovitraps will be recorded using Google maps application. This analysis could be used to plan vector surveillance and control operations. Implementation of national mosquito monitoring is an excellent example of cooperation of all involved institutions in Croatia.

Keywords: invasive species, mosquitoes, ovitraps, institutional cooperation, maps

QUANTITATIVE ANALYSIS OF *Abutilon theophrasti* Medik. EMERGENCE FROM BURIED SEED WITH INCREASING SOIL DEPTH

Vladimir Rakoš, Maja Šćepanović, Ana Pintar, Klara Barić

University of Zagreb Faculty of Agriculture, Svetošimunska 25, 10 000 Zagreb
vladimir.rakos@hotmail.com, mscepanovic@agr.hr, apintar@agr.hr, kbaric@agr.hr

Abutilon theophrasti (velvetleaf) is an invasive species originated from China and nowadays one of the worst agricultural weeds. As a summer species with rapid growth, high photosynthetic rates, and abundant seed production, velvetleaf possess the competitive superiority over crop and other weed species. Knowledge of germination ecology and emergence behavior in the field could facilitate development of effective weed control programs. In the field conditions seed germination is influenced by numerous environmental factors but final emergence depends mostly on soil depth. Emergence from different soil depths has been found to be proportional to seed specific weight. Unlike most weeds, the specific velvetlaf weight is relatively higher allowing it germination even from deeper soil depths. Field experiments were carried out at the Experimental station Maksimir of the University of Zagreb Faculty of Agriculture during vegetation seasons 2014 and 2015. Velvetleaf seeds were collected from September to November 2013 and 2014, handcleaned and stored in paper bags at room temperature until use in the trials. Experiment design was a randomized complete block with four replications. Treatments consisted of an untreated and treated (scarified) seeds and burial at three soil depths: 3, 6 and 9 cm. Results indicated that velvetleaf emergence was greatly influenced by vegetation season (33% in 2014 and 48,3% in 2015). In both years the highest emergence was observed at a shallowest depth (3 cm). At grater depths (6 and 9 cm) emergence was influenced by vegetation years and seed treatments.

Keywords: velvetleaf, weed species, seed scarification, emergence behavior

ESTIMATION OF BIOLOGICAL PARAMETERS FOR GERMINATION OF *Abutilon theophrasti* Medik.

Valentina Šoštarčić[1], Maja Šćepanović[1], Dario Magosso[2], Roberta Masin[2], Klara Barić[1]

[1] University of Zagreb, Faculty of Agriculture, Svetošimunska cesta 25, 10 000 Zagreb, Croatia (vsostarcic@agr.hr; mscepanovic@agr.hr, kbaric@agr.hr)
[2] *University of Padova*, *Department of Agronomy*, *Food*, *Natural Resources*, *Animals and the Environment* (DAFNAE), Viale dell' Università 16, 35020 Legnaro, Italy (roberta.masin@unipd.it)

Abutilon theophrasti is an *alien plant species* and one of the most *important weed species of arable crops* in Croatia. Estimating biological parameters for seed germination can contribute to integrated weed control in summer crops. Since seed germination depends on base temperature **(T_b)** and base water potential **(Ψ_b),** laboratory experiments were conducted to estimate these two parameters. Three replicates of 100 seeds were incubated at the set of constant temperature (4, 8, 12, 16, 20, 24, 28°C) and photoperiod of 12:12 h (light : dark) in petri dishes to estimate base temperature. Furthermore, at 22°C, applying different polyethylene glycol solutions (0.00, -0.05, -0.10, -0.25, -0.38, -0.50, -0.80, -1.00 MPa) the base water potential was estimated. Final germination percentage of *A. theophrasti* was above 50% at temperatures from 8°C to 28°C. The highest germination was observed at 16°C and 24°C with an average of 79% and 77%. Seeds of velvetleaf had highest germination at 0.00 MPa (77%) and -0.05 MPa (72%) while increasing of the concentration of polyethylene glycol solutions was followed by decreased germination from 57% at -0,10 MPa to 0% at -0,80 and -1,00 MPa. According to linear regression line, estimated using bootstrap method, base temperature for *A. theophrasti* is 4.5°C, while base water potential for this species is – 0, 67 MPa.

Keywords: velvetleaf, germination modelling, integrated weed management, base temperature, base water potential

SEVERE DAMAGE TO VEGETABLES BY THE BROWN MARMORATED STINK BUG (*Halyomorpha halys*) IN HUNGARY

Gábor Vétek[1], Dávid Korányi[1,2]

[1] Szent István University, Department of Entomology, Villányi út 29–43, H-1118 Budapest, Hungary, e-mail: Vetek.Gabor@kertk.szie.hu; koranyidave@gmail.com
[2] University of Pannonia, Department of Animal Sciences and Animal Husbandry, Deák Ferenc utca 16, H-8361 Keszthely, Hungary

The brown marmorated stink bug (BMSB), *Halyomorpha halys*, is indigenous to East Asia and has recently become an invasive pest in North America and Europe. Besides being considered a nuisance pest, it is also a significant economic pest causing damage to a wide range of cultivated plants. Following its first record in Budapest in Hungary, 2013, repeated reports confirmed its establishment in the region of the capital. In late summer 2016, growers began to complain about stink bug damage to dry bean and forced green hot pepper, both grown in the vicinity of a site in Budapest where BMSB had a history of at least three years. The aims of our study were to estimate the level of damage in these crops and to reveal if BMSB was the causal organism. For these purposes, fifty dry bean pods ('Etna') were randomly collected from a 0.1 ha large plot on 2 September, and the seeds in each pod were checked for the symptoms in the laboratory. To assess the rate of damaged hybrid green hot pepper ('Daras') fruits, one hundred fruits picked by the grower in a greenhouse were studied on the spot on 8 September. A vacuum device was used to collect stink bug samples from both sites. Damaged seeds were found in 47 dry bean pods (94%), and all the green hot pepper fruits (100%) were affected. BMSB has been identified as the causal organism in both cases.

Keywords: alien pest, BMSB, dry bean, green hot pepper

This paper was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.

SEVERE DAMAGE TO RASPBERRY CAUSED BY *Drosophila suzukii* IN HUNGARY IN 2016

Gábor Vétek[1], Ágnes Kákai[2], Mária Szántóné Veszelka[3], Zsolt Kárpáti[2], Béla Péter Molnár[2], Balázs Kiss[2]

[1] Szent István University, Department of Entomology, Villányi út 29–43, H-1118 Budapest, Hungary, e-mail: Vetek.Gabor@kertk.szie.hu
[2] Hungarian Academy of Sciences, Centre for Agricultural Research, Plant Protection Institute, Department of Zoology, Pf 102, H-1525 Budapest, Hungary, e-mail: kakai.agnes@gmail.com; karpati.zsolt@agrar.mta.hu; molnar.bela.peter@agrar.mta.hu; kiss.balazs@agrar.mta.hu
[3] Government Office of Nógrád County, Plant Protection and Soil Conservation Division, Mártírok útja 78, H-2660 Balassagyarmat, Hungary, e-mail: veszelka.maria@nograd.gov.hu

The spotted wing drosophila (SWD), *Drosophila suzukii*, is native to East Asia and has invaded many countries in Europe recently. Its ability to oviposit and develop in unwounded ripening fruits makes SWD a threat to a wide range of cultivated plants, including soft fruits. Since the first record of the pest in Hungary in 2012, it has become widespread throughout the country. However, only a few data of economic damage have been reported until 2015. As grower complaints about soft fruits infested with larvae have suddenly and dramatically increased since late summer of 2016, fruit samples of raspberry ('Sugana' and 'Polka') ready to pick have been collected randomly in August from a plantation located at Berkenye, Hungary. Fourty-five berries of each cultivar were put in water saturated with salt for ca. 15 minutes and then dissected under a stereo microscope to reveal larvae and eggs present in each single fruit. Five additional fruits per cultivar were stored to let *Drosophila* adults emerge so that the dominance of SWD in the fruits could be confirmed. Our results show that *Drosophila* larvae were present in more than 90% of the fruits of both 'Sugana' and 'Polka', and that both cultivars were severely infested with SWD. Although data obtained from trapping with two different trap types indicated the presence of SWD adults since the second half of July, the level of infestation confirms previous findings that adult trap catch may be a weak predictor of larval infestation.

Keywords: SWD, soft fruits, infestation, trapping

This paper was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences and the National Research, Development and Innovation Fund (NKFI 119844)

SPACE USE AND ACTIVITY PATTERNS OF BARBARY SHEEP IN MOSOR MOUNTAIN

Pavao Gančević[1], Klemen Jerina[2], Toni Safner[3], Nikica Šprem[3]

[1]Postgraduate study, Faculty of Agriculture, University of Zagreb, Svetošimunska cesta 25, 10000 Zagreb, Croatia
[2]Department of Forestry, Biotechnical Faculty, University of Ljubljana, Večna pot 83, 1000 Ljubljana, Slovenia
[3]University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia, nsprem@agr.hr

The Barbary sheep (*Ammotragus lervia*) is a species of caprid (goat-antelope) native to Atlas Mountains of North Africa from Mauritania in the west to the Red Sea in the east. During 2002, five Barbary sheep (three females and two males) of unknown origin have been illegally released in the southern Dinaric region (Mosor Mountain; 1.339 m a.s.l.) of Croatia. In order to better understand the ecology of the Barbary sheep, especially its general activity pattern, habitat selection, and potential for further spatial expansion, we captured and tracked six animals with the use of GPS-GSM collars. Animals cumulatively moved 1.63 km per day and their circadian activity had two pronounced peaks in the morning and in the evening. Peak activity changed in accordance to seasonal dynamics of the photoperiod. Generally, the tracked animals moved mainly along the mountain ridges of Mosor Mt. and several times moved along the entire range (approx. 25 km) in relatively short time (2-4 days). On the other hand, movements perpendicular to the main mountain range were short and usually stopped at the mountain foothills with higher vegetation cover and less extreme terrain. Monthly home-range size ranged from 0.6 to 17.0 km^2. For one animal we were also able to estimate its annual home-range size: 26.0 km^2. Also, camera-trapping was conducted over a 12-month period, using 10 cameras randomly distributed over the study area. Over the study period, a total of 3,519 JPEG images and six species were recorded: Barbary sheep, wild boar, grey wolf, red fox, badger and wild cat. Current data suggest that Barbary sheep in the study area are limited to the Mosor Mt. range and are unlikely to expand their range.

Keywords: *Ammotragus lervia*, ungulate, GPS collars, camera trapping, Dinarides

INVASIVE ALIEN PLANT SPECIES IN NATURAL HABITATS IN THE RIPARIAN FORESTS ALONG MURA RIVER

Aleksander Marinšek, Lado Kutnar

Slovenian Forestry Institute, Večna pot 2, SI-1000 Ljubljana (aleksander.marinsek@gozdis.si, lado.kutnar@gozdis.si)

Riparian forests along Mura River in the northeast Slovenia belong to unique forest ecosystems which are very important for the conservation of endangered animal and plant species, and their habitats. Unfortunately, their structure, species composition and dynamics is increasingly endangered by invasive alien plant species (IAS) which represent one of the most serious threat to such ecosystems. The objectives of our study were to identify invasive alien plant species in the main Natura 2000 forest habitat types (FHT) along Mura River, and estimation of their abundance and cover. We also analysed the fidelity of invasive plant species to FHT. The studied FHTs along Mura River were following: 91E0* (Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*), 91F0 (Riparian mixed forests of *Quercus robur, Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers) and 91L0 (Illyrian oak-hornbeam forests). Two forest areas of about 600 ha in total were studied. In total, 15 IAS were recorded in studied FHTs. Some species, like *Robinia pseudoacacia, Impatiens glandulifera*, *I. parviflora, Fallopia japonica, Erigeron annuus, Ambrosia artemisiifolia, Amorpha fruticosa, Conyza canadensis* and *Juncus tenuis* occur only in one or two FHTs while some species could be found in all studied FHTs (like *Solidago gigantea*/*canadensis*). The increasing presence of IAS in the study areas seriously affect natural development and continuity of floodplain FHTs, therefore some measures and guidelines for managing of these forests were suggested in this study.

Keywords: floodplain forest, forest habitat type, riverine vegetation, invasive plant species, Natura 2000

LAMPENFLORA REMOVAL AND APPLIED CONSERVATION METHODS IN VETERNICA CAVE (NATURE PARK MEDVEDNICA, CROATIA)

Najla Baković[1,2], Roman Ozimec[1,2], Kristina Vugrek Petljak[3], T. Ban Ćurić[3]

[1]ADIPA - Society for Research and Conservation of Croatian Natural Diversity, Orehovečki ogranak 37, 10000 Zagreb, Croatia (najla.bakovic@gmail.com, ozimec.roman@gmail.com)
[2]Croatian Biospeleological Society, Demetrova 1, 10000 Zagreb, Croatia
[3]Public Institution "Nature Park Medvednica", Bliznec 70, 10000 Zagreb, Croatia (info@pp-medvednica.hr)

Lampenflora is type of overgrowth that is forming in the close proximity of electrical lights in show caves. It is composed mainly of phototrophic organisms: cyanobacteria, algae and mosses, but other organisms like protozoa and invertebrates are also present. Lampenflora represents a serious threat for subterranean ecosystems. It is increasing the available organic matter in caves and by that influencing a fragile balance between populations of troglobionts, troglophiles, and trogloxenes. Overgrowths are changing cave microclimate, modifying the speleotheme mineralisation processes, and damage the bedrock inside cave. Monitoring of lampenflora in Veternica Cave (Nature Park Medvednica, Croatia) was performed during the period 2012-2014. The result of monitoring was an expert report based on collected data and current scientific knowledge about the topic. The report included recommendations for lampenflora removal and technical measures about the position and characteristics of new electrical lights that should not promote a lampenflora growth. New electrical lights have been instaled in 2015. At the same time, lampenflora and sediment in close proximity of the lamps were mechanically removed. In order to protect the microbial balance of the cave, no chemicals were used in the process. As an alternative, infected areas were covered with autochthonous clay. Monitoring of lampenflora is still continuing, and our results from 2016 showed that there is no forming of new overgrowths.

Keywords: subterranean habitats, microbial communities, overgrowth, monitoring

INVASIVE ASIAN SEED BEETLE *Megabruchidius tonkineus* (*Coleoptera, Chrysomelidae, Bruchinae*) FIRST RECORD IN CROATIA

Ivan Kurtek, Željko Zahirović, Nataša Turić, Ivana Vrućina, Goran Vignjević, Enrih Merdić, Mirta Sudarić Bogojević

Department of Biology, Josip Juraj Strossmayer University, Cara Hadrijana 8/A, 31000 Osijek, Croatia; ivan.kurtek@gmail.com

The native range of the invasive seed beetle *Megabruchidius tonkineus* (Pic 1904) is situated in the Oriental Asian region. This seed beetle resides in seed pods of *Gleditsia triacanthos* L. (Fabaceae) and is recorded for the first time in the territory of Croatia. Its first appearance in Europe was recorded in a storehouse in Germany during the 1980s. There are further recent reports from Bulgaria, France, Germany, Greece, Hungary, Russia, Serbia, Slovakia and Switzerland. Some of these countries are bordering with Croatia, for that reason it was necessary to check for the presence of this invasive species in our country. Research was carried out from 21.01.2016 to 19.02.2016 in the territory of eastern Croatia. 22 localities were investigated and the presence of this invasive species was confirmed on 18 localities. This species has a big invasive potential because it successfully managed to colonize *G. triacanthos* trees and settle inside its seed pods. There is a lot of concern what would happen if this seed beetle changes the host plant to agronomical important species like pea (*Pisum sativum*) or beans (*Phaseolus vulgaris*), in which case it can pose serious threats to both agro economy and ecology.

Keywords: *Megabruchidius tonkineus*, invasive species, new record, seed pods, Croatia

Aedes japonicus - THE NEW INVASIVE MOSQUITO SPECIES SPREADING IN CROATIA

Ana Klobučar[1], Sunčica Petrinić[1], Vanja Tešić[1], Ivan Lipovac[2], Sanja Mitrović-Hamzić[3], Vanja Slavić-Vrzić[4], Snježana Čopor[4], Biserka Hranilović[5], Nediljko Landeka[6], Tatjana Vilibić-Čavlek[7], Enrih Merdić[8]

[1]Andrija Štampar Teaching Institute of Public Health, Zagreb, Croatia (ana.klobucar@stampar.hr; suncica.petrinic@stampar.hr; vanja.tesic@stampar.hr)
[2]Institute of Public Health Krapina-Zagorje County, Zlatar, Croatia (hes-zlatar@zzjzkzz.hr)
[3]Institute of Public Health Bjelovar-Bilogora County, Bjelovar, Croatia) (sanja.mitrovic-hamzic@zzjz-bjelovar.hr)
[4]Institute of Public Health Zagreb County, Zaprešić, Croatia (vanja.slavic.vrzic@zzjz-zz.hr; ddd@zzjz-zz.hr)
[5]Institute of Public Health Karlovac County, Karlovac (hranilovicb@gmail.com)
[6]Institute of Public Health Istria County, Pula, Croatia (3kazuna@gmail.com)
[7]Croatian Institute of Public Health, Zagreb, Croatia (tatjana.vilibic-cavlek@hzjz.hr)
[8]Department of Biology, Josip Juraj Strossmayer University of Osijek, Croatia (enrih@biologija.unios.hr)

The Asian bush mosquito *Aedes japonicus* (Theobald, 1901) is one of the most invasive mosquito species in the world. In Europe it has been first detected in 2000 in a used tyre trade company in France. After that, findings and expansion have been confirmed in a numerous European countries. Due to its presence in areas bordering Croatia (Slovenia and Austria), in 2013 Andrija Stampar Teaching Institute of Public Health in collaboration with Public Health Institute Krapina – Zagorje County started a survey in Zagorje. The ovitrap method and larval sampling were used in the survey. Ovitraps were placed at points of entry of invasive mosquito species. *Aedes japonicus* was found for the first time at the cemetery in Đurmanec in August and at cross border Croatia – Slovenia in Macelj in September 2013. In 2014 and 2015 invasive mosquito spreading was recorded on the territory of this county and some findings were recorded in neighbouring areas: Zagreb County, Bjelovar-Bilogora County and Zagreb City. In 2016 most of the Public Health Institutes are included in surveillance and new records of *Ae. japonicus.* The species has been confirmed in the north-western Croatian counties: Karlovac, Varaždin, Koprivnica – Križevci and Međimurje. Because of its ability to successfully colonise diverse larval habitats and its tolerance to low temperatures in temperate climates, *Ae. japonicus* is expected to expand further in continental part of Croatia. *Ae. japonicus* is competent vector of West Nile virus, La Crosse and Japaneese encephalities virus, so this is biologically and medically important invasive mosquito species.

Keywords: *Aedes japonicus*, mosquito, survey, Croatia counties

RAPID SPREAD AND FIRST DATA ON DAMAGE LEVELS AND LIFE CYCLE OF *Corythucha arcuata* (Heteroptera, Tingidae) IN CROATIA

Milivoj Franjević[1], Milan Pernek[2], Darko Posarić[3], Dina Banović[1], Boris Hrašovec[1]

[1]University of Zagreb Faculty of Forestry, Svetošimunska 25, 10000 Zagreb, Croatia milivoj.franjevic@sumfak.hr, dinabanovic@yahoo.com, hrasovec@sumfak.hr
[2] Croatian Forest Research Institute Cvjetno naselje 41, 10450 Jastrebarsko, Croatia milanp@sumins.hr
[3]"HRVATSKE ŠUME" d.o.o., UŠP Vinkovci, Trg Bana J. Šokčevića 20 Darko.Posaric@hrsume.hr

Field studies of alien pest species *Corythucha arcuata* (Heteroptera: Tingidae) in Croatia begun in 2013 after first finding of the invasive in Eastern Slavonia. During three year period and spread of *C. arctuata* westwards, an urgent need for damage assessment and defining new treatment solutions forced Croatian forestry operatives and entomologists to intensify research focus on this newly established and growing forest pest of oak stands. Pedunculate oak nurseries are also affected and influence of *C. arctuata* attack on acorn production is being evaluated both in forest and oak seed orchards. Production of acorn in dedicated orchards is considered as an important part of Croatian forestry practice within the concept of sustainable management of even aged oak stands. Spreading od *C. arctuata* in Croatia has shown to be extremely rapid, most probably due to the main traffic corridors and as of today, three years after the first record, this invasive bug is present from easternmost parts of Croatia where its population is reaching huge numbers, all the way to the central part of the country where only scattered foci have been discovered lately. Probable undetected and future locations will appear along the main communication and transport routes. Results of the phenology and general biology of *C. arctuata* in Croatian climatic conditions are given. Potential measures of integrated pest management in nurseries, oak seed orchards and forests are discussed.

Keywords: *Corythucha arcuata,* pedunculate oak, invasive alien species, integrated pest management, oak seed orchards

NEW RECORDS AND DISTRIBUTION OF VASCULAR PLANTS ALIEN TO NORTHERN REGIONS OF TURKEY

Necmi Aksoy[1], Ahmet Uludağ[2, 3]

[1]Düzce University, Faculty of Forestry & DUOF Herbarium Düzce, Turkey. (necmiaksoy@duzce.edu.tr)
[2]Çanakkale Onsekiz Mart University, Department of Plant Protection, Çanakkale, Turkey. (ahuludag@yahoo.com)
[3] Düzce University, Faculty of Agriculture and Nature Sciences, Düzce, Turkey.

New additions to Turkish flora are a common activity due to increasing studies on systematics in botany. Furthermore, new alien species have been recorded either as a new introduction or as a secondary distribution. Northern regions of Turkey, i.e. the Black Sea (also divided three subregions: western, middle, and eastern) and the Marmara Regions, are prone to new alien introductions and distributions, which has been evidenced with earlier literature. Recently, some new plant species were added to Turkish flora as a new record or secondary distribution for north regions of Turkey and deposited at the DUOF (Düzce University, Faculty of Foresty Herbarium). New alien plant species records for Turkey happens through all northern Turkey: *Claytonia perfoliata* in the Marmara Region, *Impatiens glandulifera* in western Black Sea Region and *Rhus chinensis* in eastern Black Sea Region. *Microstegium vimineum* and *Polygonum thunbergii*, which had been recorded in middle Black Sea Region, expanded to eastern part. Several species that had been recorded from the other regions of Turkey have occurred in northern regions: *Opuntia ficus-indica*, *Clerodendrum bungei*, *Yucca filamentosa*, *Broussonetia papyrifera*, *Tagetes minuta* and *Artemisia verlotiorum* in western Black Sea, *Iris foetidissima* and *Cortaderia selloana* in the Marmara, *Citrus trifoliata* in eastern Black Sea. *Vinca minor* and *Oenothera biennis* escaped from cultivation and locally established in the forest area in western Black Sea Region. *Oplismenus undulatifolius* established occurrence at agricultural and forest area in eastern Black Sea Region as well. For Turkey being in the crossroads of old continents geographically and economically seems causing further alien (invasive) species problems. Keep raising awareness and observing all habitats is the key point.

Keywords: New record, established aliens, naturalization, secondary distribution

FIRST RECORD OF THE RACCOON DOG (*Nyctereutes procyonoides*) IN THE CROATIAN PARTS OF DINARIDES

Aljoša Duplić[1], Vedran Slijepčević[1], Nina Popović[1], Paul Jedriško[2]

[1] Karlovac University of Applied Sciences, Trg. J. J. Strossmayera 9, 47000 Karlovac, Croatia (aljosa.duplic@vuka.hr, vedran.slijepcevic@vuka.hr, nina.popovic@vuka.hr)
[2] Razdoljska 3, 51315 Mrkopalj, Croatia (paul.jedrisko@gmail.com)

The native range of the raccoon dog (*Nyctereutes procyonoides*) extends across eastern Siberia, Mongolia, Vietnam, China and Korea. In Europe, the raccoon dog was introduced to the former USSR during the period 1934-1953 for fur, from where it spread to the west. It is recorded in over 25 European countries and it was listed amongst the 100 most invasive species due to predation on birds and amphibians, competition with native species and primarily as vector of zoonoses. In Croatia, specimens were recorded in the beginning of the 1980s in the eastern part of the country. Afterwards, no presence in Croatia was recorded, although species' features include adaptability, hibernation, high reproductive and migratory potential, as well as efficient gene flow between populations. In surrounding countries, racoon dog is present in Hungary and Serbia. In Slovenia, it was recorded in 1980 with some recent individual findings. In Mrzle drage (HTRS96 E369639, N5022343) near Mrkopalj, raccoon dog was recorded by phototrap, which is the first record in the upland part of Croatia and in this part of the Dinarides. Other signs of presence were not recorded, therefore we assume that it was a migrating individual. There are few possible scenarios regarding the origin of this individual: escape from breeding farms, illegal introduction and spread by migration, which would be a confirmation of predictions that raccoon dog will spread southward. For successful control and eradication, coordination of responsible authorities of surrounding countries is necessary. We recommend monitoring of this species presence in Croatia, Slovenia, Bosnia and Herzegovina, but also in NE Italy and urgent actions in case of population establishment.

Keywords: invasive species, raccoon dog, Dinarides, Croatia

POSTERSKA PRIOPĆENJA

POSTER PRESENTATIONS

INVASIVE ALIEN SPECIES IN ENVIRONMENTAL IMPACT ASSESSMENTS: A PRELIMINARY ANALYSIS OF THE ENTANGLED RELATIONSHIP

Marina Škunca, Luka Škunca, Hrvoje Peternel

Geonatura Ltd., Fallerovo šetalište 22, HR-10000 Zagreb, Croatia (mskunca@geonatura.hr, lskunca@geonatura.hr, hpeternel@geonatura.hr)

It is a fact universally acknowledged that various human interventions in the environment contribute to the spread of invasive alien species (IAS) on local and regional scales. One way to mitigate this contribution is to recognize the unintentional spread of IAS as a potential negative impact of planned intervention during the Environmental Impact Assessment (EIA) procedure, and propose preventive, control and/or eradication measures. In our preliminary analysis we therefore focused on three main questions: (1) how often is the spread of IAS recognised as a result of planned intervention and a threat to biodiversity; (2) how often is the removal and/or monitoring of IAS proposed and (3) were proposed measures implemented in the Decision of the Competent Authority. To answer these questions we analysed 116 EIA Studies, available at the official website of the Ministry of Environmental and Nature Protection of Croatia, and the data were analysed using descriptive statistics. Furthermore we examined whether level to which invasive flora and fauna were recognized as a threat depends on EIA's and/or Decision's publication date and intervention type. The results indicate that the level to which IAS are included in aforementioned documents is very variable, while most common problems originate from the lack of available data, unfamiliarity of other sectors (such as water management, energy, construction and transport sector) with the issue of IAS and somewhat unclear legal framework.

Keywords: invasive alien species, human impacts, EIA procedures, mitigation measures

UNUSUAL OCCURENCE OF TROPICAL PLANKTONIC DIATOM SPECIES OF THE GENUS *CHAETOCEROS* IN THE SOUTH ADRIATIC SEA

Marijeta Čalić[1], Stijepo Ljubimir[2], Sunčica Bosak[3]

[1]Institute for Marine and Coastal Research, University of Dubrovnik,Kneza Damjana Jude 12, 20000 Dubrovnik, Croatia (marijeta.calic@unidu.hr)
[2]Institute for Marine and Coastal Research, University of Dubrovnik,Kneza Damjana Jude 12, 20000 Dubrovnik, Croatia (stijepo.ljubimir@unidu.hr)
[3]Faculty of Science, University of Zagreb, Rooseveltov trg 6, 10000 Zagreb, Croatia (suncica.bosak@biol.pmf.hr)

Two fairly uncommon species of planktonic diatoms of the genus *Chaetoceros, C. bacteriastriodes and C. pseudosymmetrycus,* were recorded during the study along the South Adriatic transect Dubrovnik-Bari in 2012 and 2015. Species were recorded by observing water samples under inverted microscope. From a total of 89 examined samples unusual *Chaetoceros* species were recorded in 5 cases in the South Adriatic open waters (to a depth 0-100 m) during winter period. Their abundance did not exceed 10^2 cellsL^{-1}. Both species have been described from tropical waters, showing Indo-Pacific distribution, and very rarely recorded in the Mediterranean Sea. Areal expansion and introduction of new phytoplankton species might be related to changes in sea circulation in the South Adriatic or ballast water transport. Recent investigations have shown that entering currents, of either Atlantic/Western Mediterranean or Eastern Mediterranean origin, modify the composition of the plankton community in the South Adriatic and each type of current brings different newcomers.

Keywords: diatoms, genus *Chaetoceros*, South Adriatic, tropical species

TAXONOMIC COMPOSITION OF EPIPHYTIC DIATOMS FROM AREAS AFFECTED BY INVASIVE MACROALGAE *Caulerpa taxifolia* AND *Caulerpa cylindracea* (ADRIATIC SEA, CROATIA)

Ana Car[1], Andrzej Witkowski[2], Nenad Jasprica[1]

[1]Institute for Marine and Coastal Research, University of Dubrovnik, Damjana Jude 12, Dubrovnik, Croatia (ana.car@unidu.hr; nenad.jasprica@unidu.hr)
[2]Palaeoceanology Unit, Faculty of Geosciences, University of Szczecin, Mickiewicza 18, PL-70-383 Szczecin, Poland (andrzej.witkowski@usz.edu.pl)

The present study focuses on the taxonomy of epiphytic diatoms in areas affected by invasive macroalgae representing the the genus of *Caulerpa* J.V. Lamouroux, 1809 on the eastern Adriatic Sea coast. Material for the study of epiphytic diatoms was collected during two years (autumn 2008 – autumn 2010) from an area influenced by *Caulerpa taxifolia* (Vahl) C. Agardh in the bay of Stari Grad (the Island of Hvar), and from areas influenced by *Caulerpa cylindracea* Sonder in Dubrovnik and on the Island of Mljet (Gonoturska Bay). In order to compare epiphyte assemblages, sampling of coexisting autochthonous brown and green algae was conducted at the same stations. The samples were acid cleaned (HCl/H_2O_2) prior to qualitative analysis of diatoms using light microscope (LM) (Nikon E600 microscope) under magnification of 1000x. Light and electron microscopy examinations provide for the first time the information on the general morphology and ultrastructure of taxa, and enable a determination of the taxonomy of diatoms. The seasonal dynamics were described on a fine time scale. For the first time in the Central and Southern Adriatic Sea the composition of benthic diatoms and seasonal dynamics of taxa in areas affected by invasive macroalge *Caulerpa taxifolia* and *Caulerpa cylindracea* were determined. The results of this study enable a better understanding of the functioning of ecosystems dominated by macroalgae *Caulerpa* spp. Knowledge of the diatom community structure in the areas impacted by *Caulerpa* spp. is important for studies of the toxic effects of the host.

Keywords: marine epiphytic diatoms, ‘killer seaweed’, *Cocconeis caulerpacola*, biofouling

FIRST RECORD OF *Fritillaria helenae* IN THE MEDITERRANEAN SEA

Rade Garić, Mirna Batistić

Institute for marine and coastal research, University of Dubrovnik, Kneza Damjana Jude 12, 20000 Dubrovnik, Croatia, e:mail: rade.garic@unidu.hr, e:mail: mirna.batistic@unidu.hr

In the last two decades multiple new gelatinous planktonic species were recorded in the Adriatic. Their arrival has been positively correlated with increasing sea temperature as well as with different circulation patterns in the Ionian Sea. The direction of the Ionian Sea Gyre causes advection of different water masses in the Adriatic. During its cyclonic phase it brings mainly warm and saline Eastern Mediterranean water, while during anticyclonic phase it brings more of Atlantic and Western Mediterranean waters. Here we present first record of *Fritillaria helenae* (Tunicata, Appendicularia) for the Mediterranaen Sea (Garić and Batistić, 2016). *Fritillaria helenae* was so far only known from the Atlantic. It was found in the South Adriatic in autumn 2014 when a marked drop in salinity was recorded, which suggests increased inflow of Atlantic/Western Mediterranean waters into the Adriatic.

Keywords: tunicata, zooplankton, first record, Adriatic Sea

TWO ALIEN BENTHIC INVERTEBRATES IN THE CENTRAL ADRIATIC SEA - ARE THEY INVASIVE?

Tatjana Bakran-Petricioli[1], Ante Žuljević[2], Donat Petricioli[3], Silvija Kipson[4]

[1] Faculty of Science, University of Zagreb, Department of Biology, Rooseveltov trg 6, 10000 Zagreb, Croatia (tbakran@biol.pmf.hr)
[2] Institute of Oceanography and Fisheries, Šetalište I. Meštrovića 63, 21000 Split, Croatia (zuljevic@izor.hr)
[3] D.I.I.V. Ltd., for Marine, Freshwater and Subterranean Ecology, Obala Petra Lorinija 52, 23281 Sali, Croatia (diiv@zg.t-com.hr)
[4] Faculty of Science, University of Zagreb, Department of Biology, Rooseveltov trg 6, 10000 Zagreb, Croatia (skipson@biol.pmf.hr)

Two potentially invasive benthic marine invertebrates, spotted sea hare *Aplysia dactylomela* and sally lightfoot crab *Percnon gibbesi*, were previously recorded in the Adriatic Sea. However, data on their distribution, biology and ecology are still deficient. Here we report new sightings of these species in the Central Adriatic. Moreover, we noted mass appearance (approx. 7 individuals per 100 m of island length from sea surface to 2 m depth) and spawning of *A. dactylomela* on the remote Brusnik Island in July and August 2012 but not in the years afterwards, either on this location or on the other investigated sites. To our knowledge, such mass spawning of this species was not yet noted for the Adriatic. Furthermore, numerous specimens of both juvenile and adult decapod crustacean *P. gibbesi* were recorded in 2015 and 2016 in narrow cracks and under the stones on many locations along the coast of the Island of Vis and smaller islands of Sušac and Sveti Andrija. In the Adriatic, these species are undoubtedly rapidly spreading northwards but their impact on the autochthonous species occupying the same ecological niche - shallow benthic algal grazers - is not yet known, as well as their impact on the composition and diversity of algal communities at given locations.

Keywords: Mediterranean invasive species, *Aplysia dactylomela*, mass spawning, *Percnon gibbesi*, rapid spreading

DISTRIBUTION OF THE INVASIVE ALIEN BIVALVE *Corbicula fluminea* (Müller, 1774) IN CROATIA

Jasna Lajtner[1], Petar Crnčan[2], Renata Ćuk[3], Svjetlana Dekić[1], Sanja Gottstein[1], Sandra Hudina[1], Simona Kovačević[4], Andreja Lucić[1], Momir Paunović[5], Vladica Simić[4], Jelena Tomović[5], Krešimir Žganec[6]

[1] Department of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, Zagreb, Croatia (e-mail: jasna.lajtner@biol.pmf.hr; svjetlana.dekic@gmail.com; sanja.gottstein@biol.pmf.hr; sandra.hudina@biol.pmf.hr ; andreja.lucic@biol,pmf.hr)
[2]Croatian Natural History Museum, Demetrova 1, Zagreb, Croatia (e-mail: petar.crncan@g-mail.com)
[3]Hrvatske vode, Central Water Management Laboratory, Ulica grada Vukovara 220, Zagreb, Croatia (e-mail: renata.cuk@voda.hr)
[4]University of Kragujevac, Faculty of Science, Institute for Biology and Ecology, Radoja Domanovića 12, Kragujevac, Serbia (simonakovacevic@gmail.com; simic@kg.ac.rs
[5]University of Belgrade, Institute for Biological Research "Siniša Stanković", 142 Despota Stefana Boulevard, Belgrade, Serbia (mpaunovic@sbb.rs; jelenatomovic@ibiss.bg.ac.rs)
[6]Department of Teacher Education in Gospić, University of Zadar, dr. Ante Starčevića 12 Gospić, Croatia (e-mail: kzganec@inet.hr)

The Asian clam, *Corbicula fluminea* (Müller, 1774) is a native species of fresh and brackish water in Southeast Asia. The species was introduced in North America in the early 20th century and from there it was brought to Europe, first in Portugal and France, by ballast water in the 1980s. The successful invasion of this species can be explained by specific life history strategy: good dispersion abilities, high fecundity and growth rates, high ecological tolerance, short life-span, and some particular reproductive features, as well as by human assistance. The species competes with native bivalves, reducing their abundance and population density, and may be responsible for the extinction of some species. The first record of *C. fluminea* in Croatia dated from 2001 when the species was recorded in the Danube River. In the meantime, *C. fluminea* was found in the downstream part of the Sava and Drava Rivers. Our research confirmed upstream spreading of the species in both rivers and their tributaries (e.g. rivers Kupa and Una). Density was the highest in coarse sand and sand with gravel (e.g. 4400 ind./m^2 in the Sava River at site Krapje, which accounted for 96 % of the total number of bivalves). We assume that *C. fluminea* in the inland waters of Croatia spreads by natural mechanisms (passive upstream and downstream movement), which are probably facilitated by some human activities, such as boating, fishing, fish stocking and aquaculture, recreational activities, and sand and gravel extraction.

Key words: Asian clam, Corbiculidae, Bivalvia, invasion success

DEVELOPMENT OF A NONINVASIVE METHOD FOR DETECTION OF *Aphanomyces astaci*, THE CAUSATIVE AGENT OF CRAYFISH PLAGUE

Lea Ljubej[1], Ivana Maguire[1], Sandra Hudina[1], Emina Horvat Velić[1], Ana Bielen[2]

[1]Rooseveltov trg 6, 10000 Zagreb, Croatia (University of Zagreb, Faculty of Science, Department of Biology) (lealjubej93@gmail.com, imaguire@biol.pmf.hr, sandra.hudina@biol.pmf.hr, ehvelic@stud.biol.pmf.hr)
[2]Pierottijeva 6, 10000 Zagreb, Croatia (University of Zagreb, Faculty of Food Technology and Biotechnology, Department of Biochemical Engineering) (abielen@pbf.hr)

The crayfish plague pathogen *Aphanomyces astaci* (Oomycetes) is native to North America, but has expanded through Europe via invasive North American crayfish. Alien crayfish, such as *Orconectes limosus*, *Pacifastacus leniusculus* and *Procambarus fallax f. virginalis*, co-evolved with the pathogen and are generally resistant to the disease, acting as *A. astaci* carriers. On the contrary, native crayfish species are highly susceptible and infestation with *A. astaci* causes their death. Crayfish plague has caused major declines of native European freshwater crayfish, and *A. astaci* is therefore listed among the world's 100 worst invasive alien species according to the Invasive Species Specialist Group. Monitoring of *A. astaci* in Europe is of the upmost importance for the conservation of native crayfish populations. However, current methods for detection of *A. astaci* on crayfish are invasive. Namely, animals are sacrificed, DNA is extracted from pieces of cuticle and *A. astaci* presence is confirmed by PCR based methods. To avoid sacrificing endangered native crayfish, the main goal of this research was to develop a noninvasive method of *A. astaci* detection. We have firstly optimized the procedure of DNA isolation from crayfish mixed epibiotic microbial communities, including *A. astaci*. Then, we have improved the sensitivity of the PCR-based *A. astaci* detection and tested the protocol on individuals, which were infected under controlled laboratory conditions. In perspective, this protocol will allow to detect native individuals in the early phases of the infection, remove them from the natural habitat, and develop methods for their treatment.

Keywords: invasive crayfish, oomycetes, noninvasive disease monitoring, management

MONITORING AND CONTROL OF THE INVASIVE SIGNAL CRAYFISH (*Pacifastacus leniusculus*) IN THE KORANA RIVER

Ivana Šarić[1], Sven Kapelj[1], Ivan Katanović[1], Sandra Hudina[2]

[1]Association BIOM, Preradovićeva 34, Zagreb, Croatia (ivana.saric@biom.hr)
[2] Department of Zoology, Faculty of science, University of Zagreb, Rooseveltov trg 6, Zagreb, Croatia (sandra.hudina@biol.pmf.hr)

The signal crayfish, *Pacifastacus leniusculus* (Dana, 1852), is one of the most widespread invasive crayfish species in Europe. It has recently invaded a karstic river in central Croatia, the Korana River, and is expanding its range at both the upstream and downstream direction. The spring of this river is within Plitvice lakes National Park, which is known for its unique natural and geomorphological phenomena, and which hosts populations of two native and protected crayfish species. The aim of this study was to monitor upstream expansion of the signal crayfish and to test mechanical control strategies at this upstream section. Research was performed in autumn 2016, with 4 day trapping sessions performed for three consecutive months. Within one year, the invasion front has moved upstream and is now localized within 90 km of the upper reach of the Korana River. For control purposes, we identified a signal crayfish population of high-density, which was the closest to the upstream invasion front. Here we report the results of the control campaign performed at two selected sites (upstream invasion front and the closest high-density population), discuss the efficiency and cost-effectiveness of the chosen approach, and thus suggest potential guidelines for activities aimed at conservation of the invaded karstic Korana river and its native crayfish fauna.

Keywords: freshwater invasion, range expansion, invasion front, management

FRESHWATER ALIEN FISH SPECIES INTRODUCED INTO CROATIA FOR AQUACULTURE AND CONSEQUENCES OF THEIR ESCAPES AND RELEASES IN INLAND WATERS

Marina Piria[1], Divna Lukić[1], Tatjana Boroša-Pecigoš[2]

[1]University of Zagreb, Faculty of Agriculture, Department of Fisheries, Beekeeping, Game management and Spec. zoology, Svetošimunska 25, 10 000 Zagreb, e-mail: mpiria@agr.hr
[2]Ministry of Agriculture, Directorate of Fisheries, Planinska 2a, 10 000 Zagreb, Croatia

Freshwater fishes are the major group introduced for aquaculture in Europe, including Croatia. It is known that the great bulk of global fish introductions and translocations have been carried out for aquaculture purposes. Introduction of alien (exotic) fish species is considered to be one of the biggest threats to finfish biodiversity. There is currently no adequate control of the escapees from fish farms in Croatia. Also, the list of alien fish species kept at fish farms in Croatian data repository should be updated. Furthermore, systematic research on impact of escapees in inland waters of Croatia are missing, even some consequences are already well-known (*e.g.* disappearance of *Telestes metohiensis* from the Ljuta River caused by the introduction of rainbow trout *Oncorhynchus mykiss*). In this context, the aims of this research were to compile a list of alien fish species introduced into Croatia for aquaculture, to review their presence and distribution in inland waters, and to examine consequences of their escapes and releases in inland waters. In Croatia, 13 freshwater fish species were introduced intentionally, 11 of which are now naturalised in inland waters. Nine species are distributed in the Adriatic and Danube basins, while two are restricted only to the Danube basin. Two recently introduced species, one of them being North African catfish (*Clarias gariepinus*), can apparently not adopt outside the aquaculture facilities without human assistance. Recommendations on the issues mentioned are given in this study.

Keywords: invasive alien fish species, aquaculture, open waters, escapees

THE INTRODUCTION OF SALMONIDS IN SOME ALPINE LAKES OF PIEDMONT (ITALY): A SERIOUS THREAT TO AQUATIC BIODIVERSITY

Paolo Pastorino[1,2], Elisabetta Pizzul[2], Erika Astrid Virginie Burioli[1], Marzia Righetti[1], Antonia Concetta Elia [3], Gilberto Forneris[4], Roberto Sindaco[5], Marino Prearo[1]

[1]Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Torino (Italia), paolo.pastorino@izsto.it
[2]Dipartimento di Scienze della Vita, Università degli Studi di Trieste, Trieste (Italia), pizzul@units.it
[3]Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Perugia (Italia), antonia.elia@unipg.it
[4]Dipartimento di Scienze Veterinarie, Università degli Studi di Torino, Torino (Italia), gilberto.forneris@unito.it
[5]Istituto per le Piante da Legno e l'Ambiente I.P.L.A. S.p.A., Torino (Italia), sindaco@ipla.org

Biodiversity is in the midst of another period of mass extinction, probably comparable to those of the palaeontological past. However, the fundamental difference with regard to the current crisis is that it has not been brought about by stochastic or catastrophic events, but is instead directly attributable to anthropogenic effects and by introduction of alien species. With more than 40% of the world's amphibian species in decline and an estimated extinction rate over 200 times that of their natural background rate, amphibians are possibly of greater conservation concern than any other vertebrate group. The major threats affecting common frog (*Rana temporaria*) in Alpine lakes are emerging infectious diseases (possibly related to global warming), general pollution, drainage of breeding sites and especially the introduction of alien predator fishes (*Salmo trutta*, *Salvelinus fontinalis,* etc.). The decrease or extinction of the potential prey, such as amphibians, zooplankton and macrobenthos, can produce cascading effects across the entire ecosystem. The objective of this work is to assess the pressure of non-native fish on amphibian species in some Alpine lakes of Piedmont (Italy): Balma Lakes (Alpi Cozie), Palanfrè Lakes (Alpi Marittime) and Streghe Lake (Aree Protette dell'Ossola), in order to raise awareness of the public and authorities about the need of biodiversity conservation in remote areas and convince them that the decline of amphibians can be reversed by removing fish populations.

Keywords: *Rana temporaria*, *Salvelinus fontinalis*, alpine lakes, biodiversity conservation

MONITORING OF SAN JOSE SCALE (*Quadraspidiotus perniciosus*) OCCURRENCE IN REPUBLIC OF MACEDONIA

Mimi Kratovalieva-Stanikevska[1], Stoe Smiljkov[2], Suzana Kratovalieva[3]

[1]Ministry of Agriculture Forestry and Water Economy, State Phytosanitary Laboratory, Skopje, Republic of Macedonia (mkratovalieva@yahoo.com)
[2]University "Sts Cyril and Methodius", Faculty of Natural Sciences and Mathematics, Institute of Biology, Skopje, Republic of Macedonia (stoe@pmf.ukim.mk)
[3]Ministry of Agriculture Forestry and Water Economy, State Phytosanitary Laboratory, Skopje, Republic of Macedonia (suzanakratovalieva@gmail.com)

San Jose scale, *Quadraspidiotus perniciosus* (Comstock), is subject of regular inspection in the State Phytosanitary Laboratory of the Republic of Macedonia. San Jose scale poses a potential danger because it causes damage and crop losses to many fruit crops. Females and male larvae mainly settle on stems and branches of their host plants attaching also fruit and leaves. When occurring on fruit, *Quadraspidiotus perniciosus* cause round, red spots at the points of inserting their stylets and it remains small and with the bad taste. Generally polyphagous on various fruit trees and other plants. *Quadraspidiotus perniciosus* is reported to occur on about 700 host. *Quadraspidiotus perniciosus* is cosmopolitan. From its wide geographical and climatic distribution it could be concluded that weather had no influence on its populations. Control of the presence of *Quadraspidiotus perniciosus* in Republic of Macedonia in 2016 is made on 32 fruits (7 peaches, 4 plums, 4 sour cherries, 3 pears, 10 apples, 4 cherries) with method of microscopic identification.

Keywords: fruit, presence, distribution, inspection

OCCURRENCE OF THE INVASIVE ZIGZAG ELM SAWFLY (*Aproceros leucopoda*) IN ARBORETUMS AND BOTANICAL GARDENS OF HUNGARY

Gábor Vétek[1], Dénes Bartha[2], Richárd Oláh[1]

[1] Szent István University, Department of Entomology, Villányi út 29–43, H-1118 Budapest, Hungary, e-mail: Vetek.Gabor@kertk.szie.hu; olah988@hotmail.com
[2] University of West Hungary, Institute of Botany and Nature Conservation, Bajcsy-Zsilinszky u. 4, H-9400 Sopron, Hungary, e-mail: bartha.denes@nyme.hu

The invasive zigzag elm sawfly, *Aproceros leucopoda* (Hymenoptera: Argidae), native to East Asia, was identified as a new pest of elms (*Ulmus* spp.) in Europe in 2003. Following first records in Poland and Hungary, it has been found in many other European countries. Plant taxa on which damage by larval feeding has been observed under natural conditions all belong to the genus *Ulmus*. In the cases of *Ulmus pumila* (including var. *arborea*), *U. minor*, *U. glabra* and *U. davidiana*, significant damage has been recorded in different parts of Europe and/or Asia. Some Resista® hybrid elms have also been reported as severely infested with the pest. One objective of our study was to reveal the occurrence of the sawfly species in Hungary. Moreover, we searched for *Ulmus* taxa which might be affected under natural conditions, and therefore their suitability for egg laying and sensitivity to at least partial damage by *A. leucopoda* should be considered before planting them for any purposes. To collect data on distribution and hosts, *Ulmus* taxa were carefully checked for the presence of any developmental stages of *A. leucopoda* and the characteristic feeding traces on leaves in 17 arboretums and botanical gardens throughout Hungary in 2011 and 2016. As a result, *A. leucopoda* or only the evident symptoms of damage by it have been recorded at all the locations visited and totally on 19 *Ulmus* taxa, 14 of which have been identified as new hosts.

Keywords: alien pest, Argidae, distribution, *Ulmus*, new hosts

This paper was supported by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.

NATIVE PARASITOID ASSEMBLAGES OF AN INVASIVE PEST, *Dryocosmus kuriphilus* (HYMENOPTERA: CYNIPIDAE), IN SLOVENIA, CROATIA AND HUNGARY

George Melika[1], Dinka Matošević[2], Eva Kriston[1], Nikola Lacković[2], Katarina Kos[3], Gabrijel Seljak[4], Mojca Rot[4], Laszlo Krizbai[1], Miklos Bozsó[1]

[1]Plant Health and Molecular Biology Laboratory Directorate of Plant Protection, Soil Conservation and Agri-environment National Food Chain Safety Office, Budaörsi u. 141-145, 1118 Budapest, Hungary (melikageorge@gmail.com; kristone@nebih.gov.hu; krizbail@nebih.gov.hu; mikitv.bozs@gmail.com)
[2] Department for forest protection, Croatian Forest Research Institute Cvjetno naselje 42, Jastrebarsko, Croatia(dinkam@sumins.hr; nikolal@sumins.hr)
[3] Department of Agronomy, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia (katarina.kos@bf.uni-lj.si)
[4] Kmetijsko gozdarski zavod Nova Gorica, Pri Hrastu 18, 5000 Nova Gorica, Slovenia (mojca.rot@go.kgzs.si)

The Asian sweet chestnut gallwasp, *Dryocosmus kuriphilus* (Hymenoptera, Cynipidae) is considered to be the most important pest of chestnut worldwide. Originating from China, this pest was accidentally introduced to Japan in 1941, colonized Korea in 1958 and the USA in 1974. In 2002 it was detected in Europe, Italy. Since then *D. kuriphilus* spread throughout Italy and has also been reported in all European countries where chestnut grows. Within the native range in China, 11 parasitoids species were found to associate with *D. kuriphilus* which kept the host populations at low densities; in Japan, South Korea, the USA and European countries the attack rates of indigenous parasitoid species vary from 2% to 4.7%, We studied the native parasitoid assemblages of *D. kuriphilus* across it expanding range in Italy (since 2005), Slovenia (since 2010), Croatia (since 2011) and Hungary (since 2013). All parasitoid species are known to associate with oak cynipid galls. Most of them are generalists that can shift hosts more easily and are more successful in colonizing an invasive host and thus a large parasitoid diversity within the *D. kuriphilus* community can be expected. The aim was to study the source community of parasitoids available to attack the invasive host and the way in which they may associate with *D. kuriphilus*. Since 2005, 44 species shifted onto the new pest, *D. kuriphilus*. In Italy, 39 chalcidoid parasitoid species have so far recruited naturally to the new host, 28 in Slovenia, 20 in Croatia and 17 in Hungary. The time lag between the introduction of the new host, *D. kuriphilus*, and the recruitment of native parasitoid community is short and depends on the longevity of pest's presence on a particular site. Recruitment of parasitoids to *D. kuriphilus* depends on actual parasitoid species composition of oak gallwasps to be found in the same locality and varies from year to year.

Keywords: sweet chestnut, parasitoid recruitment, host shift

BOX TREE MOTH (*Cydalima perspectalis*) BIOLOGY AND INFLUENCE OF DIFFERENT FOOD TYPE ON DEVELOPMENTAL CHARACTERISTICS

Ivan Lukić[1], Dinka Matošević[1], Nikola Lacković[1], Sanja Mrmić[2], Milan Pernek[1]

[1](Croatian Forest Research Institute, Divison for Forest Protection and Game Management, Cvjetno naselje 41, 10450 Jastrebarsko, Croatia) (ivanl@sumins.hr; dinkam@sumins.hr; nikolal@sumins.hr; milanp@sumins.hr)
[2](Croatian Forest Research Institute, Division for Genetics, Forest Tree Breeding and Seed Husbandry, Cvjetno naselje 41, 10450 Jastrebarsko, Croatia) (sanjam@sumins.hr)

Box tree moth (*Cydalima perspectalis*) is an alien invasive species that has been recorded in Croatia for the first time in 2013 and since then it has rapidly spread across the whole country. Substantial damage to box tree plants have been recorded in many urban areas, especially in private gardens and other green areas located in the cities. Biology and influence of different food type on developmental characteristics will be presented here. Pheromone baited traps were used for the insight into the number of generations, while food choice experiment was conducted in the laboratory where we have compared three ornamental plant species (*Euonymus japonicus*, *Ilex aquifolium* and *Ligustrum vulgare*) with *Buxus sempervirens*. The food choice experiment showed that the box tree moth is able to complete its development only on *B. sempervirens*, while number of generations is still not confirmed since we had problems with pheromons that we have used in the experiment. Since outbreaks of this alien invasive species continue to appear in Croatia we have also made some preliminary insight into complex of parasitoids which revealed that native parasitoids have not yet switched to box tree moth. This research confirmed that the main pathway of alien invasive species introduction are live plants trade and that this commercial activity is a serious threath to indigenous plants and ecosystems.

Keywords: invasive species, *Buxus sempervirens*, food choice test, pheromone traps, ornamental plant species

MORPHOLOGY AND DISTRIBUTION OF INVASIVE *Acizzia jamatonica* (KUWAYAMA, 1908) IN CROATIA

Maja Pintar[1], Mladen Šimala[1], Tatjana Masten Milek[2], Vjekoslav Markotić[2]

[1]Croatian Centre for Agriculture, Food and Rural Affairs, Institute for Plant Protection, Gorice 68b, 10000 Zagreb, Croatia (maja.pintar@hcphs.hr, mladen.simala@hcphs.hr)
[2]Croatian Centre for Agriculture, Food and Rural Affairs, Svetošimunska 25, 10000 Zagreb, Croatia (tatjana.masten.milek@hcphs.hr, vjekoslav.markotic@hcphs.hr)

Acizzia jamatonica (Hemiptera: Psylloidea) is an invasive psyllid species (Psyllidae) of Eastern Asian origin. It is a monophagous species that feeds on and damages allochthonous species *Albizia julibrissin* (Durazz.), a very common ornamental plant of the Adriatic coast and islands. *Acizzia jamatonica* was recorded for the first time in Croatia in 2003 in Istria. To establish its distribution a survey was carried out in 2015 and 2016. It included visual inspections of host plants and collection of adults with entomological net. Identification of the species, based on morphological characteristics of adults, was performed under stereomicroscope. The species has at least 4 overlapping generations per year. Adults usually overwinter on coniferous plant species, but individuals can sometimes be found on *Albizia julibrissin* trees during the winter. Adults are 1,8-2,3 mm long and vary in colour, depending on the generation. Overwintering adults are orange-brown, whereas summer adults are green. Females lay yellow-orange, oval, 0,3 mm long eggs. Eggs are laid singularly or in groups, along the leaflet margins and central veins. Nymphs are dorso-ventrally flattened and go through 5 developmental stages. Young nymphs are orange, whereas older nymphs are green with visible wing pads. The species is present along the entire Croatian Adriatic coast, as well as on some very remote islands and finding an Albizia tree not infested with *Acizzia jamatonica* is virtually impossible. A distribution map was made based on the collected data. Damage on the trees is caused by feeding of adults and nymphs on plant tissues and excretion of wax and honeydew that is subsequently infested by sooty moulds. Severe infestation causes yellowing of the leaves, absence of flowering and defoliation.

Key words: psyllid, invasive species, *Albizia julibrissin*, damage

POPULATION DYNAMICS OF SPOTTED WING DROSOPHILA (*Drosophila suzukii*) IN SLOVENIA IN THE PERIOD OF 2011-2016

Mojca Rot[1], Ivan Žežlina[1], Gabrijel Seljak[2]

[1] Agricultural and forestry institut of Nova Gorica, Pri hrastu 18, SI-5000 Nova Gorica, Slovenia (mojca.rot@go.kgzs.si; ivan.zezlina@go.kgzs.si)
[2]Kromberška cesta 8, SI-5000 Nova Gorica, Slovenia

The spotted wing drosophila (SWD) - *Drosophila suzukii* (Matsumura 1931) [Diptera: Drosophilidae] is higly invasive alien insects recently introduced to Europe. It has biological and ecological key characteristics of an invasive species: high reproductive rate, a wide host range, high dispersal potential and high adaptability to various environmental conditions. After the first record of the pest in Slovenia in autumn 2010, systematic monitoring has been carried out in the most endangered regions. A rapid spread of the pest was observed. In few years it has invaded the whole territory of Slovenia, from the sea level up to 1500 m in the mountains. It attacks a huge number of cultivated and wild plants of the genus; *Prunus*, *Fragaria*, *Rubus*, *Vitis*, *Vaccinium*, *Rhamnus*, *Sambucus*. The population size and density is highly variable and depends on the weather conditions during the summer months and the availability of suitable host plants. High temperatures and lack of rain in the summer 2012 resulted in a low population of *D. suzukii.* In contrast, in the wet growing seasons 2014 and 2016 the populations were extremely numerous from early summer onwards, and caused considerable yield losses of sweet cherries, peaches, blueberries and raspberries, exceeding 50% in some cases. Distribution data and population dynamics of SWD in Slovenia the period 2011 - 2016 are discussed in the paper.

Keywords: *Drosophila suzukii*, population dynamics, invasive species, host plants, Slovenia

THE SPREAD OF *Drosophila suzukii* (MATSUMURA, 1931) IN NORTHWESTERN CROATIA

Ivana Pajač Živković[1], Božena Barić[1], Milorad Šubić[2], Aleksandar Mešić[1]

[1]Faculty of Agriculture, University of Zagreb, Svetošimunska 25, 10000 Zagreb, Croatia (ipajac@agr.hr)
[2]Croatian Agricultural Advisory Service, Zrinsko-frankopana 9/III, 40000 Čakovec, Croatia (milorad.subic@savjetodavna.hr)

The spotted wing drosophila (*Drosophila suzukii*), native to Asia, is an economically important pest of thin and soft fruit skin crops. It was introduced to Europe in 2008 and is rapidly spreading across the continent. The pest is extremely fertile, has a wide range of host plants and high dispersal potential therefore it represents a serious threat to European fruit production. In Croatia the pest was first reported in 2010 in the eastern part of country (Istria County) on raspberry (*Rubus idaeus*), peach (*Prunus persica*) and grapevine (*Vitis vinifera*) and since then has spread across the coastal region and on northern counties (Međimurje and Koprivnica-Križevci County). The major detected host plants in Croatia are cherries (*Prunus cerasus* and *Prunus avium*), peach, apricot, nectarine, plum, berries (*Rubus* spp. and *Fragaria* spp.), fig and grapevine. In 2016 the presence of pest was confirmed in Zagreb County for the first time on strawberry where economic damages in production were observed, so the spread of *D. suzukii* in Croatia continues. In addition to the mentioned hosts, apple (*Malus domestica*) was detected as a newly discovered host plant in Međimurje County.

Keywords: Diptera, invasive species, new records, apple

THE INVASION OF THE EUROPEAN RABBIT (*Oryctolagus cuniculus* L., 1758) ON THE LOKRUM ISLAND – AN EXAMPLE OF POOR MANAGEMENT OF THE PROTECTED AREA

Nenad Jasprica, Katija Dolina

Institute for Marine and Coastal Research, University of Dubrovnik, Kneza Damjana Jude 12, HR-20000 Dubrovnik, Croatia (e-mail: nenad.jasprica@unidu.hr, katija.dolina@unidu.hr)

The European rabbit (*Oryctolagus cuniculus* L., 1758) is a key mammal prey species in the food webs in the Mediterranean ecosystems. According to the literature, the European rabbit prefers types of vegetation cover that offer, first of all, shelter, mainly in the form of shrub cover, and secondly, vegetation cover that always displays high fragmentation or high availability of resources. Until 2014, there were no rabbits on the island of Lokrum (72 ha), which is protected as a Special Reserve of Forest Vegetation since 1976**.** Although in protected, covered habitats, food for rabbits is scarce, limiting their population density, the population of the rabbits rapidly increased and they are considered a pest on the island. According to the Croatian legislative system, introducing rabbits on islands and/or protected areas is not allowed. Direct damage is clearly visible in the excavation, milling and damage to the root systems of many plant species in the Lokrum Botanical garden (2 ha), particularly in the fields with succulents. Visible holes in the ground give visitors a terrible first impression. All these undermine the level of expertise and management practices in the Special Reserve, including the Botanical garden**.** We emphasize the responsibilities of the management authority of a Special Reserve, local and state institutions for removing rabbits from the island in an appropriate way. However, rabbit control is time-consuming and there is no quick fix solution.

Keywords: abundance, activity, habitat structure, Mediterranean ecosystem, botanical garden, south Croatia

IS THERE RELATIONSHIP BETWEEN ANTHROPOGENIC INFLUENCE AND PRESENCE OF ALIEN PLANT TAXA ON THE ISLAND OF LOKRUM?

Katija Dolina, Nenad Jasprica

University of Dubrovnik, Institute for Marine and Coastal Research, Kneza Damjana Jude 12, 20000 Dubrovnik, Croatia (e-mail: katija.dolina@unidu.hr; nenad.jasprica@unidu.hr)

The island of Lokrum (72 ha) is located only approx. 700 meters from Dubrovnik Old Town in south Croatia. It stretches from northwest to southeast and has regular ferry service from Dubrovnik Old Town port for six months (from April to November) a year. The island is not inhabited but it is very popular tourist destination during summer. Lokrum is a Special Reserve of Forest Vegetation since 1976. Additionally, the island is included in the zone of protection of endangered monuments by UNESCO with the Dubrovnik Old Town since 1979. Until now, 460 vascular plant taxa were noted on the island. On the other hand, 200,000 visitors have visited the island in 2015, and this number continuously increases each year. Influence of tourist activities on the diversity of vascular plant taxa, particularly in the last decade, is shown by increased presence of the alien taxa (e.g. *Datura inoxia*, *D. stramonium*, *Nicotiana glauca*, *Carpobrotus acinaciformis*, *Phytolacca americana*, etc.). Monitoring the abundance and spatial structure of alien plant populations is important for designing and measuring the efficiency of long-term management strategies.

Keywords: aliens, human impacts, Mediterranean, eastern Adriatic, south Croatia

Dittrichia graveolens – HOW DOES SOIL SALINITY DETERMINE DISTRIBUTION, MORPHOLOGY, AND REPRODUCTIVE POTENTIAL?

Nina Sajna, Kristijan Adamlje, Mitja Kaligarič

Faculty of Natural Sciences and Mathematics University of Maribor, Koroška 160, Maribor, Slovenia (nina.sajna@um.si)

Highways are often recognized as a source for plant invasions, enabling large distance dispersal along road corridors. Road verges can therefore act as opportunity habitats for alien plants, while recently a number of road verges have been identified as a sanctuary for some rare native plants (e.g. dry grassland species). Such dual role of road verges is possible because these are stressful habitats, often dry, sunny, nutrient-poor, and regularly mown. However, additional human activities can establish new, artificial habitats, not existent before. Like road salting in winter, improving the safety of road travel, has a strong impact on species inhabiting road verges since it creates habitats with increased salinity. Higher levels of soil salinity represent a habitat, which can be occupied by plants exhibiting special adaptations and tolerance. As a result, *Dittrichia graveolens*, which is indigenous in the Mediterranean area, is moving inland and can be found in several Central European countries. We studied how soil salinity determines the *D. graveolens* distribution, morphologic characteristics and reproductive potential. Morphology was related to soil electrical conductivity (EC) – a measure for salinity. Our results show that the species grows best in soils where the EC ranges from 110 to 170 µS/cm, while at values less than 100 µS/cm no plants were observed. We were able to identify three classes according to plant size, which differ in the reproductive potential.

Keywords: invasive species, road verges, road salting, Slovenia

INVASIVE BEACH VITEX (VITEX ROTUNDIFOLIA) ON COASTAL DUNES OF KOLKHETI LOWLAND (GEORGIA)

Dmytro Iakushenko[1], Alla Tokaryuk[2], Izolda Matchutadze[3]

[1]University of Zielona Góra, Faculty of Biological Sciences, Z. Szafrana 1, Zielona Góra, Poland (d.iakushenko@wnb.uz.zgora.pl)
[2] Yuriy Fedkovych Chernivtsi National University, Department of Botany, Chernivtsi, Ukraine
[3] Batumi Shota Rustaveli State University, Batumi, Georgia

Beach Vitex, *Vitex rotundifolia* L. f., is a perennial shrub of Pacific Eastern Asia origin, consider as a threat to the coastal dune areas (Cousins et al. 2010). In Georgia, it was reported as slow spreading invasive species for the Black Sea coast (Kikodze et al., 2010, Thalmann et al. 2014). The aim of this research is to study the changes in species composition on coastal sand dunes caused by invasion of *V. rotundifolia*. In dataset of 54 phytosociological relevés made in July, 2015 on Kolkhetian coastal dunes between the settlements of Anaklia and Kobuleti, *V. rotundifolia* was recorded in 13 plots. The species affected shifting coastal dunes with rhizomatous grasses (*Leymus racemosus* subsp. *sabulosus*), belong to the alliance Elymion gigantei Morariu 1957. In this study, 22 plots are compared: 13 plots with (VR+) and 8 plots without *V. rotundifolia* (VR0). On VR+ plots, average number of species was slightly higher (8.9), than on VR0 plots (7.4). The maximum cover of *V. rotundifolia* in plots reached 50%. In terms of Barkman's Total Cover, average cover of the two native key-species, *Leymus racemosus* subsp. *sabulosus* and *Pancratium maritimum*, decrease on VR+ plots from 5.9 to 1.8, and for from 7.5 to 5.5, respectively. Totally on VR+ plots, frequency of *Leymus racemosus* subsp. *sabulosus*, *Pancratium maritimum* and *Calystegia soldanella* decreasing. On study area, presence of *V. rotundifolia* had negative effect on species composition in coastal sand dune habitats.

Keywords: alien plant, Black Sea coast, invasion, *Vitex rotundifolia*

ALIEN SPECIES IN SAND DUNE PLANT COMMUNITIES ON VELIKA PLAŽA IN ULCINJ (MONTENEGRO)

Danijela Stešević[1], Milica Luković[2], Danka Caković[3], Nemanja Ružić[4], Nada Bubanja[5], Urban Šilc[6]

[1]University of Montenegro, Faculty of Natural Sciences and Mathematics, Biology department, Džordža Vašingtona bb, 81 000 Podgorica, Crna Gora (danijela.stesevic@ac.me)
[2] Faculty of Tourism and Hotel Management, Department of Natural Science, University of Kragujevac, Vojvodjanska bb, 36210 Vrnjačka Banja, Serbia (mpetrovic.azs@gmail.com)
[3]University of Montenegro, Faculty of Natural Sciences and Mathematics, Biology department, Džordža Vašingtona bb, 81 000 Podgorica, Crna Gora (danka.petrovic@t-com.me)
[4]University of Montenegro, Faculty of Natural Sciences and Mathematics, Biology department, Džordža Vašingtona bb, 81 000 Podgorica, Crna Gora (nemanja.sharpe@gmail.com)
[5] Natural History Museum of Montenegro, Trg vojvode Bećir-bega Osmanagića 16, 81 000 Podgorica, Montenegro (nadabubanja@t-com.me)
[6] ZRC SAZU (Research Centre of the Slovenian Academy of Sciences and Arts), Institute of Biology, Novi trg 2, 1000 Ljubljana, Slovenia (urban@zrc-sazu.si)

For a rather long period Velika plaža in Ulcinj has been considered as one of the best preserved sites with psammophytic vegetation along the Adriatic coast. But in recent years this area has been significantly transformed as a result of different human stressors (e.g. non-sustainable approach to touristic development, illegal dumping, sand exploitation etc.), and become prone for alien plant invasions. In order to make a screening of a present state of the plant life of Velika plaza (i.e. floristic composition and zonation of plant communities), 20 transects were set perpendicular to the coast, regularly on every 500 m. Contiguous quadrats (2 x 2 m) were laid out next to each other in form of belt transect (Kent 2012) starting from the area with first colonizing plants towards the end of sand dune system with forest vegetation. This resulted in a matrix of 1124 plots (876 with present species) and 196 species (15 alien and 181 native) on which multivariate analyses was performed. Nine plant communities were detected, that are arranged in zonation from sea to inland. All of them were characterised with an alien component of flora. The least affected was plant community with *Cladium mariscus*, while the most affected ones were *Holoschoenetum romani* and *Eriantho-Schoenetum nigricanti*. Psammophytic vegetation is less affected by alien species compared to wetland communities. Foredunes are dominated by *Xanthium orientale* subsp. *italicum*, while on stabile dunes *Oenothera* species are predominant.

Key words: Psammophyte, retrodunal depressions, vegetation, invasive species

ALIEN SPECIES INVASION IN DIFFERENT HABITATS: THE CASE OF SLOVENIA

Urban Šilc[1,2], Filip Küzmič[1]

[1] Research Centre of the Slovenian Academy of Sciences and Arts, Institute of Biology, Novi trg 2, 1000 Ljubljana, Slovenia, urban@zrc-sazu.si
[2] Biotechnical Centre Naklo, Strahinj 99, 4202 Naklo, Slovenia

Analysis of habitat invasion by alien plant species in Slovenia has been performed on the basis of 18,606 vegetation plots in all vegetation types. In the whole dataset 127 archaeophytes (5.8 %) and 101 neophytes (4.6 %) of the whole flora of Slovenia were found. The highest numbers of alien species (archaeophytes and neophytes) occur on arable land. In addition, archaeophytes occur in higher numbers also in trampled areas, anthropogenic herb stands, mesic grasslands, moist tall-herb stands, sedge- and reedbeds and temperate scrublands. Neophytes are highly frequent in trampled areas, riverine scrubs, and wet and moist tall-herb stands. Number of alien species per number of native species per plot reveals that alien species numbers are highest in habitats with intermediate native species richness, while numbers decrease in extreme cases (habitats very poor or very rich with native species). Archaeophytes are overrepresented in mesic grasslands, while neophytes in riparian forests, trampled communities, tall herb fringes and standing waters. Our results show very similar patterns that have been elucidated in comparable studies for various European countries, such as Spain, Czech Republic, Moldavia and Great Britain.

Keywords: neophytes, archaeophytes, vegetation database, phytosociological relevés

INVASIVE FLORA OF RIVER AND STREAM BANKS IN CONTINENTAL CROATIA

Jasna Razlog-Grlica[1], Božena Mitić[2], Nataša Kletečki[3], I Grlica[1]

[1]Natural History Society „Drava“, Petra Berislavića 19, 33000 Virovitica, Croatia (jasna.razloggrlica@gmail.com)
[2]Department of Botany, Faculty of Science, University of Zagreb, Zagreb, Croatia (bozena.mitic@biol.pmf.hr)
[3]OŠ BogumilaTonija, Ivana Perkovca 90, 10430 Samobor, Croatia, (nkletecki@globalnet.hr)

Invasive species were studied on nine selected localities at the banks of rivers (Sava, Drava, Danube, Mura, Krapina) and streams (Gradna, Ođenica) in continental Croatia. Standard methods for plant species collection, determination and recording were applied. 19 invasive species were recorded in total. The highest number of invasive species (15) was found on the river Sava, and the lowest, four species, on the Ođenica stream. Most frequent invasive species were: *Ambrosia artemisiifolia* L., *Echinocystis lobata* (Michx.) Torr. et Gray and *Erigeron annus* (L.) Pers. Species *Ambrosia artemisiifolia* L. was present on 89% of localities. Among woody plant species we recorded *Acer negundo* L., *Ailanthus altissima* (Mill.) Swingle, *Amorpha fruticosa* L. and *Robinia pseudoacacia* L.. The largest number of invasive species 53 %) belonged to the family *Asteraceae*. Analysis of invasive species origin has shown that 79% of the species has origin in North America.

Key words: flora, river banks, Croatia, diversity invasive plants

OVERVIEW OF INVASIVE WOODY SPECIES IN HORTICULTURAL AREAS OF KARLOVAC

Marko Ožura[1],Lucija Vargović[2], Gordana Purgar[3]

[1]Karlovac University of Applied Sciences, Trg J.J. Strossmayera 9, Karlovac, Croatia (marko.ozura@vuka.hr)
[2]Hrvatske šume, d.o.o, Forest Office Duga Resa, Jozefinska cesta 64, Duga Resa, Croatia (lucija.vargovic@hrsume.hr)
[3] Zelenilo, d.o.o., Put D. Trstenjaka 6, Karlovac Croatia (gordana.purgar@zelenilo.hr)

History of tree plantations in Karlovac dates back to the time when the planting of exotic species represented a statement of prestige. Today in the historic center of Karlovac, among solitary trees and tree alleys we can find 113 species. On that list we should emphasize species that are represented as a design element, but are also on the list of invasive species. The analysis of available data from the currently incomplete database "Cadastre of greenery of city Karlovac" has extracted 82 *Robinia pseudoacacia*, 93 *Acer negundo* and 3 *Ailanthus altissima* trees. Most of those trees are forming tree alleys, which are relatively old and require additional care. All mentioned woody plants regardless of their proved invasive character in some cases, seem not to pose a threat, because with regular maintenance it is possible to destroy all new individuals of all unplanned bread or sprouted plants on green surfaces, among them also individuals of invasive species. During this survey, it was noted that private areas are containing not only woody invasive species but also other invasive plant species. This situation is mostly result of inappropriate use or abandoning land, as well as ignorance or lack of interest of the green surface owners for analysed problem. In conclusion, the problem of invasive species in urban greenery is not significant if the lawn and tree care is properly planned. Due to the health status of those invasive woody species and time of planting, they would be, in the long term, replaced with other non-invasive tree species, according to the plan of local government.

Keywords: invasive woody species, parks, urban greenery, Karlovac

INVASIVE FLORA OF THE CITY OF VARAŽDIN

Valentina Borak Martan[1], Renata Šoštarić[2]

[1]Elementary School Horvati, Horvaćanska 6, 10000 Zagreb, Croatia (valentina.borak@gmail.com)
[2]Division of Botany, Faculty of Science, University of Zagreb; Marulićev trg 20/2, 10000 Zagreb, Croatia (rsostar@biol.pmf.hr)

In the city of Varaždin during vegetation seasons of 2012, 2014 and 2015, a floristic research was conducted with special emphasis on invasive taxa. Of the total of 773 recorded taxa, 41 (5.30%) has the status of invasive. A third of invasive taxa come from the family *Asteraceae* (13 taxa; 31.71%), followed by *Amaranthaceae* (4 taxa; 9.76%), *Balsaminaceae* (3 taxa; 7.32%) and *Poaceae* (3 taxa; 7.32%). In the spectrum of life forms therophytes prevail (21 taxa; 51.22%). The analysis of flora elements indicates that the most dominant are cultivated and adventive invasive taxa (32 taxa; 78.05%). The majority of invasive taxa originate from North and South America (26 taxa; 63.41%). The results were compared with the data available for other Croatian cities (Split, Zadar, Sisak, Šibenik and Knin). Due to human population in cities, investigated area, number of invasive taxa and the proportion of life forms and origin, the invasive flora of Varaždin shows the greatest similarity with the invasive flora of the city of Sisak. Compared with invasive flora of Croatia in general and invasive flora in Sisak, Varaždin showed a higher proportion of hemicryptophytes and smaller proportion of therophytes and species of American origin. There are 2.41 invasive taxa per km^2 in Varaždin. Compared with the data for city of Split, Zadar, Sisak, Šibenik and Knin the proportion of invasive species is relatively large and is steel growing. Proof of this is the fact that in the first half of the 20th century Varaždin area domesticated 12 alien species that today have the status of invasive. This means that in less than a century the number of invasive plants increased by about 3.5 times.

Keywords: Urbanization, Allochthonous plants, Varaždin, Croatia

INVASIVE FLORA IN THE WIDER AREA OF THE TOWN OF STOLAC (BOSNIA AND HERZEGOVINA)

Emina Ademović[1], Senka Barudanović[2], Samir Đug[2], Arnela Selimić[2], Merima Imamović[2], Alma Avdibašić[2], Ajla Podrug[2], Aldin Boškailo[1], Ermin Mašić[2]

[1]Faculty of Science, University Džemal Bijedić, Sjeverni logor bb, 81104 Mostar, Bosnia and Herzegovina (eminaademovic@unmo.ba, aldinboskailo@hotmail.com)
[2]Faculty of Science, University of Sarajevo, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina (sebarudanovic@gmail.com, sdug@gmail.com, merimaimamovic@hotmail.com, almaavdibasic@gmail.com, arnela42selimic@gmail.com, ajlapodrug@hotmail.com, erminmasic@hotmail.com, arminecology@gmail.com)

The important of non-native plants and their spreading has become a common occurence in the recent years. Exotic species that have a negative impact on the native flora and vegetation, human health or cause damage to agriculture and the economy are considered invasive ones. The spreading of invasive species in the natural environment is a global problem today. Systematic research of the flora inventory of urban environment in Bosnia and Herzegovina is still at a low level, with the exception of a couple of towns. According to available literature data vascular flora of the town of Stolac is not inventoried, nor invasive species in that area. The aim of this study was to provide a preliminary overview of invasive plant species of the wider area of the town of Stolac. The research has been carried out sporadically over the past six years, and a detailed study was done in 2016. The standard methods of collection and recording of plant species are applied. The town of Stolac and neighbouring area have 28 invasive plant species, and some of them (*Ailanthus altissima* (Mill.) Swingle, *Eleusine indica* (L.) Gaertn., *Ambrosia artemisiifolia* L., *Phytolacca americana* L., etc.) are completely acclimated and pose a dangerous threat to the indigenous flora and vegetation. Among registered invasive species, the larges number of species are American neophytes (78,57%).

Keywords**:** non-native plant species, urban environment, anthropogenic influence, degradation

DISTRIBUTION OF INVASIVE ALIEN SPECIES *Reynoutria japonica* HOUTT. IN BOSNIA AND HERZEGOVINA

Senka Barudanović[1], Emina Ademović[2], Merima Imamović[1], Alma Avdibašić[1], Arnela Selimić[1], Ajla Podrug[1], Ermin Mašić[1], Aldin Boškailo[2], Armin Macanović[1]

[1]Faculty of Science, University of Sarajevo, Zmaja od Bosne 33-35, 71000 Sarajevo, Bosnia and Herzegovina (sebarudanovic@gmail.com, merimaimamovic@hotmail.com, almaavdibasic@gmail.com, arnela42selimic@gmail.com, ajlapodrug@hotmail.com, erminmasic@hotmail.com, arminecology@gmail.com)
[2]Faculty of Science, University Džemal Bijedić, Sjeverni logor bb, 81104 Mostar, Bosnia and Herzegovina (eminaademovic@unmo.ba, aldinboskailo@hotmail.com)

Reynoutria japonica Houtt. (Japanese knotweed) is a fast growing perennial that may reach 2,5 m in height. This plant was introduced in Europe in the 19th century to prevent soil erosion and horticultural purposes. It is one of the 100 worst invasive species identified by IUCN. *Reynoutria japonica* is a highly competitive species that is capable of completely displacing local vegetation. It forms dense stands that shade out other species whilst the strong rhizomes can tolerate digging and ploughing, they can also penetrate concrete, tarmac and displace stone and other structures. From an ecological point of view listed species has a strong negative environmental, health, social and economic impact. Research for this study were carried out in the area between the cities of Sarajevo and Zenica in August and September 2016. The paper gives a brief morphological description of this species and investigated localities. The aim of this study is also to determine the distribution of invasive alien species *Reynoutria japonica* in Bosnia and Herzegovina. Results obtained are compared with literature data. Due to strong impact that made on biodiversity, it is necessary to establish a permanent monitoring, create of database of habitats and maps of distribution and initiate actions of eradicating or controlling places where they are already present.

Key words: flora, invasive species, environmental impact, ecosystem, degradation

THE SPREAD OF THE INVASIVE SPECIES *Helianthus tuberosus L.* IN THE URBAN AREAS OF SAMOBOR

Diana Vlahović[1], Božena Mitić[2]

[1]Bogumil Toni Primary School, Perkovčeva 90, 10430 Samobor; email: dianavlahov@gmail.com
[2]University of Zagreb, Faculty of Science, Department of Biology, Division of Botany, Marulićev trg 9a, HR- 10000 Zagreb, Croatia; email: bozena.mitic@biol.pmf.hr

The aim of this study was to analyse the potential spread of the invasive alien species *Helianthus tuberosus L.* (fam. Asteraceae) in the urban area of the city of Samobor. The field study was conducted in the period from 2008 till 2010 and re-conducted in 2014 as to observe the potential spreading of this invasive species to new areas. Geographic location of sites were geo-referenced with GPS receiver, and coordinates were stored in the Flora Croatica Database. The habitats were classified pursuant to the Croatian Habitat Classification. Our results showed the rising number of sites and their habitat types in the re-conducted field research. We detected 25 sites of the species *H. tuberosus* in the urban area of Samobor in the period of 2008-2010, which were confirmed in 2014, together with 30 new sites. Eight different types of habitat of the species *H. tuberosus* are found, among which the following ones are the most frequent: backyards, front yards and gardens (22 sites), terraced houses with backyards (6 sites), areas with nearby road traffic (6 sites), large construction sites, single buildings under construction (5 sites), buildings with public offices with adjacent areas (5 sites), abandoned agricultural areas overgrown with herbaceous vegetation (4 sites), buildings at the edges (2 sites) and mosaic of a complex structure of crops alongside houses (2 sites). Our study indicated that *H. tuberosus* has mainly been cultivated as an ornamental plant in gardens and has spread from there into other urban areas of the city of Samobor.

Keywords: Croatia, Asteraceae, alien plants, habitat types

SPREAD OF INVASIVE WEED SPECIES *Asclepias syriaca* L. IN VOJVODINA

Milena Popov, Bojan Konstantinović, Milan Blagojević, Nataša Samardžić

University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, Novi Sad, Serbia (milena.popov@polj.uns.ac.rs)

First data on invasive weed species *A. syriaca* (common milkweed) presence in Serbia dates back to twenties of the last century. It is assumed that this weed species was introduced to Serbia from southern Hungary, and today it is present in almost all parts of Vojvodina province. The aim of a five-year mapping of *A. syriaca* was to determine whether populations of this weed species are spreading, remaining at the same level or being reduced as well as to determine type of habitats on which this weed is dominant. Spread of *A. syriaca* from abandoned to cultivated land on which it forms the plots was also observed. In the last few years, high abundance of *A. syriaca* was registered in northern parts of the country, in cut down or abandoned orchards and vineyards, on sandy terrain beside motorways and railways and on banks. On these areas monodominant stands of *A. syriaca* are most commonly formed. Occurence of new populations was observed in northwestern parts of Bačka and along the border with Croatia. *A. syriaca* population was registered on almost all soil types present in Vojvodina which leads to conclusion that soil type has minor effect on its spread and its further distribution will not be affected with this factor.

Keywords: *Asclepias syriaca*, invasive species, spread

NEW LOCALITY OF *Azolla filiculoides* IN REPUBLIC OF MACEDONIA

Renata Ćušterevska

Institute of Biology, Faculty of Natural Sciences and Mathematics, University of Ss. Cyril and Methodius, Skopje, Republic of Macedonia; (renatapmf@yahoo.com)

Azolla filiculoides is native to warm temperate and subtropical America through Western North America (including Alaska).*A. filiculoides* is known as a species which in former times was native to Europe, but died out during the last Ice Ages. Today, *A. filiculoides* has actually become a cosmopolitan plant. The species was introduced to Europe in 1880 near Bordeaux. First plants were reported from France, and since then the species spread to nearly the whole of Europe with a main occurrence in Atlantic and Mediterranean regions. First findings in Macedonia were reported by Risto Buklievin 1986, who found it on several localities in rice fields of Kočani-Štip valley. After 30 years of the first finding in the Republic of Macedonia, *A. filiculoides* was registered in June 2016 during our research of aquatic vegetation in Lake Dojran (SE Macedonia). This alien plant was recorded on two localities at the move Nikolić-Nov Dojran, on the surface of the water at about 100m². Because, there is no direct connection between the two sites with running water, probably the plant is spread out with seed material of rice. *A. filiculoides* settles in freshwater systems such as lakes, rivers, and canals ponds, ditches, water reservoirs, wetlands, channels and slow flowing rivers. Slow moving sites are particularly vulnerable to infestation by this species. It is not tolerant of turbulence or waves, and is usually flushed out of fast-flowing rivers and streams. *A. filiculoides* has negative impacts on the environment and biodiversity in aquatic ecosystems. Unfortunately, in order to prevent further spreading in Macedonia are not undertaken any control programme and methods to reduce the spread of this species. In future it is important to raise awareness of this species, develop policy and identify actions needed to deal with further spread.

Keywords: invasive alien species, prevention of spread

NEW RECORDS OF *Solanum elaeagnifolium* Cav. FROM TURKEY

Ahmet Ilcim[1], Ahmet Uludağ[2,3], Ilhan Uremis[4]

[1] Biology Department, Faculty of Sciences and Arts, Mustafa Kemal University, Hatay, Turkey (ailcim@yahoo.com)
[2] Faculty of Agriculture, Canakkale Onsekiz Mart University, Canakkale, Turkey (ahuludag@yahoo.com)
[3] Faculty of Agriculture and Nature Science, Duzce University, duzce, Turkey
[4] Faculty of Agriculture, Mustafa Kemal University, hatay, Turkey (iuremis@yahoo.com)

Solanum elaeagnifolium which is originated from Americas is an aggressive invasive alien species in the Mediterranean Basin and Balkans. Its early records go back to mid-20th century in Mediterranean Basin, where it was recorded in Morocco, Greece, Italy, Egypt and Israel. In spite of control attempts, it has been spreading in the invaded areas due to species biological features and lack of effective control methods. Before 2000, it has been recorded in Middle East side of Mediterranean. In spite of its large distribution in countries and localities around Turkey, there was no record from Turkey. It has been recorded for the first time in Turkey in 2007 in a wetland area in the South East Anatolia Region. Migration of birds has been mentioned as possible introduction pathway. New populations from 5 m above sea level to 626 m have been found in recent years, which have not been published yet. These all localities are in the same region of Turkey where it was the first record. Specimens are deposited in Mustafa Kemal University, Biology Department Herbarium. Further occurrences in Turkey are possible because it has been recorded in Aegean Islands very close to Turkish shores.

Keywords: Mediterranean Basin, Balkans, The Middle East, Aegean Islands, The South East Anatolia

Sigesbeckia orientalis L. (ASTERACEAE) - NEW ALIEN PLANT SPECIES IN THE LOWER SAVA BASIN

Jelena Knežević, Boris Radak, Milica Rat

University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovića 2, Novi Sad, Serbia
e-mail: milica.rat@dbe.uns.ac.rs

Invasive alien species are one of the most imporant threats to biodiversity; in past decades numerous actions were conducted aiming to supersede them. Fundamental of all are species lists, accoring to which further actitivies are planned. Although it is an established opinion that local flora is well known, new species are recorded annually. Family Asteraceae is the most numerous in species, both the native and the alien flora. During ESENIAS-TOOLS field works in 2015 and 2016 in the region of the Obedska bara (old flow of the River Sava, Serbia) another representative, *Sigesbeckia orientalis* L. was registered. Its native range is in Asia; in Western Europe it was introduced to botanical gardens during the 19th century. At the beginning of the 20th century it was recorded in Bosnia and Hercegovina, and in the second half of 20th centuryin Romania. Even though first data are recent, species was recorded during 2016 in large groups on two distant localities in nature reserve Obedska bara, which is also important as an Ramsar site. There is no indicator when and how it was introduced. Additionally, low knowledge about species biology and ecology in this region does not give insight what is the species' potential behaviour. Since the species is for now widespread only along the roads, appropriate recommendation would be regular maintenance of these, what will suppress further spread of the species. Potential for the creation of larger populations in the natural habitats along Sava river is unknown, and thus caution is necessary.

Keywords: invasive, alochtonous, neophytes, St Paul's-wort, Serbia

*This analysis is made within the frame of ESENIAS-TOOLS project, D-33-51/30.06.2015, FM EEA (2009-2014).

Convolvulus sabatius – JUST A CASUAL ALIEN PLANT IN DALMATIA OR…?

Dario Hruševar[1], Dalibor Vladović[2], Božena Mitić[1], Nediljko Ževrnja[2]

[1] University of Zagreb, Faculty of Science, Department of Biology, Marulićev trg 9a, 10000 Zagreb, Croatia (dario.hrusevar@biol.pmf.hr)
[2]Nature History Museum Split, Poljana kneza Trpimira 3, 21000, *Split, Croatia*

The genus *Convolvulus* L. is distributed worldwide and represented with approximately 200 taxa, with the greatest diversity in the Irano-Turanian and Mediterranean regions. Although the genus is of relatively small economic value, several species produce attractive flowers and are therefore cultivated. One of them is *C. sabatius* Viviani (syn. *C. mauritanicus* Boissier), native species of Magreb (Africa) and in Italy, popular for its beautiful funnel-shaped, violet-blue flowers. The plant is perennial, pubescent, with branched, woody stocks and petiolate, orbicular to oblong leaves. First observation of *C. sabatius* in the flora of Croatia was recorded for the town of Omiš (Tafra et al. 2012). It was reported just as a cultivated plant, without the ability to spread out. However, we observed the same plant species in the summer of 2011 in the city of Kaštela or, more precisely, in the settlement Rudine of Kaštel Novi. The population was growing outside of cultivation, on a meadow with a strong anthropogenic influence, covering an area of approximately 6 m^2. The plant grows together with the species *Cynodon dactylon*, *Digitaria sanguinalis*, *Lolium perenne*, *Cichorium intybus*, *Oxalis corniculata*, etc. Since then, we have noted that population every summer and in 2016 the population still occupies the same area. Even we assume that *C. sabatius* is a casual alien plant, it might become the first established population in Dalmatia so our caution is needed and possible monitoring in the future is recommended. Namely, according to the DAISIE database, the same species is an established alien plant in Greece, which has, at least partly, similar climatic conditions as Dalmatia.

Keywords: allochthonous plant, Convolvulaceae, Croatia, new alien taxon

Impatiens balfourii HOOK. F. 1903 (BALSAMINACEAE) IN SERBIA

Boris Radak, Nikola Todorović, Bojana Bokić, Milica Rat, Goran Anačkov

Department of Biology and Ecology, Faculty of Science, University of Novi Sad, Trg Dositeja Obradovića 2, 21000 Novi Sad, Republic of Serbia (boris.radak@dbe.uns.ac.rs)

As one of the species-richest genus within Angiosperms, *Impatiens* is represented by 6 species in Serbia. Amongst them, the only autochthonous species is *I. noli-tangere*. *I. walleriana* is decorative, whereas *I. glandulifera*, *I. balsamina* and *I. parviflora* are classified as invasive plants in the area of Vojvodina (North Serbia). The last one - *I. balfourii*, Kashmir balsam, is not listed in Flora of Serbia and first and single data about this species was given by Adamowski (2009) without any further information about precise locality. The Kashmir balsam originated from western Himalayas, from where it has been introduced into Europe since 1901 as ornamental plant. Today, this species can be found predominantly in southern Europe, but also in western and central Europe. First precise locality known for *I. balfourii* in Serbia refers to village of Lešnica in western Serbia. During our field researches in 2010 this species was registered on two microlocalities around Lešnica village. In both cases only few individuals were found, the first along the linden forest edge and the second inside planted pine-spruce forest. This year Kashmir balsam was found only on the second microlocality while the first one is now partially destroyed by forest cuttings. Also, one population with 20 specimens of *I. balfourii* was recorded around the buildings in the metropolitan area of Novi Sad in 2016. It can be concluded that at present *I. balfourii* does not express invasiveness in Serbia, but future field surveys are needed for determination of its status.

Keywords: Kashmir balsam, alien plants, Lešnica, Novi Sad

Acknowledgement: This research was conducted within the project no. 173030, funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia and project "Invasive species in our environment: City of Novi Sad as a habitat of alien plants" funded by City Administration for Environmental protection, City of Novi Sad.

CONTRIBUTION TO THE ALIEN FLORA OF MONTENEGRO

Boris Radak, Milica Rat, Slobodan Bojčić, Bojana Bokić, Goran Anačkov

Department of Biology and Ecology, Faculty of Science, University of Novi Sad, Trg Dositeja Obradovića 2, 21000 Novi Sad, Republic of Serbia (boris.radak@dbe.uns.ac.rs)

During intensive floristic investigation of the Montenegrin coast, five new alien species were found. Field investigations were conducted in period from 2011 to 2016 in wider area of village Čanj, town of Tivat and especially across the Luštica peninsula. *Tradescantia fluminensis*, spiderwort species native to South America was found near the village Čanj. This species is forming very dense population along the stream in fragmented forest of *Quercus pubescens*. Other three recorded species are also of South American origin - *Anredera cordifolia*, *Mirabilis jalapa* and *Passiflora caerulea*. The first one was found in the village of Radovići where, as a very aggressive climber, covers like a carpet all other vegetation, both herbaceous and shrubby. Other two species are found sporadically along the road above the complex "Luštica Bay", as a part of ruderal vegetation. All these are ornamental and grown often in the Mediterranean area so we assume that escaping from gardening was the way of getting into semi-natural ecosystems of Montenegro. In the area of Special nature reserve "Tivatska Solila", *Eucalyptus camaldulensis* was registered. As a species that lives along river banks and in floodplains, here it founds a niche in the marsh area of abandoned saltworks. A dozen adult plants that were planted there in the past were registered, as well as numerous offsprings. Since saltworks is an area with specific halophytic plant communities of high conservation importance, expansion of this species may have potential threat to these habitats.

Keywords: *Anredera*, ornamental plants, saline habitats, new records, Luštica peninsula

Acknowledgement: This analysis is made within the frame of ESENIAS-TOOLS project, D-33-51/30.06.2015, FM EEA (2009-2014) and the project no. 173030, funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia

INVASIVE WEED SPECIES IN THE TERRITORY OF SERBIA

Sava Vrbničanin[1], Dragana Božić[1], Danijela Pavlović[2], Ana Anđelković[2,3]

[1] Faculty of Agriculture, University of Belgrade, Nemanjina 6, Belgrade, Serbia (sava@agrif.bg.ac.rs; dbozic@agrif.bg.ac.rs)
[2] Institute for Plant Protection and Environment, Teodora Drajzera 9, Belgrade, Serbia (danijelapavlovicdk@gmail.com)
[3] Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 2, Novi Sad, Serbia (ana.andjelkovic21@gmail.com)

Given that the invasion of alien plant species presents a serious threat to native vegetation, altering the functioning and structure of the invaded ecosystems, the worldwide problem of plant invasions has become one of the focal points of research over the last 30 years. A longstanding tradition in weed research, coupled with a number of projects aimed at mapping the distribution of weeds and invasive alien species (IAS) in Serbia, has provided us with a unique insight into the current situation of invasive weeds in Serbia. One of the projects, focused on the identification, mapping and monitoring of alien weed species, has yielded valuable results pertaining to this topic, and recognized as significant the presence of 19 alien invasive weed species in Serbia, whose distribution and invasiveness have been recorded. A comparison of this list of 19 alien invasive weeds with the preliminary list of IAS in Serbia shows an overlap in 13 species. Seven of these are recognized as highly invasive: *Asclepias syriaca, Ambrosia artemisiifolia, Stenactis annua, Conyza canadensis, Helianthus tuberosus, Solidago gigantea* and *Fallopia japonica*, one (*Solidago canadensis*) as sporadically invasive and five as potentially invasive. Considering that the problem of plant invasions is gaining more traction in the scientific arena with each passing year, the research which has been done so far has set a solid foundation for further studies regarding this topic in Serbia.

Keywords: invasive weeds, mapping, distribution, Serbia, Balkans

Acknowledgement: The authors acknowledge the support of the Ministry of Education, Science and Technological Development of the Republic of Serbia (Projects No. III 46008 and TR 31018).

ALIEN PLANT TAXA IN THE ŽUPA DUBROVAČKA REGION, SOUTH CROATIA

Marija Pandža[1], Milenko Milović[2], Nenad Jasprica[3], Katija Dolina[3]

[1]"Murterski školji" Primary School, Put škole 10, HR-22243 Murter, Croatia (e-mail: marija.pandža@si.t-com.hr)
[2]"Antun Vrančić" Grammar School, Put Gimnazije 64, HR-22000 Šibenik, Croatia (e-mail: milenko.milovic@si.t-com.hr)
[3]Institute for Marine and Coastal Research, University of Dubrovnik, Kneza Damjana Jude 12, HR-20000 Dubrovnik, Croatia (e-mail: nenad.jasprica@unidu.hr, katija.dolina@unidu.hr)

Župa dubrovačka is one of the Croatian region less known from botanical point of view. In 2016, a two-years project has started with the aim to investigate flora, presence of alien plants in particular, and current status of the habitats in the area. Study area (surface area of 22.81 km² with an altitude ranging from 0-628 m a.s.l.) is characterized by complex geomorphological features (steep hillsides, agricultural terraces on slopes, occurrence of intermittent or permanent springs, etc.) and substrata diversity. The coast (cliffs, rocky and pebble beaches) has a total length of 11.4 km. The area has 8,300 year-round inhabitants (estimated 2011), but this number increases several-fold in summer. Until now, 20 alien plant taxa have been noted. These were: *Ailanthus altissima* (Mill.) Swingle, *Amaranthus deflexus* L., *A. hybridus* L., *A. retroflexus* L., *Aster squamatus* (Spreng.) Hieron., *Bidens subalternan*s DC., *Chenopodium ambrosioides* L., *Conyza sumatrensis* (Retz.) E. Walker, *Datura innoxia* Mill., *D. stramonium* L., *Euphorbia prostrata* Aiton, *Galinsoga parviflora* Cav., *Helianthus tuberosus* L., *Parthenocissus quinquefolia* (L.) Planchon, *Paspalum dilatatum* Poir., *P. paspalodes* (Michx.) Scribn., *Phytolacca americana* L., *Robinia pseudoacacia* L., *Sorghum halepense* (L.) Pers. and *Xanthium strumarium* L. ssp. *italicum* (Moretti) D. Löve. The region is affected by strong anthropogenic influences, especially grazing, fire and cutting, and more recently the urbanization of the coastal zone. These features certainly contribute to the richness of alien flora.

Keywords: vascular flora, diversity, ruderal habitats, invaded ecosystems, Mediterranean

SPREAD OF THREE ADVENTITIOUS SPECIES IN THE CROATIAN FLORA

Mirko Ruščić[1], Ljerka Marković[2], Jasenka Topić[3], Semir Maslo[4]

[1]University of Split, Faculty of Science, Department of Biology, Ruđera Boškovića 33, 21 000 Split, Croatia (e-mail: mrus@pmfst.hr)
[2]Klaićeva 41, 10 000 Zagreb, Croatia
[3]Sisačka cesta odv.2 45A, 10 000 Zagreb, Croatia (e-mail: jasenka.topic@gmail.com)
[4]Lundkerskolan Gislaved Sweden (e-mail: semmas@edu.gislaved.se)

The various anthropogenic activities in nature lead to changes in the existing flora, affecting the introduction of alien species that are a threat to the native biodiversity. Here we present spreading of three adventive species in Croatia: *Sporobolus indicus* (L.) R. Br., *Acalypha virginica* L. and *Pennisetum villosum* R.Br.ex Fresen. *Sporobolus indicus* (L.) R. Br originates from the tropical, subtropical and temperate regions of the world. The plant was found in 2007 in the city of Supetar (island Brač), within the city's lawns and the undeveloped habitat within the ruderal flora. Further findings were in the area of Split in 2013, and across wider area of Makarska in 2014. Since this plant produces a large number of seeds we are expecting gradual expansion, particularly in ruderal areas and lawns in urban flora. Species *Acalypha virginica* L. is an annual newcomer from North America. It is naturalized and widespread and was naturalized in Italy, southern Switzerland and southern Austria. In Split, the plant was recorded in September 1998, on the gravel embankment and root crops around planted tamarisk tree, on beaches Kasjuni and Kaštelet. Further record was in Zagreb, in private house yard. The latest findings from 2015 years in the damp grass of the campus Split. The plant has been represented by a smaller number of copies. We expect this species to continue with its spread in the urban areas. Plant species *Pennisetum villosum* R.Br.ex Fresen, is a perennial plant from Ethiopia and paleotropic areas. It inhabits dry habitats, and is widespread in western Mediterranean region and Portugal, and it is naturalized in Italy and the Azores. First record in Croatia was in December 1998 in Split, growing on the high southern slopes of rock Sustipan, and on a small rocky lawn on the west side of the cemetery. The plant grows in small groups with a larger number of individuals. We continuously monitor its possible further spread across the Split area.

Keywords: *Sporobolus indicus*, *Acalypha virginica, Pennisetum villosum,* , allochthonous species, ruderal flora, Croatia

KAZALO AUTORA

INDEX OF AUTHORS

KAZALO KLJUČNIH RIJEČI

INDEX OF KEY WORDS

POPIS SUDIONIKA

LIST OF PARTICIPANTS

Aksoy Necmi, necmiaksoy@duzce.edu.tr
Duzce University, Faculty of Forestry; Duzce University, Faculty of Forestry & DUOF Herbaria, Duzce, Turkey

Alegro Antun, antun.alegro@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Marulićev trg 20, Zagreb, Croatia

Anačkov Goran, goran.anackov@dbe.uns.ac.rs
University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology; Trg Dositeja Obradovića 2, Novi Sad, Serbia

Avdibašić Alma, almaavdibasic@gmail.com
Faculty of Science, University of Sarajevo; Zmaja od Bosne 33 - 35, Sarajevo, Bosnia and Herzegovina

Baković Najla, najla.bakovic@gmail.com
ADIPA - Society for Research and Conservation of Croatian Natural Diversity; Orehovečki ogranak 37, Zagreb, Croatia

Bakran-Petricioli Tatjana, tbakran@biol.pmf.hr
Faculty of Science, University of Zagreb, Department of Biology; Rooseveltov trg 6, Zagreb, Croatia

Balázs Kiss, kiss.balazs@agrar.mta.hu
Plant Protection Institute, Cebtre for Agricultural Research MTA; 15 Herman Otto ut, Budapest, Hungary

Barić Božena, baric@agr.hr
University of Zagreb, Faculty of Agriculture; Svetošimunska cesta 25, Zagreb, Croatia

Batistić Mirna, mirna.batistic@unidu.hr
Institute for Marine and Coastal Research, University of Dubrovnik; Kneza Damjana Jude 12, Dubrovnik, Croatia

Bogdanović Tomislav, tomobogdanov@gmail.com
Institute of public health of Osijek Baranja county; Drinska 8, Osijek, Croatia

Bokić Bojana, bojana.bokic@dbe.uns.ac.rs
Department of biology and ecology, Faculty of Science, University of Novi Sad; Trg Dositeja Obradovića 2, Novi Sad, Serbia

Borak Martan Valentina, valentina.borak@gmail.com
Elementary School Horvati; Horvaćanska 6, Zagreb, Croatia

Boršić Igor, igor.borsic@dzzp.hr
Croatian Agency for the Environment and Nature; Radnička cesta 80/7, Zagreb, Croatia

Božić Boris, boris.bozic@ires-ekologija.hr
IRES EKOLOGIJA d.o.o.; Prilaz baruna Filipovića 21, Zagreb, Croatia

Buzjak Suzana, suzana.buzjak@hpm.hr
Croatian Natural History Museum; Demetrova1, Zagreb, Croatia

Car Ana, ana.car@unidu.hr
Institute for marine and coastal research, University of Dubrovnik; Kneza Damjana Jude 12, Dubrovnik, Croatia

Celar Franci Aco, franci.celar@bf.uni-lj.si
Biotechnical Faculty; Jamnikarjeva 101, Ljubljana, Slovenia

Cigrovski Mustafić Martina, martina.cigrovski-mustafic@azo.hr
Croatian Agency for the Environment and Nature; Radnička cesta 80/7, Zagreb, Croatia

Čalić Marijeta, marijeta.calic@unidu.hr
Institute for marine and coastal research, University of Dubrovnik; Kneza Damjana Jude 12, Dubrovnik, Croatia

Čarni Andraž, carni@zrc-sazu.si
Institute of Biology, ZRC SAZU; Novi Trg 2, Ljubljana, Slovenia

Ćušterevska Renata, renatapmf@yahoo.com
Institute of Biology, Faculty of Natural Sciences and Mathematics, University of Ss. Cyril and Methodius, Skopje; Arhimedova 3, Skopje, Macedonia

Desnica Sonja, sonja.desnica@dzzp.hr
Croatian Agency for the Environment and Nature; Radnička cesta 80/7, Zagreb, Croatia

Dolina Katija, katija.dolina@unidu.hr
Institute for Marine and Coastal Research, University of Dubrovnik; Kneza Damjana Jude 12, Dubrovnik, Croatia

Dulčić Jakov, dulcic@izor.hr
Institute of Oceanography and Fisheries; I. Meštrovića 63, Split, Croatia

Duplić Aljoša, aljosa.duplic@vuka.hr
Karlovac University of Applied Sciences; Trg. J. J. Strossmayera 9, Karlovac, Croatia

Durbešić Paula, paula.durbesic@zg.t-com.hr
Faculty of science (retired); Rokova 11, Zagreb, Croatia

Essl Franz, franz.essl@univie.ac.at
Division of Conservation, Vegetation and Landscape Ecology, University Vienna; , Vienna, Austria

Fazinić Tina, tina.fazinic@hcphs.hr
Croatian Centre for Agriculture, Food and Rural Affairs - Institute for Plant Protection; Gorice 68b, Zagreb, Croatia

Franjević Milivoj, milivoj.franjevic@sumfak.hr
University of Zagreb, Faculty of Forestry; Svetošimunska 25, Zagreb, Croatia

Garić Rade, rade.garic@unidu.hr
Institute for Marine and Coastal Research, University of Dubrovnik; Kneza Damjana Jude 12, Dubrovnik, Croatia

Giovanetti Manuela, manuela.giovanetti@gmail.com
University of Florence, Biology Department; via Giorgio La Pira 4, I-50121 Florence, Italija

Hrašovec Boris, hrasovec@sumfak.hr
Faculty of Forestry, University of Zagreb; Svetošimunska 25, Zagreb, Croatia

Hruševar Dario, dario.hrusevar@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Marulićev trg 9a, Zagreb, Croatia

Hudina Tomislav, tomislav.hudina@biom.hr
BIOM; Preradovićeva 34, Zagreb, Croatia

Hudina Sandra, sandra.hudina@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Iakushenko Dmytro, d.iakushenko@wnb.uz.zgora.pl
Faculty of Biological Sciences, University of Zielona Gora; Z. Szafrana 1, 65-516, Zielona Gora, Poland

Imamović Merima, merimaimamovic@hotmail.com
Faculty of Science, University of Sarajevo; Zmaja od Bosne 33 - 35, Sarajevo, Bosnia and Herzegovina

Ivanek Igor, igor.ivanek@ires-ekologija.hr
IRES EKOLOGIJA d.o.o.; Prilaz baruna Filipovića 21, Zagreb, Croatia

Ivić Dario, dario.ivic@hcphs.hr
Croatian Centre for Agriculture, Food and Rural Affairs - Institute for Plant Protection; Gorice 68b, Zagreb, Croatia

Janev Hutinec Biljana, bjanev.hutinec@gmail.com
Javna Ustanova „Maksimir"; Maksimirski perivoj 1, Zagreb, Croatia

Janev-Holcer Nataša, natasa.janev@gmail.com
Croatian Institute of Public Health; Rockfellerova 7, Zagreb, Croatia

Jantol Nela, njantol@oikon.hr
Oikon Ltd. Institute of Applied Ecology; Trg Senjskih uskoka 1-2, Zagreb, Croatia

Jasprica Nenad, nenad.jasprica@unidu.hr
Institute for Marine and Coastal Research, University of Dubrovnik; Kneza Damjana Jude 12, POBox 83, Dubrovnik, Croatia

Jelaska Sven, sven.jelaska@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Marulićev trg 20, Zagreb, Croatia

Jelić Lana, lanamalovic@yahoo.com
Public Institution Maksimir; Public Institution Maksimir, Zagreb, Croatia

Juvan Mastnak Nina, nina.juvan@zrc-sazu.si
Institute of Biology, ZRC SAZU; Novi Trg 2, Ljubljana, Slovenia

Kalčićek Matea, matea.kalcicek@gmail.com
Institut za istraživanje i razvoj održivih ekosustava; Jagodno 100a, Velika Gorica, Croatia

Kaligarič Mitja, mitja.kaligaric@um.si
UNIVERSITY OF MARIBOR SLOVENIA; Koroška 160, Maribor, Slovenia

Kiss Balasz, kiss.balazs@agrar.mta.hu
Hungarian Academy of Sciences, Centre for Agricultural Research, Plant Protection Institute, Department of Zoology; Pf 102, Budapest, Hungary

Kletečki Nataša, natasa.kletecki@gmail.com
OŠ Bogumila Tonija; Ivana Perkovca 90, Samobor, Croatia

Klobučar Ana, ana.klobucar@stampar.hr
Andrija Štampar Teaching Institute of Public Health; , Zagreb, Croatia

Kos Katarina, katarina.kos@bf.uni-lj.si
Biotechnical Faculty; Jamnikarjeva 101, Ljubljana, Slovenia

Kratovalieva Mimi, mkratovalieva@yahoo.com
Ministry of Agriculture Forestry and Water Economy, State Phytosanitary Laboratory; , Skopje, Macedonia

Krpina Vesna, vesna.krpina@gmail.com
Branimira Gušića 3, Zadar, Croatia

Kühn Ingolf, ingolf.kuehn@ufz.de
Helmholtz Centre for Environmental Research – UFZ; Theodor-Lieser-Str. 4, Halle, Germany

Kurtek Ivan, ivan.kurtek@gmail.com
Department of Biology, Josip Juraj Strossmayer University; Cara Hadrijana 8/A, Osijek, Croatia

Kus Veenvliet Jana, jana.kus@zavod-symbiosis.si
Institute Symbiosis, so.e.; Metulje 9, Nova vas, Slovenia

Kutleša Petra, petra.kutlesa@dzzp.hr
Croatian Agency for the Environment and Nature; Radnička cesta 80/7, Zagreb, Croatia

Küzmič Filip, filip.kuzmic@zrc-sazu.si
Institute of Biology, ZRC SAZU; Novi Trg 2, 1000 Ljubljana, Slovenia

Lajtner Jasna, jasna.lajtner@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Lončar Goran, goran.loncar@vitaprojekt.hr
Vita projekt d.o.o.; Ilica 191, Zagreb, Croatia

Lugić Edin, edin.lugic@ires-ekologija.hr
IRES EKOLOGIJA d.o.o.; Prilaz baruna Filipovića 21, Zagreb, Croatia

Lukić Ivan, ivanl@sumins.hr
Croatian Forest Research Institute ; Cvjetno naselje 42, Jastrebarsko, Croatia

Ljubej Lea, lealjubej93@gmail.com
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Maguire Ivana, ivana.maguire@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Malić-Limari Snježana, snjezana.malic@gmail.com
Javna ustanova "Park prirode Medvednica"; Bliznec 70, Zagreb, Croatia

Marinšek Aleksander, aleksander.marinsek@gozdis.si
Slovenian Forestry Institute; Večna pot 2, Ljubljana, Slovenia

Matošević Dinka, dinkam@sumins.hr
Croatian Forest Research Institute ; Cvjetno naselje 42, Jastrebarsko, Croatia

Melika George, melikageorge@gmail.com
Plant Health and Molecular Biology Laboratory Directorate of Plant Protection, Soil Conservation and Agri-environment National Food Chain Safety Office; Budaörsi u. 141-145, Budapest, Hungary

Merdić Enrih, enrih@biologija.unios.hr
Department of Biology, Josip Juraj Strossmayer University; Cara Hadrijana 8/A, Osijek, Croatia

Mešić Aleksandar, amesic@agr.hr
University of Zagreb, Faculty of Agriculture; Svetošimunska cesta 25, Zagreb, Croatia

Mitić Božena, bozena.mitic@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Marulićev trg 9a, Zagreb, Croatia

Orešković Anja, anja.oreskovic@hotmail.com
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Orešković Mislav, oreskovic.mislav@gmail.com
Maksimirska 80, Zagreb, Croatia

Ostojić Ana, aostojic@oikon.hr
Oikon Ltd. Institute of Applied Ecology; Trg Senjskih uskoka 1-2, Zagreb, Croatia

Ožura Marko, marko.ozura@vuka.hr
Karlovac University of Applied Sciences; Trg. J. J. Strossmayera 9, Karlovac, Croatia

Pajač Živković Ivana, ipajac@agr.hr
Faculty of Agriculture, University of Zagreb; Svetošimunska 25, Zagreb, Croatia

Pandža Marija, marija.pandza@si.t-com.hr
"Murterski školji" Primary School; Put škole 10, Murter, Croatia

Pastorino Paolo, paolo.pastorino@izsto.it
Istituto Zooprofilattico Sperimentale del Piemonte; Liguria e Valle d'Aosta, Torino, Italy

Pavlović Danijela, danijelapavlovicdk@gmail.com
Institute for Plant Protection and Environment; Teodora Drajzera 9, Belgrade, Serbia

Pintar Maja, maja.pintar@hcphs.hr
Croatian Centre for Agriculture, Food and Rural Affairs - Institute for Plant Protection; Gorice 68b, Zagreb, Croatia

Piria Marina, mpiria@agr.hr
University of Zagreb, Faculty of Agriculture; Svetošimunska 25, Zagreb, Croatia

Popov Milena, milena.popov@polj.uns.ac.rs
University of Novi Sad, Faculty of Agriculture; Trg Dositeja Obradovića 2, Novi Sad, Serbia

Popović Nina, nina.popovic@vuka.hr
Karlovac University of Applied Sciences; Trg. J. J. Strossmayera 9, Karlovac, Croatia

Pušić Ana, ana.pusic9@gmail.com
Institut za istraživanje i razvoj održivih ekosustava; Jagodno 100a, Velika Gorica, Croatia

Radak Boris, boris.radak@dbe.uns.ac.rs
Department of biology and ecology, Faculty of Science, University of Novi Sad; Trg Dositeja Obradovića 2, Novi Sad, Serbia

Rat Milica, milica.rat@dbe.uns.ac.rs
University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology; Trg Dositeja Obradovića 2, Novi Sad, Serbia

Razlog-Grlica Jasna, jasna.razloggrlica@gmail.com
Natural History Society „Drava“; Petra Berislavića 19, Virovitica, Croatia

Rot Mojca, mojca.rot@go.kgzs.si
Agricultural and forestry institut of Nova Gorica; Pri hrastu 18, Nova Gorica, Slovenia

Ruščić Mirko, mrus@pmfst.hr
University of Split, Faculty of Science, Department of Biology, Ruđera Boškovića 33, Split, Croatia

Sajna Nina, nina.sajna@um.si
Faculty of Natural Sciences and Mathematics; Koroška c. 160, Maribor, Slovenia

Sedlar Zorana, zorana.sedlar@hpm.hr
Croatian Natural History Museum; Demetrova1, Zagreb, Croatia

Selimić Arnela, arnela42selimic@gmail.com
Faculty of Science, University of Sarajevo; Zmaja od Bosne 33 - 35, Sarajevo, Bosnia and Herzegovina

Sever Zdravka, zdravka.sever@hcphs.hr
Croatian Centre for Agriculture, Food and Rural Affairs - Institute for Plant Protection; Gorice 68b, Zagreb, Croatia

Slijepčević Vedran, vedran.slijepcevic@vuka.hr
Karlovac University of Applied Sciences; Trg. J. J. Strossmayera 9, Karlovac, Croatia

Slivar Sandra, sandra.slivar@dzzp.hr
Croatian agency for environment and nature; Radnička cesta 80, Zagreb, Croatia

Šapina Ivan, ccgutka@gmail.com
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Šarić Ivana, ivana.saric@biom.hr
BIOM; Preradovićeva 34, Zagreb, Croatia

Šerić Jelaska Lucija, slucija@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Šćepanović Maja, mscepanovic@agr.hr
University of Zagreb, Faculty of Agriculture; Svetošimunska cesta 25, Zagreb, Croatia

Šegota Vedran, vedran.segota@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Marulićev trg 20, Zagreb, Croatia

Šilc Urban, urban@zrc-sazu.si
Institute of Biology, ZRC SAZU; Novi Trg 2, 1000 Ljubljana, Slovenia

Škunca Marina, mskunca@geonatura.hr
Geonatura Ltd.; Fallerovo šetalište 22, Zagreb, Croatia

Šoštarčić Valentina, vsostarcic@agr.hr
University of Zagreb, Faculty of Agriculture; Svetošimunska cesta 25, Zagreb, Croatia

Šprem Nikica, nsprem@agr.hr
University of Zagreb Faculty of Agriculture; Svetošimunska 25, Zagreb, Croatia

Terlević Ana, anaterlevic1@gmail.com
Department of Biology, Faculty of Science, University of Zagreb; Rooseveltov trg 6, Zagreb, Croatia

Tmušić Goran, goran.tmusic@dbe.uns.ac.rs
Department of Biology and Ecology, Faculty of Science, University of Novi Sad; Trg Dositeja Obradovića 2, Novi Sad, Serbia

Traian Manole, traian.manole@gmail.com
Research-Development Institute for Plant Protection; Bd. Ion Ionescu de la Brad 8, District 1 , Bucharest, Romania

Uludag Ahmet, ahuludag@yahoo.com
Faculty of Agriculture, Canakkale Onsekiz Mart University; , Canakkale, Turkey

van Loo Marcela, marcela.van.loo@univie.ac.at
Department of Botany and Biodiversity Research; Rennweg 14, Vienna, Austria

Verlič Andrej, andrej.verlic@gozdis.si
Slovenian Forestry Institute; Večna pot 2, Ljubljana, Slovenia

Vetek Gabor, Vetek.Gabor@kertk.szie.hu
Szent István University, Department of Entomology; Villányi út 29–43, Budapest, Hungary

Vilović Tihana, tvilovic@gmail.com
Department of Biology, Faculty of Science, University of Zagreb; Marulićev trg 20, Zagreb, Croatia

Vitasović Kosić Ivana, ivitasovic@agr.hr
University of Zagreb Faculty of Agriculture; Svetošimunska 25, Zagreb, Croatia

Vladović Dalibor, dalibor@prirodoslovni.hr
Nature History Museum Split; Poljana kneza Trpimira 3, Split, Croatia

Vlahović Diana, dianavlahov@gmail.com
Bogumil Toni Primary School; Perkovčeva 90, Samobor, Croatia

Vrbničanin Sava, sava@agrif.bg.ac.rs
Faculty of Agriculture, University of Belgrade; Nemanjina 6, Belgrade, Serbia

Vuković Lidija, lidija.vukovic@voda.hr
Hrvatske vode; Žitnjak bb, Zagreb, Croatia

Vuković Nina, nina.vukovic@biol.pmf.hr
Department of Biology, Faculty of Science, University of Zagreb; Marulićev trg 20, Zagreb, Croatia

Zečić Emina, emina.zecic@hotmail.com
Faculty of Science, University of Sarajevo; Zmaja od Bosne 33 - 35, Sarajevo, Bosnia and Herzegovina

Žežlina Ivan, ivan.zezlina@go.kgzs.si
Agricultural and forestry institut of Nova Gorica; Pri hrastu 18, Nova Gorica, Slovenia

Žganec Krešimir, kzganec@unizd.hr
Sveučilište u Zadru, Odjel za nastavničke studije u Gospiću; dr. Ante Starčevića 12, Gospić, Croatia

Žuljević Ante, zuljevic@izor.hr
Institute of Oceanography and Fisheries; I. Meštrovića 63, Split, Croatia

BILJEŠKE

NOTES

Pod pokroviteljstvom / Patronage of:

Gradonačelnik Zagreba / Major of Zagreb
Milan Bandić

Suorganizatori/ Co-organisers:

HRVATSKI ŠUMARSKI INSTITUT | CROATIAN FOREST RESEARCH INSTITUTE

SVEUČILIŠTE U ZAGREBU 1876 1946 PRIRODOSLOVNO - MATEMATIČKI FAKULTET PMF

JAVNA USTANOVA MAKSIMIR

Donatori / Donors:

ACADEMIA SCIENTIARUM ET ARTIUM CROATICA MDCCCLXI

Ministarstvo obrazovanja
i sporta

HRVATSKE VODE

HRVATSKA KOMORA INŽENJERA ŠUMARSTVA I DRVNE TEHNOLOGIJE