Hrvatsko biološko društvo 1885
SOCIETAS BIOLOGORUM CROATICA 1885
Croatian Biological Society

9. HRVATSKI BIOLOŠKI KONGRES

s međunarodnim sudjelovanjem

Rovinj, 23. – 29. rujna 2006.

9th CROATIAN BIOLOGICAL CONGRESS

with International Participation

Rovinj, September 23 – 29, 2006.

ZBORNIK SAŽETAKA

PROCEEDING OF ABSTRACTS

Hrvatsko biološko društvo 1885
SOCIETAS BIOLOGORUM CROATICA 1885
Croatian Biological Society

9. HRVATSKI BIOLOŠKI KONGRES
S međunarodnim sudjelovanjem
23. – 29. rujna 2006.
Rovinj, Hrvatska

9th CROATIAN BIOLOGICAL CONGRESS
With International Participation
23rd – 29th September 2006
Rovinj, Croatia

ZBORNIK SAŽETAKA

PROCEEDING OF ABSTRACTS

Zagreb, 2006.

ZBORNIK SAŽETAKA
9. HRVATSKOG BIOLOŠKOG KONGRESA

PROCEEDING OF ABSTRACTS OF THE
9th CROATIAN BIOLOGICAL CONGRESS

Urednici / Editors

Višnja Besendorfer
Göran I.V. Klobučar

Odgovorni tehnički urednici / Technical Editor in Chief

Višnja Besendorfer
Indira Filipović

Hrvatsko biološko društvo 1885
Croatian Biological Society

Zagreb, 2006.

Organizator kongresa i izdavač zbornika

Hrvatsko biološko društvo 1885
Croatian Biological Society
Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (Croatia)
Telefon / Phone ++385 (0)1 4606 272; Fax: ++385 (0)1 4606 286
e-mail: hbd@zg.biol.pmf.hr
URL: www.hbd1885.hr

Malo vijeće Hrvatskog biološkog društva 1885
Executive Bord of the Croatian Biological Society

Višnja Besendorfer (predsjednica – President), Mladen Kučinić (dopredsjednik – Vice-president), Sven Jelaska (tajnik – Secretary), Petra Peharec (blagajnica – Treasurer), Marijana Krsnik-Rasol, Mirjana Pavlica, Gordana Rusak, Lela Zadražil, Krešimir Žganec

Veliko vijeće Hrvatskog biološkog društva 1885
Council of the Croatian Biological Society

Višnja Besendorfer, Mladen Kučinić, Sven Jelaska, Petra Peharec, Marijana Krsnik-Rasol, Mirjana Pavlica, Gordana Rusak, Lela Zadražil, Krešimir Žganec, Jasna Franekić-Čolić, Paula Durbešić, Srećko Jelenić, Sibila Jelaska, Ivica Valpotić, i Anđelika Plenković-Moraj, Gordana Lacković-Venturin, Srećko Leiner, Mladen Krajačić, Oskar Springer, Velimir Šipoš, Stanislav Leniček, Toni Nikolić, Petar T. Mitrikeski, Milvana Arko-Pljevac, Marija Horvat, Anika Mate, Žaklin Lukša, Branko Glamuzina, Gorenka Sinovčić

Hrvatsko biološko društvo 1885 je član / Croatian Biological Society is member of IUCN – The World Conservation Union

Grafička priprema i tisak:
Četiri boje d.o.o.
Matetičeva 43, 10000 Zagreb
Tel: ++385 (0)1 3867 100
Fax: ++385 (0)1 3867 105
e-mail: cetiriboje@cetiriboje.hr

CIP - Katalogizacija u publikaciji
Nacionalna i sveučilišna knjižnica - Zagreb

UDK 57(063)(048)

HRVATSKI biološki kongres s međunarodnim sudjelovanjem (9 ; 2006 ; Rovinj)
Zbornik sažetaka / 9. hrvatski biološki kongres s međunarodnim sudjelovanjem, 23. - 29. rujna 2006., Rovinj = Proceeding of abstracts / 9th Croatian Biological Congress with International Participation, 23rd - 29th September 2006, Rovinj ; <urednici Višnja Besendorfer, Goran I. V. Klobučar>. - Zagreb : Hrvatsko biološko društvo 1885, 2006.

Tekst usporedo na hrv. i engl. jeziku.

ISBN 953-6241-06-4

I. Biologija -- Zbornik sažetaka

300906021

Organizacijski i programski odbor
Organizing and Program Committee:

Hrvoje Fulgosi (predsjednik – President), Göran Klobučar (dopredsjednik - Vice-president), Dunja Leljak-Levanić (tajnica – Secretary), Petra Peharec (blagajnica/Treasurer), Sven Jelaska, Damjan Franjević, Kristian Vlahoviček, Božena Mitić, Irina Zupan, Petar Kružić, Zlatko Liber, Nataša Bauer, Maja Fafanđel, Bojan Hamer, Lela Zadražil

Znanstveni odbor
Scientific Committee:

Miroslav Plohl (predsjednik – President), Višnja Besendorfer (dopredsjednica/ Vice-president), Marijana Krsnik-Rasol, Mladen Kerovec, Mladen Krajačić, Gordana Lacković-Venturin, Anđelka Plenković-Moraj, Biserka Primc-Habdija, Nenad Smodlaka, Renato Batel, Jasenka Topić, Stipan Jonjić, Damir Viličić, Vera Gamulin, Ivana Weygand-Đurašević, Gordan Lauc, Jerka Dumić, Đurđica Ugarković, Ksenija Zahradka, Zoran Zgaga, Tatjana Bakran-Petricioli, Krunoslav Brčić-Kostić, Zdravko Dolenec, Toni Nikolić, Mirjana Pavlica, Ines Radanović, Mary Sopta, Zoran Tadić, Nevenka Kopjar, Dunja Leljak-Levanić, Nadica Oršolić, Dijana Škorić, Željka Vidaković-Cifrek, Vera Cesar, Maja Osmak, Andreja Ambriović-Ristov, Milorad Mrakovčić, Mladen Kučinić, Snježana Mihaljević, Jakov Dulčić, Jasna Puizina, Srećko Jelenić

Tehnička potpora
Technical support

Barbara Mikac, Daniela Marić, Igor Stanković, Ivana Furčić, Jelena Godrijan, Jelena Mlinarec, Koraljka Kralj, Lidija Kalinić, Marija Gligora, Marija Ivković, Marija Kozina, Marko Lukić, Martina Pavlek, Mateja Zajc, Mauro Stifanić, Nela Nikolić, Romana Gračan, Saško Popijač, Sunčica Bosak, Tina Šilović, Tanja Vojvoda, Tomislav Horvat, Ugo Ušić, Vlatka Mičetić

Mjesto i vrijeme održavanja
Venue and date

Hotel „Park“, Rovinj, 23. – 29. rujna 2006.
Hotel „Park“, Rovinj, 23rd – 29th September 2006

Pokrovitelji

Ministarstvo znanosti, obrazovanja i športa Republike Hrvatske
Državni zavod za zaštitu prirode
Sveučilište u Zagrebu
Biološki odsjek Prirodoslovno-matematičkog fakulteta Sveučilišta u Zagrebu
Institut „Ruđer Bošković“
Istarska županija
Grad Rovinj

Under the Auspices of

The Ministry of Science, Education and Sport of Republic of Croatia
State Institute for Nature Protection
University of Zagreb
Division of Biology, Faculty of Science, University of Zagreb
Ruđer Bošković Institute
Region of Istria
City of Rovinj

Sponzori
Sponsors

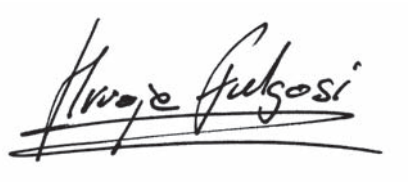
Biovit d.o.o.
Frank Analab d.o.o.
Gorea-plus d.o.o.
Labomar d.o.o.
Olympus
Profil
Školska knjiga d.d.
Carl Zeiss d.o.o.

„...evolucija je promjena nasljednih svojstava populacije kroz uzastopni slijed generacija, a određena je pomacima u frekvenciji alela. Evolucija je glavni izvor velike raznolikosti života - svi su današnji organizmi u međusobnom srodstvu, proizvodi kumulativnih evolucijskih promjena kroz milijarde godina. S vremenom, nove vrste evoluiraju od postojećih vrsta procesom specijacije, dok druge vrste izumiru, rezultirajući biološkim svijetom u stalnoj promijeni...”

Wikipedia

Hrvatsko biološko društvo 1885 započelo je sa svojim radom 1975. godine. Nakon trideset i jedne godine evolucije stvaralaštva Društva, predstavljamo Vam Deveti hrvatski biološki kongres. Uzlaznim slijedom pokušaja, pogrešaka i ispravnih rješenja pokušali smo organizirati još jedno okupljanje hrvatskih biologa. Nadamo se da će te uživati u našem Kongresu i da će te svojim radom u posvećenim sekcijama doprinijeti daljnjem razvoju i napretku hrvatske biologije.

U ime Organizacijskog i programskog odbora
Hrvoje Fulgosi



„...evolution is the change in the heritable traits of a population over successive generations, as determined by the shifting allele frequencies of genes. Evolution is ultimately the source of the vast diversity of life: all contemporary organisms are related to each other through common descent, products of cumulative evolutionary changes over billions of years. Over time, new species evolve from existing species through speciation, and other species become extinct, resulting in the ever-changing biological world..."

Wikipedia

Croatian Biological Society was founded in the year 1975. After thirty one years of creative work evolution, we present you the 9th Croatian Biological Congress. In an ascendant chain of trials, errors, and correct solutions, we have once again organized a traditional meeting of Croatian biologists. We hope that you will enjoy our Congress and that your contribution in dedicated sessions will enhance further progress and development of Croatian biology.

On Behalf of the Organizing and Programm Committee
Hrvoje Fulgosi

Tradicionalno okupljanje hrvatskih biologa u organizaciji Hrvatskog biološkog društva 1885 održava se ove godine po deveti put. Od prvog susreta 1981. godine u nedalekom Poreču do ovog sada u Rovinju prošlo je dugih 25 godina te s ponosom možemo proslaviti "srebrni pir". U međuvremenu se mnogo toga promijenilo. Na primjer, prije 25 godina nismo niti sanjali o sekvenciranim eukariotskim genomima i *in siliko* analizama baza podataka. Biologija se brzo razvija u svim svojim područjima, a znanja i spoznaje koje dobivamo kao rezultat temeljnih bioloških istraživanja predstavljaju osnovu novih pristupa, na primjer u medicini, poljoprivredi, ili pri rješavanju problema nastalih zbog utjecaja čovjeka na prirodu. Brzi razvoj cjelokupne biologije pred znanstvenike u svijetu pa tako i kod nas postavlja sve veće i veće zahtjeve; traže se novi znanstveni prodori, a cilj jest ostvariti znanstveni doprinos koji će biti zapažen u međunarodnoj znanstvenoj zajednici.

Hrvatski biološki kongresi bili su od prvog dana osmišljeni kao sveukupni prikaz biologije u Hrvatskoj, namijenjeni biolozima u najširem smislu. Bili su i ostali namijenjeni svima koji se profesionalno bave biologijom, kako temeljnim znanstvenim istraživanjima tako i radom u različitim područjima primijenjene biologije ili nastavom u školama. Zahvaljujući sve brojnijem sudjelovanju naših biologa koji rade u inozemstvu, ali i sve većem učešću stranaca, s vremenom jača i međunarodna komponenta ovih kongresa koja omogućuje usporedbu rada i rezultata dobivenih u Hrvatskoj s biologijom u svijetu. Ovakve usporedbe i vrednovanja koja iz njih proizlaze neophodna su i stimulativna jer omogućuju na jednom mjestu, tijekom samo nekoliko dana, uvid u svjetska stremljenja, nove spoznaje i koncepte u najrazličitijim područjima biologije.

Usprkos činjenici da su neki smjerovi ili teme znanstvenih istraživanja povremeno više u žarištu interesa nego drugi, nemoguće je predvidjeti razvoj znanosti u budućnosti kao i probleme koje će znanstvenici tek morati rješavati. Stoga je potrebno podsticati i "biodiverzitet" u biološkim istraživanjima, a time, posebno u malenim znanstvenim zajenicama kao što je naša, čuvati cjelovitost palete znanja i stručnjaka koji se bave raznolikim specifičnim područjima unutar biologije. U tom smislu Deveti hrvatski biološki kongres slijedi tradiciju prethodnih i predstavlja presjek bioloških istraživanja, razmišljanja i ideja postignutih u Hrvatskoj. Međunarodno će nam sudjelovanje pomoći kako bismo ojačali veze sa svijetom i svjetskom zanosti, a sve s ciljem da i ovaj skup bude još jedna karika i poticaj u procesu sakupljanja informacija i znanja neophodnih pri usmjeravanju i planiranju budućeg rada hrvatskih biologa.

U ime Znanstvenog odbora

Miroslav Plohl — Višnia Besendorfer

This year for the ninth time Croatian biologists convene at the traditional conference organized by the Croatian Biological Society 1885. From the first conference organized in the town of Porec to this years conference in Rovinj, twenty five years have passed and with pride we celebrate our silver anniversary. In that time much has changed. For example, 25 years ago we could hardly imagine the sequencing of entire eukaryotic genomes or the in silico analyses of biological databases. Biology has developed with great speed in all its areas, and the knowledge and discoveries that have emerged from fundamental studies represent the foundation for new approaches in medicine, agriculture and the solution of problems imposed by man's impact on nature. The rapid development of biological science imposes greater challenges to both international and domestic scientists: new breakthroughs are sought with the view to enhancing the biological knowledge base which will be recognized by the international scientific community.

From its inception the Croatian Biological Conference was organized to represent the entire palette of biological research in Croatia, for biologists in the widest sense. The conferences were and remain to this day dedicated to all those who work in the field of biology from fundamental researchers to those working in the areas of applied biology as well as biology teachers. Thanks to the participation of an ever greater number of Croatian scientists working abroad and increasing participation by non-Croatian scientists. With time the international component of the conference has been strengthened which allows for the comparison of Croatian biological research in the wider international context. Such comparison and evaluation of Croatian scientific research is essential to stimulating future quality research and the conference allows for insight into world trends, new breakthroughs and the development of novel concepts in all areas of biology all of which takes place in a single venue, in the course of a few days.

In spite of the fact that certain areas or themes of scientific research may be of more interest than others at a given moment, it is imposible to predict the course of scientific interest in the future or to predict the problems which scientist will need to resolve. For that reason it is important to maintain diversity in biological research and thus, particularly in a small community such as ours, mantain the entire palette of knowledge and expertise of those working in various fields of biological research. In this respect the ninth Croatian Biological Conference continues with tradition and presents a cross-section of biological research and ideas developed in Croatia. International participation will help us to strengthen our ties with the international community with the aim that this conference will be another link in the chain by which knowledge and information will be exchanged and form the foundation for future directions in Croatian biological research.

On Behalf of the Scientific Committee

Miroslav Plohl Višnja Besendorfer

Predgovor / Foreword ..... vi-ix

UVODNO PREDAVANJE
OPENING LECTURE

(PL-1) P. Forterre..... 40
THE ORIGIN OF VIRUSES AND THEIR POSSIBLE ROLES IN THE EMERGENCE OF MODERN CELLS

ZAVRŠNO PREDAVANJE
CLOSING LECTURE

(PL-14) S. Volarević..... 42
RIBOSOMAL PROTEIN S6 HAPLOINSUFFICIENCY ACTIVATES A P53-DEPENDENT CHECKPOINT DURING GASTRULATION"

PLENARNA PREDAVANJA
PLENARY LECTURES

(PL-2) J.W. Kadereit 44
THE PHYLOGEOGRAPHY OF EUROPEAN COASTAL PLANTS: THE RELATIVE ROLES OF HISTORY AND MODERN BIOTIC AND ABIOTIC FACTORS

(PL-3) K.Y. Lim, A. Kovarik, R. Matyášek, S. Knapp, M.W. Chase, J.J. Clarkson, A.R. Leitch..... 45
ALLOPOLYPLOID EVOLUTION IN THE GENUS *Nicotiana* - RECENT TO ANCIENT

(PL-4) S. Jenni, T. Maier, M. Leibundgut, N. Ban..... 46
STRUCTURAL BASIS OF FATTY ACID SYNTHESIS IN EUKARYOTES

(PL-5) J. Ozga, D. Reinecke 47
Hormonal Interactions in Fruit Development

(PL-6) S. Sprunck, B. Bellmann, M. Gebert, D. Leljak-Levanic, M.L. Márton, A. Amien, T. Dresselhaus 47
A transcriptomics approach to study female gametophyte functions in flowering seed plants

(PL-7) E. Schleiff..... 49
PROTEIN TRANSLOCATION ACROSS MEMBRANES

(PL-8) G.M. Burghardt..... 50
THE ORIGINS AND BIOLOGY OF ANIMAL PLAY

(PL-9) P. Chevaldonné, C. Lejeusne 50
LESSONS FROM MARINE MEDITERRANEAN CAVE-DWELLING ORGANISMS: FROM CLIMATE CHANGE TO THE MAKING OF NEW SPECIES

(PL-10) F. Médail, K. Diadema..... 52
IMPORTANCE OF REFUGIA IN SHAPING MEDITERRANEAN PLANT BIODIVERSITY

(PL-11) J.A.M. Leunissen, M. van den Bosch, H. Luo, G. Kappé, W.W. de Jong
THE PROREPEAT DATABASE: A DIRECTORY OF EXACT TANDEM REPEATS IN PROTEINS 53

(PL-12) J.C. Saiz 54
WEST NILE VIRUS: AN OVERVIEW

(PL-13) D. Lamba 55
STRUCTURAL STUDIES OF A HYPOALLERGENIC ISOFORM OF THE MAJOR BIRCH POLLEN ALLERGEN BET V 1 AND ITS LIKELY BIOLOGICAL FUNCTION AS A PLANT STEROID CARRIER

GENETIKA, MOLEKULARNA GENETIKA, EVOLUCIJA
BIOLOGIA GENORUM ET EVOLUTIO
GENETICS, MOLECULAR GENETICS, EVOLUTION

Uvodna tematska predavanje
Introductory Lectures

(IL-1) N. Meštrović, P. Castagnone-Sereno, M. Plohl 58
DVOFAZNI MODEL EVOLUCIJE SEKVENCI SATELITNIH DNA: UZAJAMNI UTJECAJ SELEKTIVNOG PRITISKA I NASUMIČNIH DOGOĐAJA
TWO-STAGE MODEL OF EVOLUTION OF SATELLITE DNA SEQUENCES: AN INTERPLAY OF SELECTIVE CONSTRAINTS AND STOCHASTIC EVENTS

(IL-2) K. Zahradka, M. Radman 59
POPRAVAK DNA KOD BAKTERIJE *Deinococcus radiodurans:* OD STOTINA FRAGMENATA DO CJELOVITOG KROMOSOMA
DNA REPAIR in *Deinococcus radiodurans*: FROM HUNDREDS OF FRAGMENTS TO THE FUNCTIONAL CHROMOSOME

Kratka usmena priopćenja
Oral Presentations

(OP-1) T. Horvat, I. Biruš, N. Bauer, D. Papeš, V. Zoldoš 61
PRIMARNA STRUKTURA I STRUKTURALNA OBILJEŽJA INTERGENSKE RAZMAKNICE IZMEĐU 26S I 18S rRNA GENA U VRSTE *Quercus petraea*
THE NUCLEOTIDE SEQUENCE AND STRUCTURAL FEATURES OF rDNA SPACER REGION BETWEEN 26S AND 18S rRNA GENES IN *Quercus petraea*

(OP-2) J. Mlinarec, D. Papeš, V. Besendorfer..... 62
UZASTOPNO PONAVLJAJUĆE I RASPRŠENE PORODICE DNA U GENOMIMA VRSTA RODA *Anemone*
SATELLITE AND DISPERSED REPETITIVE DNA FAMILIES IN THE GENOME OF *Anemone* SPECIES

(OP-3) M. Štifanić, R. Batel..... 64
KRATKI INTRONI UKAZUJU NA KOMPAKTAN GENOM KOD SPUŽAVA
SHORT INTRONS INDICATE A COMPACT GENOME IN SPONGES

(OP-4) K. Štingl, Z. Grubić, E. Čečuk-Jeličić, R. Žunec, R. Serventi-Seiwerth, B. Labar, V. Brkljačić-Kerhin 65
POVEZANOST PODUDARNOSTI MIKROSATELITA HLA S ISHODOM TRANSPLANTACIJE HEMATOPOETSKIH MATIČNIH STANICA
THE EFFECT OF HLA MICROSATELLITES MATCHING IN OUTCOME OF HEMATOPOIETIC STEM CELL TRANPLANSPLANTATION

(OP-5) R. Žaja, R. Sauerborn Klobučar, T. Smital..... 67
MOLEKULARANA I FUNKCIONALNA KARAKTERIZACIJA TRANSPORTNIH PROTEINA (PGP I MRP2) U PRIMARNIM HEPATOCITIMA PASTRVE (*Oncorhynchus mykiss*)
MOLECULAR AND FUNCTIONAL CHARACTERIZATION OF PGP AND MRP2 EFFLUX TRANSPORTERS IN PRIMARY CULTURE OF RAINBOW TROUT (*Oncorhynchus mykiss*) HEPATOCYTES

Posterska priopćenja
Posters

(P-1) I. Biruš, S. Krčmar, K. Brčić-Kostić, G. Lauc 69
ANALIZA SRODSTVENIH ODNOSA OBADA (DIPTERA: TABANIDAE) IZ RODOVA *Tabanus* I *Philipomyia* USPOREDBOM MITOHONDRIJSKE DNA
PHYLOGENETIC ANALYSIS OF HORSEFLIES (DIPTERA: TABANIDAE) BELONGING TO GENI *Tabanus* AND *Philipomyia* BY COMPARISON OF MITOCHONDRIAL DNA

(P-2) V. Boraska, V. Škrabić, M. Peruzović, T. Zemunik..... 70
TNF-á PROMOTORSKI POLIMORFIZMI I PREDISPOZICIJA ZA NASTANAK ŠEĆERNE BOLESTI TIP 1 U POPULACIJI DALMACIJE
TNF-á PROMOTER POLYMORPHISMS AND SUSCEPTIBILITY TO TYPE 1

DIABETES IN THE DALMATIAN POPULATION

(P-3) M. Buljubašić, K. Zahradka, M. Petranović, D. Zahradka 71
UČINAK MUTACIJE *recG* NA HOMOLOGNU REKOMBINACIJU I PORAVAK DNA KOD MUTANATA *recBC sbcBC* BAKTERIJE *Escherichia coli*
EFFECTS OF A *recG* MUTATION ON HOMOLOGOUS RECOMBINATION AND DNA REPAIR IN *recBC sbcBC* MUTANTS OF *Escherichia coli*

(P-4) H. Car, K. Štingl, R. Žunec, E. Čečuk-Jeličić, V. Kerhin-Brkljačić, Z. Grubić..... 73
RAZNOLIKOST MIKROSATELITSKIH LOKUSA UNUTAR GENA ODGOVORNOG ZA NEKROZU TUMORA (TNF) U POPULACIJI HRVATSKE
TUMOUR NECROSIS FACTOR MICROSATELLITE POLYMORPHISMS IN THE CROATIAN POPULATION

(P-5) D. Đermić, D. Zahradka, M. Petranović 74
EGZONUKLEAZNA AKTIVNOST JE NUŽNA ZA HOMOLOGNU REKOMBINACIJU U *recD* MUTANTIMA BAKTERIJE *Escherichia coli*
EXONUCLEASE ACTIVITY IS ESSENTIAL FOR HOMOLOGOUS RECOMBINATION IN *recD* MUTANTS OF *Escherichia coli*

(P-6) M. Harcet, L. Lukić-Bilela, H. Ćetković, W.E.G. Müller, V. Gamulin 76
DVIJE NUKLEOZID-DIFOSFAT KINAZE (NDPK/Nm23) IZ MORSKE SPUŽVE Suberites domuncula
TWO NUCLEOSIDE DIPHOSPHATE KINASES (NDPK/Nm23) FROM THE MARINE SPONGE *Suberites domuncula*

(P-7) I. Ivančić Baće, I. Vlašić, G. Čogelja Čajo, E. Salaj-Šmic, K. Brčić-Kostić..... 77
PriA I RecBCD SUDJELUJU U STVARANJU SIGNALA ZA UV-INDUCIRANU INHIBICIJU RESTRIKCIJE U BAKTERIJI *Escherichia coli*
PriA AND RecBCD FUNCTIONS COOPERATE TO CREATE A SIGNAL FOR UV-INDUCED RA IN *Escherichia coli*

(P-8) A. Mojsović, D. Đikić, I. Biruš, B. Viljetić, I. Labak, M. Heffer-Lauc..... 79
SIJALOGLIKOKONJUGATI U MOZGU ŠARANA
SIALOGLYCOCONJUGATES IN THE CARP BRAIN

(P-9) D. Perina, H. Cetkovic, M. Harcet, L. Lukic-Bilela, W.E.G. Müller, V. Gamulin..... 80
RIBOSOMSKI PROTEINI MORSKE SPUŽVE *Suberites domuncula*

THE COMPLETE SET OF RIBOSOMAL PROTEINS FROM THE MARINE SPONGE *Suberites domuncula*

(P-10) A. Posavec, R. Žunec, K. Štingl, E. Čečuk-Jeličić, Z. Grubić, R. Serventi-Seiwerth, B. Labar, V. Brkljačić-Kerhin 82
RAZNOLIKOST SLABIH TKIVNIH ANTIGENA HA-1, HA-2 I HA-8 U TRANSPLANTACIJI KOŠTANE SRŽI
MINOR HISTOCOMPATIBILITY ANTIGENS HA-1, HA-2 AND HA-8 POLYMORPHISMS IN HLA-IDENTICAL RELATED BONE MARROW TRANSPLANTATION

(P-11) D. Zahradka, K. Zahradka, M. Buljubašić, M. Petranović 84
ULOGA NUKLEAZA SbcB I SbcCD U SPONTANOJ RAZGRADNJI DNA KOD *recA* MUTANATA BAKTERIJE *Escherichia coli*
THE ROLE OF SbcB AND SbcCD NUCLEASES IN SPONTANEOUS DNA DEGRADATION IN *recA* MUTANTS OF *Escherichia coli*

STANIČNA I MOLEKULARNA BIOLOGIJA
BIOLOGIA CELLULARIS ET BIOLOGIA MOLECULARIS SENSU LATO
CELL AND MOLECULAR BIOLOGY

Uvodna tematska predavanja
Introductory Lectures

(IL-3) J. Pavelić, I. Sansović, I. Barišić, T. Matijević, J. Knežević 88
UČESTALOST 35delG MUTACIJE GENA *GJB2* U OBOLJELIH OD NESINDROMSKE GLUHOĆE U HRVATSKOJ
THE PREVALENCE OF THE 35delG MUTATION IN *GJB2* GENE IN PATIENTS WITH NON-SYNDROMIC HEARING LOSS FROM CROATIA

Kratka usmena priopćenja
Oral Presentations

(OP-6) V. Benković, N. Oršolić, N. Kopjar, A. Horvat Knežević, S. Ramić, D. Đikić, I. Bašić..... 90
UTVRĐIVANJE RADIOPROTEKTIVNOG UČINKA PROPOLISA I FLAVONOIDA KOMET TESTOM
DETECTION OF RADIOPROTECTIVE EFFECTS OF PROPOLIS AND FLAVONOIDS WITH COMET ASSAY

(OP-7) T. Čačev, S. Kapitanović 93
EKSPRESIJA INTERLEUKINA 10 U SPORADIČNOM KARCINOMU DEBELOG CRIJEVA
INTERLEUKIN 10 EXPRESSION IN SPORADIC COLON CANCER

(OP-8) S. Dabelić, J. Dumić 93
PROMJENE EKSPRESIJE GALEKTINA-3 U MONOCITNIM STANICAMA IZLOŽENIH DJELOVANJU NESTEROIDNIH PROTUUPALNIH LIJEKOVA
MODULATION OF GALECTIN-3 EXPRESSION IN MONOCYTE-LIKE CELLS BY NON-STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDs)

Posterska priopćenja
Posters

(P-12) M. Ćurkovic Perica, M. Šeruga Musić 95
UČINAK INDOL-3-MASLAČNE KISELINE I ß-AMINOMASLAČNE KISELINE NA FITOPLAZME U ZARAŽENIM IZDANCIMA VRSTE *Catharantus reoseus* (L.) G. DON U KULTURI TKIVA *in vitro*
INFLUENCE OF INDOLE-3-BUTYRIC ACID AND ß-AMINOBUTYRIC ACID ON PHYTOPLASMAS IN INFECTED *Catharantus reoseus* (L.) G. DON SHOOTS GROWN *in vitro*

(P-13) J. Dovhanj, K. Kljaić, K. Marjanović, A. Včev 96
OKSIDATIVNI STRES U GASTRIČNOJ MUKOZI
OXIDATIVE STRESS IN GASTRIC MUCOSA

(P-14) V. Dunkić, N. Bezić, N. Ljubešić 98
RAZVOJNE FAZE ŽLJEZDANIH STRUKTURA RODA SATUREJA
STAGES OF DEVELOPMENT OF *SATUREJA* GENUS GLANDULAR STRUCTURE

(P-15) A. Horvat Knežević, V. Benković, N. Kopjar, S. Ramić, D. Lisičić, N. Oršolić, I. Bašić 99
ZAŠTITNI UČINAK PROPOLISA I FLAVONOIDA U SPREČAVANJU KROMOSOMSKIH OŠTEĆENJA UZROKOVANIH ZRAČENJEM
PROTECTIVE EFFECT OF PROPOLIS AND FLAVONOIDS ON RADITION-INDUCED CHROMOSOMAL DAMAGE

(P-16) L. Kalinić, A. Ruso, V. Vojvoda, B. Nagy 101
POVEZANOST EKSPRESIJE FADD PROTEINA I APOPTOZE POTAKNUTE UV SVJETLOM
CONNECTION OF FADD EXPRESSION AND UV-LIGHT INDUCED APOPTOSIS

(P-17) M. Popović, B. Pivčević, T. Smital 102
KARAKTERIZACIJA NIH 3T3 MIŠJIH FIBROBLASTA I HL60 HUMANIH STANICA TRANSFECIRANIH HUMANIM MDR1 I MRP1 TRANSPORTNIM PROTEINIMA
CHARACTERISATION OF NIH 3T3 MOUSE FIBROBLASTS AND HL60 HUMAN CELLS TRANSFECTED WITH HUMAN MDR1 AND MRP1 TRANSPORT PROTEINS

(P-18) K. Vajn, B. Viljetić, G. Lauc, M. Heffer-Lauc 104
DISTRIBUCIJA MIJELINSKIH MOLEKULA POD UVJETIMA IZOLACIJE RAFTOVA: UČINAK RAZLIČITIH DETERGENATA
DISTRIBUTION OF MYELIN MOLECULES UNDER CONDITIONS OF RAFT ISOLATION: EFFECT OF DIFFERENT DETERGENTS

(P-19) A. Vojta, E. Schleiff..... 105
TRANSLOKATOR PROTEINA NA VANJSKOJ MEMBRANI KLOROPLASTA (TOC)
PROTEIN TRANSLOCON ON THE OUTER ENVELOPE OF CHLOROPLASTS (TOC)

(P-20) L.Vojta, B. Bölter, J. Soll 107
KARAKTERIZACIJA IMPORTA PROTEINA IZ MEĐUMEMBRANSKOG PROSTORA KLOROPLASTA
IMPORT CHARACTERIZATION OF A CHLOROPLASTIC INTERMEMBRANE SPACE PROTEIN

GENOMIKA, FARMAKOGENETIKA, PROTEOMIKA, BIOINFORMATIKA I MOLEKULARNA DIJAGNOSTIKA
BIOLOGIA MOLECULARIS SENSU STRICTO
GENOMICS, PHARMACOGENETICS, PROTEOMICS, BIOINFORMATICS AND MOLECULAR DIAGNOSTICS

Kratka usmena priopćenja
Oral Presentations

(OP-9) P. Korać, M. Gilming Vintar, A. H. Banham, R. Ventura, I. Kardum Skelin, B. Jakšić, M. Dominis..... 112
EKSPRESIJA FOXP1 U B-KRONIČNOJ LIMFOCITNOJ LEUKEMIJI
FOXP1 EXPRESSION IN B-CELL CHRONIC LYMPHOCYTIC LEUKEMIA

Posterska priopćenja
Posters

(P-21) M. Jokić, S. Kapitanović..... 114
POLIMORFIZMI GENA ZA TIMIDILAT SINTETAZU U FARMAKOGENETICI 5’ FLUOROURACILA
TS POLYMORPHISMS IN 5’ FLUOROURACIL (5-FU) PHARMACOGENETICS

(P-22) M.M. Dabić, K. Meljanac, A. Bonevski S. Seiwerth 115
DETEKCIJA TRANSLOKACIJE t(11;22) KOD PACIJENATA SA EWING-OVIM SARKOMOM
DETECTION OF t(11;22) TRANSLOCATION IN EWING SARCOMA

(P-23) S. Šupraha, J. Dumić 117
ANALIZA MUTACIJA U ALG6 GENU PCR-SSCP METODOM
THE ANALYSIS OF THE MUTATIONS IN ALG6 GENE BY PCR-SSCP METHOD

VIROLOGIJA, MIKROBIOLOGIJA I MIKOLOGIJA
BIOLOGIA VIRORUM ET MICROBORUM, BIOLOGIA FUNGORUM
VIROLOGY, MICROBIOLOGY AND MYCOLOGY

Uvodna tematska predavanja
Introductory Lectures

(IL-4) M. Šeruga Musić, M. Novokmet, S. Botti, D. Škorić, A. Bertaccini 120
FITOPLAZME IZ JABLANA – NOVA VRSTA ILI MOLEKULARNA VARIJABILNOST UNUTAR VRSTE '*CANDIDATUS* PHYTOPLASMA ASTERIS'?
PHYTOPLASMAS INFECTING CROATIAN POPLAR - A NOVEL TAXON OR MOLECULAR VARIABILITY WITHIN '*CANDIDATUS* PHYTOPLASMA ASTERIS' SPECIES?

(IL-5) S. Sladoljev, B.Filipič, S.Toth 121
BIOLOGICAL ASSAYS OF INTERFERONS

Kratka usmena priopćenja
Oral Presentations

(OP-10) S. Černi, D. Škorić, M. Krajačić, G. Nolasco 123
PRISUTNOST VISOKOPATOGENIH SOJEVA VIRUSA TRISTEZA U HRVATSKOJ
OCCURRENCE OF SEVERE CITRUS TRISTEZA VIRUS STRAINS IN CROATIA

(OP-11) B. Filipič , S. Tóth , S. Sladoljev, S. Koren 124
AMINO ACIDS MODULATE THE BIOLOGICAL ACTIVITIES OF HuIFN-á IN DIFFERENT WAYS

(OP-12) S. Likić, G. Rusak, M. Krajačić 125
ODVAJANJE VIRUSNE SATELITNE dsRNA PRIMJENOM HPLC
SEPARATION OF PLANT VIRAL SATELLITE dsRNA USING HPLC

Posterska priopćenja
Posters

(P-24) B. Blažeković, S. Pepeljnjak, G. Stanić, S. Vladimir-Knežević 128

ODREĐIVANJE ANTIFUNGALNE AKTIVNOSTI ETANOLNIH EKSTRAKATA VRSTE *Helichrysum italicum* (ROTH) G. DON
DETERMINATION OF ANTIFUNGAL ACTIVITIES OF ETHANOLIC EXTRACTS FROM *Helichrysum italicum* (ROTH) G. DON

(P-25) I. Kosalec, J. Serkedjieva, N. Oršolić, M. Bakmaz, S. Pepeljnjak 129
ANTIVIRUSNI UČINAK I SADRŽAJ FLAVONOIDA U PROPOLISU IZ HRVATSKE I BRAZILA
ANTIVIRAL ACTIVITY AND FLAVONOID CONTENT OF PROPOLIS FROM CROATIA AND BRAZIL

(P-26) D. Poljuha, B. Sladonja, M. Bubola, Đ. Peršurić 131
ZDRAVSTVENO STANJE AUTOHTONIH KULTIVARA VINOVE LOZE U ISTRI
SANITARY STATUS OF AUTOCHTHONOUS GRAPEVINE VARIETIES IN ISTRIA

(P-27) I. Vardić, D. Kapetanović, B. Kurtović, D. Valić, Z. Teskeredžić, E. Teskeredžić 132
MOLEKULARNA DETEKCIJA I KARAKTERIZACIJA HRVATSKOG IZOLATA VIRUSA ZARAZNE NEKROZE GUŠTERAČE IZ MLAĐI UZGOJENE KALIFORNIJSKE PASTRVE
MOLECULAR DETECTION AND CHARACTERIZATION OF CROATIAN INFECTIOUS PANCREATIC NECROSIS VIRUS ISOLATE FROM REARED RAINBOW TROUT FRY

(P-28) I. Zurak 134
IZOLACIJA SALMONELLA VRSTA UPOTREBOM MODIFICIRANOG SELENIT BUJONA
ISOLATING SALMONELLA SPECIES WITH MODIFYING SELENITE BROTH

(P-29) P. Tashkoski, B. Gveroska, M. Dimitrieski, G. Miceska 135
RESISTANCE OF SOME ORIENTAL TOBACCOS TO TOBACCOMOSAIC VIRUS (TMV)

(P-30) I. Kungulovski , Dz. Kungulovski , N. Atanasova-Pancevska, M. Milosevski, J. Bossert 136
USE OF DIFFUSER “DALMACIJA+40%” FOR NITRIFICATION OF SYNTHETIC WASTEWATER

(P-31) N. Atanasova-Pancevska, Dz. Kungulovski 137
CELLULOLYTIC ENZYMES OF RUMEN ANAEROBIC FUNGUS *Neocallimastix frontalis* STRAIN J3

(P-32) B. Gveroska, P. Taskoski, P. Jovancev 138
THE EFFECT OF NUTRIENT MEDIUM UPON THE GROWTH OF *Alternaria alternata* IN TOBACCO

(P-33) T. Milicevic, D. Ivic, B. Cvjetkovic 138
ZASTUPLJENOST REZISTENTNIH FENOTIPOVA NA FUNGICIDE U POPULACIJAMA FITOPATOGENE GLJIVE *Botrytis cinerea* NA VINOVOJ LOZI I JAGODAMA
PRESENCE OF RESISTANT PHENOTYPES TO FUNGICIDES IN POPULATIONS OF PLANT PATHOGENIC FUNGUS *Botrytis cinerea* ON GRAPEVINE AND STRAWBERRY

(P-34) I .Zurak 140
SABOURAUD MUCIN MIKOLOŠKI AGAR
SABOURAUD MUCIN MYCOLOGY MEDIUM

BILJNA BIOLOGIJA
BIOLOGIA PLANTARUM
PLANT BIOLOGY

Uvodna tematska predavanja
Introductory Lectures

(IL-6) B. Mitić, I. Dobrović, I. Boršić, M. Milović, S. Bogdanović, P. Cigić, I. Rešetnik, T. Nikolić 144
PRIJEDLOG HRVATSKOG NACIONALNOG STANDARDA I KRITERIJA ZA TRETIRANJE AUTOHTONE I ALOHTONE FLORE
PROPOSAL FOR CROATIAN NATIONAL STANDARD AND CRITERIA FOR AUTOCHTHONOUS AND ALOCHTHONOUS FLORA TREATMENT

Kratka usmena priopćenja
Oral Presentations

(OP-13) I. Dobrović, I. Boršić, M. Milović, S. Bogdanović, P. Cigić, I. Rešetnik, T. Nikolić, B. Mitić 146
INVAZIVNE VRSTE U HRVATSKOJ – PRELIMINARNI IZVJEŠTAJ
INVASIVE ALIEN SPECIES IN CROATIA – PRELIMINARY REPORT

(OP-14) J. Kamenjarin, I. Trinajstić, I. Petričević 147
VEGETACIJA STIJENA KANJONA RIJEKE CETINE KOD OMIŠA (HRVATSKA)
ROCK VEGETATION OF CETINA RIVER CANYON NEAR OMIŠ (CROATIA)

(OP-15) I. Vitasović Kosić, M. Britvec, I. Ljubičić 148

ENDEMIČNE BILJKE NA TRAVNJACIMA OBITELJSKIH GOSPODARSTAVA U ISTRI
ENDEMIC GRASSLAND PLANTS ON THE FAMILY FARMS IN ISTRIA

(OP-16) K. Hazler Pilepić, M. Balić, F. Orač, M. Morović, M. Šantor, V. Vejnović..... 150
PCR-RFLP ANALIZA cpDNA RODA *Hypericum* (Clusiaceae)
PCR-RFLP ANALYSIS OF cpDNA IN THE GENUS *Hypericum* (Clusiaceae)

(OP-17) M. Mitreski, J. Aleksoski, A. Korubin-Aleksoska 151
OBTAINING A RESISTANCE TO BLACK SHANK (*Phytophthora parasitica var.nicotianae*)

(OP-18) M. Gligora, K. Kralj, A. Plenković-Moraj, I. Grigorszky, K. T. Kiss, E. Acs, G. Borics, J. Makk 151
TEKATNI DINOFLAGELATI SLATKOVODNIH EKOSUSTAVA HRVATSKE
ARMOURED DINOFLAGELLATES IN CROATIAN FRESHWATER ECOSYSTEMS

Posterska priočenja
Posters

(P-35) D. Ballian, F. Bogunić, M. Idžojtić, R. Brus, T. Mikić 154
VARIJABILNOST OSKORUŠE (*Sorbus domestica* L.) IZ BALKANSKOG DIJELA AREALA, NA OSNOVI MORFOMETRIJSKE ANALIZE LIŠĆA
VARIABILITY OF SERVICE TREE (*Sorbus domestica* L.) FROM THE BALKAN AREA BASED ON THE MORPHOMETHRIC LEAF ANALYSIS

(P-36) D. Dujmović Purgar, T. Kunštek – Kučanda, J. Babić Čegelj 155
LIJEČENJE BILJEM U HOMEOPATIJI
THE PLANTS TREATMENT IN HOMEOPATHY

(P-37) D. Dujmović Purgar, N. Hulina..... 157
KOROVNA FLORA VRTOVA PLEŠIVIČKOG PRIGORJA (SZ Hrvatska)
THE GARDENS WEED FLORA OF PLEŠIVICA HILLS (NW Croatia)

(P-38) N. Hristovski, Dz.Tomovska, E. Jovanova-Hristovska..... 158
SOME TREES AND SHRUBS FROM BITOLA AND NEIGHBOUR WHICH IS NEED TO BE PROTECTED

(P-39) S.D. Jelaska, T. Nikolić, V. Kušan 159
UTJECAJ KLIMATSKIH PROMJENA NA DINARSKE BUKOVO-JELOVE ŠUME
IMPACT OF CLIMATE CHANGE ON DINARIC SILVER FIR – BEECH FORESTS

(P-40) A. Korubin-Aleksoska 161
HYBRIDIZATION BETWEEN DIFFERENT TYPES OF TOBACCO

(P-41) S. Marić, M. Miloš 162
UTJECAJ NADMOSRKE VISINE I RAZVOJNOG STADIJA NA HLAPLJIVE KOMPONENTE KADULJE (*Salvia officinalis* L.) S PROSTORA HERCEGOVINE
THE IMPACT OF THE LOCALITY ALTITUDES AND STAGES OF DEVELOPMENT ON THE VOLATILE CONSTITUENTS OF *Salvia officinalis* L. FROM HERZEGOVINA

(P-42) T. Miceski 163
TOBACCO PRODUCTION IN R. MACEDONIA AS A RESULT OF THE EFFECT OF NATURAL AND SOCIO-ECONOMIC FACTORS

(P-43) A. Mijatović 164
URBANA FLORA U MOSTARU
URBAN FLORA OF MOSTAR, BOSNIA AND HERZEGOVINA

(P-44) V. Mitic, S. Patceva 164
PHYTOPLANKTON AS BIOLOGICAL PARAMETER OF THE WATER QUALITY OF LAKE OHRID

(P-45) G. Nikšić, I. Pongrac, S. Kovačić, Z. Liber 165
MOLEKULARNA FILOGENIJA DINARSKIH ZVONČIĆA (CAMPANULACEAE)
MOLECULAR PHYLOGENY OF DINARIC CAMPANULAS (CAMPANULACEAE)

(P-46) S. Patceva, V. Mitic 166
COMPARATIVE ANALYSIS OF THE PHYTOPLANKTON COMPOSITION IN LAKES OHRID AND PRESPA

(P-47) M. Randić, Ž. Modrić 167
FLORA I VEGETACIJA GROMAČA, SUHOZIDA I ŠKRAPARA RIJEČKOGA PODRUČJA
FLORA AND VEGETATION OF KARST STONE HEAPS, DRY STONE WALLS AND KARREN FIELDS OF THE RIJEKA REGION

(P-48) S. Stojanoska, L. Stojanoski 168
QUANTITATIVE CHARACTERISTICS OF TOBACCO PRODUCTION IN THE REPUBLIC OF MACEDONIA

(P-49) M. Vrbek, S. Buzjak 169
RUDERALNA I KOROVNA FLORA ŽUMBERKA
RUDERAL AND WEED FLORA OF ŽUMBERAK

BILJNA BIOLOGIJA
3.SIMPOZIJ HRVATSKOG DRUŠTVA ZA BILJNU FIZIOLOGIJU

PLANT BIOLOGY
3rd SYMPOSIUM OF THE CROATIAN SOCIETY OF PLANT PHYSIOLOGY

Uvodna tematska predavanja
Introductory Lectures

(IL-7) H. Fulgosi, S. Jurić, H. Lepeduš, K. Hazler-Pilepić, T. Bionda 172
REDOKS REGULACIJA FOTOSINTEZE – ZA Z-SHEMU POTREBAN JE TROL
REDOX REGULATION OF PHOTOSYNTHESIS – Z-SCHEME REQUIRES TROL

(IL-8) D. Leljak-Levanić, T. Dresselhaus, I. Šumanovac, S. Sprunck..... 173
FUNKCIONALNA ANALIZA PROTEINA S DOMENAMA MATH/BTB EKSPRIMIRANIH U JAJNOJ STANICI I RANOJ EMBRIOGENEZI PŠENICE
FUNCTIONAL ANALYSIS OF MATH/BTB DOMAIN PROTEINS SPECIFICALLY EXPRESSED IN EGG CELLS AND AT THE ONSET OF WHEAT (*Triticum aestivum* L.) EMBRYOGENESIS

(IL-9) B. Salopek-Sondi, A. Tomašić, V. Magnus..... 175
AUKSIN-AMIDOHIDROLAZA IZ PŠENICE – REGULATOR AKTIVNOSTI AUKSINA U BILJAKA
WHEAT AUXIN-AMIDOHYDROLASE: A REGULATOR OF AUXIN ACTIVITY IN PLANTS

Kratka usmena priopćenja
Oral Presentations

(OP-19) N. Bauer, H. Fulgosi, S. Jelaska..... 177
POJAČANA EKSPRESIJA FENILALANIN-AMONIJ-LIJAZE I SINTEZA RUŽMARINSKE KISELINE U TRANSGENOM KORIJENJU UKRASNE KOPRIVE *Coleus blumei* Benth.
PHENYLALANINE AMMONIA-LYASE OVEREXPRESION AND ROSMARINIC ACID PRODUCTION IN TRANSGENIC ROOTS OF *Coleus blumei* Benth.

(OP-20) S. Bosak, M. Grgić, B.Viljetić, H. Fulgosi..... 178
ULOGA RODANAZE CIJANOBAKTERIJE *Synechocystis* sp. PCC 6803 U UVJETIMA NEDOSTATKA SUMPORA
THE FUNCTION OF A RHODANESE UNDER SULFUR LIMITATION CONDITIONS IN CYANOBACTERIUM *Synechocystis* sp. PCC 6803

(OP-21) D. Car, J. Gospočić, I. Križaić, M. Tkalec, Ž. Vidaković-Cifrek,

B. Pevalek-Kozlina..... 180
OKSIDACIJSKI STRES U LISTOVIMA BILJKE *Kalanchoe daigremontiana* NAKON INFEKCIJE BAKTERIJOM *Agrobacterium tumefaciens*
OXIDATIVE STRESS IN *Kalanchoe daigremontiana* CAUSED BY *Agrobacterium tumefaciens*

(OP-22) V. Magnus, B. Ayele, S. Mihaljević, D.M. Reinecke, J.A. Ozga, B. Salopek-Sondi..... 182
BIOAKTIVNI GIBERELINI U PLODNICI I PLODU BIJELOG KUKURIJEKA (*Helleborus niger* L.)
BIOACTIVE GIBBERELLINS IN CARPELS AND FRUIT OF THE CHRISTMAS ROSE (*Helleborus niger* L.)

(OP-23) G. Miceska, M. Dimitrieski, P. Taskoski, B. Gveroska..... 183
POSSIBILITIES FOR APPLICATION OF NEW METHODS IN CREATION OF ORIENTAL TOBACCO VARIETIES RESISTANT TO *Phytophthora parasitica var.nicotianae* IN CONDITIONS *in vitro*

(OP-24) S. Mihaljević, R. Garić, G. Horvat, D. Leljak Levanić, S. Jelaska 184
RAST, POTROŠNJA GLUKOZE I EKSKRECIJA PROTEINA U TRI EMBRIOGENE LINJE BUNDEVE (*Cucurbita pepo* L.)
GROWTH PARAMETERS, GLUCOSE UPTAKE AND PROTEIN EXCRETION OF THREE EMBRYOGENIC LINES OF PUMPKIN (*Cucurbita pepo* L.)

(OP-25) D. Pavoković, D. Hagege, M. Krsnik-Rasol 185
„SUGAR SENSING“ U STANIČNIM LINIJAMA ŠEĆERNE REPE (Beta vulgaris L.)
SUGAR SENSING IN SUGAR BEET CELL LINES (*Beta vulgaris* L.)

(OP-26) P. Peharec, B. Balen, M. Krsnik-Rasol 187
RAZVOJNO SPECIFIČNI SASTAV PROTEINA I GLIKOPROTEINA U KULTURI TKIVA HRENA *Armoracia lapathifolia* Gilib.
DEVELOPMENTALLY SPECIFIC PROTEIN AND GLYCOPROTEIN PATTERNS IN HORSE-RADISH *Armoracia lapathifolia* Gilib. TISSUE CULTURE

(OP-27) S. Radić, B. Pevalek-Kozlina..... 188
UČINAK SUŠE I POVIŠENOG SALINITETA NA DUBROVAČKU ZEČINU (*Centaures ragusina* L.) U UVJETIMA *in vitro*
RESPONSE OF *in vitro* CULTURED ENDEMIC PLANT SPECIES *Centaurea ragusina* L. TO DROUGHT AND SALINITY

Posterska priopćenja
Posters

(P-50) T. Prebeg, N. Ljubešić, M. Wrischer 191
UČINAK TAME NA DIFERENCIJACIJU KROMOPLASTA U LATICAMA KRASTAVCA
THE EFFECT OF DARKNESS ON CHROMOPLAST DIFFERENTIATION IN CUCUMBER PETALS

(P-51) M. Skendrović , H. Lepeduš, N. Pavičić, V. Cesar 192
AKTIVNOST PEROKSIDAZA U ZDRAVIM I OŠTEĆENIM PLODOVIMA MANDARINE UNSHIU NAKON DVA RAZLIČITA NAČINA SKLADIŠTENJA – SKLADIŠTENJE NA STALNOJ NISKOJ TEMPERATURI I SKLADIŠTENJE NA NISKOJ TEMPERATURI UZ CIKLIČKO PREKIDANJE SKLADIŠTENJEM NA SOBNOJ TEMPERATURI
PEROXIDASE ACTIVITY IN THE PEEL OF HEALTHY AND DAMAGED FRUITS OF UNSHIU MANDARIN AFTER THE TWO DIFFERENT APPROACHES OF POSTHARVEST STORAGE –CONTINUOUS CHILLING AND INTERMITTENT WARMING

(P-52) M. Šoškić, V. Magnus 194
VEZANJE DERIVATA INDOL-3-OCTENE KISELINE NA SERUMSKI ALBUMIN
BINDING OF INDOLE-3-ACETIC ACID DERIVATIVES TO SERUM ALBUMIN

(P-53) A. Tomašić, M. Šoškić, V. Magnus 195
VEZANJE AMINOKISELINSKIH KONJUGATA AUKSINA NA SERUMSKI ALBUMIN
BINDING OF AUXIN-AMINO ACID CONJUGATES TO SERUM ALBUMIN

BIOLOGIJA ŽIVOTINJA
BIOLOGIA ANIMALIUM
ANIMAL BIOLOGY

Ekologija životinja, fauna-taksonomija i sistematika, zoogeografija
Ecology, Fauna-Taxonomy and Systematics, Zoogeography

Kratka usmena priopćenja
Oral Presentations

(OP-28) M. Harcet, H. Bilandžija, J. Bedek, V. Gamulin 200
HRVATSKA ENDEMIČNA STIGOBIONTSKA SLATKOVODNA SPUŽVICA NE PRIPADA RODU *Eunapius*
CROATIAN ENDEMIC STYGOBITIC FRESHWATER SPONGE DOES NOT BELONG TO THE GENUS *Eunapius*

(OP-29) A. Klobučar, N. Benić, D. Krajcar , V. John, E. Merdić, I. Boca, N.

Landeka, T. Žitko, J. Čulig 201
ŠIRENJE AZIJSKOG TIGRASTOG KOMARCA, *Stegomyia albopicta* (*Aedes albopictus*) U HRVATSKOJ
SPREADING OF THE ASIAN TIGER MOSQUITO, *Stegomyia albopicta* (*Aedes albopictus*) IN CROATIA: AN OVERVIEW

(OP-30) I. Maguire, G. Klobučar, J. Lajtner, A. Lucić, A. Štambuk, R. Erben..... 203
MORFOMETRIJSKE ZNAČAJKE I RAST U VRSTE *Austropotamobius torrentium* SCHRANK
MORPHOLOGICAL CHARACTERISTICS AND GROWTH OF *Austropotamobius torrentium* SCHRANK

(OP-31) I. Pavlinić, K. Čivić, R. Topić 204
MONITORING ZIMSKIH KOLONIJA ŠIŠMIŠA
MONITORING OF THE BAT HIBERNATION SITES

(OP-32) A. Popijač, I. Sivec..... 205
RAZNOLIKOST OBALČARA (INSECTA: PLECOPTERA) NA PODRUČJU NP PLITVIČKA JEZERA TE RIJEKA CETINE, KRKE, ZRMANJE, KRUPE I UNE
DIVERSITY OF STONEFLIES (INSECTA: PLECOPTERA) IN THE AREA OF NP PLITVIČKA JEZERA AND RIVERS CETINA, KRKA, ZRMANJA, KRUPA AND UNA

(OP-33) R. Ozimec..... 207
FAUNA I EKOLOGIJA LAŽIŠTIPAVACA (Pseudoscorpiones) U HRVATSKOJ
FAUNA AND ECOLOGY OF PSEUDOSCORPIONS (Pseudoscorpiones) IN CROATIA

(OP-34) R. Slapnik..... 208
SUBTERRANEAN AND SPRINGS SNAILS (MOLLUSCA: GASTROPODA) FROM GORJANCI AND ŽUMBERAČKA GORA

Posterska priopćenja
Posters

(P-54) I. Bogut, J. Vidaković, G. Palijan, D. Čerba 210
MEIOFAUNA U ZAJEDNICAMA RAZLIČITIH TIPOVA MAKROFITA U SPOROTEKUĆEM KANALU
MEIOFAUNA IN PURE STANDS OF VARIOUS MACROPHYTE TYPES IN A SLOW-FLOWING CHANNEL

(P-55) I. Bogut, J. Vidaković, D. Čerba, G. Palijan 211
BROJNOST I RAZNOLIKOST FITOFILNE MAKROFAUNE U KANALU ČONAKUT, PARK PRIRODE KOPAČKI RIT, HRVATSKA

PHYTOPHILOUS MACROFAUNA ABUNDANCE AND DIVERSITY IN THE ČONAKUT CHANNEL, KOPAČKI RIT NATURE PARK, CROATIA

(P-56) P. Čolig, J. Kusak, Đ. Huber 213
AKTIVNOST VUKOVA BILJEŽENA GPS OGRLICOM I TUMAČENA PROMATRANJEM AKTIVNOSTI PASA S GPS OGRLICOM
WOLF ACTIVITY MONITORED BY THE USE OF GPS COLLAR AND INTERPRETED BY MONITORING OF DOGS WITH GPS COLLARS

(P-57) R. Ćuk, S. Kovačević, M. Vrsalović, I. Vučković..... 215
KLASIFIKACIJA POVRŠINSKIH VODA PREMA BIOLOŠKIM POKAZATELJIMA
CLASSIFICATION OF SURFACE WATERS ACCORDING TO BIOLOGICAL INDICATORS

(P-58) M. Cukrov, R. Ozimec, J. Bedek, B. Jalžić..... 215
BIOSPELEOLOŠKA ISTRAŽIVANJA ĐUROVIĆA ŠPILJE U KONAVLIMA
BIOSPELEOLOGICAL INVESTIGATION OF ĐUROVIĆA CAVE IN KONAVLE

(P-59) T. Gomerčić, Ž. Gottstein, I. Sadarić, J. Sadarić, M. Đuras Gomerčić, A. Galov i Đ. Huber 217
KONTROLNA REGIJA MITOHONDRIJSKE DNA EUROAZIJSKOG RISA (*Lynx lynx*) IZ HRVATSKE
CONTROL REGION OF THE MITOCHONDRIAL DNA OF EURASIAN LYNX (*Lynx lynx)* FROM CROATIA

(P-60) N. Hristovski, S. Smilkov, Dz. Tomovska, E. Popovich, D. Kostich 219
HELMINTOFAUNA OF *Rana kurtsmulleri* GAUDA, 1940 SYN. *Rana balcanica* SHNEIDER ET SINISH, 1992 (ANURA RANIDAE) FROM DOJRAN LAKE, MACEDONIA AND GREECE

(P-61) N. Hristovski, Dz. Tomovska, S.Stojanovski..... 220
HELMINTH FAUNA OF Bufo viridis (ANURA BUFONIDAE) FROM ISLAND OF HVAR, CROATIA

(P-62) M. Ivković, B. Horvat 220
VODENE MUHE PLESAČICE (DIPTERA, EMPIDIDAE: CLINOCERINAE; HEMERODROMIINAE) RIJEKE CETINE
AQUATIC DANCE FLIES (DIPTERA, EMPIDIDAE: CLINOCERINAE; HEMERODROMIINAE) OF THE RIVER CETINA

(P-63) I. Kocijan, E. Prukner-Radovčić, R. Beck, A. Marinculić, G. Sušić 221
MIKROFLORA I PARAZITI PROBAVNOG SUSTAVA BJELOGLAVOG

SUPA (*Gyps fulvus*; Hablizl, 1783.) U HRVATSKOJ
MICROFLORA AND PARASITES OF THE DIGESTIVE TRACT OF CROATIAN GRIFFON VULTURES (*Gyps fulvus*; Hablizl, 1783.)
(P-64) B. Kokan, M. Definis-Gojanović, D. Sutlović, B. Milošević 223
FORENZNIČNA ENTOMOLOGIJA U SPLITU I HRVATSKOJ
FORENSIC ENTOMOLOGY IN SPLIT AND CROATIA

(P-65) J. Lajtner , A. Lucić, I. Maguire, I. Krulik, R. Erben..... 224
HISTOLOŠKA ANALIZA VRSTE *Dreissena polymorpha* (MOLLUSCA, BIVALVIA) ZARAŽENE METILJIMA
HISTOLOGICAL ANALYSIS OF ZEBRA MUSSEL, *Dreissena polymorpha* (MOLLUSCA, BIVALVIA) INFECTED WITH TREMATODES

(P-66) M. Ljuština, B. Vitas 226
Fauna VRETENACA (Odonata) Parka prirode „Žumberak i Samoborsko gorje„
Fauna OF Odonata IN NATURE Park «Žumberak - Samoborsko gorje»

(P-67) V. Micetić, P. Durbešić, M. Kučinić..... 228
FAUNA DANJH LEPTIRA (INSECTA:LEPIDOPTERA:RHOPALOCERA) PARKA PRIRODE LONJSKO POLJE
FAUNA OF BUTTERFLIES (INSECTA:LEPIDOPTERA:RHOPALOCERA) OF NATURE PARK LONJSKO POLJE

(P-68) N. Mihoković, M. Ljuština, B. Vitas, V. Zlatar, N. Horvat, A. Slavikovski, A. Melnjak, P. Falamić, K. Kovačec, L. Malović, M. Jelić, D. Dubravčić, M. Franković..... 229
DOPRINOS STUDENTSKIH ISTRAŽIVAČKIH KAMPOVA UDRUGE STUDENATA BIOLOGIJE “BIUS” POZNAVANJU I KARTIRANJU FAUNE VRETENACA (INSECTA: ODONATA) HRVATSKE.
CONTRIBUTION OF STUDENTS’ RESEARCH CAMPS ORGANIZED BY THE BIOLOGY STUDENTS’ ASSOCIATION “BIUS” TO THE KNOWLEDGE AND MAPPING OF CROATIAN DRAGONFLIES (INSECTA: ODONATA).

(P-69) L. Pađen, M. Maurić, T. Gomerčić, Ž. Gottstein, M. Đuras Gomerčić, A. Galov, J. Kusak, Đ. Huber..... 230
GENETSKA RAZLIKA VUKA I PSA USPOREDBOM KONTROLNIH REGIJA MITOHONDRIJSKE DNA
GENETIC DIFFERENCE BETWEEN WOLF AND DOG COMPARING THE CONTROL REGION OF THE MITOCHONDRIAL DNA

(P-70) D. Prelik, A. Cvetkovska - Gjeorgievska, M. Kostadinovski, A. Stojanov, M. Milev, M. Gjorgjievski 232
SPATIAL VARIATION OF TERRESTRIAL MACROFAUNA ALONG AN URBAN-RURAL GRADIENT IN THE CITY OF SKOPJE (PRELIMINARY RESULTS)

(P-71) M. Romanović 233
SEZONSKA DINAMIKA I RAZNOLIKOST STANIŠTA MEDICINSKI VAŽNIH KOMARACA U DALMACIJI
SEASONAL DYNAMICS AND BREEDING HABITAT DIVERSITY OF MEDICALLY IMPORTANT MOSQUITOES IN THE COASTAL AREA OF CROATIA

(P-72) L. Šerić Jelaska , P. Durbešić, M. Blanuša, G. Gregorović 235
KALCIJ U TLU, LISTINCU I TRČCIMA U ŠUMSKOM EKOSUSTAVU
CALCIUM CONCENTRATION IN GROUND BEETLES, SOIL AND LEAF LITTER OF A FOREST ECOSYSTEM

(P-73) S. Smiljkov, B. Budzakoska-Gjoreska, J. Shapkarev and S. Trajanovski 236
DOMINANT SPECIES OF THE GASTROPOD FAUNA FROM THE LITTORAL REGION IN LAKE OHRID OF R.MACEDONIA

(P-74) S. Stanić, M. Kučinić, P. Durbešić 236
RAZNOLIKOST I SEZONSKA DINAMIKA FAUNE TULARA (Trichoptera, Insecta) SREDIŠNJEG DIJELA HERCEGOVINE
DIVERSITY AND SEASONAL DYNAMICS OF CADDISFLIES (Trichoptera, Insecta) IN THE CENTRAL HERZEGOVINA

(P-75) M. Temunović, L. Šerić Jelaska, P. Durbešić 238
PRIVREMENE LOKVE KAO STANIŠTA VODENIH KORNJAŠA (COLEOPTERA) NA PODRUČJU PARKA PRIRODE LONJSKO POLJE
TEMPORARY PONDS AS HABITATS FOR AQUATIC BEETLES (COLEOPTERA) IN NATURE PARK LONJSKO POLJE

(P-76) K. Vlahović, M. Popović, R. Resanović 240
SOCIO-KULTURNO I ZDRAVSTVENO ZNAČENJE HRANJENJA GRADSKIH GOLUBOVA (*Columba livia* FORMA *domestica*) U GRADU ZAGREBU
SOCIO-CULTURAL AND HEALTH MEANING OF FERAL PIGEONS FEEDING (*Columba livia* FORMA *domestica*) IN THE CITY OF ZAGREB.

(P-77) T. Žitko, E. Merdić 241
Nalaz nove vrste komarca u fauni Hrvatske
Finding of a New Mosquito Species in Croatian Fauna

ANIMALNA FIZIOLOGIJA, IMUNOLOGIJA, HISTOLOGIJA, EMBRIOLOGIJA
ANIMAL PHYSIOLOGY, IMUNOLOGY, HISTOLOGY, EMBRYOLOGY

Uvodna tematska predavanja
Introductory Lectures

(IL-10) I. Valpotić, D. Kezić, H. Valpotić 243
MUKOZNA IMUNOST I IMUNOMODULACIJA U ENTERIČKIM INFEKCIJAMA SVINJA IZAZVANIM SOJEVIMA BAKTERIJE *E. coli*
MUCOSAL IMMUNITY AND IMMUNOMODULATION IN PORCINE ENTERIC INFECTIONS DUE TO *E. coli* STRAINS

(IL-11) N. Oršolić, D. Štajcar, L. Šver, I. Kosalec, M. Bakmaz, S. Terzić, I. Bašić 244
SELEKTIVNI UČINAK PROPOLISA I NJEGOVIH POLIFENOLNIH SASTAVNICA NA PRIMARNU KULTURU STANICA TUMORA MOKRAĆNOG MJEHURA I NORMALNIH EPITELNIH STANICA U LJUDI
THE SELECTIVE EFFECT OF PROPOLIS AND ITS POLYPHENOLIC COMPOUNDS ON PRIMARY CULTURE OF HUMAN URINARY BLADDER CANCER AND NORMAL EPITHELIAL CELLS

Kratka usmena priopćenja
Oral Presentations

(OP-35) A. Kovšca, F. Božić, N. Vijtiuk, G. Lacković, I. Valpotić 247
MODULACIJA SVINJSKIH ILEALNIH M STANICA ŽIVIM ORALNIM VAKCINAMA PROTIV KOLIDIJAREJE I KOLIENTEROTOKSEMIJE ODBIJENE PRASADI
MODULATION OF PORCINE ILEAL M CELLS WITH LIVE ORAL VACCINES AGAINST POSTWEANING COLIDIARRHEA AND COLIENTEROTOXEMIA

(OP-36) N. Vijtiuk, F. Božić, M. Popović, G. Lacković, I. Valpotić..... 248
DJELOVANJE Baypamun® N (BPNN) SA ŽIVIM ORALNIM CJEPIVOM PROTIV KOLIBACILOZE U ODBIJENE PRASADI
THE EFFECT OF Baypamun® N (BPNN) WITH LIVE ORAL VACCINE AGAINST POSTWEANING COLIBACILLOSIS IN PIGS

Posterska priopćenja
Posters

(P-78) D. Lisičić, Z. Tadić, D. Đikić, N. Oršolić, V. Benković, A. Horvat Knežević, I. Bašić..... 251
HEMATOLOŠKE I BIOKEMIJSKE ODREDNICE KRVI POSKOKA (*Vipera ammodytes*)
HEMATOLOGY AND PLASMA CHEMISTRY OF NOSE-HORNED VIPER (*Vipera ammodytes*)

(P-79) D. Lisičić, Z. Tadić, R. Coz-Rakovac, I. Strunjak-Perović, M. Hacmanjek, N. Topić Popović..... 252
PRELIMINARNE BIOKEMIJSKE ODREDNICE KRVI ŠARE POLJARICE (*Hierophis gemonensis*)

PRELIMINAR BLOOD PLASMA BIOCHEMISTRY OF CAPTIVE BALKAN WHIP SNAKE (*Hierophis gemonensis*)
(P-80) N. Oršolić, I. Bašić 253
IZRAVNI ANTITUMORSKI UČINAK PČELINJEG OTROVA U UVJETIMA *in vitro* I *in vivo*
DIRECT ANTITUMOR ACTIVITY OF HONEY BEE VENOM *in vitro* AND *in vivo*

(P-81) N. Oršolić, V. Benković, A. Horvat-Knežević, N. Kopjar, D. Lisičić, D. Đikić, I. Bašić..... 255
PROPOLIS I NJEGOVE POLIFENOLNE SASTAVNICE KAO RADIOPROTEKTIVNE TVARI U MIŠA
PROPOLIS AND ITS POLYPHENOLIC COMPOUNDS AS A RADIOPROTECTIVE AGENTS IN MICE

(P-82) N. Oršolić, I. Bašić 257
ANTITUMORSKA AKTIVNOST MAKROFAGA AKTIVIRANIH VODENOM OTOPINOM PROPOLISA
TUMORICIDAL ACTIVITY OF MACROPHAGES BY WATER SOLUBLE DERIVATIVE OF PROPOLIS

(P-83) M. Puc, I. Humar, Ž. Duić, V. Kerhin 258
DJELOVANJE INTRAVENOZNE IMUNOGLOBULINSKE TERAPIJE NA FREKVENCIJU PREKURSORA POMOĆNIČKIH T LIMFOCITA (fTp) I RAZINU TNF-á KOD ŽENA S UČESTALIM SPONTANIM POBAČAJIMA
EFFECTS OF INTRAVENOUS IMMUNOGLOBULIN THERAPY ON THE PRECURSOR OF T HELPER FREQUENCIES (fTh) AND TNF-á LEVEL IN WOMEN WITH RECURRENT SPONTANEOUS ABORTIONS

BIOLOGIJA MORA
BIOLOGIA MARIS
MARINE BIOLOGY

Uvodna tematska predavanja
Introductory Lectures

(IL-12) I. Jardas..... 262
POGLEDI NA ENDEMIZAM U SREDOZEMNOJ I JADRANSKOJ IHTIOFAUNI
ASPECTS ON ENDEMISM IN THE MEDITERRANEAN AND ADRIATIC ICHTHYOFAUNA

Kratka usmena priopćenja
Oral Presentation

(OP-37) B. Antolić, A. Žuljević 264

BENTOSKE MORSKE ALGE REDA CERAMIALES (RHODOPHYTA) NA ISTOČNOJ OBALI JADRANA
BENTHIC MARINE ALGAE OF THE ORDER CERAMIALES (RHODOPHYTA) ON THE EASTERN ADRIATIC COAST

(OP-38) V. Bartulović, B. Glamuzina 265
NOVAČENJE MLAĐI CIPLA DUGAŠA, *Liza saliens* (RISSO, 1810) NA PODRUČJU UŠĆA NERETVE
RECRUITMENT OF LEAPING GREY MULLET, *Liza saliens* (RISSO, 1810) FRY IN THE ESTUARY OF NERETVA RIVER

(OP-39) H. Čižmek, M. Radolović, D. Petricioli, S. Dujmović, P. Kružić, T. Bakran-Petricioli 266
RASPROSTRANJENOST BENTOSKIH ZAJEDNICA DUŽ SVJETLOSNOG GRADIJENTA UZ UVALU BRBINJŠĆICA, DUGI OTOK
DISTRIBUTION OF BENTHIC COMMUNITIES ALONG THE LIGHT GRADIENT IN BRBINJŠĆICA COVE, DUGI OTOK

(OP-40) M. Legac 268
NOVI DOPRINOS ISTRAŽIVANJU MNOGOLJUŠTURAŠA (Polyplacophora), ŠKOLJKAŠA (Bivalvia) I KOPONOŽACA (Scaphopoda) OTOKA RABA
NEW CONTRIBUTION TO THE RESEARCH OF CHITONS (Polyplacophora), BIVALVE (Bivalvia) AND SCAPHODS (Scaphopoda) OF THE RAB ISLAND

(OP-41) T. Makovec, V. Onofri, A. Benović, D. Lučić..... 269
MOGUĆNOST PROCJENE RASPODJELE, BROJNOSTI I VERTIKALNOG KRETANJA POPULACIJE MEDUZA VIDEO TEHNIKOM
POSSIBILITIES OF EVALUATION OF DISTRIBUTION, ABUNDANCE AND VERTICAL MIGRATION OF JELLYFISH POPULATIONS BY VIDEO TECHNIQUE

(OP-42) B. Mustać, G. Sinovčić 270
NEKI ASPEKTI BIOLOGIJE SRDELE, *Sardina pilchardus* (WALB., 1792.), U ZADARSKOM PODRUČJU
SOME BIOLOGICAL ASPECTS OF SARDINE, *Sardina pilchardus* (WALB., 1792), IN THE MIDDLE ADRIATIC SEA

(OP-43) A. Žuljević, M. Despalatović, I. Cvitković, B. Antolić 271
ŠIRENJE INVAZIVNIH KAULERPI POMAŽE ŠIRENJU AUTOHTONIH ASKOGLOSNIH PUŽEVA
THE SPREAD OF INVASIVE CAULERPAS CONTRIBUTES TO SPREADING OF NATIVE ASCOGLOSSANS

(OP-44) V. Nikolić, A. Žuljević, M. Despalatović, B. Antolić..... 272

HRANJENJE HRIDINSKOG JEŽINCA *Paracentrotus lividus* INVAZIVNIM ALGAMA *Caulerpa taxifolia* i *Caulerpa racemosa* var. *cylindracea*
FEEDING OF THE SEA URCHIN *Paracentrotus lividus* WITH INVASIVE ALGAE *Caulerpa taxifolia* AND *Caulerpa racemosa* var. *cylindracea*

(OP-45) Lj. Šimunić, B. Antolić, M. Despalatović, A. Žuljević 274
REPRODUKTIVNE ZNAČAJKE ALGE *Dictyopteris polypodioides*
REPRODUCTIVE CHARACTERISTICS OF THE ALGA *Dictyopteris polypodioides*

(OP-46) A. Žuljević, B. Antolić, M. Despalatović 275
Dictyota dichotoma – KOLIKO JE VARIJETETA U JADRANSKOM MORU?
Dictyota dichotoma – HOW MANY VARIETIES ARE LIVING IN THE ADRIATIC SEA?

(OP-47) A. Jaklin 276
PRELIMINARNI PREGLED MAKROBENTOSA U OKOLICI NEREZINA (OTOK LOŠINJ, SJEVERNI JADRAN)
A MACROBENTHOS PRELIMINARY SURVEY IN THE VICINITY OF NEREZINE (LOŠINJ ISLAND, NORTHERN ADRIATIC)

(OP-48) B. Mikac 277
STRUKTURA I DINAMIKA FAUNE MNOGOČETINAŠA SEDIMENTNOG DNA SJEVERNOG JADRANA
STRUCTURE AND DYNAMICS OF THE NORTHERN ADRIATIC SOFT BOTTOM POLYCHAETE ASSEMBLAGES

(OP-49) V. Nerlović, A. Jaklin 279
PREGLED PRIDNENIH ZAJEDNICA U UVALI GAŽENICA (TRAJEKTNI TERMINAL ZADAR, SREDNJI JADRAN)
A SURVEY OF BENTHIC COMMUNITIES IN GAŽENICA BAY (ZADAR, MIDDLE ADRIATIC)

(OP-50) W. Zucht, M. Sidri, A. Jaklin, B. Hamer, F. Brümmer 280
BROJNOST I EKOLOŠKE ZNAČAJKE FAUNE SPUŽAVA LIMSKOG KANALA (SJEVERNI JADRAN, HRVATSKA)
ABUNDANCE AND ECOLOGICAL STRUCTURE OF SPONGES IN THE LIMSKI KANAL (NORTHERN ADRIATIC, CROATIA)

Posterska priopćenja
Posters

(P-84) N. Antolović, N. Glavić, D. Skaramuca, P. Tutman, B. Skaramuca 283
KONDICIONIRANJE MATIČNOG JATA I MRIJEST IVERKA *Platichthys flesus* (Linnaeus,1758)

CONDITION AND SPAWNING OF EUROPEAN FLOUNDER *Platichthys flesus* (Linnaeus,1758)

(P-85) B. Berković, A. Obarčanin, T. Bakran-Petricioli 284
OSNOVNA OBILJEŽJA NASELJA MORSKE CVJETNICE *Posidonia oceanica* (L.) Delile NA OTOKU VISU I DUGOM OTOKU
THE BASIC CHARACTERISTICS OF *Posidonia oceanica* (L.) Delile MEADOWS ON THE ISLANDS VIS AND DUGI OTOK

(P-86) D. Bojanić 286
KALANOIDNI KOPEPODI U KANALIMA SREDNJEG JADRANA
CALANOID COPEPODS IN THE COASTAL MIDDLE ADRIATIC SEA

(P-87) M. Despalatović, I. Grubelić, I. Cvitković..... 287
RASPROSTRANJENOST DEKAPODNOG RAKA *Solenocera membranacea* U JADRANSKOM MORU
DISTRIBUTION OF DECAPOD SHRIMP *Solenocera membranacea* IN THE ADRIATIC SEA

(P-88) A. Divokvić, H. Gomerčić, T. Gomerčić, M. Đuras Gomerčić, H. Lucić, D. Škrtić, S. Ćurković, S. Vuković 288
VELIČINA REPNE PERAJE DOBRIH DUPINA (*Tursiops truncatus*) IZ JADRANSKOG MORA
SIZE OF TAIL FLUKES OF BOTTLENOSE DOLPHINS *(Tursiops truncatus)* FROM THE ADRIATIC SEA

(P-89) L. Drinovec, M. Berden Zrimec, A. Zrimec 290
MODULAR SPECTRAL LUMINOMETER/FLUOROMETER FOR MEASUREMENTS OF PHYTOPLANKTON

(P-90) M. Đuras Gomerčić, T. Gomerčić, H. Gomerčić, H. Lucić, D. Škrtić, S. Ćurković, S. Vuković..... 290
USPOREDBA MORFOMETRIJSKIH ZNAČAJKI DOBROG DUPINA (*Tursiops truncatus*) IZ JADRANSKOGA MORA I DUPINA IZ RODA TURSIOPS IZ DRUGIH SVJETSKIH MORA
COMPARISON OF MORPHOMETRICAL CHARACTERISTICS OF THE BOTTLENOSE DOLPHIN (*Tursiops truncatus*) FROM THE ADRIATIC SEA WITH SPECIES OF THE GENUS TURSIOPS FROM OTHER SEAS

(P-91) J. Ferri, S. Matić- Skoko, M. Kraljević, J. Dulčić..... 292
BIOLOGIJA NEDORASLE OVČICE, *Lithognathus mormyrus* (LINAEUS, 1758) (TELEOSTEI, SPARIDAE) NA ISTOČNOJ OBALI JADRANSKOG MORA
BIOLOGY OF JUVENILE STRIPED SEABREAM, *Lithognathus mormyrus* (LINAEUS, 1758) (TELEOSTEI, SPARIDAE) IN THE EASTERN PART OF THE ADRIATIC SEA

(P-92) A. Galov, G. Lauc, T. Gomerčić, I. Kocijan, M. Đuras-Gomerčić, I. Bašić, H. Gomerčić 293
GENETIČKA RAZNOLIKOST DOBROG DUPINA (*Tursiops truncatus*) IZ HRVATSKOG DIJELA JADRANSKOG MORA MJERENA ANALIZOM MIKROSATELITSKIH LOKUSA
GENETIC DIVERSITY OF BOTTLENOSE DOLPHIN (*Tursiops truncatus*) FROM CROATIAN PART OF THE ADRIATIC SEA REVEALED BY MICROSATELLITE ANALYSIS

(P-93) N. Glavić, P. Tutman, N. Antolović, B. Skaramuca, D. Skaramuca, V. Kožul 295
MRIJEST SIPE (*Sepia officinalis*, Linnaeus, 1758) I IZVALJIVANJE JAJAŠACA U LABORATORIJSKIM UVJETIMA
SPAWNING OF CUTTLEFISH (*Sepia officinalis*, Linnaeus, 1758) AND EGG HATCHING IN THE LABORATORY.

(P-94) H. Gomerčić, M. Đuras Gomerčić, T. Gomerčić, H. Lucić, D. Škrtić, S. Ćurković, S. Vuković, Đ. Huber, V. Gomerčić, J. Bubić Špoljar 297
POJAVA I STRADANJA GLAVATIH DUPINA (*Grampus griseus*) U POSLJEDNJIH 15 GODINA U HRVATSKOM DIJELU JADRANA
ABUNDANCE AND MORTALITY OF RISSOS'S DOLPHINS (*Grampus griseus*) IN THE LAST 15 YEARS IN THE CROATIAN PART OF THE ADRIATIC SEA

(P-95) V. Kožul, N. Antolović, V. Onofri, S. Tomšić 299
POKUSNI UZGOJ RANIH RAZVOJNIH FAZA UŠATE (*Oblada melanura*, Linnaeus, 1758)
EXPERIMENTAL REARING OF EARLY DEVELOPMENTAL STAGES OF SADDLE BREAM (*Oblada melanura*, Linnaeus, 1758)

(P-96) P. Kružić, I. Petrov-Rančić 300
PORODICE LAMNIDAE, ALOPIIDAE I CARCHARHINIDAE (SQUALIFORMES) U RIBARSKOM ULOVU NA PODRUČJU SREDNJEG DIJELA JADRANSKOG MORA
FAMILIES LAMNIDAE, ALOPIIDAE AND CARCHARHINIDAE (SQUALIFORMES) IN FISHING CATCH IN THE CENTRAL PART OF THE ADRIATIC SEA

(P-97) M. Kovačić, D. Golani 301
PRVI NALAZ TRI VRSTE GLAVOČA (PISCES: GOBIIDAE) U LEVANTU
FIRST RECORDS OF THREE GOBIID SPECIES (PISCES: GOBIIDAE) IN THE LEVANT

(P-98) I. Kovačić, T. Gomerčić, M. Đuras Gomerčić, H. Lucić, H. Gomerčić 302
SADRŽAJ ŽELUCA KRUPNOZUBOG DUPINA (Z*iphius cavirostris*) IZ

JADRANSKOG MORA
STOMACH CONTENTS OF THE CUVIER'S BEAKED WHALE (*Ziphius cavirostris*) FROM THE ADRIATIC SEA

(P-99) P. Kružić, I. Radić, A. Požar-Domac 303
VARIJABILNOST ŽARNICA U LOVKAMA POLIPA KAMENIH KORALJA *Cladocora caespitosa* (Linnaeus, 1767) i *Balanophyllia europaea* (Risso, 1826) U JADRANSKOM MORU
CNIDAE VARIABILITY IN THE POLYP TENTACLES OF THE SCLERACTINIAN CORALS *Cladocora caespitosa* (Linnaeus, 1767) AND *Balanophyllia europaea* (Risso, 1826) IN THE ADRIATIC SEA

(P-100) P. Kružić, I. Radić, A. Požar-Domac 305
PRODUKCIJA KARBONATA KOD KORALJA *Cladocora caespitosa* (Linnaeus, 1767) U JADRANSKOM MORU
CARBONATE PRODUCTION OF THE CORAL *Cladocora caespitosa* (Linnaeus, 1767) IN THE ADRIATIC SEA

(P-101) B. Lazar, R. Gračan, D. Zavodnik, A. Jaklin, J. Katić, M. Buršić, N. Tvrtković 307
MEKUŠCI U ISHRANI GLAVATE ŽELVE (*Caretta caretta*) U ISTOČNOM JADRANU
MOLLUSCS IN THE DIET OF THE LOGGERHEAD SEA TURTLE (*Caretta caretta*) IN THE EASTERN ADRIATIC SEA

(P-102) H. Lucić, S. Vuković, H. Gomerčić, M. Đuras-Gomerčić, T. Gomerčić, S. Ćurković, D. Škrtić 308
DOBNE I SPOLNE RAZLIKE U MINERALNOJ GUSTOĆI NADLAKTIČNE KOSTI I PODLAKTIČNIH KOSTIJU DOBROG DUPINA (*Tursiops truncatus*) IZ JADRANSKOG MORA
AGE AND GENDER RELATED DIFFERENCES OF THE BONE MINERAL DENSITY OF THE ARM AND FOREARM OF THE BOTTLENOSED DOLPHINS (*Tursiops truncatus*) FROM THE ADRIATIC SEA

(P-103) D. Lučić, J. Njire 310
KARNIVORNI ZOOZOOPLANKTON SJEVERNOG JADRANA (LIPANJ 1999-SRPANJ 2002)
CARNIVORROUS ZOOPLANKTON IN THE NORTHERN ADRIATIC SEA (JUNE 1999-JULY 2002)

(P-104) J. Maršić-Lučić, M.Tudor, V. Šćekić 311
KOLIČINA UKUPNOG HLAPLJIVOG BAZNOG DUŠIKA (TVB-N) I TRIMETILAMIN-DUŠIKA (TMA-N) U SRDELAMA I HARINGAMA KORIŠTENIM KAO HRANA ZA TOV TUNA
QUANTITIES OF TOTAL VOLATILE BASES NITROGEN (TVB-N) AND TRIMETHYLAMINE NITROGEN (TMA-N) IN SARDINES AND

HERRINGS UTILIZED AS FOOD FOR TUNA FATTENING

(P-105) N. Nikolić, A. Galov, T. Gomerčić, M. Đuras-Gomerčić, I. Kocijan, I. Bašić, H. Gomerčić 313
RAZNOLIKOST KONTROLNE REGIJE MITOHONDRIJSKE DNA PLAVOBIJELOG DUPINA (*Stenella coeruleoalba*) IZ HRVATSKOG DIJELA JADRANSKOG MORA – PRELIMINARNO ISTRAŽIVANJE
DIVERSITY OF MITOCHONDRIAL DNA CONTROL REGION OF STRIPED DOLPHIN (*Stenella coeruleoalba*) FROM THE CROATIAN PART OF THE ADRIATIC SEA – A PRELIMINARY RESEARCH

(P-106) D. Petricioli, T. Bakran-Petricioli 315
MRIJEŠĆENJE STRAŽNJEŠKRŽNJAKA (GASTROPODA, OPISTHOBRANCHIA) POD UZGAJALIŠTIMA TUNA NA JADRANU
SPAWNING OF OPISTHOBRANCHIATE GASTROPODS UNDER THE TUNA FARMS IN THE ADRIATIC SEA

(P-107) M. Radolović, H. Čižmek, D. Petricioli, T. Bakran-Petricioli 316
SPUŽVE U ŽIVOTNIM ZAJEDNICAMA UNUTAR MORSKE ŠPILJE "Y", UVALA BRBINJŠĆICA, DUGI OTOK
SPONGES IN LIVING COMMUNITIES INSIDE THE MARINE CAVE "Y", BRBINJŠĆICA COVE, DUGI OTOK

(P-108) D. Skaramuca, N. Antolović, N. Glavić, J. Bolotin, P. Tutman, I. Brautović, B. Skaramuca 318
KARAKTERIZACIJA VRSTE *Mytilus galloprovincialis* (Lamarck, 1819) GENETIČKIM MARKERIMA U MALOSTONSKOM ZALJEVU I UŠĆU NERETVE
CHARACTERIZATION OF SPECIES *Mytillus galloprovincialis* (Lamarck, 1819) WITH GENETIC MARKERS IN THE MALI STON BAY AND NERETVA ESTUARY

(P-109) N. Stagličić, M. Prime, K. Madirazza, D. Brajčić, Ž. Erak, M. Zoko, D. Blažević, K. Jelić, Z. Popović, M. Peharda 319
RASPROSTRANJENOST IMPOSEKSA KOD VRSTE *Hexaplex trunculus* U KAŠTELANSKOM ZALJEVU
IMPOSEX INCIDENCE IN *Hexaplex trunculus* FROM THE KAŠTELA BAY

(P-110) S. Tomšić, I. Dupčić, B. Glamuzina 321
DISTRIBUCIJA VELIČINA I REPRODUKCIJSKI CIKLUS HRIDINSKOG JEŽINCA (*Paracentrotus lividus*) IZ UVALE BISATRINA
SIZE DISTRIBUTION AND REPRODUCTION OF SEA URCHIN (*Paracentrotus lividus*) IN BISTRINA LAGOON

(P-111) P. Tutman, N. Glavić, V. Kožul, N. Antolović, D. Skaramuca, B. Skaramuca 322

ZNAČENJE UVALA DONJI MOLUNAT I PRAPRATNA NA DNEVNO - NOĆNU RAZNOLIKOST RIBLJIH NASELJA
IMPORTANCE OF DONJI MOLUNAT AND PRAPRATNA BAY ON DIEL DIVERSITY OF FISH ASSEMBLAGE

(P-112) A. Jaklin, B. Hamer 323
DOPRINOS POZNAVANJU EKOLOGIJE SPUŽVE *Suberites domuncula* (OLIVI, 1792) U SJEVERNOM JADRANU
CONTRIBUTION TO ECOLOGY OF SPONGE *Suberites domuncula* (OLIVI, 1792) IN THE NORTHERN ADRIATIC

(P-113) T. Radić, R. Kraus, D. Fuks 325
UTJECAJ SASTAVA MIKROFITOPLANKTONA NA NASTAJANJE TEP-a
INFLUENCE OF MICROPHYTOPLANKTON COMPOSITION ON TEP FORMATION

(P-114) T. Šilović, D. Fuks, T. Radić 326
RASPODJELA DAPI- ŽUTIH ČESTICA (DYP) SJEVERNOG JADRANA
DISTRIBUTION OF DAPI-YELLOW PARTICLES (DYP) IN THE NORTHERN ADRIATIC

(P-115) T. Vojvoda, A. Travizi, A. Požar-Domac 328
STRUKTURA I DINAMIKA FAUNE BODLJIKAŠA (ECHINODERMATA) POMIČNOG DNA SJEVERNOG JADRANA
STRUCTURE AND DYNAMICS OF THE NORTHERN ADRIATIC SEA SOFT-BOTTOM ECHINODERMS FAUNA (ECHINODERMATA)

(P-116) E. Marčelja, V. Onofri, N. Jasprica, D. Lučić, J. Njire..... 329
PROMJENA ABUNDANCIJE I SASTAVA PLANKTONSKIH ZAJEDNICA U EKSPERIMENTALNIM UVJETIMA UZGOJA LIČINKI KAMENICA (*Ostrea edulis*)
CHANGES IN ABUNDANCE AND COMPOSITION OF PLANKTON COMMUNITIES IN EXPERIMENTAL CONDITIONS OF REARING OYSTER LARVAE (*Ostrea edulis*)

KONGRESNI DAN POSVEĆEN 115. OBLJETNICI CENTRA ZA ISTRAŽIVANJE MORA INSTITUTA “RUĐER BOŠKOVIĆ”
CONGRESS DAY DEDICATED TO THE 115TH ANNIVERSARY OF THE CENTER FOR MARINE RESEARCH, RUĐER BOŠKOVIĆ INSTITUTE

(IL-13) W.E.G. Müller, I.M. Müller 331
TRADITIONAL AND MODERN BIOMEDICAL PROSPECTING: SUSTAINABLE EXPLOITATION OF BIODIVERSITY (SPONGES AND INVERTEBRATES) IN THE ADRIATIC SEA AT ROVINJ (CROATIA)

(IL-14) N. Bihari 332
25 godina genotoksikoloških istraživanja u Centru za istraživanje mora
25 Years of Genotoxicological Studies in Center for Marine Research

(IL-15) D. Degobbis, R. Precali, T. Đakovac 333
UZ 115. GODIŠNJICU ISTRAŽIVANJA MORA U ROVINJU: PROCES EUTROFIKACIJE I POJAVA CVJETANJA MORA U SJEVERNOM JADRANU

(IL-16) A. Travizi 335
UZ 115. GODIŠNJICU MORSKE ISTRAŽIVAČKE POSTAJE U ROVINJU: SUVREMENA ISTRAŽIVANJA BENTOSA
THE 115th ANNIVERSARY OF THE MARINE RESEARCH STATION AT ROVINJ: RECENT BENTHIC RESEARCH

(IL-17) R. Batel 337
PRIRODNI I ANTROPOGENI UTJECAJI NA PROCESE I EKOLOŠKE ODNOSE U JADRANSKOM MORU (PRIJEDLOG PROGRAMA ISTRAŽIVANJA U CENTRU ZA ISTRAŽIVANJE MORA U NAREDNIH 5 GODINA)
NATURAL AND ANTHROPOGENIC IMPACTS ON THE ADRIATIC SEA ECOSYSTEM (PROGRAM PROPOSED BY CENTER FOR MARINE RESEARCH TO BE PERFORMED WITHIN NEXT 5 YEARS)

TOKSIKOLOGIJA, EKOTOKSIKOLOGIJA I BIOMONITORING
TOXICOLOGIA ET OECOTOXICOLOGIA
TOXICOLOGY, ECOTOXICOLOGY AND BIOMONITORING

Uvodna tematska predavanja
Introductory Lectures

(IL-18) S. Krča, R.Žaja, V.Čalić, T. Smital 342
EKOTOKSIKOLOŠKI POKAZATELJI ONEČIŠĆENJA U KLENU (*Leuciscus cephalus* L.) – ISTRAŽIVANJA U OKVIRU EU FP6 PROJEKTA “SARIB”
EKOTOXICOLOGICAL INDICATORS OF POLLUTION IN THE EUROPEAN CHUB (*Leuciscus cephalus* L.) – RESEARCH WITHIN THE EU FP6 “SARIB” PROJECT

(IL-19) B. Hamer, J. Pavičić, D. Ivanković, L. Perić, D. Pavičić-Hamer, Ž. Jakšić 343
UČINAK KOLEBANJA ČIMBENIKA OKOLIŠA NA BIOLOŠKE POKAZATELJE STRESA U DAGNJI *M. galloprovincialis*
EFFECT OF ENVIRONMENTAL CONDITIONS VARIATION ON BIOLOGICAL STRESS INDICATORS IN MUSSEL *M. galloprovincialis*

Kratka usmena priopćenja
Oral Presentations

(OP-51) M. Berden Zrimec, L. Drinovec, T. Tišler, M. Monti, A. Beran, I. Molinari, A. Zrimec 346
DELAYED FLUORESCENCE MEASUREMENTS IN TOXICOLOGY AND PHYSIOLOGY OF ALGAE AND PLANTS

(OP-52) P. Cvjetko, M. Babić, D. Papeš, M. Pavlica 347
UČINAK TALIJ-ACETATA NA VODENU LEĆU *Lemna minor* L.
EVALUATION OF THALLIUM-ACETATE TOXICITY USING AQUATIC PLANT *Lemna minor* L.

(OP-53) N. Kopjar, D. Želježić S. Ramić, V. Garaj-Vrhovac 348
PROCJENA RAZINE PRIMARNIH OŠTEĆENJA DNA U LEUKOCITIMA PERIFERNE KRVI ISPITANIKA OPĆE POPULACIJE HRVATSKE PRIMJENOM KOMET-TESTA
EVALUATION OF DNA DAMAGE IN WHITE BLOOD CELLS OF HEALTHY HUMAN VOLUNTEERS USING THE ALKALINE COMET ASSAY

(OP-54) B. Pivčević, T. Maltar, T. Smital 350
ODREĐIVANJE ESTROGENOSTI UZORAKA PRIOBALNE VODE JADRANSKOG MORA I VODE IZ PROČIŠĆIVAČA MIJEŠANIH OTPADNIH VODA UPOTREBOM YES (“YEAST ESTROGEN SCREEN”) BIOTESTA
ESTROGENICITY OF WATER SAMPLES FROM ADRIATIC COAST AND FROM MUNICIPAL SEWAGE TREATMENT PLANTS IN CROATIA USING YEAST ESTROGEN SCREEN BIOASSAY

(OP-55) M. Podrug, Z. Dragun, M. Erk, B. Raspor 351
KONCENTRACIJA METALOTIONEINA I METALA (Zn, Cu, Cd) U CITOSOLU JETRE KLENA (*Leuciscus cephalus* L.) IZ RIJEKE SAVE
METALLOTHIONEIN AND METAL (Cu, Zn, Cd) CONCENTRATIONS IN LIVER CYTOSOL OF CHUB (*Leuciscus cephalus* L.) FROM SAVA RIVER

Posterske prezentacije
Posters

(P-117) Z. Cvetnić, S. Pepeljnjak 354
INTERAKCIJE ATOKSINOGENIH SOJEVA PLIJESNI I AFLATOKSINOGENOG SOJA *Aspergillus flavus* NNRL 3251
INTERACTION OF ATOXIGENIC MOULD STRAINS WITH AFLATOXIN-PRODUCER *Aspergillus flavus* NRRL 3251

(P-118) M. Ilieva, B. Gosic-Markovska 355

USE OF ERYTHROPOIETIN AND ITS EFFECTS ON BLOOD LACTATE IN HAEMODIALYSIS PATIENTS

(P-119) N. Landeka, B. Hamer, Ž. Jakšić, R. Batel 356
POGODNOST RIBE *Gambusia affinis* ZA MONITORING ZAGAĐENJA KOPNENIH VODA PESTICIDIMA
USE OF THE FISH *Gambusia affinis* FOR MONITORING OF FRESH WATERS PESTICIDE CONTAMINATION

(P-120) J. Lončar, R. Žaja, M. Ahel, T. Smital 358
EKOTOKSIKOLOŠKA KARAKTERIZACIJA OTPADNIH VODA EROD BIOTESTOM (PLHC-1 STANIČNA LINIJA) I TESTOM TOKSIČNOSTI NA ALGAMA (*Pseudokirchneriella subcapitata*)
ECOTOXICOLOGICAL CHARCTERISATION OF WASTEWATER SAMPLES USING EROD BIOASSAY (PLHC-1 CELL LINE) AND ALGAL TOXICITY ASSAY (*Pseudokirchneriella subcapitata*)

(P-121) I. Pavičić, I. Trošić 359
BIOELEKTROMAGNETSKI PRISTUP PROCJENI BIOLOŠKIH UČINAKA FREKVENCIJA MOBILNE TELEFONIJE
BIOELECTROMAGNETICS APPROACH IN THE ASSESSMENT OF MOBILE PHONE FREQUENCY BIOEFFECTS

(P-122) J. Razinger , M. Dermastia, J.D. Koce, A. Zrimec 361
BIOCHEMICAL MARKERS OF CADMIUM INDUCED OXIDATIVE STRESS IN DUCKWEED (*Lemna minor* L.)

(P-123) A. Štambuk, M. Pavlica, G.I.V. Klobučar 361
DUGOTRAJNA POSTOJANOST ALKILACIJSKOG OŠTEĆENJA DNA U HEMOCITIMA ŠKOLJKAŠA *Unio pictorum*
LONG-TERM PERSISTENCE OF THE ALKYLATION DNA DAMAGE IN HAEMOCYTES OF FRESHWATER MUSSEL *Unio pictorum*

(P-124) L. Traven, S. Krča, R. Žaja, J. Lončar, V. Mićović, T. Smital
ODREĐIVANJE DETOKSIFIKACIJSKOG I BIOAKTIVACIJSKOG POTENCIJALA RAZLIČITIH ŽIVOTNIH STADIJA BRANCINA (*Dicentrarchus labrax* L.) 363
DETERMINATION OF DETOXIFICATION AND BIOACTIVATION POTENTIAL IN DIFFERENT LIFE STAGES OF SEA BASS (*Dicentrarchus labrax* L.)

(P-125) M. Đurinec, V. Garaj-Vrhovac 365
ALKALNI KOMET TEST KAO BIOMARKER OŠTEĆENJA DNA U RADNIKA ZAPOSLENIH U INDUSTRIJI CIGARETA
THE ALKALINE COMET ASSAY AS BIOMARKER OF DNA DAMAGE IN WORKERS IN CIGARETTE MANUFACTORY

KONZERVACIJSKA BIOLOGIJA, ZAŠTITA PRIRODE I OKOLIŠA I ZAKONODAVSTVO
BIOLOGIA CONSERVATIONIS, PROTECTIO NATURAE ET LEGISLATIO
CONSERVATION BIOLOGY, CONSERVATION OF NATURE, ENVIRONMENTAL PROTECTION AND LEGISLATION

Uvodna tematska predavanja
Introductory Lectures

(IL-20) J. Radović, R.Topić 368
NACIONALNA EKOLOŠKA MREŽA – NOVI MEHANIZAM ZAŠTITE PRIRODE
NATIONAL ECOLOGICAL NETWORK – NEW MECHANISM OF NATURE PROTECTION

Kratka usmena priopćenja
Oral Presentations

(OP-56) T. Dubravac, S. Dekanić, B. Vrbek 370
ISTRAŽIVANJE ŠUMA HRASTA CRNIKE (*Quercus ilex* L.) I MOGUĆNOST PRIRODNE OBNOVE U ISTRI
INVESTIGATION OF EVERGREEN OAK FORESTS (*Quercus ilex* L.) AND POSSIBILITY OF NATURAL REFORESTATION IN ISTRIA

(OP-57) S.D. Jelaska, O. Antonić..... 371
USPOREDBA BILJNE RAZNOLIKOSTI PRAŠUMA I GOSPODARENIH BUKOVO-JELOVIH ŠUMA NA KRŠU HRVATSKE
COMPARISON OF PHYTODIVERSITY IN VIRGIN AND LOGGED SILVER FIR – BEECH FORESTS ON CROATIAN KARST

(OP-58) D. Kiš-Novak 373
ZAŠTIĆENA PRIRODNA VRIJEDNOST - MEĐIMURSKI KONJ
PROTECTED NATURAL VALUE – MUR INSULAN HORSE

(OP-59) S. Leiner, B. Pevalek–Kozlina 375
CRNA RIJEKA (N.P. PLITVIČKA JEZERA) KAO UZGOJNI VODOTOK AUTOHTONE POTOČNE PASTRVE (*Salmo trutta*)
THE CRNA RIJEKA (PLITVICE LAKES NATIONAL PARK) AS REARING STREAM OF NATIVE BROWN TROUT (*Salmo trutta*)

(OP-60) M. Lukić..... 376
FILM – ŠPILJSKA FAUNA NP KRKA
FILM – CAVE FAUNA OF THE NATIONAL PARK KRKA, CROATIA

(OP-61) S. Malić-Limari, B. Janev Hutinec..... 377
INTERPRETACIJA U URBANIM ZAŠTIĆENIM PODRUČJIMA
INTERPRETATION IN URBAN PROTECTED AREAS

(OP-62) R. Ozimec, I. Lučić 379
ŠPILJA VJETRENICA – NAJBOGATIJI PODZEMNI EKOSUSTAV NA SVIJETU
THE VJETRENICA CAVE – RICHEST SUBTERANEAN ECOSYSTEM IN WORD

(OP-63) S. Perić, J. Medak, I. Pilaš..... 381
USPIJEVANJE PROVENIJENCIJA DUGLAZIJE (*Pseudostsuga menziesii* (MIRB.) FRANCO) U SREDIŠNJOJ HRVATSKOJ
GROWTH OF DOUGLAS FIR PROVENANCES (*Pseudostsuga menziesii* (MIRB.) FRANCO) IN CENTRAL CROATIA

(OP-64) A. Štrbenac, Đ. Huber, J. Kusak, A. Bath, A. Majić – Skrbinšek, J. Jeremić, S. Desnica..... 382
ZAŠTITA VUKA UZ PRIHVAĆANJE SVIH INTERESNIH SKUPINA: IZRADA PLANA UPRAVLJANJA VUKOM U HRATSKOJ
CONSERVATION OF WOLF THROUGH ACCEPTANCE BY ALL INTEREST GROUPS: DEVELOPMENT OF THE CROATIAN WOLF MANAGEMENT PLAN

(OP-65) M. Gradečki-Poštenjak, K. Poštenjak 384
FENOTIPSKE OSOBINE HRASTA LUŽNJAKA IZ SJEMENSKIH SASTOJINA HRVATSKE
PHENOTYPICAL CHARACTERISTICS OF PEDUNCLED OAK FROM CROATIAN SEED STANDS

(OP-66) I. Laćan, J.R. McBride 385
PEST VULNERABILITY MATRIX (PVM): A GRAPHIC MODEL FOR ASSESSING THE INTERACTION BETWEEN TREE SPECIES DIVERSITY AND URBAN FOREST SUSCEPTIBILITY TO INSECTS AND DISEASES

Posterska priopćenja
Posters

(P-126) J. Antolović, M. Antolović, N. Antolović, B. Furlan, Lj. Adamić – Antolović, R. Antolović, I. Čok..... 387
VIĐENJA SREDOZEMNE MEDVJEDICE (*Monachus monachus*) U HRVATSKOM DIJELU JADRANA S POSEBNIM OSVRTOM NA POPULACIJU PUČINSKIH OTOKA
SIGHTINGS OF THE MONK SEAL ((*Monachus monachus*) IN THE CROATIAN PART OF THE ADRIATIC WITH A SPECIAL REFERENCE TO THE POPULATION OF OPEN-SEA ISLANDS

(P-127) B. Banjad Ostojić, M. Stojan 389
PROJEKTI KRAJOBRAZNOG UREĐENJA AUTOCESTA U FUNKCIJI ZAŠTITE BIOLOŠKE I KRAJOBRAZNE RAZNOLIKOSTI
HIGHWAY LANDSCAPE PLANNING PROJECTS IN FUNCTION OF BIOLOGICAL AND LANDSCAPE DIVERSITY PROTECTION

(P-128)
K. Batelja, N. Ljubešić, T. Prebeg, S. Goreta 390
DJELOVANJE TRIFLURALINA NA KLIJANCE BOSILJKA (*Ocimum basilicum* L.)
EFFECTS OF TRIFLURALIN ON SPROUTS OF SWEET BASIL (*Ocimum basilicum* L.)

(P-129) A. Belančić, I. Špoljarić 392
STATUS UGROŽENOSTI I ZAŠTITE POZNATIH VRSTA FLORE I FAUNE U NACIONALNOM PARKU PLITVIČKA JEZERA
DEGREE OF THREAT AND CONSERVATION STATUS OF KNOWN FLORA AND FAUNA SPECIES IN PLITVIČKA JEZERA NATIONAL PARK

(P-130) H. Bilandžija, J. Bedek, B. Jalžić, M. Kerovec, S. Gottstein Matočec 393
MORFOLOŠKA OBILJEŽJA, BIOGEOGRAFIJA I UGROŽENOST OGULINSKE ŠPILJSKE SPUŽVICE *Eunapius subterraneus* SKET I VELIKONJA 1985 (DEMOSPONGIA, SPONGILLIDAE)
MORPHOLOGICAL CHARACTERISTICS, BIOGEOGRAPHY AND ENDANGERMENT OF OGULIN CAVE SPONGE *Eunapius subterraneus* SKET & VELIKONJA 1985 (SPONGILLIDAE, DEMOSPONGIA)

(P-131) M. Crnčević, P. Tutman, D. Bojanić, N. Glavić, N. Sudarević 395
ZAŠTIĆENE PRIRODNE VRIJEDNOSTI NA PODRUČJU GRADA DUBROVNIKA – ZAŠTITA I UPRAVLJANJE
SPECIALLY PROTECTED AREAS IN THE CITY OF DUBROVNIK – PROTECTION AND MANAGEMENT

(P-132) T. Gomerčić, J. Barišić, M. Vuđan, S. Ćurković, G. Gužvica, M. Đuras Gomerčić, D. Pavlović, A. Frković, Đ. Huber 397
ODREĐIVANJE DOBI EUROAZIJSKIH RISOVA (*Lynx lynx*) U HRVATSKOJ PREMA SLOJEVIMA ZUBNOG CEMENTA SJEKUTIĆA
AGE DETERMINATION IN EUROASIAN LYNXES (*Lynx lynx*) IN CROATIA BY COUNTS OF INCREMENTAL LINES IN INCISOR TEETH CEMENTUM

(P-133) S. Jelenić 398
DESET GODINA TRŽIŠNOG UZGOJA BILJAKA OPLEMENJENIH GENETIČKIM INŽENJERSTVOM
TEN YEARS OF COMMERCIAL GROWTH OF GENETICALLY ENGINEERED CROPS

(P-134) Ž. Lukša, M. Rašan, T. Bartolić 400
KARTIRANJE PROLJETNOG DRIJEMOVCA (*Leucojum vernum* L) , OBIČNE KOCKAVICE (*Fritillaria meleagris* L.) I KEBRAČA (*Myricaria germanica* (L.) DESV.
CHARTING OF THE *Leucojum vernum* L., THE *Fritillaria meleagris* L. AND THE *Myricaria germanica* (L.) DESV.

(P-135) A. Partl, V. Posavec Vukelić 401
ZAŠTITA KLOŠTARSKIH PIJESAKA
PROTECTION OF KLOŠTAR SANDS

(P-136) D. Pavlović, T. Gomerčić, G. Gužvica, Đ. Huber i J. Kusak, S. Ćurković 403
DOBNA I SPOLNA STRUKTURA VUKOVA U HRVATSKOJ
AGE AND SEX STRUCTURE OF WOLVES IN CROATIA

(P-137) G. Piasevoli 404
POLAZIŠTA ZA UPRAVLJANJE POSEBNIM REZERVATOM PANTAN
STARTING POINTS FOR THE PANTAN SPECIAL RESERVE MANAGEMENT

(P-138) J. Stritih, Ana Štrbenac, V. Posavec Vukelić, M. Gluhaković, V. Hršak 406
PILOT PROJEKT ZAŠTITE I UPRAVLJANJA POSEBNIM BOTANIČKIM REZERVATOM "CRET DUBRAVICA"
PILOT PROJECT FOR CONSERVATION AND MANAGMENT OF THE SPECIAL BOTANIC RESERVE "BOG DUBRAVICA"

(P-139) K. Vlahović, E. Prukner Radovčić, M. Pavlak, G. Gregurić Gračner 407
ZDRAVLJE PTICA, LJUDI I OKOLIŠA
HEALTH OF BIRDS, HUMANS AND ENVIRONMENT

(P-140) B. Vrbek, I. Pilaš, T. Dubravac 409
TLA CRNIKINIH ŠUMA ISTRE I KVARNERA
SOILS OF EVERGREEN OAK FORESTS IN ISTRIA AND KVARNER

(P-141) D. Vrhovšek, D. Istenič 411
ECOREMEDIATION AS A NEW PERSPECTIVE OF ENVIRONMENTAL PROTECTION AND RESTORATION

(P-142) D. Zima, M. Đurkić, M. Tomašević 411
ANALIZA UGROŽENOSTI BILJAKA IZ PORODICE ORCHIDACEAE U POŽEŠKOJ KOTLINI I OKOLNOM GORJU
ANALYSIS OF THREATENED PLANTS FROM ORCHIDACEAE FAMILY OF THE POŽEGA VALLEY AND SURROUNDING MOUNTAINS

(P-143) I. Zupan, K. Fabrio, V. Posavec-Vukelić, I. Žeger, R. Topić, J. Radović, A. Alegro 412
rijetka i ugrožena vlažna staništa Plaščanske doline
RARE AND THREATENED WET HABITATS OF THE PLAŠKI VALLEY

(P-144) B. Lazar, V. Besendorfer, B. Hamer, D. Holcer, S. S. Heppell, S. A. Heppell 414

MEĐUNARODNA ŠKOLA KONZERVACIJSKE BIOLOGIJE:
OBRAZOVANJEM DO OČUVANJA BIORAZNOLIKOSTI
INTERNATIONAL SCHOOL OF CONSERVATION BIOLOGY:
EDUCATION TOWARDS BIODIVERSITY CONSERVATION

BIOLOGIJA U SUVREMENOJ HRVATSKOJ ŠKOLI
BIOLOGIA ET EDUCATIO
BIOLOGY IN MODERN CROATIAN SCHOOL

Uvodna tematska predavanja
Introductory Lectures

(IL-21) B. Borović, S Ilić 418
OSVRT NA PROGRAME NASTAVE BIOLOGIJE U GIMNAZIJI
REFLECTING ON BIOLOGY SYLLABUS IN SECONDARY SCHOOLS

Kratka usmena priopćenja
Oral Presentations

(OP-67) E. Borić, I. Labak, T. Jelić 420
ISTRAŽIVAČKA NASTAVA KAO STANDARD SUVREMENE ŠKOLE
TEACHING-AS-RESEARCH AS THE STANDARD FOR CONTEMPORARY SCHOOLS

(OP-68) B. Staroveški, J. Šikić 421
ISTRA I PRIRODOSLOVLJE U XVIII. I XIX. ST.
ISTRIA AND NATURAL SCIENCES IN THE 18th AND 19th CENTURY

(OP-69) D. Karakaš, S. Kapov 422
USPOREDBA UČENIČKIH POSTIGNUĆA PRIMJENOM DVIJE METODE TESTIRANJA ZNANJA
COMPARISON OF STUDENTS' ACHIEVEMENTS APPLYING TWO METHODS OF EXAMINATION

(OP-70) I. Labak, E. Borić 424
UČIMO BIOLOGIJU AKTIVNIM ČITANJEM
LEARNING BIOLOGY THROUGH ACTIVE READING

(OP-71) Ž. Lukša, T. Dragić-Runjak, N. Sinković..... 425
GRUPNI RAD U NASTAVI BIOLOGIJE
GROUP WORK IN BIOLOGY TEACHING

(OP-72) I. Radanović, D. Dragun 426
VIVARIJ U NASTAVI BIOLGIJE
VIVARIUM IN BIOLOGY CLASS

(OP-73) K. Trojko, M. Rašan..... 428
MULTIDISCIPLINARNI PRISTUP TERENSKOJ NASTAVI EKOLOGIJE
MULTI-DISCIPLINARY APPROACH TO FIELD WORK IN TEACHING ECOLOGY

(OP-74) Lj. Vrček 429
PRIMJENA MATEMATIČKO STATISTIČKE METODE U EKSPERIMENTALNOM PROJEKTU UČENIKA
THE APPLICATION OF MATHEMATICAL STATISTICAL METHOD IN STUDENTS EXPERIMENTAL PROJECT

(OP-75) Lj. Vöglein, S. Vučetić, A. Delić 431
GLEDAM AIDS - VIZUALNI PRISTUP AIDS-u
LOOKING AT AIDS: A VISUAL APPROACH TO AIDS

(OP-76) V. Radek, G. Sušić 432
VRATIMO DJECU PRIRODI – VRATIMO PRIRODU DJECI
RECONECTING CHILDREN WITH NATURE AND NATURE WITH CHILDREN

ERRATUM

(P-145) D. Fuks, J. Radić, T. Radić, T. Šilović 436
METABOLIČKA AKTIVNOST MORSKIH BAKTERIJA U RAZLIČITIM UVJETIMA HRANJIVIH SOLI
PROPORTION OF METABOLICALLY ACTIVE MARINE BACTERIA UNDER DIFFERENT NUTRIENT REGIMES

(P-146) D. Marić 437
UČINAK KADMIJA NA ULTRASTRUKTURU CRVENE MAKROALGE *Gracilaria longa*
THE EFFECTS OF CADMIUM ON THE ULTRASTRUCTURE OF A RED MACROPHYTE *Gracilaria longa*

(P-147) R. Kraus 439
ULOGA MIKROFITOPLANKTONA U CVJETANJU MORA
ROLE OF MICROPHYTOPLANKTON IN MUCILAGE EVENT

PLAĆENI OGLASI 441
ADVERTISEMENTS

SPONZORI 445
SPONZORS

DODATAK - Predgovor prve najave 458
APPENDIX - Foreword to First Announcement

ZAHVALE 462
ACKNOWLEDGMENTS

KAZALO AUTORA 466
INDEX OF AUTHORS

UVODNO PREDAVANJE
OPENING LECTURE

Predavanje pod pokroviteljstvom Predsjednice
Hrvatskog biološkog društva 1885

Lecture Under the Auspice of the President of the
Croatian Biological Society

PL-1

THE ORIGIN OF VIRUSES AND THEIR POSSIBLE ROLES IN THE EMERGENCE OF MODERN CELLS

P. Forterre
Institut de Génétique et Microbiologie (IGM) Bat 409, Université Paris-Sud, Centre d'Orsay, 91405 Orsay Cedex,France (patrick.forterre@igmors.u-psud.fr), Institut Pasteur, 28 rue du Dr Roux 75724 Paris Cedex 15 (Forterre@pasteur.fr)

For a long time, viruses were considered as ousiders of the living world, fragments of cellular genomes that once escaped from their cellular environment and became infectious. Eucaryotic viruses were though to have originated from eucaryotes and «bacteriophages» from bacteria. Together with the procaryote/eucaryote dichotomy itself, this view has been challenged by the accumulation of data from genomic projects and structural analyses, as well as by the discovery of fascinating new viruses (such as the giant mimivirus and the morphologically unique archaeal viruses). Our knowledge of the modern viral world points now for the existence an ancient virosphere that predated the divergence between the three domains of life (Eukarya, Archaea and Bacteria). On the other hand, each domain of modern cells is characterized by its own virosphere. I will discuss these somewhat contradictory data on the light of recent speculations on the origin of viruses and their possible roles in the emergence of modern cells. In particular, I have suggested that viruses might have « invented » DNA and that three founder viruses were at the origin of modern DNA genomes in the three cellular domains of life (or at least played a major part in the origin).

ZAVRŠNO PREDAVANJE
CLOSING LECTURE

Predavanje pod pokroviteljstvom Predsjednice
Hrvatskog biološkog društva 1885

Lecture Under the Auspice of the President of the
Croatian Biological Society

PL-14

RIBOSOMAL PROTEIN S6 HAPLOINSUFFICIENCY ACTIVATES A P53-DEPENDENT CHECKPOINT DURING GASTRULATION”

S. Volarević
Department of Molecular Medicine and Biotechnology, School of Medicine, University of Rijeka, Rijeka, Croatia

Nascent ribosome biogenesis is required during cell growth. To gain insight into importance of this process during mouse oogenesis and embryonic development, we deleted one allele of the ribosomal protein S6 gene in growing oocytes and generated S6-heterozygous embryos. Oogenesis and embryonic development until E5.5 were normal. However, inhibition of entry into M phase of the cell cycle and apoptosis became evident post E5.5, leading to peri-gastrulation lethality. Genetic inactivation of p53 bypassed this checkpoint and prolonged development until E12.5, when they die with defective translation of D-type cyclins and erythropoiesis. Thus, a p53-dependent checkpoint is activated during gastrulation in response to ribosome insufficiency to prevent improper execution of the developmental program.

PLENARNA PREDAVANJA
PLENARY LECTURES

PL-2

THE PHYLOGEOGRAPHY OF EUROPEAN COASTAL PLANTS: THE RELATIVE ROLES OF HISTORY AND MODERN BIOTIC AND ABIOTIC FACTORS

J.W. Kadereit
Institut für Spezielle Botanik und Botanischer Garten, Johannes Gutenberg-Universität Mainz, D-55099 Mainz, Germany (kadereit@uni-mainz.de)

The phylogeographic structure of six species of European coastal plant species (*Cakile maritima*, *Calystegia soldanella*, *Eryngium maritimum*, *Salsola kali*, *Halimione portulacoides*, *Crithmum maritimum*) was analysed using AFLP data. With the exception of *Calystegia soldanella*, where complete absence of phylogeographic structure is attributed to frequent long-distance dispersal and long persistence of clones, all species show a distinct and partly similar phylogeographic structure:

1. All species contain a distinct Black Sea/Aegean Sea cluster, and all except *E. maritimum* contain a distinct Adriatic Sea cluster. The genetic discontinuity between the Aegean Sea and the Adriatic Sea is explained with modern sea currents acting as gene flow barriers.
2. All species except *Crithmum maritimum* contain a distinct Atlantic Ocean/North Sea/Baltic Sea cluster which is clearly separate from the Mediterranean material. This discontinuity also is explained with modern sea currents.
3. In the west Mediterranean basin, two species groups exist. In *Salsola kali* and *Eryngium maritimum* material from this area falls into only one genetic cluster, but material of *Cakile maritima*, *Halimione portulacoides* and *Crithmum maritimum* falls into two clusters of either more Atlantic or more central Mediterranean affinity. This difference is explained in terms of species-specific Quaternary histories. Whereas the more cold-tolerant *Salsola kali* and *Eryngium maritimum* could inhabit the north coast of the west Mediterranean basin throughout Quaternary glacials, the less cold-tolerant *Halimione portulacoides* and *Crithmum maritimum* had to retreat south and recolonized northern parts of the coast from southeast and southwest.

A detailed analysis of the phylogeographic structure of *Cakile maritima* and *Eryngium maritimum* in four sea straits, the Kattegat (North Sea/Baltic Sea), the Strait of Gibraltar, the Dardanelles (Aegean Sea/Marmara Sea) and the Bosporus (Marmara Sea/Black Sea), reveals that phylogeographic structure depends on both historical and modern factors. Whereas no phylogeographic structure is detectable in the geologically very young Kattegat area, the sharp genetic discontinuity in the Strait of Gibraltar is explained by modern sea currents and that in the Bosporus by glacial closure of this strait. These results illustrate that species of essentially identical and continuous distribution in a

linear ecosystem can have different phylogeographic structure. Differences result from species-specific combinations of biological properties, Quaternary history and contemporary abiotic factors.

PL-3
ALLOPOLYPLOID EVOLUTION IN THE GENUS *Nicotiana* - RECENT TO ANCIENT

K.Y. Lim[1], A. Kovarik[2], R. Matyášek[2], S. Knapp[3], M.W. Chase[4], J.J. Clarkson[4] and [1]A.R. Leitch[1]
[1]School of Biological and Chemical Sciences, Queen Mary University of London, London E1 4NS, UK, [2]Institute of Biophysics, Academy of Sciences of the Czech Republic, CZ-61265 Brno, Czech Republic, [3]Jodrell Laboratory, Royal Botanic Gardens Kew, Richmond, Surrey TW9 3DS, UK, [4]Department of Botany, Natural History Museum, Cromwell Road, London SW7 5BD, UK

Polyploidy is a major driving force in plant evolution and has given rise to many of our present day crop species. We have examined the genetic consequences of allopolyploidy in the plant genus *Nicotiana* by studying allopolyploids that formed recently (from generation 1) to long ago (ancient, 10 million years old). In synthetic tobacco (*N. tabacum* 2n = 4x = 48) an allotetraploid hybrid between *N. sylvestris* and *N. tomentosiformis* (both 2n=2x=24), we find rapid changes in the first few generations. These changes include the amplification and spread of a novel rDNA family across and between loci and the loss of tandem and dispersed repeats, particularly from the paternally derived genome. For recent allotetraploid species such as *N. tabacum, N. rustica* and *N. arentsii*, it is straightforward to identify the parental origin of chromosomes using genomic *in-situ* hybridisation (GISH). We observe that chromosomal location of 5S and 35S rDNA loci and various tandem repeats is as predicted from their positions in the parents. However the sequences of rDNA repeat at these loci have been altered, probably through gene conversion mechanisms. In older allotetraploids such as *N. clevelandii* and *N. quadrivalvis* (section *Polydicliae*, 2n = 4x = 48) that formed about 0.5-1 Mya, there is a reduction in the number of rDNA loci from that expected in the progenitors. Furthermore GISH less readily distinguishes the parental genomes because genome homogenisation in these allotetraploids has begun. In the older polyploid section *Repandae*, estimated to have formed 4.5Mya, GISH fails completely in some species. In these species new sequences (dispersed and tandem) are likely to have evolved since the allopolyploid event both in the polyploids and/or the diploids. In ancient *Nicotiana* allopolyploids formed 10 Mya (section Suaveolentes; 26

species), species radiation has been accompanied by chromosome fusion, leading to numbers ranging from 2n=4x=48 to 2n=4x=32.

Predavanje pod pokroviteljstvom
Predsjednika Organizacijskog i programskog odbora
Lecture under the Auspice of the
President of the Organizing and Programme Committee

PL-4
STRUCTURAL BASIS OF FATTY ACID SYNTHESIS IN EUKARYOTES

S. Jenni, T. Maier, M. Leibundgut and N. Ban
ETH Zurich, Swiss Federal Institute of Technology, Institute for Molecular Biology and Biophysics, Zurich, Switzerland

Synthesis of fatty acids is a central cellular process that has been studied for many decades. Fatty acids are used in the cell as energy storage compounds and as messenger molecules. Previously, individual steps of this process have been studied on isolated bacterial enzymes. However, in higher organisms, fatty acid synthesis is catalyzed by large multifunctional proteins where many individual enzymes are brought together to form a “molecular assembly line”. Our recent work focused on studying the architecture of two representative classes of fatty acid synthases in higher organisms. Fungal and mammalian systems reveal two different architectural solutions that allow these giant multi-enzymes to hand over the products of one enzymatic active site to the next for efficient cyclic synthesis of fatty acids. Fungal fatty acid synthase is a huge molecular assembly with two reaction chambers, each containing three full sets of active sites separated by large distances across which the substrates have to be shuttled during the reaction cycle. In contrast, mammalian fatty acid synthase is an X-shaped molecule with a full set of active sites present in each of two semicircular reaction chambers on both sides of the molecule. Besides an academic interest in the function of this multi-enzyme with a central role in the primary metabolism, fatty acid synthase is considered a promising drug target for the treatment of obesity and obesity-related diseases as well as cancer. Most fat accumulated in animals and human bodies is delivered to cells by ingestion and not by synthesis from scratch. However, compounds that inhibit the function of mammalian fatty acid synthase show the potential for weight reduction in animal models, although the exact mechanism of this effect is not well understood. Furthermore, due to the increased requirement for fatty acid synthesis in cancer cells it has been demonstrated that inhibitors

of this enzyme have antitumor activity making fatty acid synthase an attractive drug target for anticancer therapy. Finally, understanding the structures of large multienzymes such as fatty acid synthases may teach us something about how nature synthesizes complicated natural products, which are extremely difficult to synthesize chemically. Fatty acid synthases serve as a paradigm for the structural organization of various modular enzymes, which are responsible for the biosynthesis of important cellular compounds with antibiotic, anticancer, antifungal and immunosuppressive properties.

PL-5
HORMONAL INTERACTIONS IN FRUIT DEVELOPMENT

J. Ozga and D. Reinecke
Plant Physiology and Molecular Biology Research Group, Department of Agricultural, Food and Nutritional Science, University of Alberta Edmonton, Alberta, Canada T6G 2P5, (jocelyn.ozga@ualberta.ca, dennis.reinecke@ualberta.ca)

Fruit development involves a complex interplay of cell division, differentiation and expansion of sporophytic and gametophytic tissues that is carefully coordinated over time. Plant hormones are signals that regulate many processes of plant development including fruit development leading to mature fruit and viable mature seed. Auxins, gibberellins (GAs), cytokinins, abscisic acid, and ethylene have been implicated at various stages of fruit development. In the past hormone application studies and hormone analysis studies have supported that fruit development is in part regulated by hormonal interaction. More recently, biochemical and molecular studies are showing how hormones effect fruit development. This talk will focus on understanding the interaction between auxin and gibberellin in pea fruit development using physiological, biochemical, and molecular approaches.

PL-6
A TRANSCRIPTOMICS APPROACH TO STUDY FEMALE GAMETOPHYTE FUNCTIONS IN FLOWERING SEED PLANTS

S. Sprunck[1], B. Bellmann[1], M. Gebert[1], D. Leljak-Levanic[3], M.L. Márton[1], A. Amien[4] and T. Dresselhaus[1, 2]
[1]Department of Developmental Biology & Biotechnology, University of Hamburg, Ohnhorststrasse 18, D-22609 Hamburg, Germany (sprunck@botanik.uni-hamburg.de), [2]Cell Biology & Plant Physiology,

University of Regensburg, Universitätsstrasse 31, D-93053 Regensburg, Germany (thomas.dresselhaus@biologie.uni-regensburg.de), [3]Department of Molecular Biology, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia (dunja@zg.biol.pmf.hr), [4]Plant Breeding Laboratory, University of Padjadjaran, Jl. Raya Jatinangor Ujung Berung, Bandung 40600, Indonesia (suseno99@yahoo.de)

The female gametophyte (FG or embryo sac) of most flowering seed plants (angiosperms) consists of the haploid cells of the egg apparatus (egg cell and two synergids), a diploid central cell as well as three antipodal cells. In Arabidopsis, the antipodals degenerate, while they undergo endoreduplication and form a cluster of 20-40 cells in cereals. All FG cells are derived from one megaspore after meiosis. A number of functions have been addressed to the FG that include pollen tube guidance and discharge, translocation of the two sperm cells towards the female gametes (egg and central cell), regulation of the double fertilization process, fusion of gamete nuclei, prevention of polyspermy, maternal control of embryo and endosperm development as well as the induction of seed development after fertilization. In stark contrast to our knowledge about these processes at the morphological level, little is known about the molecules and mechanistic pathways regulating the various processes. Until now, most of our knowledge about FG development and function has been generated through genetic screenings and a small number of genes have been identified that are required for FG development and maternal control of seed development. We have performed an alternative transcriptomics based approach: cell-type-specific cDNA libraries have been generated from the individual cells of the FG before and after fertilization followed by differential screening of these libraries using methods such as classical plaque screening, SSH, RFDD-PCR, random EST sequencing and microarrays to identify and clone genes differentially and specifically expressed in the individual cells of the FG (Dresselhaus, Curr. Opin. Plant Biol., 2006). Bioinformatics was applied to select candidate genes for functional studies. Interestingly, a large number of specifically expressed genes seem to be involved in cell-cell communication events, establishment of polarity and cell identity, gene regulation and cell cycle control. A surprisingly high number of specifically expressed genes encode proteins involved in the regulation of protein degradation indicating that post-transcriptional regulation events are important for FG function. We will present results from bioinformatic analyses as well as functional studies of small secreted extracellular peptide ligands as candidate molecules for mediating cell identity and for short range pollen tube guidance as well as sperm cell discharge. Proteins involved in downstream signaling include, for example, Armadillo-repeat and BTB/POZ-domain proteins.

PL-7

PROTEIN TRANSLOCATION ACROSS MEMBRANES

E. Schleiff
Department of Cell biology and Physiolgy of Plants, Department of Biology I, LMU Munich, Menzinger Str. 63, D-80683 Munich, Germany (schleiff@lrz.uni-muenchen.de)

Protein translocation across and into membranes is a fundamental process as up to 50% of all proteins synthesized in the cytosol need to traverse at least one membrane to reach their place of function in eukaryotic and prokaryotic cells. The basic principles of protein translocation have been established, although the extent, to which the molecular mechanism of each system has been determined, varies. Proteins destined for chloroplasts are synthesised in the cytosol as precursor containing a targeting signal. They are subsequently delivered to the surface of the organelle by guiding complexes. At the surface, a membrane located multi-subunit complex, the translocation machinery named Toc and Tic complex (Translocon on the outer/inner envelope of chloroplasts) recognises the precursor proteins and facilitates their translocation. The protein targeting toward and translocation into chloroplasts is a highly ordered and regulated process involving the action of protein kinases and phosphatases as well as GTP dependent and redox regulated machines at the membranes. The recognition at the surface requires the Toc complex. This complex is composed of so far five identified subunits, which select proteins to be imported and facilitate their translocation across the outer envelope. Phosphorylation, GTP hydrolysis and redox sensing tightly regulate this action of this machine as well as the dynamic assembly of this complex. Investigations of the complex reconstituted into liposomes or of soluble receptor domains gave a comprehensive picture on the function of the translocon *in vitro*. The resulting information and the mechanistic consequences for protein translocation in chloroplasts and the biochemical/biophysical characteristics of this process will be discussed. Here, the focus will be placed to the different molecular mechanisms for different subsets of incoming proteins. In addition, evolutionary aspects of the translocation of proteins across membranes will be highlighted based on the phylogentic analysis of the translocation channel and specific receptor domains.

PL-8
THE ORIGINS AND BIOLOGY OF ANIMAL PLAY

G.M. Burghardt
University of Tennessee, USA

Our understanding of the evolution and phylogeny of playfulness in animals is surprisingly minimal, largely because the function of play in both human and nonhuman animals remains controversial. Consequently, biologists have typically ignored play. After all, something frivolous and fun cannot be too important as compared to feeding, mating, fighting, and rearing young. An even greater problem, perhaps, is the difficulty of identifying play in species where play is not already acknowledged to exist. In other words, play is usually defined with vague or problematic terminology that often leads to unproductive debates rather than good science. This talk will explore the concept of play, present a set of new defining criteria, and show how play is distributed in birds and mammals using a modern phylogenetic framework. The talk will then document, with videos, that the origins of play can be traced back to turtles, lizards, fishes, and even invertebrates. In order to make sense of this expanded view of play, an integrative theoretical perspective, Surplus Resource Theory, will be described that places animal play in a larger biological framework (physiology, ecology, ethology, ontogeny) and leads to testable predictions. These findings have implications for neural, cognitive, developmental, and other approaches to play in mammals, including humans, and some of these will be discussed.

PL-9
LESSONS FROM MARINE MEDITERRANEAN CAVE-DWELLING ORGANISMS: FROM CLIMATE CHANGE TO THE MAKING OF NEW SPECIES

P. Chevaldonné and C. Lejeusne
UMR 6540 DIMAR, Centre d'Océanologie de Marseille, Station Marine d'Endoume, Rue de la Batterie des Lions, 13007 Marseille, France (chevaldonne@com.univ-mrs.fr)

Dark underwater caves are an extreme and fragmented marine environment. They represent patches of habitat resembling the deep-sea, isolated within the dynamic and shallow littoral zone. They are often inhabited by specialized organisms such as some species of mysids (Crustacea: Mysidacea). On the one hand, caves are an excellent model to study the influence of life-cycle and

fragmentation on the diversity and genetic structure of species. On the other hand, mysids are an interesting biological model for evolutionary ecology since they brood their young, and therefore only disperse through the juvenile and adult stages. This combination makes them very useful for detecting and understanding the early signs of biodiversity loss in the marine littoral zone. In Mediterranean waters, mysids of the genus *Hemimysis* are particularly common in cryptic shallow-water habitats, but their difficult identification often warrants a closer examination of species boundaries with a molecular approach. A long term regular survey of some Mediterranean populations led us to document a shift in dominance between *H. speluncola*, long considered the dominant mysid of the NW Mediterranean caves, and its congener *H. margalefi*, formerly only episodically noticed. The shift occurred while significant thermal anomalies were documented, and a general warming of the area is now demonstrated. Thermal tolerance experiments confirmed the lesser resistance of *H. speluncola*, now confined to only 3 known populations, including one in the Northern Adriatic. Also, stress markers such as heat shock proteins (HSP) proved that such organisms can play a significant role as biomarkers of their capability to resist to the ongoing climatic warming. Several aspects of the biology and life cycle of *H. margalefi,* largely unknown until now, have been studied, as well as its population demographic and genetic structuring. Genetic studies were conducted on several closely related species using several mitochondrial and nuclear molecular markers. Some species exhibited a very strong population genetic structuring, and there were several cases of possible cryptic species. In the best studied *H. margalefi*, populations display isolation by distance at the NW Mediterranean scale. At a more local scale, near Marseille, previously unsuspected hydrodynamic barriers are the main structuring factors refraining exchanges over short geographical distances. These results highlight the determining role played by habitat fragmentation on the potential recovery abilities of species or populations under additional constraints. At the species level, the survival of *H. speluncola* populations is problematic due to the warming waters and impossibility to move further northwards. At the population level, we recently observed how the island-like conformation of the cave habitat allows a simple parasitic (Ellobiopsidae) outbreak to virtually decimate a cave population within a few months. The study of this simplified model habitat with poorly resilient communities provides many insights on the current threats over marine littoral biodiversity.

PL-10

IMPORTANCE OF REFUGIA IN SHAPING MEDITERRANEAN PLANT BIODIVERSITY

F. Médail and K. Diadema
Institut Méditerranéen d'Ecologie et de Paléoécologie (IMEP, UMR CNRS 6116), Université Paul Cézanne / Aix-Marseille III, Europôle méditerranéen de l'Arbois, B.P.80, F-13545 Aix-en-Provence, France (f.medail@univ.u-3mrs.fr , katia.diadema@univ.u-3mrs.fr)

Recent research combining genetics and biogeography, i.e. phylogeography, has shown that glacial refugia have had a previously unsuspected role in shaping modern biodiversity in temperate regions, in particular to explain both the survival of paleoendemics and the speciation of neoendemics. The Mediterranean Basin hotspot represents a major biogeographical crossroads where several lineages have persisted or have been differentiated since the Tertiary. Conservation of the unique Mediterranean biodiversity is recognised as a world-scale priority and the identification and description of refuge areas is critical for an optimal evolutive conservation of this highly threatened ecoregion. We present here a detailed analysis of the scientific literature in order to identify refugia in the Mediterranean region, based upon intraspecific phylogeographical studies of plant species. 50 glacial refugia are identified, and with a shared total of 24 refugia, the role played by the three major peninsulas (iberic, italian and balkan) is confirmed. Also, we emphasize the importance of areas that have previously been attributed a lesser role (large Mediterranean islands, North Africa, Turkey and Catalonia-Provence). There is growing evidence at both a global-scale and for Mediterranean-type ecosystems, indicating that areas with high contemporary diversity and endemism are those that have experienced long-term climate stability. Biodiversity hotspots coincide indeed generally with areas that were buffered against climatic extremes. Our results are consistent with these broad patterns and suggest that the Mediterranean refugia would have been least affected by global climatic changes compared to Europe. The 50 identified Mediterranean refugia are strictly coincident with the major plant endemism areas (i.e. level of range-restricted endemics > 10%) and the regional biodiversity hotspots, which are mainly situated on islands and mountains. These ecologically and climatically stable areas have a high conservation priority because they constitute threatened key-areas for the long-term persistence of species and genetic diversity, faced with the extensive environmental changes occurring around the Mediterranean Sea. Mediterranean refugia represent generally "phylogeograpical hotspots", i.e. significant reservoirs of unique genetic diversity for preserving the future of evolutionary processes of Mediterranean species.

PL-11

THE PROREPEAT DATABASE: A DIRECTORY OF EXACT TANDEM REPEATS IN PROTEINS

J.A.M. Leunissen[1], M. van den Bosch[1], H. Luo[1], G. Kappé[2] and W.W. de Jong[2]
[1]Laboratory of Bioinformatics, Wageningen University, P.O. Box 8128, 6700 ET Wageningen, The Netherlands (Jack.Leunissen@wur.nl, Maarten.vandenBosch@wur.nl, Hong.Luo@wur.nl), [2] Department of Biochemistry, National Centre for Molecular Life Sciences, Radboud University, P.O. Box 9101, 6500 HB Nijmegen, The Netherlands (G.Kappe@ncmls.ru.nl, W.deJong@ncmls.ru.nl)

Repeating sequences in proteins are common and can be as simple as repeating single amino acids or as complicated as the repeating PHGGGWGQ sequence of the prion protein. Single amino acid (SAA) repeats have been extensively studied as they are abundant and are involved in a number of SAA repeat diseases like Huntington's disease and spino-cerebellar ataxia. To induce the disease these SAA repeats must expand beyond a certain length. A number of mechanisms by which protein repeat expansions can be achieved have been proposed of which unequal recombination and replication slippage are the most likely mechanisms. To analyse the evolutionary processes that give rise to protein tandem repeats we collect all exact repeats present in the Uniprot database and selected completed proteomes (human, chimpanzee, mouse, rat, dog, chicken, zebrafish, C. elegans, yeast, rice and Arabidopsis) as present in the RefSeq protein database. The repeats are detected using a standard suffix-trees based algorithm, that is guaranteed to find all *exact* tandem repeats, with the added constraint that mono-amino acid repeats have to be at least five units long, di-amino acid repeats are a minimum of three units long, and all other repeats consist of at least two units. The resulting ProRepeat database is a comprehensive directory containing all exact protein tandem repeats in these data sets, and can be used to further study the mechanisms controlling the length of protein repeats and the evolution between species by looking at exact protein repeat orthologs. The database is implemented in Oracle 10g, and is accessible through a PHP-based web interface. The interface allows selection criteria based upon repeat unit, number of units, length, source protein, and taxonomic group. The results can be visualized in lists, for which various sort options are available, or in the form of a taxonomic or GO (gene ontology) tree. The ProRepeat database can be queried via its web interface at URL http:// prorepeat.bioinformatics.nl/. The results obtained by mining the repeats represented in the database will be discussed.

PL-12
WEST NILE VIRUS: AN OVERVIEW

J.C. Saiz
Dpto. de Biotecnología, Instituto Nacional de Investigaciones Agrarias (INIA), Madrid, Spain (jcsaiz@inia.es)

West Nile virus is a mosquito-borne flavivirus that was first isolated in 1937 from a febrile woman in the West Nile district of Uganda. Endemic in areas of Africa and Asia, the virus has been the cause of sporadic epizootic outbreaks in Europe and the Mediterranean basin. Although many mosquitoes species can transmit the virus, the main vectors are mosquitoes of the Culex species, and the main hosts are wild birds, but human and horses are also incidental hosts of the virus. Most human infections are clinically unapparent, or cause a relatively mild febrile condition, but the disease may cause fatal encephalitis, mainly in immunocompromised patients, children and the elderly. Humoral and cellular immune responses against viral proteins contributes to protection and recovery from WNV disease but, no human licensed vaccine or prophylactic therapy is currently available. Since the mid-90´s a change in the epidemiological trends for WNV has been observed, resulting in an increase number and frequency of outbreaks in human and horses, and increase number of severe human cases, and a very high avian death rates. In 1999, WNV was first detected in New York and, since then, it has spread all over the United States, Canada, Mexico and the Caribbean, causing thousands of deaths among wild birds and horses, and more than 20.000 human cases, which resulted in over 700 deaths. In humans, and although the usual viral transmission route is throughout exposure to infected mosquitoes, alternative routes (blood transfusion, organ transplantation, breastfeeding, and intrautrine) have been also reported. Overwintering of WNV has been observed in the apparent absence of vectors, and although many different species of birds, mammals, reptiles and invertebrates have shown evidence of WNV infection in nature and laboratory settings, the reservoirs for overwinting and annual reemergence of the virus have not yet been identified, and therefore, the possibility that birds or other animals contribute significantly to the perpetuation of WNV by means of persistent infections need further evaluation. In an attempt to gain insights into the mechanisms of WNV transmission and the establishment of persistent infections, we infected pregnant mice, a suitable animal model for WNV infection, with different doses of virus. Our aim was to analysed and characterized the possible establishment of persistent infection in intrauterine infected newborn mice. Unexpectedly, an extremely high mortality rate was observed in pregnant mice (98%, 60/61) when compared with non-pregnant animals (52%, 28/53, $p<.001$), independently of the infecting dose administered

or the week of pregnancy (1st, 2nd or 3rd) at which they were infected. Analyzes of tissues obtained from euthanized mice at different times post-coitus revealed the presence of WNV-RNA in placentas and fetus of infected dams. Virus was also recovered from babies up to 25 days after birth. Three babies born to the only surviving mother presented specific IgG one month after birth and were protected against WNV infection. The implications of our results in the transmission route of WNV and in the possible establishment of persistence infections will be discussed.

PL-13

STRUCTURAL STUDIES OF A HYPOALLERGENIC ISOFORM OF THE MAJOR BIRCH POLLEN ALLERGEN BET V 1 AND ITS LIKELY BIOLOGICAL FUNCTION AS A PLANT STEROID CARRIER

D. Lamba
Iistituto di Cristallografia, Trieste Outstation, Consiglio Nazionale delle Ricerche, Area Science Park – Basovizza, S.S. 14 Km 163,5, I-34012 Trieste, Italy

Allergens are proteins characterized by their ability to induce pathogenic IgE response in susceptible individuals, giving rise to manifestations of allergy such as hay fever, asthma, rhinitis and topic dermatitis. Birch pollinosis is one of the prevailing allergic diseases in regions with birch trees such as Northern and Central Europe and Northern America. Bet v 1 is a major cause of tree pollen allergy in humans affecting an estimated 100 million people worldwide. Bet v 1 is a 17 kDa protein constituting 10% (w/w) of the protein fraction in aqueous extracts of mature pollen from the White birch tree. Approximately 50 isoforms have been cloned and sequenced, displaying a primary amino acid sequence identity in the range of 99% to 72%. The Bet v 1 protein belongs to the ubiquitous family of pathogenesis-related plant proteins (PR-10), which are produced in defense-response to pathogen infection or environmental stress. Although the allergenic properties of PR-10 proteins have been extensively studied, the exact mechanism of their biological activity in the pollen is not clear. Bet v 1 shows remarkable structural similarity to the 200 amino acid START domain of MLN64, a protein involved in the mobilisation of cholesterol in human placenta and brain, although there is no sequence homology. A yellow lupine PR-10 protein demonstrates that it is capable of binding *trans*-zeatin, an important plant hormone from the cytokinin family. Bet v 1l is a naturally occurring hypoallergenic isoform of the major birch pollen allergen Bet v 1. The crystal structure of Bet v 1l in complex with deoxycholate has been determined to a resolution of 1.9Å using the method of

molecular replacement. The main feature of the structure is a seven-stranded anti-parallel β-sheet that wraps around a 25 residue long C-terminal α-helix. The β-sheet and the C-terminal part of the long helix are separated by two small consecutive helices. The structure reveals a large hydrophobic Y-shaped cavity that spans the protein and is partly occupied by two deoxycholate molecules, which are bound in tandem and only partially exposed to solvent. This finding indicates that the hydrophobic cavity may have a role in facilitating the transfer of apolar ligands. The structural similarity of deoxycholate and brassinosteroids (BRs) ubiquitous plant steroid hormones, prompted the mass spectrometry (MS) study in order to examine whether BRs can bind to Bet v 1l. The MS analysis of a mixture of Bet v 1l and BRs revealed a specific non-covalent interaction of Bet v 1l with brassinolide and 24-epicastasterone. These findings may indicate a general plant-steroid carrier function for Bet v 1 and PR-10 proteins in the plant defense response to pathogen invasion, as well as in growth and development processes.

GENETIKA, MOLEKULARNA GENETIKA, EVOLUCIJA
BIOLOGIA GENORUM ET EVOLUTIO
GENETICS, MOLECULAR GENETICS, EVOLUTION

Uvodna tematska predavanje
Introductory Lectures

IL-1

DVOFAZNI MODEL EVOLUCIJE SEKVENCI SATELITNIH DNA: UZAJAMNI UTJECAJ SELEKTIVNOG PRITISKA I NASUMIČNIH DOGOĐAJA

N. Meštrović[1], P. Castagnone-Sereno[2] i M. Plohl[1]
[1]Zavod za molekularnu bioplogiju, Institut "Ruđer Bošković", Bijenička 54, HR-10002 Zagreb, Hrvatska (plohl@irb.hr), [2]Interactions Plantes-Microorganismes et Santé Végétale, INRA/UNSA/CNRS, 400 Route des Chappes, Bp167, F-06903 Sophia Antipolis Cedex, France

Satelitne DNA su nukleotidne sekvence koje su u eukariotskom genomu uzastopno ponovljene puno puta, a smještene su u konstitutivnom heterokromatinu. Prema modelu knjižnice, srodne vrste dijele zajedničke satelitne DNA koje su u svakoj vrsti amplificirane u različitom broju kopija. Vrsna specifičnost satelitnih profila posljedica je prvenstveno brzih promjena u broju kopija dok nukleotidna sekvenca satelitnih DNA može ostati nepromijenjena tijekom dugih evolucijskih razdoblja. Analiza srodnih satelitnih DNA koje postoje u knjižnici partenogenetskih oblića iz korijenovih kvržica otkrila je tri razine varijabilnosti monomerne sekvence koji su odredili nakupljanje nukleotidnih razlika tijekom nastanka današnjih satelita. Ova opažanja ukazuju na mogući paradoks u evoluciji satelitnih sekvenci, jer neke satelitne DNA ne pokazuju nikakve vrsne specifičnosti uključivo niti u polimorfnim dijelovima monomera čak i onda kada su vrste u kojima se nalaze evolucijski dugo odvojene. Na toj osnovi mi predlažemo dvofazni model u evoluciji barem nekih satelitnih sekvenci. U prvoj fazi nastanak divergentnih varijanti satelitne sekvence može biti ograničen funkcionalnim potrebama koje određuju njihovo širenje i preživljavanje u knjižnici. U drugoj fazi homogenizacijski mehanizmi djeluju na cijeloj duljini monomerne sekvence novih satelitnih DNA čime podstiču opstanak uspostavljenog mutacijskog profila uzduž cijele monomerne sekvence (tj. u "sačuvanim" i u "promjenljivim" segmentima). Nasumični događaji mogu istovremeno biti odlučujući pri diferencijalnoj amplifikaciji satelitnih DNA sličnih osobina u biblioteci.

TWO-STAGE MODEL OF EVOLUTION OF SATELLITE DNA SEQUENCES: AN INTERPLAY OF SELECTIVE CONSTRAINTS AND STOCHASTIC EVENTS

N. Meštrović[1], P. Castagnone-Sereno[2] and M. Plohl[1]
[1]Deptartment of Molecular Biology, Ruđer Bošković Institute, Bijenička 54, HR-10002 Zagreb, Croatia (plohl@irb.hr), [2]Interactions Plantes-Microorganismes et Santé Végétale, INRA/UNSA/CNRS, 400 Route des Chappes, Bp167, F-06903 Sophia Antipolis Cedex, France

Satellite DNAs are tandemly arranged, highly repetitive sequences located in the constitutive heterochromatin of all eukaryotes. According to the library model, related species have in common satellite DNA sequences amplified in differing abundances: species-specificity of satellite profiles results primarily from rapid fluctuations in the monomer copy-number while nucleotide sequences of satellite DNAs can remain unchanged for significant evolutionary periods. Analysis of related satellites coexisting in the library of parthenogenetic root-knot nematodes disclosed three levels of variability along the monomer sequences that modulated accumulation of sequence divergences during formation of extant satellites. These observations indicate a possible paradox in the evolution of satellite sequences, since some satellites distributed in species separated over long-time periods do not show any specific traits even in polymorphic segments of their monomers. We propose a two-stage model in the evolution of at least some satellite sequences. In the first stage, the necessity to meet functional requirements might determine formation of diverged satellite variants, their spread and survival in the library. In the second stage, homogenization mechanisms acting on whole-length monomers of new satellites can favor persistence of established mutational profile along the entire monomer sequence (i.e. both in "conserved" and "variable" sequence segments). In the same time, stochastic events can be dominant in differential amplification of satellite DNAs of similar properties in the library.

IL-2

POPRAVAK DNA KOD BAKTERIJE *Deinococcus radiodurans:* OD STOTINA FRAGMENATA DO CJELOVITOG KROMOSOMA

K. Zahradka[1] i M. Radman[2]
[1]Institut «Ruđer Bošković», Zavod za molekularnu biologiju, Bijenička 54, HR-10000 Zagreb, Hrvatska (kvlahovi@irb.hr), [2]Université de Paris-Descartes, Faculté de Médecine, INSERM Site Necker, U571, 156 rue de Vaugirard, 75015 Paris, Francuska (radman@necker.fr)

Bakterija *Deinococcus radiodurans* poznata je po svojoj izuzetnoj otpornosti na zračenje. Ona može preživjeti ekstremne doze ionizirajućeg zračenja

koje cijepaju njezin genom na stotine malih fragmenata. U samo nekoliko sati ti se fragmenti sklapaju u funkcionalni kromosom zahvaljujući iznimno učinkovitom i preciznom popravku DNA. Pronašli smo da je za taj popravak odgovoran poseban mehanizam koji uključuje sparivanje dugačkih novosintetiziranih jednolančanih krajeva DNA (engl. extended synthesis-dependent strand annealing, ESDSA). Mali fragmenti DNA nastali zračenjem povezuju se procesom ESDSA u dugačke linearne intermedijere koji se zatim sklapaju u funkcionalne kružne kromosome RecA-ovisnom homolognom rekombinacijom. Popravljeni kromosomi predstavljaju mozaik sastavljen od starih (sintetiziranih prije zračenja) i novih (sintetiziranih nakon zračenja) dvolančanih blokova DNA.

DNA REPAIR in *Deinococcus radiodurans*: FROM HUNDREDS OF FRAGMENTS TO THE FUNCTIONAL CHROMOSOME

K. Zahradka[1] and M. Radman[2]
[1]Ruđer Bošković Institute, Division of Molecular Biology, Bijenička 54, HR-10000 Zagreb, Croatia (kvlahovi@irb.hr), [2]Université de Paris-Descartes, Faculté de Médecine, INSERM Site Necker, U571, 156 rue de Vaugirard, 75015 Paris, France (radman@necker.fr)

Bacterium *Deinococcus radiodurans* is one of the most radiation resistant organisms known. It can sustain extreme levels of ionizing radiation breaking its genome into hundreds of shorts fragments. Remarkably, in just couple of hours these fragments are reassembled into functional chromosomes due to an efficient and precise DNA repair process. We found that this repair involves a special kind of «extended synthesis-dependent strand annealing» (ESDSA) followed by homologous recombination. In ESDSA, chromosomal fragments produced by radiation are used both as primers and templates for a massive synthesis of long single strand extensions which then anneal thereby accurately connecting contigous DNA fragments into long linear intermediates. These intermediates are finally matured by RecA-dependent homologous recombination into functional circular chromosomes that are patchworks of old (synthesized before radiation) and new (synthesized after radiation) double-stranded DNA blocks.

Kratka usmena priopćenja
Oral Presentations

OP-1
PRIMARNA STRUKTURA I STRUKTURALNA OBILJEŽJA INTERGENSKE RAZMAKNICE IZMEĐU 26S I 18S rRNA GENA U VRSTE *Quercus petraea*

T. Horvat[1], I. Biruš[2], N. Bauer[1], D. Papeš[1] i V. Zoldoš[1]
[1]Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (vzoldos@zg.biol.pmf.hr), [2]DNA Laboratorij Medicinskog fakulteta Sveučilišta u Osijeku, J. Huttlera 4, HR-31000 Osijek, Hrvatska

Intergenska razmaknica (IGS) između 25S and 18S rRNA gena evolucijski je nestabilnija od kodirajuće regije rDNA područja u eukariotskim genomima. Međtutim, IGS sadrži nekoliko strukturnih elemenata koji su uključeni u kontrolu i regulaciju transkripcije rRNA gena. Važni elementi su takozvani pojačivači transkripcije čiji broj kopija varira između IGS razmaknica različitih rDNA lokusa, čime se dobivaju različite dužinske varijante (slvs) razmaknice unutar istog genoma. Broj kopija pojačivača i transkripcijska aktivnost pojedinačnih rRNA gena unutar rDNA lokusa u pozitivnoj su korelaciji. U genomu vrste *Q. petrea* postoji najmanje 5 različita slvs-ova dužine otprilike 560, 1200, 1400, 2000 and 3500 pb. Nakon određivanja kompletnog nukleotidnog slijeda dominantnih slvs-ova u genomu, dana je detaljna struktura IGS razmaknice u svrhu otkrivanja: (i) pozicije promotora gena i promotora razmaknice, (ii) glavnog ponavljajućeg elementa koji sadrži pojačivače.

THE NUCLEOTIDE SEQUENCE AND STRUCTURAL FEATURES OF rDNA SPACER REGION BETWEEN 26S AND 18S rRNA GENES IN *Quercus petraea*

T. Horvat[1], I. Biruš[2], N. Bauer[1], D. Papeš[1] and V. Zoldoš[1]
[1]Department of Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia (vzoldos@zg.biol.pmf.hr), [2]DNA Laboratory , University of Osijek School of Medicine, J. Huttlera 4, HR-31000 Osijek, Croatia

Intergenic spacer region (IGS) between 25S and 18S rRNA genes is

evolutionary more unstable than rRNA coding regions in eukaryotic DNA, though it contains several structural elements involved in control and regulation of rRNA transcription. One of these elements are enhancers, of which copy number varies usually between the spacers of different rDNA clusters in the same genome, creating the spacer length variants (slvs). Copy number of enhancer elements and transcriptional activity of individual rRNA genes in an rRNA cluster are positively correlated. In *Q. petrea* there are at least 5 different slvs of around 560, 1200, 1400, 2000 and 3500 pb in length. After determination of complete nucleotide sequence of dominant slvs in the genome, detailed structured analysis was performed in order to reveal: (i) the position of gene promoter and spacer promoters, (ii) the main repeat element containing enhancer elements.

OP-2
UZASTOPNO PONAVLJAJUĆE I RASPRŠENE PORODICE DNA U GENOMIMA VRSTA RODA *Anemone*

J. Mlinarec, D. Papeš i V. Besendorfer
Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska
(jelena@zg.biol.pmf.hr, dpapes@zg.biol.pmf.hr, vbesend@zg.biol.pmf.hr)

Dvije porodice uzastopno ponavljajućih sekvenci DNA (JME i JMH2) i jedna raspršena porodica (JMH1) klonirane su i okarakterizirane po prvi put u genomu *Anemone hortensis* L obzirom na organizaciju, položaj na kromosomima te distribuciju unutar roda *Anemone*. Uzastopne ponavljajuće sekvence izolirane nakon digestije genomske DNA restrikcijskim enzimima *Eco*RV (JME porodica) i *Hind*III (JMH2 porodica) bile su duge ~567 pb i 743 pb. Obje satelitne porodice obuhvaćaju heterokromatinska područja u vrste *A. hortensis*; porodica JME pokriva interkalarna DAPI pozitivna heterochromatinska područja na svim akrocentričnim kromosomima, dok porodica JMH2 obuhvaća terminalna DAPI pozitivna područja svih akrocentrika, meta-submetacentričnog kromosoma 4 i metacentričnog kromosoma 5. Meta-submetacentrični kromosomski par pokazao je polimorfizam JMH2 i telomernog signala *Arabidopsis* $(TTTAGGG)_n$ tipa. Porodica JMH1, jedinice ponavljanja od ~945 pb, izolirana je nakon digestije genomske DNA enzimom *Hind*III. Fluorescencijska hibridizacija *in situ* (FISH) pokazala je raspršenu organizaciju porodice JMH1 na svim kromosomima *A. hortensis*. Porodica JMH1 ima djelomičnu homologiju s retrotranspozonom iz skupine *Ty*3/*gypsy*, dok JME i JMH2 nisu pokazale sličnost niti sa jednom sekvencom prijavljenom u banci gena. Uzastopne ponavljajuće porodice JMH2 i JME predstavljaju 0,74% i 0,03%, dok raspršena porodica JMH1 sačinjava

8,77% genoma *A. hortensis*. PCR-om i hibridizacijom po Southern-u utvrđeno je da su JMH2 i JMH1 široko rasprostranjene unutar roda *Anemone*, dok je porodica JME prisutna u 5 od 11 istraženih vrsta. Dodatna analiza sekvenci ponavljajućih porodica DNA omogućit će bolji uvid u evoluciju genoma roda *Anemone*. Poliomorfizam terminalnog FISH signala u vrste *A. hortensis* ukazuju na plastičnost genoma ove vrste.

SATELLITE AND DISPERSED REPETITIVE DNA FAMILIES IN THE GENOME OF *Anemone* SPECIES

J. Mlinarec, D. Papeš and V. Besendorfer
Department of Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia
(jelena@zg.biol.pmf.hr, dpapes@zg.biol.pmf.hr, vbesend@zg.biol.pmf.hr)

Two families of satellite DNAs (JME and JMH2) and one dispersed repetitive element (JMH1) of *Anemone hortensis* L. genome have been cloned and characterized with respect to genomic organization, chromosomal localization and their distribution within genus *Anemone*. These DNA sequences are the first representatives of repetitive DNAs described for *A. hortensis*. The tandem repeats isolated after digestion of genomic DNA with *Eco*RV (JME family) and *Hind*III (JMH2 family) were ~567 bp and 743 bp long, respectively. Both satellites cover all the heterochromatic regions of *A. hortensis*. JME family localized to intercalary DAPI-positive heterochromatic regions of all acrocentric chromosomes, while JMH2 family localized to terminal DAPI-positive regions of all acrocentrics, meta-submetacentric 4 and metacentric 5. Polymorphism of meta-submetacentric pair 4 concerning hybridization pattern of JMH2 and *Arabidopsis*-type $(TTTAGGG)_n$ telomere probe was observed after fluorescence *in situ* hybridization (FISH). Repeat unit of ~945 bp belonging to the JMH1 family was isolated after digestion with *Hind*III. FISH revealed dispersed organization of the JMH1 repeat family on all *A. hortensis* chromosomes. JMH1 exhibited partial homology to the *Ty*3/*gypsy*-like retroelement and has to be confirmed as a part of a retrotransposon, while JME and JMH2 had no significant similarity to entry in the gene bank. Satellite DNA families JMH2 and JME represented 0.74% and 0.03% of *A. hortensis* genome, respectively, while dispersed element JMH1 constitutes 8.77%. PCR and Southern hybridization data revealed the widespread occurrence of JMH2 and JMH1 in the genus, while JME family was present in the 5 of 11 *Anemone* species examined. Sequence analysis of repetitive families will shed light on *Anemone* genome evolution. Polymorphism of terminal FISH signals in *A. hortensis* indicates genome plasticity of this species.

OP-3

KRATKI INTRONI UKAZUJU NA KOMPAKTAN GENOM KOD SPUŽAVA

M. Štifanić i R. Batel
Institut Ruđer Bošković, Centar za istraživanje mora, G. Paliaga 5, HR-52210 Rovinj, Hrvatska (mauro.stifanic@cim.irb.hr, batel@cim.irb.hr)

Spužve su jedne od najstarijih višestaničnih životinja i kao takve vrlo su zanimljive sa evolucijskog stajališta. Dosadašnja saznanja o veličini i organizaciji genoma spužava kontradiktorna su. Cilj ovog rada je zaključak o organizaciji genoma spužava na temelju ststističke analize veličine eksona i introna. Analizirani geni odabrani su pretraživanjem NCBI baze podataka. U prvom koraku odabrani su, uz negativnu selekciju mitohondrijskih gena i patenata, genomski slijedovi koji kodiraju za proteine a duži su od 1000 nukleotida,. Uz pomoć BLASTN algoritma, odabrani genomski slijedovi korišteni su za pronalaženje odgovarajućih cDNA slijedova. Na ovaj način izolirano je 18 cDNA i 15 odgovarajućih genomskih slijedova. U ovom radu prezentirana je statistička analiza veličine eksona i introna svih gena spužava za koje su, u vrijeme pisanja ovog rada, u NCBI nukleotidnoj bazi bili deponirani i cDNA i genomski slijedovi. Analiza je provedena na svim cijelim eksonima sadržanim u CDS slijedovima (od engl. Coding Sequence), i svim intronima prisutnim između start i stop kodona genomskh slijedova. Prosječna veličina 78 eksona iznosila je 146 nukleotida (nt) uz median od 119, dok je ona za 96 introna iznosila 259 nt uz median od 181. Analizirani geni, u regiji od start do stop kodona, sadrže ukupno 19143 kodirajućih i 24822 nekodirajućih nukleotida. Prosječan omjer kodirajućih i nekodirajućih nukleotida iznosi 0.77, što je vrlo visoka vrijednost. Temeljeno na pozitivnoj korelaciji veličine introna i veličine genoma zaključujemo da spužve imaju kompaktan genom.

SHORT INTRONS INDICATE A COMPACT GENOME IN SPONGES

M. Štifanić and R. Batel
Ruđer Bošković Institute, Center for Marine Research, G. Paliaga 5, HR-52210 Rovinj, Croatia (mauro.stifanic@cim.irb.hr, batel@cim.irb.hr)

Sponges are among the oldest multicellular animals and, as such, are very interesting from an evolutionary point of view. Current knowledge of genome size and organisation in sponges is contradictory. The aim of this study was a statistical exon/intron size analysis in sponges, in order to conclude about their genome organisation. The NCBI nucleotide sequence database was searched

for Poriferan protein-coding genomic sequences longer than 1000 nucleotides, excluding mitochondrial genes and patents. The retreaved sequences were then used to search for corresponding cDNAs using the BLASTN algorithm. We finally obtained 18 cDNA sequences that matched to 15 genomic clones. Here we present a statistical exon/intron size analysis of all sponge genes with both the CDS and the genomic sequences deposited in the NCBI sequence database at the time of writing. The analysis was based on all complete exons contained within the CDSs and all introns between the start and stop codons. The average size of 78 exons, and 96 introns is 146 nt with a median of 119, and 259 nt with a median of 181 respectively. The regions between the start and stop codons of the analysed genes contain a total of 19143 coding and 24822 noncoding nucleotides making a very high "CDSs size" vs. "introns contained within" ratio of 0.77. Based on the positive correlation of intron size and genome size, we conclude that sponges have a compact genome.

OP-4

POVEZANOST PODUDARNOSTI MIKROSATELITA HLA S ISHODOM TRANSPLANTACIJE HEMATOPOETSKIH MATIČNIH STANICA

K. Štingl[1], Z. Grubić[1], E. Čečuk-Jeličić[1], R. Žunec[1], R. Serventi-Seiwerth[2], B. Labar[2] i V. Brkljačić-Kerhin[1]
[1]Zavod za tipizaciju tkiva (kstingl@kbc-zagreb.hr), [2]Zavod za hematologiju, Klinički bolnički centar Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Hrvatska

Podudarnost primatelja i davatelja u genima Glavnog sustava histokompatibilnosti (HLA) je najvažniji čimbenik u ishodu alogenične transplantacije koštane srži (aloTKS). Predložena je uporaba mikrosatelita HLA u pronalaženju nesrodnog davatelja identičnog s primateljem za čitavu regiju HLA. Cilj rada bila je retrospektivna analiza dvadeset bolesnika koji su bili podvrgnuti aloTKS. Petnaest ih je primilo presadak od nesrodnog davatelja (podudarnog za HLA-A, -B, -DRB1, -DQB1), dok je za preostalih pet bolesnika davatelj bio roditelj (HLA-A, -B, -DRB1, -DQB1 podudaran u 2 slučaja; nepodudaran za alel HLA-B u jednom slučaju; nepodudaran za alel HLA-B i -DRB1 u 2 slučaja). Svi parovi analizirani su za 12 mikrosatelita HLA (D6S1014, D6S265, D6S273, D6S2793, D6S291, D6S2927, D6S2939, MICA, MIB, TNFa, TNFb, TNFd). Uzorci su analizirani elektroforezom na 6% poliakrilamidnom gelu u ALFexpress sekvenceru. Mikrosateliti su podijeljeni na 3 grupe obzirom na postotak podudarnosti para primatelj-davatelj: mikrosateliti s visokom razinom podudarnosti (>80%, D6S2927, MICA, MIB, TNFb), srednjom (50-80%, D6S1014, D6S273, TNFd) i niskom razinom podudarnosti (<50%, D6S265, D6S2793, D6S291, D6S2939, TNFa). Dobiveni rezultati su u skladu

s udaljenošću istraživanih mikrosatelita i gena HLA, njihovom neravnotežom udruživanja, te stupnjem raznovrsnosti mikrosatelita. Dvanaest bolesnika (60%) imalo je stupanj reakcije presatka protiv primatelja 3-4 (Graft versus Host Disease, GvHD), a od preostalih 8 bolesnika, kod 2 je došlo do odbacivanja presatka. Na temelju rezultata ove studije nije moguće donijeti konačan zaključak o povezanosti razine podudarnosti u mikrosatelitima HLA i GvHD, te je povećanje broja parova primatelj-davatelj nužno za definiranje uloge mikrosatelita HLA u odabiru nesrodnog davatelja.

THE EFFECT OF HLA MICROSATELLITES MATCHING IN OUTCOME OF HEMATOPOIETIC STEM CELL TRANPLANSPLANTATION

K. Stingl[1], Z. Grubić[1], E. Čečuk-Jeličić[1], R. Žunec[1], R. Serventi-Seiwerth[2], B. Labar[2] and V. Brkljačić-Kerhin[1]
[1]Tissue Typing Centre (kstingl@kbc-zagreb.hr), [2]Department of Hematology, Clinical Hospital Centre, Kispaticeva 12, HR-10000 Zagreb, Croatia

Matching of Major Histocompatibility Complex (MHC) of donor and recipient is the most important factor in outcome of allogeneic bone marrow transplantation (alloBMT). The potential use of microsatellites in identification of unrelated donor-recipient pairs identical for the entire MHC has been proposed. Twenty patients who underwent alloBMT were retrospectively studied. Fifteen received transplant from unrelated donor (HLA-A, -B, -DRB1 and -DQB1 matched), while for remaining 5 patients, donor was parent (HLA-A, B, DRB1, DQB1 matched in 2 cases; HLA-B allele mismatched in one case; HLA-B and -DRB1 allele mismatched in 2 cases). All pairs were tested for 12 HLA microsatellites (D6S1014, D6S265, D6S273, D6S2793, D6S291, D6S2927, D6S2939, MICA, MIB, TNFa, TNFb and TNFd). Analysis was performed using electrophoresis on 6% polyacrylamide gel in ALFexpress sequencer. According to percentage of allele matching, microsatellites were divided in 3 groups: microsatellites with high matching level (>80%, D6S2927, MICA, MIB and TNFb), intermediate matching level (50-80%, D6S1014, D6S273 and TNFd), and low matching level (<50%, D6S265, D6S2793, D6S291, D6S2939 and TNFa). This was expected since level of matching is proportional to distance between microsatellites and HLA loci, their linkage disequilibrium and level of microsatellite polymorphism. Association of matching level and degree of GvHD could not be determined since 12 patients (60%) had GvHD grade 3 or higher, and out of the remaining 8 patients, 2 showed signs of transplant rejection and disease relapse. A larger group of patients is necessary to obtain conclusive results about role of microsatellites in better definition of unrelated donors.

OP-5

MOLEKULARANA I FUNKCIONALNA KARAKTERIZACIJA TRANSPORTNIH PROTEINA (PGP I MRP2) U PRIMARNIM HEPATOCITIMA PASTRVE (*Oncorhynchus mykiss*)

R. Žaja, R. Sauerborn Klobučar i T. Smital
Laboratorij za molekularnu ekotoksikologiju, Zavod za istraživanje mora i okoliša, Institut Ruđer Bošković, Bijenička 54, HR-10000 Zagreb, Hrvatska

Mehanizam multiksenobiotičke otpornosti (MXR, engl. *multixenobiotic* resistance) u vodenih organizama jedinstveni je obrambeni sustav protiv velikog broja ksenobiotika koji sprječava njihovo nakupljanje u stanici te ispoljavanje njhovog toksičnog učinka na stanicu. Molekularna osnova MXR-a slična je dobro poznatom mehanizmu rezistencije na kemoterapeutike i lijekove kod sisavaca (MDR, engl. *multidrug resistance*). Slično kao u slučaju MDR-a, izbacivanje hidrofobnih ksenobiotika i njihovih metabolita iz stanica kod vodenih organizama vjerojatno je posredovano aktivnošću nekoliko različitih tipova ABC transportnih proteina. Glavni cilj ovog rada je detekcija gena koji kodiraju sintezu Pgp (P-glikoproteina) i MRP2 (*multidrug resistance-associated protein)*, te karakterizacija transportne aktivnosti posredovane tim proteinima u primarnoj kulturi hepatocita pastrve (*Oncorhynchus mykiss*). Koristeći specifične početnice identificirane su dvije nukleotidne sekvence dužine 800 i 2000 parova baza. Amino-kiselinski slijed izveden iz dobivenih nukleotidnih sekvenci pokazuje visok stupanj homologije s Pgp (50% s Abcb1) i MRP2 (59% s Abcc2) proteinima sisavaca. Transportne aktivnosti Pgp-a i MRP2 karakterizirane su koristeći specifične fluorescentne supstrate (rodamin 123, bodipy-verapamil i kalcein-AM) i modelne inhibitore (ciklosporin, verapamil, reversin 205 i MK571). Različiti tipovi inhibitora rezultirali su različitom razinom akumulacije fluorescentnih supstrata ukazujući na prisustvo dvije različite transportne aktivnosti. Dobiveni rezultati ukazuju da je MXR kao dio cjelovitog detoksifikacijskog sustava u jetri riba (koštunjača) posredovan aktivnošću barem dva različita ABC transportna proteina.

MOLECULAR AND FUNCTIONAL CHARACTERIZATION OF PGP AND MRP2 EFFLUX TRANSPORTERS IN PRIMARY CULTURE OF RAINBOW TROUT (*Oncorhynchus mykiss*) HEPATOCYTES

R. Žaja, R. Sauerborn Klobučar and T. Smital
Laboratory for Molecular Ecotoxicology, Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička 54, HR-10000 Zagreb, Croatia

The multixenobiotic resistance (MXR) mechanism in aquatic organisms is

a unique defence system directed against numerous xenobiotics, preventing their intracellular accumulation and potentially toxic effect. The molecular basis of MXR is analogous to the well-known multidrug resistance (MDR) phenomenon found in many mammalian cell types. Similarly to MDR, the extrusion of hydrophobic xenobiotics and their metabolites in fish could be mediated by the activities of several types of the ABC transport proteins. The main goals of this study were detection of the P-glycoprotein (Pgp) and multidrug resistance-associated protein (MRP) related genes, and characterization of the Pgp and MRPs related transport activities in primary cultured rainbow trout (*Oncorhynchus mykiss*) hepatocytes. Using specific pairs of primers we identified two nucleotide sequences, 800 bp and 2000 bp in length. Amino acid sequence deduced from 800 bp nucleotide sequence showed a high degree of homology with human Pgp-like proteins (65% to Abcb11 and 50% to Abcb1). The polypeptide deduced from the 2000 bp nucleotide sequence shared a high degree of homology with mammalian MRP2 proteins (~59%). The Pgp- and MRP-like transport activities were detected using specific fluorescent substrates (rhodamine 123, bodipy-verapamil and calcein-AM) and model inhibitors (cyclosporine, verapamil, reversin 205 and MK571). Different types of inhibitors lead to various levels of fluorescent substrates accumulation, indicating the presence of two distinctive efflux activities mediated by Pgp- and MRP-like transporters. Therefore, the MXR as integral part of detoxification system in liver of teleost fish species is mediated by at least two different efflux transporters.

Posterska priopćenja
Posters

P-1

ANALIZA SRODSTVENIH ODNOSA OBADA (DIPTERA: TABANIDAE) IZ RODOVA *Tabanus* I *Philipomyia* USPOREDBOM MITOHONDRIJSKE DNA

I. Biruš[1], S. Krčmar[2], K. Brčić-Kostić[3] i G. Lauc[1]
[1]Medicinski fakultet Sveučilišta J.J. Strossmayera Osijek, Huttlerova 4, HR-31000 Osijek, Hrvatska (ivan.birus@zg.t-com.hr, glauc@public.srce.hr), [2]Odjel za biologiju Sveučilišta J.J. Strossmayera Osijek, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska (stjepan@ffos.hr), [3]Instutut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (brcic@irb.hr)

Rodovi obada (Diptera: Tabanidae) *Philipomyia sp.* i *Tabanus sp.* po svojim su morfološkim osobinama razdvojeni u dva tribusa, iako su nekoć pripadali istom rodu. U ovom radu sekvencirana je mitohondrijska DNA obada kako bi se odredila prikladnost nekih njezinih regija za taksonomsko razlikovanje rodova i tribusa, te srodstvenih odnosa rodova *Philipomyia sp.* i *Tabanus sp*. Umnoženi su fragmenti gena za podjedinicu I citokrom-oksidaze i dio gena za ribosomsku RNA 16S u genomu mitohondrija 8 vrsta obada. Rekonstrukcija filogenetičkih stabala rađena je metodama "združivanja susjeda", "najveće štedljivosti" i "najveće vjerojatnosti". Rezultati, prikazani kladogramima, pokazuju smještanje rodova *Philipomyia sp.* i *Tabanus sp.* u izdvojene skupine. Analiza sljedova pokazala je da je ispitivano područje gena za podjedinicu I citokrom-oksidaze pogodnije za analize na razini roda, a ispitivano područje gena za 16S ribosomsku RNA za analizu viših taksonomskih kategorija.

PHYLOGENETIC ANALYSIS OF HORSEFLIES (DIPTERA: TABANIDAE) BELONGING TO GENI *Tabanus* AND *Philipomyia* BY COMPARISON OF MITOCHONDRIAL DNA

I. Biruš[1], S. Krčmar[2], K. Brčić-Kostić[3] and G. Lauc[1]
[1]Faculty of Medicine Josip Juraj Strosmayer University of Osijek, Huttlerova 4, HR-31000 Osijek, Hrvatska (ivan.birus@zg.t-com.hr, glauc@public.srce.hr), [2]Department of Biology J.J. Strossmayer University of Osijek, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska (stjepan@ffos.hr), [3]Rudjer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (brcic@irb.hr)

Tabanid geni *Philipomyia sp*. and *Tabanus s*p. are currently classified in two

different tribes according to their morphological features, although they used to belong to the same genus. In the present study, tabanid mitochondrial DNA was sequenced in order to determine its suitability for taxonomical differentiation of geni, tribes and phylogenetic relationships of *Philipomyia* and *Tabanus* geni of tabanids. Fragments of genes encoding for cytochrome oxidase I and 16S rDNA were amplified from 8 tabanid species. Reconstruction of phylogenetic trees was done by neighbor-joining, maximum parsimony and maximum likelihood methods. Results, presented as cladograms, show placing of geni *Philipomyia* and *Tabanus* in separate clusters (or phylogenetic clades). Sequence analysis showed that studied area of COI is more suitable for genus-level analyses, and studied area of 16SrDNA is more suitable for the analysis of higher-level taxonomic categories.

P-2

TNF-á PROMOTORSKI POLIMORFIZMI I PREDISPOZICIJA ZA NASTANAK ŠEĆERNE BOLESTI TIP 1 U POPULACIJI DALMACIJE

V. Boraska[1], V. Škrabić[2], M. Peruzović[1] i T. Zemunik[1]
[1]Katedra za medicinsku biologiju, Medicinski fakultet Sveučilišta u Splitu, Šoltanska 2, HR-21000 Split, Hrvatska (vboraska@bsb.mefst.hr, mp@bsb.mefst.hr, tzemunik@bsb.mefst.hr), [2]Odjel za pedijatriju, KB Split, Spinčićeva 1, HR-21000 Split, Hrvatska (vskrabic@kbsplit.hr)

Šećerna bolest tip 1 (T1DM) nastaje zbog kronične progresivne i upalne autoimune reakcije koja rezultira selektivnom eliminacijom â stanica gušterače. Tumor nekrozni faktor (TNF-á) je kao jaki imunomodulator i pro-upalni citokin povezan s patogenezom mnogih upalnih i autoimunih bolesti. Zbog toga smo testirali povezanost dvaju polimorfizama (SNP) iz promotorske regije TNF-á gena s predispozicijom na nastanak T1DM-a u populaciji Dalmacije. Genotipizirano je 205 T1DM bolesnika i 144 ispitanika iz kontrolne skupine na polimorfizme G-238A i G-308A iz promotorske regije TNF-á gena PCR metodom nakon čega je slijedilo cijepanje s restrikcijskim enzimima *MspI* (G-238A) i *NcoI* (G-308A). Haplotipska analiza polimorfizama obavljena je pomoću statističkog programa EH+. Genotipska i haplotipska povezanost s T1DM je potom analizirana $\div^2$ testom. Raspodjela genotipova za G-238A i G-308A TNF-á promotorske polimorfizme nije se razlikovala između dviju ispitivanih skupina (p=0.127, p=0.132). Međutim, učestalost alela A iz G-308A polimorfizma je bila signifikantno veća kod oboljelih od T1DM-a (p=0.045). Također, specifični haplotip (-238G, -308A) je uočen više puta kod T1DM bolesnika (p=0.045) što je ukazalo na njegovu moguću ulogu kao faktora rizika za nastanak bolesti. Naše je istraživanje pokazalo da gen TNF-á

može pridonijeti nastanku T1DM u populaciji Dalmacije kroz svoje specifične haplotipske kombinacije.

TNF-á PROMOTER POLYMORPHISMS AND SUSCEPTIBILITY TO TYPE 1 DIABETES IN THE DALMATIAN POPULATION

V. Boraska[1], V. Škrabić[2], M. Peruzović[1] and T. Zemunik[1]
[1]Department of Medical biology, School of Medicine, University of Split, Soltanska 2, HR-21000 Split, Croatia (vboraska@bsb.mefst.hr, mp@bsb.mefst.hr, tzemunik@bsb.mefst.hr), [2]Department of Pediatrics, Clinical hospital Split, Spinciceva 1, HR-21000 Split, Croatia (vskrabic@kbsplit.hr)

Type 1 diabetes mellitus (T1DM) is characterized by a chronic progressive inflammatory autoimmune reaction that causes the selective elimination of pancreatic â cells. Tumor necrosis factor (TNF-á) is a potent immunomodulator and proinflamatory cytokine that has been implicated in the pathogenesis of many kinds of inflamatory or autoimmune diseases. Therefore we tested an association of two single nucleotide polymorphisms (SNP) in promoter region of TNF-á gene with the susceptibility to T1DM in the Dalmation population. 205 T1DM patients and 144 control subjects were genotyped for a G-238A and G-308A promoter variants of TNF-á gene by PCR followed with *MspI* and *NcoI* endonuclease restriction, respectively. Haplotype analysis of these two SNPs was made using the statistical program EH+. Genotype and haplotype association and susceptibility to T1DM was further investigated using chi-square test. A genotype distribution of G-238A and G-308A TNF-á promoter variants did not differ between the T1DM patients and the controls (p=0.127, p=0.132, respectively). However the TNF-á -308A minor allele was significantly more frequent in the T1DM patients (p=0.045). Furthermore, a specific haplotype (-238G, -308A) was observed more often in the T1DM patients (p=0.045) indicating its possible role as a risk factor. Our findings indicate that TNF-á gene may contribute to the susceptibility to T1DM in the Dalmatian population through its specific haplotype combinations.

P-3

UČINAK MUTACIJE *recG* NA HOMOLOGNU REKOMBINACIJU I PORAVAK DNA KOD MUTANATA *recBC sbcBC* BAKTERIJE *Escherichia coli*

M. Buljubašić, K. Zahradka, M. Petranović i D. Zahradka
Institut «Ruđer Bošković», Zavod za molekularnu biologiju, Bijenička 54, HR-10000 Zagreb, Hrvatska (mbuljub@irb.hr)

Protein RecG je DNA helikaza koja potiče izmjenu lanaca DNA i produljenje heteroupleksa tijekom homologne rekombinacije kod bakterije *Escherichia coli*. Stanice mutirane u genu *recG* pokazuju smanjenu rekombinacijsku sposobnost i povećanu UV-osjetljivost u odnosu na stanice divljeg tipa. Proučavali smo učinak mutacije *recG* na rekombinacijski popravak DNA nakon UV-zračenja, na konjugacijsku rekombinaciju te na morfologiju stanica kod dva tipa mutanata *recBC sbcBC* bakterije *E. coli*. Kod jednog mutanta je gen *sbcB* bio inaktiviran točkastom mutacijom (*sbcB15*), dok je kod drugog bio u potpunosti deletiran (Λ*sbcB*). Uvođenje mutacije *recG* u soj *recBC sbcB15 sbcC* izazvalo je jako smanjenje učinkovitosti rekombinacije i rekombinacijskog popravka DNA te velike poremećaje u segregaciji kromosoma i staničnoj diobi. Suprotno tome, kod mutanta *recBC* Λ*sbcB sbcC*, mutacija *recG* je imala razmjerno blag učinak na rekombinacijske procese i morfologiju stanica. Na temelju dobivenih rezultata zaključujemo da mutacija *sbcB15* modificira rekombinacijski proces na način da on postaje jače ovisan o proteinu RecG. Moguće je da se mutirani protein SbcB15 veže na rekombinogene 3' krajeve DNA i ometa razrješenje rekombinacijskih intermedijera u odsutnosti proteina RecG.

EFFECTS OF A *recG* MUTATION ON HOMOLOGOUS RECOMBINATION AND DNA REPAIR IN *recBC sbcBC* MUTANTS OF *Escherichia coli*

M. Buljubašić, K. Zahradka, M. Petranović and D. Zahradka
Ruđer Bošković Institute, Division of Molecular Biology, Bijenička 54, HR-10000 Zagreb, Croatia (mbuljub@irb.hr)

RecG protein is a DNA helicase that promotes DNA strand exchange and heteroduplex extension during homologous recombination in *Escherichia coli*. Cells mutated in the *recG* gene show moderate recombination deficiency and increased UV-sensitivity compared to the wild type cells. We have studied the effects of *recG* mutation on recombinational DNA repair after exposure to UV-irradiation, on conjugal recombination, and on cell morphology in two types of *recBC sbcBC* mutants of *E. coli*. In one mutant, the *sbcB* gene was inactivated by point mutation (*sbcB15*), while in other it was completely deleted (Λ*sbcB*). We found that introduction of the *recG* mutation in *recBC sbcB15 sbcC* background strongly reduced the efficiency of recombination and recombinational DNA repair, and caused severe defects in chromosome segregation and cell division. On the contrary, in *recBC* Λ*sbcB sbcC* background, the *recG* mutation had relatively mild effect on both recombination processes and cell morphology. We inferred that the *sbcB15* mutation modifies the recombinational process in a way that the process

becomes more dependent on the RecG protein. It is possible that the mutant SbcB15 protein binds to recombinogenic 3' DNA ends and interferes with the processing of recombination intermediates in the absence of RecG protein.

P-4

RAZNOLIKOST MIKROSATELITSKIH LOKUSA UNUTAR GENA ODGOVORNOG ZA NEKROZU TUMORA (TNF) U POPULACIJI HRVATSKE

H. Car, K. Štingl, R. Žunec, E. Čečuk-Jeličić, V. Kerhin-Brkljačić i Z. Grubić.
Zavod za tipizaciju tkiva (helena_car@net.hr), KBC-Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Hrvatska

Lokus TNF smješten je unutar regije Glavnog sustava histokompatibilnosti kod čovjeka (sustav HLA) i to između lokusa HLA-B i -DRB1. Sadrži gene koji kodiraju faktor nekroze tumora (TNFα) i limfotoksin (TNFβ), a koji imaju značajnu ulogu u imunološkim reakcijama, te su stoga od velikog znanstvenog interesa. Do danas je poznato šest mikrosatelita (TNFa, TNFb, TNFc, TNFd, TNFe i TNFf) unutar lokusa TNF. Cilj ovog istraživanja bio je ispitati raznolikost mikrosatelitskih lokusa TNFa, TNFb i TNFd, neravnotežu udruživanja (LD) unutar TNF regije, kao i povezanosti alela TNF mikrosatelita s alelima lokusa HLA-B i -DRB1. Ispitivanu skupinu tvorila su 152 nesrodna ispitanika stanovnika grada Zagreba (podrijetlom iz različitih krajeva Hrvatske), prethodno tipizirana za alele lokusa HLA-A, -B i -DRB1. Analiza dužine fragmenta TNF mikrosatelita provedena je elektroforezom PCR produkata na poliakrilamidnom gelu u automatskom sekvenceru (ALFexpress). Najčešći aleli u hrvatskoj populaciji bili su TNFa10 (22.4%), TNFb4 (44.4%) i TNFd4 (56.6%). Najjaču vrijednost LD-a pokazali su slijedeće haplotipske sveze: TNFb1-TNFa2 (LD=3.86; P<0.0001), TNFa13-TNFd6 (LD=1.98; P<0.0001) i TNFb1-TNFd5 (LD=1.44; P=0.0114). Analiza tri-lokus haplotipskih sveza pokazala je najveću vrijednost LD-a za svezu TNFb4-TNFa10-TNFd4 (LD=3.26; P=0.0023), dok je najveća statistička značajnost uočena za svezu: TNFb1-TNFa2-TNFd5 (LD=1.95; P=0.0001). Tri najčešće haplotipske sveze pet lokusa unutar naše populacije bile su: HLA-B*18-TNFb4-TNFa10-TNFd4-DRB1*11; HLA-B*35-TNFb4-TNFa10-TNFd4-DRB1*11 i HLA-B*07-TNFb4-TNFa11-TNFd4-DRB1*15. Na temelju dobivenih rezultata može se zaključiti da unutar hrvatske populacije osim haplotipskih sveza uočenih u drugim europskim populacijma, postoje i sveze karakteristične samo za našu populaciju. Rezultati ovog istraživanja naći će veliku primjenjenu u budućim istraživanjima povezanosti alela lokusa TNF i autoimunih bolesti.

TUMOUR NECROSIS FACTOR MICROSATELLITE POLYMORPHISMS IN THE CROATIAN POPULATION

H. Car, K. Štingl, R. Žunec, E. Čečuk-Jeličić, V. Kerhin-Brkljačić and Z. Grubić.
Tissue Typing Centre (helena_car@net.hr), University Hospital Centre Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Croatia

TNF locus or TNF gene cluster, located in the HLA class III region between HLA-B and DRB1 locus, contains genes which encode two important cytokines: the tumour necrosis factor (TNFα) and lymphotoxin (TNFβ), both of which are a focus of scientific interest due to their immunomodulatory activities and other biological effects. Six microsatellites (TNFa, TNFb, TNFc, TNFd, TNFe, and TNFf) have been described within TNF locus. Polymorphism of TNFa, TNFb and TNFd microsatellites, linkage disequilibrium (LD) within TNF region and their relationship with alleles at HLA-B and -DRB1 loci was investigated in this study. Sample of 152 Croatians, previously typed for HLA-A, -B and DRB1 loci, was tested. Analysis was performed using electrophoresis of PCR amplified products on polyacrylamide gel in automated sequencer (ALFexpress). TNFa10, TNFb4 and TNFd4 alleles were the most frequent (22.4%, 44.4%, and 56.6%, respectively). LD between TNFa, TNFb and TNFd loci was investigated analysing two- and three-locus haplotypic associations. The strongest two-locus haplotypic associations were TNFb1-TNFa2 (LD=3.86; P<0.0001), TNFa13-TNFd6 (LD=1.98; P<0.0001), and TNFb1-TNFd5 (LD=1.44; P=0.0114). Among three-locus haplotypic associations the highest LD was observed for the TNFb4-TNFa10-TNFd4 (LD=3.26; P=0.0023), while the most significant P value was calculated for TNFb1-TNFa2-TNFd5 (LD=1.95; P=0.0001). Three most common five-locus haplotypic associations in our population were: B*18-TNFb4-TNFa10-TNFd4-DRB1*11; B*35-TNFb4-TNFa10-TNFd4-DRB1*11 and B*07-TNFb4-TNFa11-TNFd4-DRB1*15. In conclusion, this investigation revealed haplotypic associations which are characteristic for the Croatian population in addition to associations which Croatians share with other populations. These results should be considered in future studies about association between TNF microsatellite alleles and autoimmune diseases.

P-5

EGZONUKLEAZNA AKTIVNOST JE NUŽNA ZA HOMOLOGNU REKOMBINACIJU U *recD* MUTANTIMA BAKTERIJE *Escherichia coli*

D. Đermić, D. Zahradka i M. Petranović

Zavod za molekularnu biologiju, Institut "Ruđer Bošković", Bijenička 54, HR-10002 Zagreb, Hrvatska (dermic@irb.hr)

Većina homologne rekombinacije u divljem tipu bakterije *Escherichia coli* je inicirana heterotrimernim enzimom RecBCD, koji, uz helikaznu i nukleaznu aktivnost, vrši polimerizaciju RecA proteina. Kada je RecD podjedinica inaktivirana, kao u *recD* mutantima, rezultirajući RecBC enzim je rekombinacijski proficijentan iako više nije nukleaza, već zadržava samo helikaznu aktivnost i sposobnost polimerizacije proteina RecA. Međutim, bakterija *E. coli* sadržava nekoliko drugih egzonukleaza koje razgrađuju dvolančanu ili jednolančanu DNA, te bi stoga mogle omogućiti provođenje rekombinacijskih reakcija djelujući zajedno s enzimom RecBC. Da bismo provjerili tu pretpostavku, inaktivirali smo više egzonukleaza (t.j. egzonukleazu I, egzonukleazu X, egzonukleazu VII, RecJ, i SbcCD egzonukleazu) u mutantu *recD*, te utvrdili sposobnost tako konstruiranih mutanata da provode homolognu rekombinaciju tijekom Hfr-konjugacije, P1-transdukcije i ë-križanja. Pokazano je da su ove egzonuklease nužne za homolognu rekombinaciju kataliziranu enzimom RecBC. Predložen je model za procesiranje donorske DNA u *recD* transkonjugantima i transduktantima.

EXONUCLEASE ACTIVITY IS ESSENTIAL FOR HOMOLOGOUS RECOMBINATION IN *recD* MUTANTS OF *Escherichia coli*

D. Đermić, D. Zahradka and M. Petranović
Division of Molecular Biology, Ruđer Bošković Institute, Bijenička 54, HR-10002 Zagreb, Croatia (dermic@irb.hr)

Most of homologous recombination in wild-type *Escherichia coli* is initiated by heterotrimeric RecBCD enzyme, which possesses helicase, nuclease and RecA loading activity. When the enzyme lacks its RecD subunit, the resulting RecBC enzyme, active in *recD* mutants, is recombination proficient although it has just helicase and RecA loading activity, but is not a nuclease. However, *E. coli* encodes for several other exonucleases that digest double-stranded and single-stranded DNA, and thus might act in consort with the RecBC enzyme to efficiently promote recombination reactions. To test this hypothesis, we inactivated multiple exonucleases (*i.e.* exonuclease I, exonuclease X, exonuclease VII, RecJ, SbcCD) in *recD* mutant and assessed the ability of the resultant mutants to promote homologous recombination during Hfr conjugation, P1 transduction and ë lytic crosses. These exonucleases were shown to be essential for homologous recombination, dependent on RecBC enzyme. A model for donor DNA processing in *recD* transconjugants and transductants was proposed.

P-6

DVIJE NUKLEOZID-DIFOSFAT KINAZE (NDPK/Nm23) IZ MORSKE SPUŽVE Suberites domuncula

M. Harcet[1], L. Lukić-Bilela[1], H. Ćetković[1], W.E.G. Müller[2] i V. Gamulin[1]
[1]Instutut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (matija.harcet@irb.hr, lukic@irb.hr, cetkovic@irb.hr, gamulin@irb.hr), [2]Institut für Physiologische Chemie, Abteilung Angewandte Molekularbiologie, Johannes Gutenberg Universität, Mainz, Germany (wmueller@uni-mainz.de)

Suberites domuncula je pripadnik najstarije i najjednostavnije postojeće skupine (koljena) višestaničnih životinja – spužvi (Porifera). Nasumičnim sekvenciranjem cDNA S. domuncula nedavno je konstruirana baza EST-ova (expressed sequence tags). Ovdje su opisana dva NDPK/Nm23 proteina iz spužve Suberites domuncula. Spužvini proteini nazvani su Nm23-SD1 i Nm23-SD6 jer su po aminokiselinskim sljedovima najsličniji ljudskim Nm23-H1 i -H6 proteinima. Ukupna sačuvanost sekvence između Nm23-SD1 i Nm23-H1 vrlo je visoka i iznosi 79 % (71 % je identična). Nm23-SD6 ima inserciju na C-kraju i pokazuje ukupnu homologiju od 55 % (40 % identičnosti) s ljudskim Nm23-H6. Predikcija sekundarne strukture pokazuje da su oba proteinska para gotovo jednaka. Nm23 proteini iz spužve S. domuncula pokazuju visoku sličnost s homolozima iz sisavaca/čovjeka, višu nego s npr. NDPK/Nm23 proteinima iz vinske mušice ili drugih beskralješnjaka. Osim toga, sličniji su proteinima iz sisavaca/čovjeka od većine poznatih Nm23 proteina iz beskralješnjaka.

TWO NUCLEOSIDE DIPHOSPHATE KINASES (NDPK/Nm23) FROM THE MARINE SPONGE *Suberites domuncula*

M. Harcet[1], L. Lukić-Bilela[1], H. Ćetković[1], W.E.G. Müller[2] and V. Gamulin[1]
[1]Instutut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (matija.harcet@irb.hr, lukic@irb.hr, cetkovic@irb.hr, gamulin@irb.hr), [2]Institut für Physiologische Chemie, Abteilung Angewandte Molekularbiologie, Johannes Gutenberg Universität, Mainz, Germany (wmueller@uni-mainz.de)

Suberites domuncula is a member of the most ancient and simplest extant phylum of multicellular animals – Sponges (Porifera). Database of *S. domucula* expressed sequence tags (ESTs) was recently constructed by random cDNA sequencing. Two NDPK/Nm23 proteins from the sponge *Suberites domuncula* are reported here. Sponge proteins were named Nm23-SD1 and Nm23-SD6, because they display the highest sequence similarity with human Nm23-H1

and -H6 proteins. Overall sequence conservation of Nm23-SD1 with human Nm23-H1 is very high - 79% (71% identity). Nm23-SD6 possesses an insertion at the C-terminus and displays 55% overall homology (40% identity) with human Nm23-H6. Secondary structure predictions for both sponge and human Nm23 protein pairs are almost identical. *S. domuncula* Nm23 proteins display high similarity with homologues from mammals/human, higher than with i.e. NDPK/Nm23 proteins from *Drosophila* or other invertebrates. Sponge Nm23 proteins are more similar to mammalian/human Nm23 proteins than most known Nm23 proteins from invertebrates.

P-7

PriA I RecBCD SUDJELUJU U STVARANJU SIGNALA ZA UV-INDUCIRANU INHIBICIJU RESTRIKCIJE U BAKTERIJI *Escherichia coli*

I. Ivančić Baće[1], I. Vlašić[2], G. Čogelja Čajo[2], E. Salaj-Šmic[2] i K. Brčić-Kostić[2]

[1]Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (ivanai@irb.hr), [2]Institut "Ruđer Bošković", Bijenička 54, HR-10000 Zagreb, Hrvatska

Modifikacija DNA je obrambeni mehanizam zaštite bakterijske stanice od vlastitog sustava restrikcije i modifikacije. Zaštita vlastitog kromosoma postiže se metiliranjem specifičnih baza adenina i citozina unutar ciljnog mjesta prepoznavanja restrikcijske endonukleaze EcoKI. Međutim, u određenim uvjetima npr. nakon UV zračenja, u kromosomu bakterije *E. coli* mogu privremeno nastati nemetilirana ciljna mjesta prepoznavanja. Kada se nemetilirana mjesta nalaze u kromosomu restrikcijska endonukleaza EcoKI ih neće pocijepati, jer proteaza ClpXP modulira aktivnost enzima. Naime, proteaza ClpXP cijepa podjedinicu HsdR enzima EcoKI što inaktivira enzim, a fenomen je poznat pod imenom UV-inducirana inhibicija restrikcije (RA). Kako je prethodnim istraživanjima pokazano da UV-inducirana inhibicija restrikcije ovisi o genima *recA*, *recBCD* i *lexA*, predloženo je da kromosomska nemetilirana DNA nastaje homolognom rekombinacijom tijekom popravka oštećene DNA. U ovom istraživanju željeli smo istražiti koji su ostali rekombinacijski geni uključeni u nastanak nemetilirane DNA. U tu svrhu, pratili smo inhibiciju restrikcije enzima EcoKI mjerenjem preživljenja nemodificiranog faga lambda u stanicama ozračenim UV-svjetlom. Pretpostavili smo da će nedostatak produkta gena potrebnog za nastanak nemetilirane DNA smanjiti preživljenje nemodificiranog faga lambda. Gentičkom analizom

pokazali smo da UV-inducirana inhibicija restrikcije ovisi o proteinu UvrA i da ovisi o nanošenju proteina RecA enzimom RecBCD. Također, pokazali smo da su geni *recF/O/R* vjerojatno potrebni za indukciju SOS odgovora i uspostavljanje replikacije DNA na substratu pripremeljenom enzimom RecBCD. Protein PriA je potreban da započne replikaciju u ovom procesu. Na temelju dobivenih rezultata predlažemo da je D-omča glavni međuprodukt u ovom procesu.

PriA AND RecBCD FUNCTIONS COOPERATE TO CREATE A SIGNAL FOR UV-INDUCED RA IN *Escherichia coli*

I. Ivančić Baće[1], I. Vlašić[2], G. Čogelja Čajo[2], E. Salaj-Šmic[2] and K. Brčić-Kostić[2]
[1]Department of Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia, (ivanai@irb.hr), [2]Ruđer Bošković" Institute, Bijenička 54, HR-10000 Zagreb, Croatia

It has been traditionally considered that DNA modification is a defense mechanism of bacteria against their own restriction-modification systems. By methylating specific adenine or cytosine residue within target nucleotide sequences, restriction endonulcease protect their DNA from degradation. But, under certain conditions, for example after UV irradiation of *E. coli K12* bacteria, unmodified target sequences for EcoKI enzyme are temporarily generated in the chromosome. Such target sequences are not cleaved by EcoK restriction system since the activity of EcoKI restriction endonuclease is modulated by proteolytic degradation of HsdR subunit of holoenzyme by ClpXP protease, phenomenon known as alleviation of DNA restriction (RA). It was previously shown that UV-induced RA depends on functional *recA, recBCD* and *lexA* genes and it has been proposed that chromosomal unmethylated target sequences can be generated by homologous recombination during the repair of damaged DNA. In this study, we wanted to further investigate the genetic requirements for recombination proteins involved in the generation of unmethylated target sequences. For this purpose, we monitored the alleviation of EcoKI restriction by measuring the survival of unmodified ë in UV-irradiated cells. We assumed that absence of gene products required for generation of unmethylated DNA would decrease the survival of unmodified ë phage. Our genetic analysis confirmed earlier observation that UV-induced RA depends on excision repair protein UvrA. We show that *recF/O/R* genes are necessary to induce the SOS response and possibly to stimulate recombination directed replication reaction on DNA substrate prepared by RecBCD enzyme. In addition to helicase

activity of RecBCD enzyme, the loading activity of RecA protein by RecBCD is also required for UV-induced RA. PriA, a primosome assembly protein is needed to initiate DNA replication restart and we propose that D-loop is the major recombination intermediate in this process.

P-8

SIJALOGLIKOKONJUGATI U MOZGU ŠARANA

A. Mojsović[1], D. Đikić[2], I. Biruš[3], B. Viljetić[3], I. Labak[4] i M. Heffer-Lauc[3]
[1]Zdravstveno Veleučilište, Mlinarska cesta 38, HR-10000 Zagreb, (Ana.Mojsovic@zvu.hr), [2]Zavod za biologiju, Prirodoslovno-matematički fakultet, Roosveltov trg 6, HR-10000 Zagreb, (magistar_djikic1@yahoo.com), [3]Medicinski fakultet, J. Huttlera 4, HR-31000 Osijek, (ibirus@mefos.hr, bviljetic@mefos.hr, mheffer@public.srce.hr), [4]Odjel za biologiju Sveučilišta u Osijeku, Trg Ljudevita Gaja 6, HR-31000 Osijek, (irena.barisic@inet.hr)

Distribucija sijaloglikokonjugata višestruko je opisana u mozgu sisavaca. Iako su rezultati ovih studija ponekad dvojbeni, većina pokazuje da se distribucija glavnih gangliozida podudara: GM1 je marker mijeliniziranih aksona, GD1a je prisutan na tijelima svih neurona te u sloju osjetilnih vlakana u kralješničnoj moždini, a GD1b i GT1b obilježavaju većinu neurona mozga i kralješnične moždine. Mlade interneurone obilježava molekula PSA-NCAM koja na sebi nosi á- 2,8 vezanu polisijalinsku kiselinu, a čija je raspodjela poznata kod sisavaca. Sambuccus nigra aglutinin (SNA) prepoznaje á- 2,6 vezanu sijalinsku kiselinu, dok Maackia amaurensis hemaglutinin (MAA) prepoznaje á- 2,3 vezanu, a njihova je distribucija dobro opisana kod primata. Kod riba je biokemijski dokazana prisutnost ovih sijalinskih epitopa, ali ne postoji studija njihove distribucije. Koristeći protutijela na glavne gangliozide, protutijelo na PSA-NCAM te lektine SNA i MAA na rezovima mozga šarana, utvrdili smo njihovu raspodjelu. Niti na jednoj razini nismo utvrdili prisutnost gangliozida GM1. GD1b se pronašli samo u supkortikalnim jezgrama koje pokreću repnu peraju. GD1a je dominantni gangliozid mozga šarana i marker većine neurona. Za razliku od sisavaca, GD1a možemo naći i u vlaknima koja koru povezuju sa supkortikalnim strukturama te dijelu senzoričkih puteva koji prolaze kroz pons. Distribucija gangliozida GT1b prati distribuciju GD1a. Za razliku od gangliozida, lektini SNA i MAA podjednako dobro obilježavaju i neurone i vlakna. Distribucija PSA-NCAM u mozgu šarana se poklapa sa raspodjelom GD1a do granice sa cerebelumom.Ova studija jasno pokazuje da se distribucija sijaloglikokonjugata značajno razlikuje u riba i sisavaca.

SIALOGLYCOCONJUGATES IN THE CARP BRAIN

A. Mojsović[1], D. Đikić[2], I. Biruš[3], B. Viljetić[3], I. Labak[4] and M. Heffer-Lauc[3]
[1]University of Zagreb School of Health, Mlinarska cesta 38, HR-10000 Zagreb, (Ana.Mojsovic@zvu.hr),
[2]Department of Biology, Faculty of Science, Roosveltov trg 6, HR-10000 Zagreb, (magistar_djikic1@yahoo.com), [3]University of Osijek School of Medicine, J. Huttlera 4, HR-31000 Osijek (ibirus@mefos.hr, bviljetic@mefos.hr, mheffer@public.srce.hr), [4]University of Osijek School of Biology, Trg Ljudevita Gaja 6, HR-31000 Osijek(irena.barisic@inet.hr)

The distribution of sialoglycoconjugates has been thoroughly studied in brains of mammals. The distribution of main gangliosides is in general similar: GM1 is mainly distributed in myelinated axons, GD1a is present in neuron somata and in sensory fibers of spinal cord, and GD1b and GT1b label most of neuron somata in brain and spinal cord. Young interneurons of mammalian brain are labeled with antibody to PSA-NCAM, a molecule that carries á-2,8 linked polysialic acid chains. The lectin SNA recognizes á-2,6 linked sialic acid, while lectin MAA recognizes á-2,3 linked sialic acid, and their distribution has been described in primates. It has been reported that these sialic acid epitopes exist in fish, but their distribution has not been investigated so far. Using anti-ganglioside antibodies, antibody against PSA-NCAM and SNA and MAA lectins on carp brain sections, we studied their distribution. GM1 was not detected anywhere in the analyzed samples. GD1b was found only in subcortical nuclei. Ganglioside GD1a was found on practically all neurons. Contrary to mammals, carp brain GD1a was found to be located in fibers that connect cortex to subcortical structures and in some pontine sensory fibers. The distribution of GT1b was similar to that of GD1a. Contrary to gangliosides, SNA and MAA were binding to epitopes on both somata and fibers. The distribution of PSA-NCAM was similar to that of GD1a, except in cerebellum and caudally from it. These observations clearly demonstrate that the distribution of sialoglycoconjugates in fish brain significantly differs from their distribution in mammalian brain.

P-9

RIBOSOMSKI PROTEINI MORSKE SPUŽVE *Suberites domuncula*

D. Perina[1], H. Četković[1], M. Harcet[1], L. Lukić-Bilela[1], W.E.G. Müller[2] i V. Gamulin[1]
[1]Institut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (dperina@irb.hr, cetkovic@irb.hr, matija.harcet@irb.hr, lukic@irb.hr,

gamulin@irb.hr), [2]Institut für Physiologische Chemie, Abteilung Angewandte Molekularbiologie, Johannes Gutenberg Universität, Mainz, Germany (wmueller@uni-mainz.de)

Morska spužva *Suberites domuncula* pripada najstarijem i najjednostavnijem živućem koljenu višestaničnih životinja – Porifera, koje se prvo odvojilo od zajedničkog pretka svih Metazoa. Odredili smo primarnu strukturu 79 ribosomskih proteina (r-proteina) spužve *Suberites domuncula* i to 32 r-proteina iz male (40S) podjedinice i 47 iz velike (60S) ribosomske podjedinice. Polipeptidi L39, sastavljen od 51 aminokiseline kod štakora i L41, sastavljen od 25 ak-a kod štakora, u spužvi nisu pronađeni. Spužva *S. domuncula* je poslije oblića *Caenorhabditis elegans* i kukca *Drosophila melanogaster* treći beskralješnjak sa svim poznatim sljedovima aminokiselina r-proteina. Usporedba r-proteina spužve s homolozima iz modelnih organizama (*D. melanogaster, C. elegans*, štakor, *Arabidopsis thaliana* and *Saccharomyces cerevisiae)* pokazuje da su najsličniji r-proteinima štakora. Osim u nekoliko izuzetaka, sačuvanost sekvenci r-proteina izmedu spužve i štakora je 80% ili čak i veća. Filogenetsko stablo konkateniranih r-proteina iz 6 eukariotskih vrsta (ukorjenjeno s r-proteinima arheja) ima najkraće grane između spužve i štakora. Oba beskralješnjaka doživjeli su nedavnu ubrzanu evoluciju, pa iako su se spužve prve odvojile od zajedničkog pretka svih višestaničnih životinja njeni r-proteini vrlo vjerojatno bolje odražavaju strukturu r-proteina ancestralnog ribosoma Metazoa koji se malo promijenio tijekom evolucije. Nadalje, r-proteini biljke *A. thaliana* su znatno bliži metazojskim r-proteinima nego homolozi iz kvasca *S. cerevisiae.*

THE COMPLETE SET OF RIBOSOMAL PROTEINS FROM THE MARINE SPONGE *Suberites domuncula*

D. Perina[1], H. Cetkovic[1], M. Harcet[1], L. Lukic-Bilela[1], W.E.G. Müller[2] and V. Gamulin[1]
[1]Rudjer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (dperina@irb.hr, cetkovic@irb.hr, matija.harcet@irb.hr, lukic@irb.hr, gamulin@irb.hr),[2]Institut für Physiologische Chemie, Abteilung Angewandte Molekularbiologie, Johannes Gutenberg Universität, Mainz, Germany (wmueller@uni-mainz.de)

The siliceous marine sponge *Suberites domuncula* is a member of the most ancient and simplest extant phylum of multicellular animals - Porifera, which have branched off first from the common ancestor of all Metazoa. We have determined primary structures of 79 ribosomal proteins (r-proteins) from *S.*

domuncula: 32 proteins from the small ribosomal subunit and 47 proteins from the large ribosomal subunit. Only L39 and L41 polypeptides (51 and 25 residues long in rat, respectively) are missing from the data set of sponge r-proteins. The sponge *S. domuncula* is, after nematode *Caenorhabditis elegans* and insect *Drosophila melanogaster* the third representative of invertebrates with known amino acid sequences of all r-proteins. Comparison of *S. domuncula* r-proteins with r-proteins from *D. melanogaster, C. elegans*, rat, *Arabidopsis thaliana* and *Saccharomyces cerevisiae* revealed very interesting findings. The majority of the sponge r-proteins are more similar to their homologues from rat, than to those either from *C. elegans* or *D. melanogaster* or yeast or plant. With few exceptions, the overall sequence conservation between sponge and rat r-proteins is 80% or higher. The phylogenetic tree of concatenated r-proteins from 6 eukaryotic species (rooted with archaeal r-proteins) has the shortest branches connecting sponge and rat. Both model invertebrate organisms experienced recently accelerated evolution and therefore sponge r-proteins very probably better reflect structures of proteins in the ancestral metazoan ribosome, which changed only little during metazoan evolution. Furthermore, r-proteins from the plant *A. thaliana* are significantly closer to metazoan r-proteins than are those from the yeast *S. cerevisiae.*

P-10

RAZNOLIKOST SLABIH TKIVNIH ANTIGENA HA-1, HA-2 I HA-8 U TRANSPLANTACIJI KOŠTANE SRŽI

A. Posavec[1], R. Žunec[1], K. Štingl[1], E. Čečuk-Jeličić[1], Z. Grubić[1], R. Serventi-Seiwerth[2], B. Labar[2] i V. Brkljačić-Kerhin[1]
[1]Zavod za tipizaciju tkiva, KBC Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Hrvatska (ana.posavec@zg.t-com.hr, rzunec@kbc-zagreb.hr), [2]Zavod za hematologiju, Klinički bolnički centar Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Hrvatska

Najnovije spoznaje na području transplantacije krvotvornih matičnih stanica ukazuju da, uz gene HLA, veliki značaj u smanjenju jačine reakcije transplantata protiv primatelja (engl. graft versus host desease - GvHD),. imaju i slabi tkivni antigeni (engl. minor histocomaptibility antigens - mHAg). To su polimorfni, endogeno sintetizirani proteini koje aloreaktivni T-limfociti prepoznaju u sklopu molekula glavnog sustava tkivne snošljivosti. U prvom dijelu istraživanja odredili smo polimorfizam 10 slabih tkivnih antigena kod 100 zdravih nesrodnih osoba. Dobiveni rezultati činili su bazu podataka za analizu imunogeničnosti mHAg kod HLA-identičnih parova davatelj/primatelj. U drugom dijelu istraživanja odredili smo polimorfizam relevantnih

mHAg (HA-1, HA-2 i HA-8) u 20 HLA-identičnih parova primatelj/davatelj pozitivnih za alel HLA-A2. HA-1 i HA-8 ispunili su oba uvjeta za razvitak GvHD: imunogenični su i prisutni s umjerenom fenotipskom učestalošću u zdravoj populaciji (65% za HA-1 i 63% za HA-8), dok HA-2 ima učestalost 92% pa stoga u većini parova nije relevantan. Učestalosti alela, genotipova i fenotipova sva tri mHAg u istraživanih parova odgovaraju učestalostima kod zdravih osoba. Rezultati su pokazali da u 8 parova primatelj i davatelj imaju iste fenotipove HA-1, HA-2 i HA-8, dok je u 12 parova fenotip primatelja i davatelja različit za barem jedan od mHAg (4 za HA-1, 1 za HA-2, 6 za HA-8 te 1 za HA-2 i HA-8). Za sve istraživane parove napravili smo i usporedbu podataka o razvitku i jačini GvHD s mHAg fenotipovima primatelja i davatelja, no takva analiza nije ukazala na njihovu povezanost.

MINOR HISTOCOMPATIBILITY ANTIGENS HA-1, HA-2 AND HA-8 POLYMORPHISMS IN HLA-IDENTICAL RELATED BONE MARROW TRANSPLANTATION

A. Posavec[1], R. Zunec[1], K. Stingl[1], E. Cecuk-Jelicic[1], Z. Grubic[1], R. Serventi-Seiwerth[2], B. Labar[2] and V. Brkljacic-Kerhin[1]
[1]Tissue Typing Center, Urological Clinic, Clinical Hospital Center Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Croatia (ana.posavec@zg.t-com.hr, rzunec@kbc-zagreb.hr), [2]Department of Hematology, Clinical Hospital Center Zagreb, Kišpatićeva 12, HR-10000 Zagreb, Croatia

Minor histocompatibility antigens (mHAgs) are polymorphic, endogenously synthesized products recognized by alloreactive T cells in the context of major histocompatibility complex (MHC) molecules. Recipients of allogenic bone marrow grafts run the risk of graft-versus-host disease (GvHD), even when the donor is HLA-identical sibling. These may arise from disparities in mHAgs between donor and recipient, with the antigen present in the recipient and not in the donor. In such cases, T cells in the transplanted donor marrow respond to recipient's mHAgs. We have typed 100 healthy individuals for the 10 mHAgs. The obtained genotype frequencies provided database for the analysis of mHAg's immunogenicity in HLA identical donor/recipient pairs. We have typed 20 HLA identical sibling donor/recipient pairs positive for HLA-A2 allele. Allele, genotype and phenotype frequencies among pairs were in concordance with the ones obtained for the healthy population. Potentially relevant mHAgs for these pairs are HA-1, HA-2 and HA-8 antigens. HA-1 and HA-8 fulfilled both conditions for induction of GvHD: immunogenicity and had moderate phenotypic frequency (65% and 63% respectively) in the healthy population. HA-2 has a phenotypic frequency of 92%, therefore it is

not relevant in the majority of pairs. Eight pairs where matched for HA-1, HA-2 and HA-8 antigens. Twelve pairs had mismatches in GvHD direction for at least one of the relevant mHAgs (4 for HA-1, 1 for HA-2, 6 for HA-8, 1 for HA-2 and HA-8). Correlation between GvHD and mHAgs matching/mismatching revealed that GvHD was equally distributed among matched and mismatched donor/recipient pairs.

P-11

ULOGA NUKLEAZA SbcB I SbcCD U SPONTANOJ RAZGRADNJI DNA KOD *recA* MUTANATA BAKTERIJE *Escherichia coli*

D. Zahradka, K. Zahradka, M. Buljubašić i M. Petranović
Institut «Ruđer Bošković», Zavod za molekularnu biologiju, Bijenička 54, HR-10000 Zagreb, Hrvatska (zahradka@irb.hr)

Stanice *recA* mutanata bakterije *Escherichia coli* tijekom eksponencijalnog rasta pokazuju jaku spontanu razgradnju DNA koja započinje na mjestima oštećenja, a ovisi o nukleaznoj aktivnosti enzima RecBCD (ExoV). Uslijed ovakve «neobuzdane» razgradnje DNA u populacijama *recA* mutanata pojavljuje se značajan udio anukleiranih stanica. Naši rezultati pokazuju da se razgradnja DNA i stvaranje anukleiranih stanica mogu učinkovito dokinuti uvođenjem mutacija u genima *sbcB* i *sbcD*. Produkti ovih gena kodiraju za egzonukleazu I i nukleazu SbcCD. S obzirom da se snažan supresijski učinak na degradaciju DNA postiže samo istodobnom inaktivacijom gena *sbcB* i *sbcD* dok pojedinačne mutacije imaju tek neznatan supresijski učinak, zaključujemo da nukleaze ExoI i SbcCD imaju redundantnu ulogu u regulaciji razgradnje DNA u stanicama *recA* mutanata. Pretpostavljamo da ovi enzimi djeluju u nukleolitičkoj pripremi krajeva DNA za vezanje enzima RecBCD.

THE ROLE OF SbcB AND SbcCD NUCLEASES IN SPONTANEOUS DNA DEGRADATION IN *recA* MUTANTS OF *Escherichia coli*

D. Zahradka, K. Zahradka, M. Buljubašić and M. Petranović
Ruđer Bošković Institute, Division of Molecular Biology, Bijenička 54, HR-10000 Zagreb, Croatia (zahradka@irb.hr)

Exponentially growing *recA* mutants of *Escherichia coli* display pronounced spontaneous DNA degradation that presumably starts at the sites of DNA damage and depends on the RecBCD nuclease (ExoV) activity. As a consequence of this «reckless» DNA degradation, populations of *recA*

mutants contain a large proportion of anucleate cells. We have found that both DNA degradation and anucleate cell production are efficiently suppressed by mutations in *sbcB* and *sbcD* genes. The products of these genes are known to code for ExoI and SbcCD nucleases, respectively. Since both *sbcB* and *sbcD* mutations are required for full suppression of DNA degradation while individual mutations have only a slight suppressive effect, we infer that ExoI and SbcCD play redundant roles in regulating DNA degradation in *recA* cells. We suggest that their role might be in processing (blunting) DNA ends thereby producing suitable substrate for RecBCD binding.

STANIČNA I MOLEKULARNA BIOLOGIJA

BIOLOGIA CELLULARIS ET BIOLOGIA MOLECULARIS SENSU LATO

CELL AND MOLECULAR BIOLOGY

Uvodna tematska predavanja
Introductory Lectures

IL-3

UČESTALOST 35delG MUTACIJE GENA *GJB2* U OBOLJELIH OD NESINDROMSKE GLUHOĆE U HRVATSKOJ

J. Pavelić[1], I. Sansović[2], I. Barišić[2], T. Matijević[1] i J. Knežević[1]
[1]Institut "Ruđer Bošković", Zavod za molekularnu medicinu, Bijenička c. 54, HR-10002 Zagreb, Hrvatska (jpavelic@irb.hr, jknezevic@irb.hr), [2]Dječja bolnica Zagreb, Klinika za pedijatriju, Medicinski fakultet, Sveučilište u Zagrebu, Klaićeva 16, HR-10000 Zagreb, Hrvatska (ivona.sansovic@zg.htnet.hr, ingeborg.barisic@kdb.hr)

Nesindromski oblik gluhoće (NSHL) uzrokovan je u ljudi autosomalnom recesivnom mutacijom u jednom ili više od preko 30 različitih gena. Jedan od njih je i gen GJB2 (13q11). Član je velike obitelji proteina koji izgrađuju zjapne veze između stanica. Kodira za koneksin 26 koji je ključan za process recikliranja iona kalija u unutrašnjem uhu. Kodirajući slijed (ekson 2) dužine je 681parova baza. Najčešća mutacija ovog gena (zahvaća 70% alela) je delecija jedne baze (35delG) koja uzrokuje pomak okvira čitanja (frameshift mutacija) uslijed čega na pogrešnom mjestu nastaje stop kodon. Svrha ovog istraživanja bila je ispitati učestalost 35delG mutacije u osoba koje boluju od NSHL. Analizirano je 27 nesrodnih oboljelih osoba i 342 zdrave osobe. Mutacija je detektirana metodom PCR-mediated site-directed mutagenesis, nakon čega je slijedila digestija restrikcijskim enzimom Bsi YI. U oboljelih osoba mutacija je nađena na 51,85% alela. Unutar skupine zdravih osoba pronađeno je 1% prenositelja bolesti (1 unutar 68). Osobe u kojih nije nađena ova mutacija testirani su, dodatno, sekvencioniranjem. Tako su pronađene dvije nove, dosada neopisane, mutacije: W24X i 313del114. Relativno visoka učestalost mutacije 35delG u osoba, stanovnika Hrvatske, koje boluju od NSHL upućuje na činjenicu da je ona značajan uzrok NSHL u Hrvatskoj. Mogućnost ranog dijagnosticiranja ove mutacije znatno će unaprijediti genetsko savjetovanje, kao i liječenje osoba koje boluju od ove bolesti, naročito djece.

THE PREVALENCE OF THE 35delG MUTATION IN *GJB2* GENE IN PATIENTS WITH NON-SYNDROMIC HEARING LOSS FROM CROATIA

J. Pavelić[1], I. Sansović[2], I. Barišić[2], T. Matijević[1], J. Knežević[1]

[1]Rudjer Bošković Institute, Division of Molecular Medicine, Bijenička c. 54, HR-10002 Zagreb, Croatia (jpavelic@irb.hr, jknezevic@irb.hr), [2]Children's Hospital Zagreb, Department of Paediatrics, University of Zagreb, Medical School, Klaićeva 16, HR-10000 Zagreb, Croatia (ivona.sansovic@zg.htnet.hr, ingeborg.barisic@kdb.hr)

Non-syndromic hearing loss (NSHL) in humans is mostly caused by autosomal recessive mutations in one or more of over 30 different genes. One of them, the *GJB2* gene (13q11) is a member of large "gap-junction-forming-proteins" family. It codes for connexin 26, which plays a critical role in recycling of potassium ions, in inner ear during sensory transduction. The coding sequence (exon 2) is 681 base pairs long. Although there are more than 90 different mutations in this gene identified so far, single base deletion (35delG mutation, frameshift mutation creating stop codon) accounts for about 70% of all *GJB2* mutant alleles. The aim of this study was to investigate the allelic frequency of 35delG mutation in patients with NSHL compared to normal hearing individuals. For this purpose we have analysed 27 unrelated individuals with NSHL and 342 healty individuals. The method we used is based on the principle of PCR-mediated site-directed mutagenesis, followed by a *Bsi YI* digestion. Among patients with NSHL the 35delG mutation was found on 51.85% alleles. Carrier frequency among healthy control individuals was 1 in 68.4 (1.46%). The patients, found to be wild-type were further tested by direct sequencing. Among them, two different mutations were observed, W24X and 313del114. Relatively high prevalence of 35delG mutation among patients with NSHL indicate it as an important cause of NSHL in Croatia. The ability of early diagnosis by identification of the 35delG mutation would greatly improve genetic counselling, as well as treatment and management of deafness in Croatia.

Kratka usmena priopćenja
Oral Presentations

OP-6
UTVRĐIVANJE RADIOPROTEKTIVNOG UČINKA PROPOLISA I FLAVONOIDA KOMET TESTOM

V. Benković[1], N. Oršolić[1], N. Kopjar[2], A. Horvat Knežević[1], S. Ramić[2], D. Đikić[1] i I. Bašić[1]
[1]Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska, [2]Institut za medicinska istraživanja i medicinu rada, Ksaverska c. 2, HR-10000 Zagreb, Hrvatska

Zbog sve prisutnije primjene zračenja u dijagnostici i/ili liječenju postoji stalna potreba za pronalaskom neotrovnih i lako dostupnih tvari koje bi se mogle koristiti u zaštiti od štetnih posljedica zračenja. Kao posljedica zračenja u organizmu dolazi do nastanka i nakupljanja slobodnih reaktivnih radikala koji su toksični i mogu dovesti do oštećenja DNA i drugih makromolekula, mutacija, promjena u imunološkom sustavu i teratogenih učinaka. Pčelinji proizvod propolis i njegove sastavnice flavonoidi zbog utvrđenih antioksidativnih svojstava potencijalni su učinkoviti i netoksični radioprotektori. Radioprotektivne učinke vodene otopine propolisa (VOP), alkoholne otopine propolisa (AOP), kvercetina, kafeinske kiseline, krizina i naringina istražili smo na modelu miša (CBA). Životinje smo obrađivali preventivno i terapijski injiciranjem intraperitonealno u dozi od 100 mg/kg. Primjenili smo ã-zračenje ^{60}Co u dozi od 9 Gy. Oštećenja leukocitne DNA utvrđivali smo primjenom standardnog komet testa u alkalnim uvjetima. U miševa obrađenih s istraživanim tvarima preventivno tijekom tri dana, te zatim ozračenih uočili smo značajno smanjenje oštećenja leukocitne DNA. Terapijsko obrađivanje životinja nije smanjilo oštećenja leukocitne DNA. Primjena istraživanih tvari ne uzrokuje genotoksična oštećenja DNA u limfocitima neozračenih životinja. Ovo istraživanje pokazuje da propolis i flavonoidi posjeduju zaštitni učinak odnosno smanjuju oštećenja DNA uzrokovana zračenjem.

DETECTION OF RADIOPROTECTIVE EFFECTS OF PROPOLIS AND FLAVONOIDS WITH COMET ASSAY

V. Benković[1], N. Oršolić[1], N. Kopjar[2], A. Horvat Knežević[1], S. Ramić[2], D.

Đikić[1] and I. Bašić[1]
[1]Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia, [2] Institute for Medical Research and Occupational Health, Ksaverska c. 2, HR-10000 Zagreb, Croatia

The use of ionizing radiation for medical diagnosis and therapy is widespread throughout the world. Recently, there has been considerable interest in finding nontoxic, commonly used substances which can protect cells from deleterious radiation effects. Formation of toxic free radicals, result in DNA damaging and mutations, changes in immunological system and theratogenic effects. Bee product, propolis and their compounds flavonoids, are potentially nontoxic radiprotectors because of their antioxidant propertis. The radioprotective effects of water-soluble derivate of propolis (WSDP), hydroalcoholic solution of propolis (HASP), quercetin, caffeic acid, chrysin and naringin in the whole-body irradiated Swiss albino and CBA mice were investigated. Animals were treated preventively and therapeuticly by intraperitoneal injection of 100 mg/kg. Irradiation was performed using a ^{60}Co ã-ray source, and absorbed dose was 9 Gy. DNA damages in lymphocytes were detected using Comet assay in alkaline conditions. When tested, compounds were given preventively daily for three days and mice irradiated with dose of 9 Gy. Significantly DNA protection has been observed, while protection effects in therapeutic treatment were not observed. On the other hand, in nonirradiated animals, treated with tested compounds, DNA damages were not observed. Our study demonstrates that propolis and flavonoids protects DNA against the radiation induced damage.

OP-7

EKSPRESIJA INTERLEUKINA 10 U SPORADIČNOM KARCINOMU DEBELOG CRIJEVA

T. Čačev i S. Kapitanović
Zavod za molekularnu medicinu, Institut Ruđer Bošković, Bijenička c. 54, HR-10000 Zagreb, Hrvatska (tcacev@irb.hr, kapitan@irb.hr)

Interleukin 10 (IL-10) je citokin koji pokazuje snažnu protuupalnu i imunosupresivnu aktivnost. Uloga ovog citokina u imunologiji tumora je još uvijek kontroverzna. Ekspresija glasničke RNA za IL-10 detektirana je u nizu tumora u ljudi uključujući karcinome jajnika, dojke, bubrega, pluća te kože. Za nekoliko staničnih linija karcinoma debelog crijeva, pluća te kože također je dokazana ekspresija IL-10. Biološki značaj ekspresije IL-10 u

tumorskim stanicama još je nedovoljno istražen. Postoje kontradiktorni dokazi o njegovom uticaju na karcinome. Ovisno o eksperimentalnom modelu koji je bio korišten IL-10 je poticao ili kočio postanak i napredovanje tumora. U nekim slučajevima djeluje kao čimbenik rasta tumora ili kao imunosupresivna molekula koju tumori luče kako bi izbjegli imunološki nadzor dok su u drugim primjerima dokazana njegova imunostimulativna i antitumorska svojstva. Također je dokazana njegova uloga u kočenju angiogeneze te invazivnosti tumora. Kako bi istražili ulogu i utjecaj IL-10 na sporadične karcinome debelog crijeva analizirali smo njegovu ekspresiju na proteinskom nivou u 100 uzoraka tumorskog tkiva metodom imunohistokemije. U 50 uzoraka tumora debelog crijeva kao i pripadajućim uzorcima normalne sluznice ispitali smo ekspresiju glasničke RNA gena IL-10 metodom real-time kvantitativnog PCR. Ekspresija IL-10 mRNA bila je niža u tkivu tumora u odnosu na pripadajuću normalnu sluznicu i ta je razlika bila statistički značajna. Ekspreija proteina IL-10 također je bila niža u tumorima klasificiranim kao Duke'C te u loše diferenciranim tumorima. Stoga možemo zaključiti da je smanjena ekspresija IL-10 u sporadičnim karcinomima debelog crijeva ukazuje na njegovu inhibitornu ulogu u progresiji tumora debelog crijeva.

INTERLEUKIN 10 EXPRESSION IN SPORADIC COLON CANCER

T. Čačev and S. Kapitanović
Division of Molecular Medicine, Rudjer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (tcacev@irb.hr, kapitan@irb.hr)

Interleukin 10 (IL-10) is cytokine with potent anti-inflammatory and immunosuppressive activity. The role of this pleiotropic cytokine in tumor immunology is controversial. Expression of IL-10 mRNA was observed in a variety of human tumors including ovarian, breast, renal cell, lung and skin carcinomas. Several human tumor cell lines from colon, lung and skin carcinomas produce IL-10. The biological significance of IL-10 production by tumor cells remains unexplored. There is conflicting evidence about its influence on cancer. Dependent of the experimental model it seems to favour or inhibit the existence and progression of tumors. In some cases it may act as tumor growth factor or as immunosuppressive molecule secreted by tumors to escape from immune surveillance, but in some cases it has also been shown to posses immunostimulating and antitumor properties. IL-10 was also shown to inhibit tumor angiogenesis and invasiveness. In order to elucidate its influence on sporadic colon cancer we have analyzed IL-10 protein expression in 100 sporadic colon tumor tissue samples by immunohistochemistry. In 50 sporadic colon tumor tissue samples as well as corresponding normal mucous tissue

mRNA expression was analyzed by real-time quantitative RT-PCR. IL-10 mRNA expression was lower in tumor tissue samples then in corresponding normal mucous tissue and this difference was found to be statistically significant. IL-10 protein expression was reduced in tumors classified as Dukes' C and poorly differentiated tumors. Thus, we may conclude that reduced expression of IL-10 in sporadic colon cancer may point to its inhibitory role in progression of colon tumors.

OP-8

PROMJENE EKSPRESIJE GALEKTINA-3 U MONOCITNIM STANICAMA IZLOŽENIH DJELOVANJU NESTEROIDNIH PROTUUPALNIH LIJEKOVA

S. Dabelić i J. Dumić
Zavod za biokemiju i molekularnu biologiju, Farmaceutsko-biokemijski fakultet Sveučilišta u Zagrebu, A. Kovačića 1, HR-10000 Zagreb, Hrvatska (sanjad@pharma.hr, jdumic@pharma.hr)

Tijekom posljednjih nekoliko desetljeća intenzivno je proučavan učinak nesteroidnih protuupalnih lijekova na brojne biološke molekule i procese. Pa ipak, njihov učinak kako na ekspresiju lektina tako i na njihovu funkciju i dalje ostaje nerasvijetljen. U predstavljenim smo istraživanjima koristili humanu monocitnu staničnu liniju THP-1 kako bismo proučili učinak dvaju najčešće rabljenih protuupalnih lijekova (aspirina i indometacina) na galektin-3, lektin koji veže â-galaktozidne jedinice i većinom djeluje kao proinflamatorni signal. Rezultati su pokazali da oba lijeka, primijenjena u različitim terapijskim rasponima, mijenjaju ekspresiju gena za galektin-3 (*LGALS3*) i samog proteina. Promjene na proteinskoj razini kvalitativno se i kvantitativno razlikuju od promjena na razini mRNA, a ovisne su o stupnju aktivacije stanica, vrsti lijeka i primijenjenim koncentracijama kao i vremenu izloženosti stanica istima. Dobiveni rezultati ukazuju na galektin-3 kao novu ciljnu molekulu djelovanja nesteroidnih protuupalnih tvari te predstavljaju važan korak u razumijevanju njihova sveobuhvatnog djelovanja na imuni odgovor.

MODULATION OF GALECTIN-3 EXPRESSION IN MONOCYTE-LIKE CELLS BY NON-STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDS)

S. Dabelić and J. Dumić
Department of Biochemistry and Molecular Biology, Faculty of Pharmacy

and Biochemistry, University of Zagreb, A. Kovačića 1, HR-10000 Zagreb, Croatia (sanjad@pharma.hr, jdumic@pharma.hr)

During the last few decades, the effects of non-steroidal anti-inflammatory drugs (NSAIDs) on numerous molecules and biological processes have been widely studied. Nevertheless, the relationship between anti-inflammatory drugs and lectin's expression/function is still to be elucidated. In this study we used human monocytic cell line THP-1 to investigate the effects of two most frequently used non-steroidal anti-inflammatory drugs (aspirin and indomethacin) on galectin-3, a multifunctional â-galactoside binding lectin which in general acts as a strong pro-inflammatory signal. The results showed that aspirin and indomethacin applied in clinically relevant doses affect both the gene (*LGALS3*) and protein expression level of galectin-3. The provoked changes on protein level are qualitatively and quantitatively different comparing to the effects on galectin-3 mRNA level, and depend on the activation state of the cell, drug type and applied concentration as well as time of the exposure. Our data revealed galectin-3 as a new target molecule of anti-inflammatory drugs, thus suggesting an additional pathway of their action on immune response.

Posterska priopćenja
Posters

P-12
UČINAK INDOL-3-MASLAČNE KISELINE I ß-AMINOMASLAČNE KISELINE NA FITOPLAZME U ZARAŽENIM IZDANCIMA VRSTE *Catharantus reoseus* (L.) G. DON U KULTURI TKIVA *in vitro*

M. Ćurkovic Perica i M. Šeruga Musić
Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Marulićev trg 9a, HR-10000 Zagreb, Hrvatska (mirna@botanic.hr, martina@botanic.hr)

Do danas nisu poznati načini liječenja bolesti povezanih s fitoplazmama, biljnim patogenim bakterijama koje nije moguće uzgojiti na umjetnoj podlozi. Zbog toga se fitoplazme obično uzgajaju u kulturi tkiva vrste *Catharanthus roseus* (L.) G. Don, na MS podlozi s dodatkom benzilaminopurina (BAP). Cilj našeg istraživanja bio je ispitati učinak indol-3-maslačne kiseline (IBA) i ß-aminomaslačne kiseline (BABA) na rast izdanaka vrste *C. roseus* u kulturi tkiva *in vitro,* zaraženih različitim sojevima fitoplazmi, te na prisutnost fitoplazmi. Zaraženi izdanci prebačeni su s medija obogaćenog BAP-om, na medije s dodatkom različitih koncentracija IBA-e i BABA-e. Umnažanje fitoplazmatskog gena za 16S rRNA metodom ugniježđene lančane reakcije polimerazom korišteno je za utvrđivanje prisutnosti fitoplazmi u testiranim izdancima. Prisutnost BABA-e u mediju inducirala je rast fitoplazmama zaraženih izdanaka samo u prvoj supkulturi, no nije imala učinak na prisutnost fitoplazmi. Dodatak IBA-e imao je povoljan utjecaj na rast i povlačenje simptoma na izdancima zaraženim fitoplazmatskim sojevima HYDB, EY-C i SA-I, kroz sve supkulture, a učinak na prisutnost fitoplazmi sojeva EY-C i SA-1 nije zabilježen. Kod izdanaka zaraženih sojem HYDB, nakon prebacivanja na medij s IBA-om došlo je do pada titra fitoplazmi ispod razine osjetljivosti ugniježđene lančane reakcije polimerazom u otprilike polovici testiranih izdanaka. Nakon ukupno jedne godine uzgoja na podlozi s dodatkom IBA-e, izdanci zaraženi sojem HYDB vraćeni su na podlogu s BAP-om. Dio izdanaka koji su pokazivali povlačenje simptoma tijekom uzgoja na polozi s IBA-om, trajno su oslobođeni fitoplazmi, što je potvrđeno testiranjem ugniježđenom lančanom reakcijom polimerazom.

INFLUENCE OF INDOLE-3-BUTYRIC ACID AND ß-AMINOBUTYRIC ACID ON PHYTOPLASMAS IN INFECTED *Catharantus reoseus* (L.) G.

DON SHOOTS GROWN *in vitro*

M. Ćurkovic Perica and M. Šeruga Musić
Department of Botany, Faculty of Science, University of Zagreb, Marulićev trg 9a, HR-10000 Zagreb, Croatia (mirna@botanic.hr, martina@botanic.hr)

Until today, there are no effective means to cure diseases associated with phytoplasmas, non-cultivable phytopathogenic bacteria that are usually maintained in *Catharanthus roseus* (L.) G. Don shoots grown *in vitro* on MS medium supplemented with benzylaminopurine (BA). The aim of our research was to examine influence of indole-3-butyric acid (IBA) and ß-aminobutyric acid (BABA) on growth of periwinkle shoots infected with different phytoplasma strains. Infected *C. roseus* shoots were transferred from the medium supplemented with BA to the medium supplemented with different concentrations of IBA or BABA. Amplification of phytoplasma conserved 16S rRNA gene by nested PCR was used to verify the phytoplasma presence in tested shoots. BABA induced growth of phytoplasma-infected shoots only in the first, but not in consequent subcultures. It had no influence on phytoplasma presence in infected tissues. IBA supported plant growth and remission of symptoms in HYDB, EY-C and SA-I phytoplasma-infected shoots through all subcultures. It showed no effect on the presence of EY-C and SA-I phytoplasma strains in tested tissue. When periwinkle shoots infected with HYDB phytoplasma strain were transferred to the medium with IBA, the titer of this strain dropped bellow the sensitivity limit of the nested PCR in approximately half of the tested samples. After one year of IBA treatment, HYDB-infected periwinkle shoots were retransferred to the medium supplemented with BA. Some of the shoots showing remission of symptoms during the IBA treatment permanently escaped the infection and remained negative when tested for phytoplasma presence.

P-13
OKSIDATIVNI STRES U GASTRIČNOJ MUKOZI

J. Dovhanj[1], K. Kljaić[2], K. Marjanović[3] i A. Včev[4]
[1]Medicinski fakultet, Katedra za kemiju i biokemiju, Sveučilište u Osijeku, Huttlerova 4, HR-31000 Osijek, Hrvatska (jdovhanj@yahoo.com), [2]Poliklinika ”Šalata” , Novakova 17, HR-10000 Zagreb, Hrvatska (ksenija.kljaic@zg.t-com.hr), [3]Odjel za patologiju, Klinička bolnica Osijek, Hutllerova 4, HR-31000 Osijek, Hrvatska (ksenija.marjanovic@os.htnet.hr), [4]Interna klinika, Klinička bolnica Osijek, Hutlerova 4, HR-31000 Osijek, Hrvatska (vcev.aleksandar@kbo.hr)

Infiltracija neutrofila u gastričnoj sluznici je histološki pokazatelj kroničnog gastritisa induciranog Helicobacter pylori infekcijom.Bakterija aktivira oksidativni prasak u neutrofilima kojim nastaje superoksidni radikal što dovodi do povećanog oštećenja gastrične sluznice. Ovo uzrokuje indukciju enzima, superoksid dismutaze (SOD), u sluznici želuca. Istraživanje se zasniva na hipotezi da promjena aktivnosti Cu,Zn-SOD u krvi može biti povezana sa rizikom upale gastrične sluznice kod bolesnika sa kroničnim gastritisom i pozitivnom Helicobacter pylori infekcijom (H.p.). U istraživanje je bilo uključeno 56 bolesnika i 30 zdravih osoba. Svim bolesnicima je napravljena ezofagogastroduodenoskopija.Histološka analiza izuzetih uzoraka tkiva sluznice antruma i korpusa želuca je napravljena prema Sydney klasifikaciji. Urea izdisajni test i histološka metoda bojanja po Giemsi su korišteni za dokazivanje H.p. infekcije. Spektrofotometrijsko određivanje aktivnosti SOD je napravljeno u uzorcima heparinizirane pune krvi. Aktivnost SOD je statistički značajno ($p<0,05$) veća u odnosu na zdrave ispitanike. Zbroj po Sydney klasifikaciji bolesnika sa aktivnim bakterijskim kroničnim gastritisom je veći u odnosu na bolesnike sa inaktivnim (Helicobacter pylori pozitivnim i Helicobacter pylori negativnim) kroničnim gastritisom. Dobiveni rezultati pokazuju odgovor organizma na slobodne radikale nastale upalnim procesom u gastričnoj sluznici. Evaluacija aktivnosti SOD u eritrocitima mogla bi poslužiti kao jedan od pokazatelja oksidativnog stresa u gastroduodenalnim bolestima.

OXIDATIVE STRESS IN GASTRIC MUCOSA

J. Dovhanj[1], K. Kljaić[2], K. Marjanović[3] and A. Včev[4]
[1]School of Medicine, Department of Chemistry and Biochemistry, University Of Osijek, Huttlerova 4, HR-31000 Osijek, Croatia (jdovhanj@yahoo.com), [2]Polyclinic ”Šalata”, Novakova 17, HR-10000 Zagreb, Croatia (ksenija.kljaic@zg.t-com.hr), [3]Department of Pathology, Clinical hospital Osijek, Hutllerova 4, HR-31000 Osijek, Croatia (ksenija.marjanovic@os.htnet.hr), [4]Internal Clinic, Clinical Hospital Osijek, Hutlerova 4, HR-31000 Osijek, Croatia (vcev.aleksandar@ kbo.hr)

Chronic Helicobacter pylori-induced gastritis is characterised histologically by considerable neutrophil infiltration into gastric mucosa. The bacteria activate respiratory burst liberating superoxide anion in neutrophils which results in enhanced oxidative damage to gastric mucosa. The host react by induction of the superoxide scavenger superoxide dismutase (SOD). The presented study is based on the idea that altered activities of Cu,Zn-SOD in blood might be directly related to the risk of gastric mucosa inflammation in patients with chronic gastritis (regardless of Helicobacter pylori infection).

We include 56 patients and 30 control healthy individuals in the study. All patients underwent a gastric endoscopy and tissue sample was collected from gastric antrum and corpus.Gastric histology of infected host was reviewed using the update Sydney system. Urea breath test and histologic examination by Giemsa staining were performed for detection of Helicobacter pylori infection. Heparinised whole blood samples were used to spectrophotometric measure of erythrocyte SOD. The activity of SOD was significantly increased ($p<0,05$) in patients compared to control group. The Sydney score in patients with chronic active Helicobacter pylori gastritis was higher compared to patients with chronic inactive (H.p. positive and H.p. negative) gastritis. Our results reflects a response of the body to excessive oxygen free radical release due to inflammation process in gastric mucosa. The evaluation of erythrocytes SOD would be useful for monitoring oxidative stress in peptic disease.

P-14

RAZVOJNE FAZE ŽLJEZDANIH STRUKTURA RODA SATUREJA

V. Dunkić, N. Bezić i N. Ljubešić
Fakultet prirodoslovno matematičkih znanosti i kineziologije, Teslina 12, HR-21000 Split, Hrvatska (jurinv@pmfst.hr)

Razvoj žljezdanih struktura kserofitnih vrsta *Satureja montana* L., *Satureja cuneifolia* Ten. and *Satureja subspicata* Vis., porodice Lamiaceae, dijeli se na predsekrecijske, sekrecijske i postsekrecijske razvojne faze. Biljni materijal je sakupljen u submediteranskom dijelu Hrvatske (planina Kozjak, pokraj Splita), te je obrađen za elektronsko mikroskopsku analizu, u svrhu određivanja submikroskopskog razvoja žljezdanih dlaka vriska. Žljezdana dlaka nastaje iz epidermalne stanice lista koja se asimetrično dijeli tvoreći bazalnu stanicu, stanicu stapke i vršnu stanicu. U sljedećoj fazi se dijeli vršna stanica, tvoreći dvanaeststaničnu glavu, sa subkutikularnim prostorom u koji se nakuplja uljni sadržaj. Predsekrecijska žlijezda nalikuje meristemoidnim stanicama s proplastidima, malim vakuolama i velikom jezgrom. Sekrecijska faza je vrijeme velike biosintetske aktivnosti stanica i nakupljanja nastalog uljnog sadržaja u subkutikularni prostor. U postsekrecijskoj žljezdanoj fazi dolazi do degeneracije ulrastruktura i čitavih žljezdanih stanica. U submikroskopskom pogledu u žljezdanim stanica uočava se dobra razvijenost troslojne stanične stijenke, dominacija plastida, mitohondrija i endoplazmatskog retikuluma koji sudjeluju kako u produkcijskim, tako i u transportnim metaboličkim procesima.

STAGES OF DEVELOPMENT OF *SATUREJA* GENUS GLANDULAR STRUCTURE

V. Dunkić, N. Bezić and N. Ljubešić
Faculty of Natural Sciences, Mathematics and Kinesiology, Teslina 12, HR-21000 Split (jurinv@pmfst.hr)

Development of glandular structures of xerophytes species *Satureja montana* L., *Satureja cuneifolia* Ten. and *Satureja subspicata* Vis., of Lamiaceae family, can be divided to pre-secretory, secretory and post-secretory stage of development. Plant materials were collected in sub-Mediterranean region of Croatia (Kozjak Mountain near Split). Conventional chemical fixation methods for Electron Microscopy were employed to examine the ultra structure of developing glandular trichomes of savory. Glands trichomes appear as epidermal foliar protuberances which divide asymmetrically to produce a basal cell, a stalk cell, and a cytoplasmically dense apical cell. Further divisions of the apical cell produce a glandular trichome with one basal cell, one stalk cell, and a twelve-cell head with subcuticular oil storage space. Presecretory gland cells resemble meristemic cells because they contain proplastids, small vacuoles and large nuclei. The secretory phase coincides with the intensive biosynthesis, separation and essential oil accumulation in sub-cuticular storage space. The ultrastructure of the post-secretory gland is fragile and tend to loose organizational integrity. Submicroscopic analyses of these cells showed well defined three-ply cell walls and the domination of plastids, mitochondria and endoplasmatic reticulum, all of them taking part in the metabolites production and transportation processes.

P-15

ZAŠTITNI UČINAK PROPOLISA I FLAVONOIDA U SPREČAVANJU KROMOSOMSKIH OŠTEĆENJA UZROKOVANIH ZRAČENJEM

A. Horvat Knežević[1], V. Benković[1], N. Kopjar[2], S. Ramić[2], D. Lisičić[1], N. Oršolić[1] i I. Bašić[1]
[1]Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska, [2]Institut za medicinska istraživanja i medicinu rada, Ksaverska c. 2, HR-10000 Zagreb, Hrvatska

Oštećenja molekula DNA u stanicama izloženim ionizirajućem zračenju posljedica su djelovanja slobodnih radikala. Zbog utvrđenih antioksidativnih učinaka propolisa i flavonoida istražili smo njihovo moguće radioprotektivno

djelovanje primjenom citohalazin–B blokiranog mikronukleus testa na ljudskim limfocitima u uvjetima *in vitro*. Određivali smo učestalost mikronukleusa (MN) u dvojezgrenim limfocitima te proliferacijski indeks. Vodenu otopinu propolisa (VOP) i alkoholnu otopinu propolisa (AOP) primjenili smo 30 minuta prije zračenja, jednokratno u dozi od 100 mg/kg, a kvercetin, kafeinsku kiselinu, krizin i naringin u dozi od 50 µM. Uzorke smo zračili ã zračenjem ^{60}Co u dozi od 4 Gy. Broj MN u ozračenim uzorcima bio je značajno povećan ($p<0,05$) primjenom AOP-a, kafeinske kiseline, krizina i naringina, a smanjen primjenom VOP-a i kvercetina U neozračenim uzorcima primjena VOP-a značajno je povećala broj MN. U ozračenim uzorcima krizin i naringin su smanjili, a kvercetin je povećao vrijednosti proliferacijskog indeksa (NDI). Obrada uzoraka krvi s istraživanim tvarima bez primjene zračenja dovela je do povećanja vrijednosti NDI. Rezultati dobiveni ovim istraživanjem daju nam uvid u moguću primjenu propolisa i istraživanih flavonoida u zaštiti od zračenja.

PROTECTIVE EFFECT OF PROPOLIS AND FLAVONOIDS ON RADITION-INDUCED CHROMOSOMAL DAMAGE

A. Horvat Knežević[1], V. Benković[1], N. Kopjar[2], S. Ramić[2], D. Lisičić[1], N. Oršolić[1] and I. Bašić[1]
[1]Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia,
[2]Institute for Medical Research and Occupational Health, Ksaverska c. 2, HR-10000 Zagreb, Croatia

DNA damage induced by ionizing radiation is mediated through free radical formation. The radioprotective effects of propolis and flavonoids were investigated by using the cytochalasin-B blocked micronucleus test, and frequency of micronucleus (MN) was scored in binucleacted cells. The nuclear proliferation index was calculated. A single administration of water-soluble derivate of propolis (WSDP), hydroalcoholic solution of propolis (HASP) in doses of 100 mg/kg, and quercetin, caffeic acid, chrysin and naringin in dose of 50 µM were used 30 minutes before irradiation. Irradiation was performed using a ^{60}Co ã-ray source, and absorbed dose was 4 Gy. Treatment with HASP, caffeic acid, chrysin and naringin significantly increase MN frequency, while treatment with WSDP and quercetin decrease MN frequency in irradiated samples. In nonirradiated samples administration of HASP significantly increase MN frequency. Nuclear proliferation index (NDI) was increased in non-irradiated samples treated with all tested compounds. WSDP, chrysin and naringin significantly decreased, while quercetin significantly increased

the value of NDI. The resultes of this investigation get us a better insigth of potential use of propolis and investigated flavonoids as radioprotectors.

P-16

POVEZANOST EKSPRESIJE FADD PROTEINA I APOPTOZE POTAKNUTE UV SVJETLOM

L. Kalinić, A. Ruso*, V. Vojvoda* i B. Nagy (*autorice su jednako doprinijele rezultatima)
Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (lkalinic@zg.biol.pmf.hr, ana_ruso@yahoo.com, vvojvoda@yahoo.com, bnagy@zg.biol.pmf.hr)

Membranski receptori iz porodice TNF (tumor necrosis factor) imaju glavnu ulogu u apoptozi. FADD (FAS-pridružena smrtonosna domena) je univerzalni adapterski protein koji sudjeluje u signalnim putovima svih članova te porodice. Cilj ovog istraživanja je uočiti povezanost ekspresije FADD-a i apoptoze potaknute UV svjetlom. Dvije stanične linije, divlji tip i FADD-knockout embrionalne stanice miša, tretirane su na dva načina. Prvo, stanice su ozračene različitim dozama UV svjetla (50, 75, 100, 150, 200, 250, 300 i 350 J/m^2) i uzgajane u inkubatoru (37°C, 5%CO_2) različito vrijeme (1, 3, 5, 7, 24, 30 i 48 sati). Stanice su zatim analizirane bojanjem Hoechst 33258 reagensom i propidij-jodidom (PI), te Western blotom. Drugo, stanice su tretirane s različitim koncentracijama TNF-á (25 i 50 ng/ml) uz dodatak cikloheksamida (10µg/ml), inkubirane 24 i 48 sati, te analizirane Western blotom. Western blotom je dokazana prisutnost cijelog PARP proteina i njegovih fragmenata. PARP (poli-ADP-riboza-polimeraza) je protein iz sustava DNA popravka čija razgradnja predstavlja jedan od najranijih signala apoptoze. Usporedbom dobivenih rezultata uočeno je da FADD-knockout stanice u manjem postotku ulaze u apoptozu od stanica divljeg tipa. Iz toga se može zaključiti da gubitak funkcije FADD proteina uzrokuje smanjenu regulaciju apoptoze.

CONNECTION OF FADD EXPRESSION AND UV-LIGHT INDUCED APOPTOSIS

L. Kalinić, A. Ruso*, V. Vojvoda* and B. Nagy (*authors contributed equally)
Department of Molecular Biology, Faculty of Science and Mathematics, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia

(lkalinic@zg.biol.pmf.hr, ana_ruso@yahoo.com, vvojvoda@yahoo.com, bnagy@zg.biol.pmf.hr)

Membrane receptors from TNF (tumor necrosis factor) family have an important role in apoptosis. FADD (FAS-associated death domain) is universal adapter protein that participates in signaling pathways of all family members. The objective of this study is to connect FADD expression and UV-light induced apoptosis. Two cell lines, wild type and FADD-knockout embryonic mouse cells were treated in two ways. First, cells were irradiated with different dozes of UV-light (50, 75, 100, 150, 200, 250, 300, 350 J/m^2) and grown in incubator (37°C, 5% CO_2) for different time periods (1, 3, 5, 7, 24, 30, 48 hours). Cells were analyzed with Hoechst 33258 and propidium-iodide staining, and by Western blot. Second, cells were treated with different concentrations of TNF-á (25 and 50 ng/ml) with addition of 10 µg/ml cyclohexamide, incubated for 24 and 48 hours and analyzed by Western blot. Western blot was used to test the presence of complete PARP protein or his fragments. PARP (poly ADP-ribose polymerase) is a protein included in DNA repair system, whose cleavage is one of the earliest apoptosis signals. The induction of apoptosis by UV-lights is different in FADD-wild type and FADD-knockout cells. It can be concluded that loss of function of FADD protein leads to reduced regulation of apoptosis.

P-17

KARAKTERIZACIJA NIH 3T3 MIŠJIH FIBROBLASTA I HL60 HUMANIH STANICA TRANSFECIRANIH HUMANIM MDR1 I MRP1 TRANSPORTNIM PROTEINIMA

M. Popović, B. Pivčević i T. Smital
Laboratorij za molekularnu ekotoksikologiju, Zavod za istraživanje mora i okoliša, Institut ”Ruđer Bošković”, Bijenička c. 54, HR-10000 Zagreb, Hrvatska (mpopovic@irb.hr)

ABC (*ATP Binding Cassette*) transportni proteini imaju važnu ulogu u adsorpciji, distribuciji i eliminaciji brojnih lijekova i ksenobiotika. Najviše istraživani i toksikološki najvažniji ABC proteini sisavaca su P-glikoprotein (MDR1; Pgp) i različiti članovi MRP (*Multidrug Resistance-Associated Proteins*) porodice. Stoga istraživanje mehanizma njihova djelovanja i modulacije predstavlja nužan korak u farmakološkim i toksikološkim istraživanjima, a različite stanične linije sisavaca (mišje ili humane) su raspoložive u tu svrhu. Međutim, u litreraturi su zabilježene velike razlike u transportnim aktivnostima i ekspresiji odgovarajućih transportnih proteina

izmjerenima u istim staničnim linijama. Ključan razlog za ovu nedosljednost može biti činjenica da stanične linije transfecirane s pojedinačnim ABC proteinom od interesa obično nisu analizirane na prisustvo i/ili funkciju drugih ABC transportnih proteina. Glavni cilj ovog istraživanja bila je karakterizacija prisustva i transportne aktivnosti MDR1 i MRP1 transportnih proteina u često korištenih NIH 3T3 mišjih fibroblasta i HL60 stanica promiolitične leukemije čovjeka. Obje stanične linije, roditeljske i stanice transfecirane s MDR1 i MRP1 genom su funkcionalno testirane upotrebom tehnike na mikroploči ili protočnom citometrijom, uz korištenje kalceina-AM ili rodamina 123 kao modelnih fluorescentnih supstrata, te verapamila, ciklosporina A, reversina 205 i MK-571 kao modelnih inhibitora. Osim toga, prisustvo i količina MDR1 i MRP1 mRNA kvantitativno se određivala upotrebom RT-PCR tehnike. Profili ekspresije i transportne aktivnosti navedenih staničnih linija biti će prikazani uz kritički osvrt na značenje dobivenih rezultata za daljnja istraživanja.

CHARACTERISATION OF NIH 3T3 MOUSE FIBROBLASTS AND HL60 HUMAN CELLS TRANSFECTED WITH HUMAN MDR1 AND MRP1 TRANSPORT PROTEINS

M. Popović, B. Pivčević and T. Smital
Laboratory for molecular ecotoxicology, Department for marine and environmental research, Ruđer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (mpopovic@irb.hr)

The ABC (ATP Binding Cassette) transport proteins have an important role in the adsorption, distribution and elimination of numerous drugs and xenobiotics. The most studied and toxicologically most important mammalian ABC proteins are the P-glycoprotein (MDR1; Pgp) and various members of the MRP (Multidrug Resistance-Associated Proteins) family. Studying their mechanism of action and modulation is a necessary step in pharmacological and toxicological research and various Pgp or MRPs transfected mammalian (mouse or human) cell lines are available for that purpose. However, large differences in transport activities corresponding to the same cell line(s) have been reported in the literature. A critical reason for that discrepancy may be the fact that the cell lines transfected with single ABC protein are usually not well studied regarding possible presence of other ABC efflux transporters. The main goal of this study was to characterize widely used NIH 3T3mouse fibroblasts and human promyelocytic leukemia HL60 cell lines on the presence and functional activity of the MDR1 and MRP1 efflux transporters. Both cell lines parental and MDR1 or MRP1 transfected were functionally tested using microplate or flow citometry based transport activity assays with calcein-

AM and rhodamine 123 as model fluorescent substrates, and verapamil, cyclosporine A, reversine 205 and MK-571 as model inhibitors. In addition, the presence and quantity of related MDR1 and MRP transcripts was analyzed using RT-PCR technique. The patterns of expression and transport activity for the described cell lines will be presented and further research implications of the obtained results additionally discussed.

P-18

DISTRIBUCIJA MIJELINSKIH MOLEKULA POD UVJETIMA IZOLACIJE RAFTOVA: UČINAK RAZLIČITIH DETERGENATA

K. Vajn[1], B. Viljetić[2], G. Lauc[2] i M. Heffer-Lauc[1]
[1]Katedra za biologiju, Medicinski fakultet, J.Huttlera 4, HR-31000 Osijek, (kvajn@mefos.hr, mheffer@public.srce.hr) [2]Katedra za kemiju i biokemiju, Medicinski fakultet, J. Huttlera 4, HR-31000 Osijek, (bviljetic@mefos.hr, glauc@mefos.hr)

Nekoliko tipova molekula smješteno je u staničnoj membrani pomoću lipidnog sidra koje je usidreno u jedan od fosfolipidnih slojeva. Glikolipidi su uvijek smješteni u vanjskom sloju membrane, dok proteini mogu biti smješteni u vanjskom sloju (putem glikozilfosfatidilinozitolnog (GPI) sidra) ili u unutarnjem sloju (putem prenilnog, miristilnog ili farnezilnog sidra). Imunohistokemija na ove molekule u središnjem živčanom sustavu je kompleksna, s obzirom da debela hidrofobna mijelinska ovojnica priječi pristup hidrofilnim protutijelima do aksonalne membrane, pa je potreban pretretman detergentima da bi se mijelinske membrane načinile poroznima i tako otkrile aksonalne epitope. Nedavno smo pokazali, da jedan od tih detergenata koji se nalazi u većini imunohistokemijskih protokola uzrokuje artefakte redistribucije, kad se koristi za analizu molekula usidrenih pomoću lipidnog sidra. Mi smo ispitali nekoliko detergenata, u nadi da ćemo pronaći one koje čine pore u mijelinu, a ne uzrokuju redistribuciju molekula usidrenih pomoću lipidnog sidra. Koristeći različite imunohistokemijske protokole, istražili smo grupu molekula koje su ili integralni membranski proteini (kao što su mijelinu - pridružen protein, MAG te protein $p75^{NTR}$) ili molekule usidrene u membrani pomoću lipidnog sidra (Nogo receptor, gangliozidi, te oligodendrocitni mijelinski glikoprotein, OMgp). Različiti detergenti, koncentracije detergenata te različita vremena i temperature inkubacije utječu na ove dvije vrste molekula, što može dovesti do promjene njihove imunohistokemijske lokalizacije. Naši rezultati jasno pokazuju da rutinski imunohistokemijski protokoli moraju biti prilagođeni kada se koriste za analizu molekula usidrenih pomoću lipidnog sidra i da su potrebni dodatni dokazi da se potvrdi njihova stvarna fiziološka lokalizacija.

DISTRIBUTION OF MYELIN MOLECULES UNDER CONDITIONS OF RAFT ISOLATION: EFFECT OF DIFFERENT DETERGENTS

K. Vajn[1], B. Viljetić[2], G. Lauc[2] and M. Heffer-Lauc[1]
[1]Department of Biology, University of Osijek School of Medicine, J.Huttlera 4, 31000 Osijek, Croatia (kvajn@mefos.hr, mheffer@public.srce.hr), [2]Department of Chemistry and Biochemistry, University of Osijek School of Medicine, J. Huttlera 4, 31000 Osijek, Croatia (bviljetic@mefos.hr, glauc@mefos.hr)

Several types of molecules are bound to the membrane via lipid anchor that is inserted into one of the phospholipid leaflets in the membrane. Glycolipids are always situated in the outer membrane leaflet, while proteins can be anchored either in the outer leaflet (via GPI–anchor), or in the inner leaflet (via prenyl, myristyl or farnesyl anchors). Immunochemical detection of these molecules in the brain is somewhat complex because of extensive myelin sheets that block access of antibodies to cell membranes and require pre-treatment with detergents. Recently, we discovered that one of these detergents used in most of immunohistochemistry protocols is causing redistribution artifacts when used in studies of lipid - anchored molecules. Since membranes have to be made porous to enable detection of axonal epitopes, we tested several detergents hoping to find one that makes pores in membrane, but does not result in significant redistribution of lipid-anchored molecules. Using different immunochemical procedures, we studied a set of molecules involved in the myelination that are either integral membrane proteins (MAG, $p75^{NTR}$), or only attached to the outer leaflet of the membrane through lipid anchor (NogoR, gangliosides, OMgp). Different detergents, detergent concentrations, incubation time and temperature, were found to affect some of these molecules, leading to apparently different immunohistochemical localization. Our results clearly demonstrate that routine immunohistochemical protocol needs to be adjusted when used for the analysis of lipid-anchored molecules and that additional evidence might be needed to confirm their real physiological localization.

P-19

TRANSLOKATOR PROTEINA NA VANJSKOJ MEMBRANI KLOROPLASTA (TOC)

A. Vojta[1] i E. Schleiff[2]
[1]Department Biologie I, Botanik, Ludwig-Maximilians-Universität München, Menzinger Str. 67., D-80638 München, Njemačka (a.vojta@lrz.uni-muenchen.

de), [2]Department Biologie I, Botanik, Ludwig-Maximilians-Universität München, Menzinger Str. 67, D-80638 München, Njemačka (schleiff@lrz.uni-muenchen.de)

Kloroplasti su organele endosimbiotskog porijekla. Tijekom evolucije biljne stanice većina njihovih gena bila je prenesena u jezgru domaćina, te se zbog toga proteini kloroplasta, koji se sada sintetiziraju u citosolu, moraju vratiti u organelu iz koje potječu. Proteinski kompleksi u ovojnici kloroplasta koji omogućavaju ovaj proces su Toc translokon u vanjskoj i Tic translokon u unutarnjoj membrani ovojnice. Istraživali smo strukturu i regulaciju osnovnog Toc kompleksa, koji se sastoji od dva receptora s GTPaznom aktivnošću, Toc34 i Toc159, te proteina Toc75 koji funkcionira kao pora. Toc34 prepoznaje prekursore proteina predodređene za transport u kloroplaste i nakon ciklusa hidrolize GTPa predaje ih receptoru Toc159 također smještenom u vanjskoj membrani. Utvrdili smo da receptori Toc34 i Toc159 prepoznaju različite dijelove signalne sekvence, što nam je omogućilo daljnje pretpostavke o mehanizmu njihovog djelovanja. Toc159 bi mogao biti molekularni motor koji energiju hidrolize GTPa koristi za provođenje početnog koraka translokacije. Osim toga, u biljkama roda *Arabidopsis* nađeno je nekoliko izoformi svih komponenata osnovnog Toc kompleksa. Smatra se da bi izoforme mogle prepoznavati različite tipove prekursora ili biti specifične za određena tkiva. Provedene analize ekspresije i tkivne lokalizacije komponenata translokona podržavaju ovu pretpostavku. Naše istraživanje je trenutno usmjereno na izolaciju i pročišćavanje Toc kompleksa, što bi nam pomoglo u boljem razumijevanju njegove strukture i dinamike. U tu svrhu smo razvili nove tehnike koje mogu pomoći pri daljnjem istraživanju Toc kompleksa rekonstituiranog u proteoliposome.

PROTEIN TRANSLOCON ON THE OUTER ENVELOPE OF CHLOROPLASTS (TOC)

A. Vojta and E. Schleiff
Department Biologie I, Botanik, Ludwig-Maximilians-Universität München, Menzinger Str. 67., D-80638 München, Germany (a.vojta@lrz.uni-muenchen.de, schleiff@lrz.uni-muenchen.de)

Chloroplasts are organelles of endosymbiotic origin. In the course of evolution of the plant cell most of their genes had been transferred to the host nucleus, and the chloroplast proteins which are now synthesized in the cytosol have to be re-imported into the organelle. This is facilitated by protein complexes in the chloroplast envelope – the Toc translocon on the outer, and the Tic

translocon on the inner envelope membrane. We investigated structure and regulation of the Toc core complex, consisting of two receptors with GTPase activity – Toc34 and Toc159 – and the pore forming protein Toc75. Toc34 recognizes preproteins to be imported and hands them over to the second membrane located receptor Toc159 after undergoing a GTP hydrolysis cycle. We observed that the two receptors recognize different parts of the presequence and a model for the receptor action can be proposed. The Toc159 may be a motor protein which generates power by GTP hydrolysis and executes the first step of preprotein translocation. However, there are several isoforms of Toc core components found in *Arabidopsis*. It was speculated that they may recognise different sets of precursors or be present in different tissues. Performed expression analysis and the investigation of tissue-specific localization of the translocon components support this view. Currently, our effort is focused on Toc complex isolation and purification which would help us to gain insight into its structure and dynamics. To this end, we developed new techniques to aid further studies of the Toc complex reconstituted into artificial proteolyposomes.

P-20
KARAKTERIZACIJA IMPORTA PROTEINA IZ MEĐUMEMBRANSKOG PROSTORA KLOROPLASTA

L.Vojta, B. Bölter i J. Soll
Department Biologie I, Botanik, Ludwig-Maximilians-Universität München, Menzinger Str. 67, D-80638 München, Njemačka (lea.vojta@lycos.com, boelter@lrz.uni-muenchen.de, soll@lrz.uni-muenchen.de)

Manje od 200 proteina potrebnih za razvitak i pravilno funkcioniranje kloroplasta kodirano je u kloroplastnom genomu, i njihova sinteza se odvija u stromi. Oko 3000 ostalih gena je tijekom evolucije bilo prenešeno u jezgru, gdje su dobili signale za import natrag u kloroplaste. Ovisno o njihovoj konačnoj lokalizaciji, proteini predodređeni za kloroplaste mogu se spontano ugraditi u membranu, kao što je slučaj kod većine proteina vanjske membrane, mogu prvo biti usmjerenu u stromu i kasnije preusmjereni u unutarnju membranu, ili se mogu direktno ugraditi u unutarnju membranu pomoću stop-transfer signala. Većina proteina namijenjenih tilakoidima sadrži dvodjelnu presekvencu, koja prvo obilježava protein za import u stromu, dok njen drugi dio određuje put prijenosa u tilakoide. Put unosa proteina u međumembranski prostor kloroplasta još uvijek nije detaljno proučen. Zbog toga smo odlučili istražiti karakteristike importa proteina od 22 kDa, smještenog u unutranjoj membrani kloroplasta. Tic22 je protein kodiran u jezgri, koji se sintetizira na

ribosomima u citosolu i ima N-terminalni signal za prijenos u kloroplaste. Utvrđeno je da se nalazi pričvršćen na površinu vanjske strane unutarnje membrane, a manjim dijelom uz unutarnju stranu vanjske membrane kloroplasta. Pokazali smo da dodatak ATPa nije uvjet za import proteina Tic22, iako povećava njegovu učinkovitost, te da su za import neophodne komponentete na površini kloroplasta osjetljive na termolizin. Kemijskim povezivanjem (crosslinking) i taloženjem s protutijelima pokazali smo da Tic22 tijekom translokacije međudjeluje s komponentama Toc translokona u vanjskoj membrani kloroplasta. Analizom kompeticije za import dokazali smo da Tic22 koristi Toc mašineriju na glavnom putu importa u kloroplaste i stoga pretpostavljamo da proteini međumembranskog prostora koriste isti translokacijski put kao i proteini strome.

IMPORT CHARACTERIZATION OF A CHLOROPLASTIC INTERMEMBRANE SPACE PROTEIN

L.Vojta, B. Bölter and J. Soll
Department Biologie I, Botanik, Ludwig-Maximilians-Universität München, Menzinger Str. 67, D-80638 München, Germany (lea.vojta@lycos.com, boelter@lrz.uni-muenchen.de, soll@lrz.uni-muenchen.de)

Less than 200 proteins needed for chloroplast development and proper function are encoded by the chloroplastic genome and synthesized in the stroma. Around 3000 other genes had been transferred to the nucleus in the course of evolution, where they acquired targeting signals for import back into the organelle. Dependent on their final location, proteins destined for chloroplasts can insert either spontaneously, like most of outer envelope proteins, target to the stroma and subsequently re-export to the inner envelope membrane, or insert into the inner envelope directly, by stop-transfer signal. Proteins targeted to thylakoids mostly contain a bipartite presequence, which targets them first to the stroma, while its second part determines the pathway for the thylakoids. The pathway for targeting to the intermembrane space of chloroplasts has not been intensively studied yet. For this reason, the analysis of the translocation of a 22 kDa intermembrane space localized protein was issued. It is a nuclear-encoded protein, synthesized on cytosolic ribosomes with a cleavable N-terminal chloroplast targeting presequence. It is found to be associated with the outer face of the inner envelope membrane, as well as with the inner face of the outer envelope, even though at a lower level. We confirmed that import of Tic22 is enhanced by, but not dependent on, addition of external ATP and that it demands thermolysin sensitive components on the chloroplast surface. By chemical crosslinking and immunoprecipitation we

have demonstrated that Tic22 interacts with components of the Toc translocon of the chloroplast outer envelope during its translocation. By performing import competition experiments we proved that Tic22 uses Toc machinery of the general import pathway. Therefore, proteins targeted to the intermembrane space seem to use the same translocation mode as stromal proteins.

GENOMIKA, FARMAKOGENETIKA, PROTEOMIKA, BIOINFORMATIKA I MOLEKULARNA DIJAGNOSTIKA

BIOLOGIA MOLECULARIS SENSU STRICTO

GENOMICS, PHARMACOGENETICS, PROTEOMICS, BIOINFORMATICS AND MOLECULAR DIAGNOSTICS

Kratka usmena priopćenja
Oral Presentations

OP-9
EKSPRESIJA FOXP1 U B-KRONIČNOJ LIMFOCITNOJ LEUKEMIJI

P. Korać[1], M. Gilming Vintar[1], A. H. Banham[2], R. Ventura[2], I. Kardum Skelin[3], B. Jakšić[3] i M. Dominis[1]
[1]Odjel za patologiju i citologiju, KB "Merkur", HR-10000 Zagreb, Hrvatska (petrakorac@postmaster.co.uk, marija.vintar@zg.htnet.hr, mara.dominis@zg.htnet.hr), [2]Nuffield Department of Clinical Laboratory Sciences, University of Oxford, John Radcliffe Hospital, Oxford, UK (alison.banham@ndcls.ox.ac.uk, roland.ventura@ndcls.ox.ac.uk), [3]Klinika za unutarnje bolesti, KB " Merkur", HR-10000 Zagreb, Hrvatska (ika.kardum-skelin@zg.t-com.hr, branimir.jaksic@zg.htnet.hr)

Gen za FOXP1 protein nalazi se na 3p14.1 regiji za koju je poznato da sadržava tumor supresor gene i da u tumorima često pokazuje gubitak heterozigotnosti. *FOXP1* mRNA i protein široko su eksprimirani u normalnom tkivu, uključujući B limfocite. FOXP1 u solidnim tumorima često pokazuje promjenjenu ekspresiju. Otkrivene su njegove translokacije u difuznom B-velikostaničnom limfomu i ekstranodalnom limfomu marginalne zone - MALT tip limfomu. Jaka ekspresija FOXP1 povezana je sa lošom prognozom pacijenata, dok su translokacije relativno rijetke, a mehanizam deregulacije FOXP1 nepoznat. Do sada nije proučena FOXP1 ekspresija u B-kroničnoj limfocitnoj leukemiji. Ovu bolest karakterizira infiltracija koštane srži tumorskim stanicama – malim limfocitima za koje se pretpotavlja da su porijeklom ishodišni stadiji razvoja B limfocita, kao i prisutnost tih limfocita u perifernoj krvi. Tip infiltracije koštane srži povezan je sa ishodom bolesti. Ekspresiju FOXP1 analizirali smo kod 66 bolesnika s kroničnom limfocitnom leukemijom. Promjene na razini gena analizirali smo metodom FISH, a prisutnost i lokalizaciju proteina imunohistokemijskim bojanjem. Rezultati su pokazali da postoji statistički značajna povezanost proteinske ekspresije FOXP1 i tipa infiltracije koštane srži, ali da nema povezanosti promjena na genu i proteinske ekspresije. To upućuje na zaključak da se kod kronične limfocitne leukemije regulacija jake FOXP1 ekspresije najvjerojatnije odvija mehanizmom koji ne uključuje numeričke aberacije gena ili translokacije, već vjerojatno mehanizmom na razini mRNA. Također, u patogenezi B-kronične limfocitne leukemije FOXP1 protein bi mogao biti uključen u signalne puteve tumorskih stanica koji određuju način infiltriracije koštane srži bolesnika ili ta povezanost govori i o povezanosti sa lošijom prognozom.

FOXP1 EXPRESSION IN B-CELL CHRONIC LYMPHOCYTIC LEUKEMIA

P. Korać[1], M. Gilming Vintar[1], A. H. Banham[2], R. Ventura[2], I. Kardum Skelin[3], B. Jakšić[3] and M. Dominis[1]
[1]Department of Clinical Pathology and Cytology, Merkur University Hospital, HR-10000 Zagreb, Croatia (petrakorac@postmaster.co.uk, marija.vintar@zg.htnet.hr, mara.dominis@zg.htnet.hr), [2]Nuffield Department of Clinical Laboratory Sciences, University of Oxford, John Radcliffe Hospital, Oxford, UK (alison.banham@ndcls.ox.ac.uk, roland.ventura@ndcls.ox.ac.uk), [3]Department of Medicine Merkur University Hospital, HR-10000 Zagreb, Croatia (ika.kardum-skelin@zg.t-com.hr, branimir.jaksic@zg.htnet.hr)

The *FOXP1* gene is located at 3p14.1 – a region exhibiting loss of heterozygosity in many tumours and thus thought to harbour tumour suppressors. *FOXP1* mRNA and protein are highly expressed in a wide range of normal tissues, including B cells. In solid tumours FOXP1 commonly shows deregulated expression. Translocations involving *FOXP1* gene have been described in diffuse large B cell lymphoma and extranodal marginal zone lymphoma-MALT type. While high FOXP1 expression is associated with a poor prognosis in these patients the translocations are relatively rare and the mechanisms of FOXP1 de-regulation are largely unknown. FOXP1 expression in B-cell chronic lymphocytic leukemia (B-CLL) has not been previously reported. B-CLL is characterized by bone marrow infiltrates of small lymphocytes that originate from early stages in B-cell development, which are also present in peripheral blood. Type of bone marrow infiltration is linked with disease outcome. We have analyzed FOXP1 expression in 66 patients with B-CLL. FISH analysis was used for detection of FOXP1 gene aberrations and immunohistochemical staining for FOXP1 protein detection. Results showed a statistically significant correlation between FOXP1 protein expression and bone marrow infiltration. However, there was no connection between genetic aberrations and FOXP1 protein expression. Our data suggest that in B-CLL high level FOXP1 expression is regulated by mechanisms other than numerical gene aberrations or translocations, possibly by regulation at the mRNA level. In B-CLL pathogenesis FOXP1 expression may have a role in influencing type of bone marrow infiltration or the relationship may indicate a common association with poor prognosis.

Posterska priopćenja
Posters

P-21
POLIMORFIZMI GENA ZA TIMIDILAT SINTETAZU U FARMAKOGENETICI 5' FLUOROURACILA

M. Jokić i S. Kapitanović
Zavod za Molekularnu Medicinu, Institut Ruđer Bošković, Bijenička c. 54, HR-10000 Zagreb, Hrvatska (mjokic@irb.hr, kapitan@irb.hr)

5' fluorouracil je važan antitumorski agens široko primjenjen u kemoterapiji. Aktivni metabolit FdUMP inhibira timidilat sintetazu (TS), ključni enzim za sintezu DNA koji katalizira reduktivnu metilaciju dUMP preko N^5,N^{10}-MTHF u dTMP. Humana TS promotorska regija sadržava polimorfni pojačivač s dva ili tri 28-pb uzastopna ponavljanja koja utječu na ekspresiju TS mRNA. Većina humanih TS alela pokazuje dvostruko (2R) ili trostruko ponavljanje (3R) za ovaj polimorfizam što daje genotipove 2R/2R, 2R/3R i 3R/3R. Kod pojedinaca koji su homozigoti za 3R, primjećena je povišena razina TS mRNA i proteina. G→C SNP u drugom ponavljanju 3R alela pokazuje da 3R sekvenca s G ima tri do četiri puta veću razinu translacije nego 3R sa C ili 2R sekvenca. Zbog povezanosti TS polimorfizama s ishodom kemoterapije zasnovane na 5-FU, proveli smo istraživanje u svrhu određivanja distribucije TS polimorfizama u hrvatskoj populaciji. Ukupno 125 zdravih nesrodnika je genotipizirano na polimorfizme u 5' UTR gena za TS koristeći PCR-RFLP metodu s HaeIII restrikcijskim enzimom. Frekvencija genotipova za 5' UTR TS polimorfizme je 26,4 %, 16%, 2,4%, 42,4%, 8,8% i 4% za 2R/3G, 3G/3C, 3G/3G, 2R/2R, 2R/3C, 3C/3C genotipove. Naši rezultati pokazuju da su u hrvatskoj populaciji genotipovi povezani s niskom ekspresijom TS učestaliji (55.2%) od genotipova povezanih s viskom ekspresijom TS (44.8%), ali ne signifikantno.

TS POLYMORPHISMS IN 5' FLUOROURACIL (5-FU) PHARMACOGENETICS

M. Jokić and S. Kapitanović
Division of Molecular Medicine, Rudjer Boskovic Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (mjokic@irb.hr)

5'FU is an important anticancer agent widely used in chemotherapy. Its active

metabolite FdUMP suppresses thymidylate synthase (TS), an essential enzyme for DNA synthesis which catalyzes the reductive methylation of dUMP by 5,10-MTHFR to dTMP. The human TS promoter region includes polymorphic enhancer with two or three 28-bp tandem repeats and has been implicated in affecting on TS mRNA expression. The majority of human TS alleles harbor either a double repeat (2R) or a triple repeat (3R) for this polymorphism, giving genotypes of 2R/2R, 2R/3R and 3R/3R. Individuals homozygous for the 3R were found to have elevated intratumoral TS mRNA and protein level. G→C SNP in the second repeat of the 3R alleles shows that the 3R sequence with G has three to four times greater efficiency of translation than the 3R with C and the 2R sequence. Due to associations of the TS polymorphisms with the outcome of 5-FU based chemotherapy , we performed a study to determine the distribution of TS polymorphisms in Croatian population. A total of 125 healthy unrelated individuals were genotyped for the TS 5' UTR polymorphisms using PCR-RFLP method with HaeIII restriction enzyme. Genotype frequencies for 5' UTR TS polymorphisms were 26,4 %, 16%, 2,4%, 42,4%, 8,8% and 4% for 2R/3G, 3G/3C, 3G/3G, 2R/2R, 2R/3C, 3C/3C genotype respectively. Our results showed that in Croatian population low TS expression genotypes were more frequent (55.2%) than high TS expression genotypes (44.8%) but not significant.

P-22

DETEKCIJA TRANSLOKACIJE t(11;22) KOD PACIJENATA SA EWING-OVIM SARKOMOM

M.M. Dabić[1], K. Meljanac[1], A. Bonevski[2] i S. Seiwerth [1]
[1]Laboratorij Molekularne Patologije, Zavod za Patologiju, Medicinski Fakultet i KBC Zagreb, HR-10000 Zagreb, Hrvatska (mirtmirela@yahoo.com, kmeljanac@yahoo.com), [2]Odjel za onkologiju, Klinika za dječje bolesti Klaićeva, HR-10000 Zagreb, Hrvatska

Specifičan dijagnostički marker za Ewingov sarkom je EWS/FLI1 t(11;22) translokacija. Najčeščća fuzija spaja EWS ekson 7 sa FLI1 eksonom 6 (tip I) te je povoljan prognostički faktor. Cilj je praćenje pacijenata sa uočenim translokacijama u parafinskim blokovima/svježem tkivu za minimalnu ostatnu bolest (MRD) u perifernoj krvi i/ili koštanoj srži. Od Listopada 2003. do Siječnja 2006. primili smo uzorke tumora uklopljene u parafin u paru sa uzorcima periferne krvi od 11 pacijenata kojima je dijagnosticiran Ewingov sarkom, a za vrijeme liječenja prema protokolu EURO EWING 99. Primili smo i šest uzoraka krvi i šest uzoraka koštane srži od pacijenata kojima je završeno liječenje. Ukupna RNA je izolirana te su fuzionirani transkripti EWS-FLI1

detektirani pomoću RT-PCR-a korištenjem početnica EWS22.2 Bam i FLI1C koje specifično umnožavaju obje varijante fuzije – tip 1 od 125 pb i tip II od 191 pb. Devet uzoraka parafina je bilo pozitivno za tip I EWS-FLI1 fuzije, od kojih 2 pacijenta nisu preživjela, i dva za tip II. Jedan od uzoraka krvi je bio pozitivan za tip I, i jedan za tip II fuzije, i to od pacijenata kojio su završili s liječenjem. U preostalim uzorcima krvi nije bilo pozitivnih transkripata, kao ni u svim uzorcima koštane srži. Ova specifična RT-PCR metoda nužna je za utvrđivanje dijagnoze Ewingovog sarkoma i praćenje minimalne ostatne bolesti u perifernoj krvi i koštanoj srži, pogotovo u pozitivnih pacijenata koji su završili s liječenjem. Ubuduće će se pratiti svi pacijenti te će se utvrditi utjecaj pozitivnih translokacija u krvi i srži na prognozu.

DETECTION OF t(11;22) TRANSLOCATION IN EWING SARCOMA

M.M. Dabić[1], K. Meljanac[1], A. Bonevski[2] and S. Seiwerth[1]
[1]Laboratory of Molecular Pathology, Institute of Pathology, Medical Faculty and Department of Pathology, Clinical Hospital Center, HR-10000 Zagreb, Croatia (mirtmirela@yahoo.com, kmeljanac@yahoo.com), [2]Department of Oncology, Children Hospital Center Klaićeva, HR-10000 Zagreb, Croatia

A specific diagnostic marker for Ewing Sarcoma is EWS-FLI1 t(11;22) translocation. The most common fusion joins EWS exon 7 with FLI1 exon 6 (type I fusion) and is a favourable prognostic factor. Our aim was to follow-up patients with detected translocations in parrafin blocks/fresh tissue for minimal reisidual disease in peripheral blood and/or bone marrow. From October 2003. until January 2006. we received tumor samples (paraffin-embedded) paired with blood samples of eleven patients diagnosed with Ewing sarcoma during the treatment according to EURO EWING 99 protocol and we received six blood samples and six bone marrow samples collected from patients who finished the treatment. Total RNA was isolated and the EWS-FLI1 fusion transcripts were detected by RT-PCR using primers EWS22.2 Bam and FLI1C that specifically amplify both 125 pb type 1 fusion and 191 pb type 2 variant. Nine paraffin samples were positive for type I EWS-FLI1 fusion of which two didn't survive, and two for type II. Two blood samples were positive, one for type I, and another one for type II fusion in patients who finished the treatment. The rest of the blood samples as well as all bone marrow samples showed no positivity for transcripts. This specific RT-PCR assay is essential for Ewing sarcoma diagnosis and monitoring minimal residual disease especially in EWS-FLI1 positive patients who have finished the treatment protocol. All patients will be followed-up in future and impact of blood and bone marrow positivity on prognosis will be assessed.

P-23

ANALIZA MUTACIJA U ALG6 GENU PCR-SSCP METODOM

S. Šupraha i J. Dumić
Zavod za biokemiju i molekularnu biologiju, Farmaceutsko-biokemijski fakultet Sveučilišta u Zagrebu, A. Kovačića 1, HR-10000 Zagreb, Hrvatska, (jdumic@pharma.hr, sandras@pharma.hr)

Urođeni poremećaji glikozilacije (*eng.* congenital disorders of glycosylation, CDGs) su skupina nasljednih autosomno recesivnih poremećaja uzrokovanih defektima u sintezi N- i O-vezanih glikana. Brojne su studije pokazale da učestalost bolesti nije u skladu s učestalošću zdravih nositelja mutacija (najčešće heterozigota). Nedavno smo započeli projekt kojem je cilj odrediti učestalost različitih mutacija/polimorfizama u genima koji kodiraju glikoziltransferaze povezane sa CDG u hrvatskoj populaciji. Jedan od najčešćih tipova CDG je tip Ic, uzrokovan mutacijama u hALG6 genu koji kodira Man(9)GlcNAc(2)-PP-Dol á1,3-glukoziltransferazu. Do danas je otkriveno šesnaest različitih mutacija u hALG6 genu koje uzrokuju CDG Ic, od kojih je A333V najčešća. U ovom radu objavljujemo novu PCR-SSCP metodu optimiranu za analizu mutacija u eksonu 11 hALG6 gena kojom su analizirani uzorci dobiveni od 350 krvno nesrodnih zdravih pojedinaca. Umnoženi DNA fragmenti koji obuhvaćaju ekson 11 hALG6 gena podvrgnuti su elektroforezi pri različitim uvjetima. Najbolje razdvajanje jednolančanih fragmenata postignuto je pri uvjetima: 6% PAG, 4° C tijekom 5 sati uz 6W. U analiziranim uzorcima mutacija A333V nije detektirana.

THE ANALYSIS OF THE MUTATIONS IN ALG6 GENE BY PCR-SSCP METHOD

S. Šupraha and J. Dumić
Department of Biochemistry and Molecular Biology, Faculty of Pharmacy and Biochemistry, University of Zagreb, A. Kovačića 1, HR-10000 Zagreb, Croatia (jdumic@pharma.hr, sandras@pharma.hr)

Congenital disorders of glycosylation (CDGs) are inherited autosomal recessive disorders caused by defects in the pathways of N- and O-linked glycosylation. The frequency of the diseases and the frequency of the healthy carriers (usually heterozygous) are inconsistent, as shown by some population studies. We have recently undertaken a comprehensive project to determine the frequency of various mutations/polymorphisms in genes encoding glycosyltransferases related to CDGs in Croatian population.

One of the most common types of CDGs is type Ic, caused by mutations in hALG6 gene encoding Man(9)GlcNAc(2)-PP-Dol á1,3-glucosyltransferase. Sixteen different hALG6 mutations causing CDG-Ic have been described so far, where A333V accounts for the majority of the alleles. Here we report a new PCR-SSCP method optimized for the analysis of mutations in the exon 11 of hALG6 gene and present results obtained by screening of 350 healthy unrelated Croats. The multiplied DNA fragments encompassing exon 11 of hALG6 genes were subjected to electrophoresis under different conditions. The best separation was obtained on 6% PAG, at 4° C for 5 hours using 6W. In the samples analyzed until now A333V mutation has not been identified.

VIROLOGIJA, MIKROBIOLOGIJA I MIKOLOGIJA

BIOLOGIA VIRORUM ET MICROBORUM, BIOLOGIA FUNGORUM

VIROLOGY, MICROBIOLOGY AND MYCOLOGY

Uvodna tematska predavanja
Introductory Lectures

IL-4
FITOPLAZME IZ JABLANA – NOVA VRSTA ILI MOLEKULARNA VARIJABILNOST UNUTAR VRSTE '*CANDIDATUS* PHYTOPLASMA ASTERIS'?

M. Šeruga Musić[1], M. Novokmet[1], S. Botti[2], D. Škorić[1] i A. Bertaccini[2]
[1]Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Marulićev trg 9a, HR-10000 Zagreb, Hrvatska (martina@botanic.hr, dijana@botanic.hr, mislav4@gmail.com), [2]DiSTA, Patologia Vegetale, Alma Mater Studiorum, University of Bologna, viale Fanin 42, I-40127 Bologna, Italija (bertaccini_a@biblio.cib.unibo.it, s.botti@racine.ra.it)

Fitoplazme su unutarstanične patogene bakterije bez stanične stijenke koje naseljavaju floem biljaka, a nalazimo ih i u kukcima. Nije ih moguće uzgojiti na umjetnom mediju, stoga je njihova klasifikacija otežana i definirana nizom pravila čija je osnova prvenstveno raznolikost gena za 16S rRNA. Cilj ovog istraživanja bio je utvrditi rasprostranjenost i raznovrsnost fitoplazmi u populaciji jablana (*Populus nigra* L. 'Italica') na širem području grada Zagreba. Ukupne nukleinske kiseline izolirane su iz uzoraka listova prikupljenih sa 34 stabala. Prisutnost ovih patogena dokazivana je umnažanjem fitoplazmatskog gena za 16S rRNA direktnom i ugniježđenom lančanom reakcijom polimerazom uz pomoć univerzalnih i specifičnih početnica, te RFLP-analizom umnoženih fragmenata. U 12 uzoraka detektirane su fitoplazme iz ribosomske skupine 16SrI ('*Candidatus* Phytoplasma asteris'). Iz tih uzoraka dodatno su umnožene i druge konzervirane genske regije (gen za elongacijski faktor Tu, geni za ribosomske proteine L22 i S3, gen za aminokiselinsku kinazu). RFLP-analiza pokazala je da 10 izolata pripada ribosomskoj podskupini 16SrI-P, ranije opisanoj samo kod jablana sa zagrebačkog područja .Kod preostala 2 izolata uočeni su jedinstveni obrasci u tri dodatno istraživane genske regije uz pojavu mješovitog restrikcijskog obrasca gena za ribosomske proteine kod jednog od izolata. Rezultati ukazuju na molekularnu varijabilnosti unutar analiziranih genskih regija. Zbog detaljnije analize tih dvaju uzoraka, umnoženi fragmenti gena za 16 rRNA su klonirani i sekvencirani. Filogenetske analize te stupanj sličnosti dobivenih sekvenci s referentnim sojevima ukazuju na mogućnost da bi jedna fitoplazma koja zaražava zagrebačke jablane ipak mogla predstavljati zasebnu vrstu. Potrebna su dodatna istraživanja kako bi se potkrijepila ova tvrdnja.

PHYTOPLASMAS INFECTING CROATIAN POPLAR - A NOVEL TAXON OR MOLECULAR VARIABILITY WITHIN '*CANDIDATUS* PHYTOPLASMA ASTERIS' SPECIES?

M. Šeruga Musić[1], M. Novokmet[1], S. Botti[2], D. Škorić[1] and A. Bertaccini[2]
[1]Department of Botany, Faculty of Science, University of Zagreb, Marulićev trg 9a, HR-10000 Zagreb, Croatia (martina@botanic.hr, dijana@botanic.hr, mislav4@gmail.com), [2]DiSTA, Patologia Vegetale, Alma Mater Studiorum, University of Bologna, viale Fanin 42, I-40127 Bologna, Italy (bertaccini_a@biblio.cib.unibo.it, s.botti@racine.ra.it)

Phytoplasmas are wall-less bacteria that reside endocellularly in plant phloem and insects. Since they are not cultivable *in vitro*, their classification is difficult and defined by a set of rules that mainly rely on their 16S rRNA gene sequence. The aim of this research was to examine the phytoplasma incidence and variability in *Populus nigra* L. 'Italica' (Lombardy poplar) tree population of wider Zagreb urban area. For routine phytoplasma identification, total nucleic acids were extracted from leaf samples of 34 trees. Phytoplasma 16S rDNA was amplified in direct and nested PCRs by using universal and group-specific primers and analyzed by RFLP. Phytoplasmas belonging to the 16SrI ribosomal group ('*Candidatus* Phytoplasma asteris') were detected in 12 samples. For positive samples, other phytoplasma conserved genes (ribosomal protein genes *rpl22* and *rps3*; *tuf* gene; putative gene for aa kinase) were also analyzed. RFLP profiles from 10 samples were referable to the phytoplasma 16SrI-P ribosomal subgroup previously found only in a poplar from Zagreb. In two samples, unique restriction patterns were found, suggesting the molecular variability within conserved regions. Mixed profile of ribosomal protein gene was also detected in one of these samples. In order to analyze these two phytoplasmas in more detail, their 16S rRNA and spacer regions were amplified, cloned and sequenced. Results of phylogenetic analyses and sequence similarity shared with the reference strains, suggest that the phytoplasma infecting Croatian poplar might be considered as a distinct taxon. However, other investigations are necessary to confirm this hypothesis.

IL-5
BIOLOGICAL ASSAYS OF INTERFERONS

S. Sladoljev[1], B. Filipič[2] and S. Toth[3]
[1]Institute of Immunology, Rockefellerova 4, HR-10000 Zagreb, Croatia (Ssladoljev@imz.hr), [2]Institute of Microbiology and Immunology, Med. Fac., Zaloška 4, 1105 Ljubljana, Slovenija (A_Stanonik@yahoo.com),

[3]Blood Transfusion Unit, City Hospital, 5900 Könd u. 59, Orosháza, Hungary (yksi@freemail.hu)

Although more than a quarter of a century has passed since the discovery of the Interferons (IFN), a universally accepted method for its biological assay is still unavai- lable. One of the reason is definitely in the fact, that the IFNs are pleiotropic molecules showing not only antiviral but also antiproliferative, cytocidal, antitumor, immunomodulatory and radioprotective activity. Presently the most widely used method for IFN quantitation is based on the measurment of various parameters of viral replication in IFN-treated cells. Among these parameters the one based on cytopathic effect (CPE)-inhibition offers the most useful assay to determine the biological activity of IFN. Such an activity is expressed in the I.U. (International units)/ ml. Although diploid fibroblast cells can be more sensitive, the use of different continous cell lines is more practical. The purpose of this study was to compare three established cell lines (WISH, HAC-3/T2 and MDBK) to ascertain which cell-virus system is more appropriate for qunatitation of both Human (Alpha, Beta and Gamma) and Porcine (Alpha, Beta and Gamma) Interferons. Subseqently, the antiviral activity was compared with the antiproliferative activity using the same cells and cytocidal activity using the PLA cells. The sensitivity and reproducibility of different test system was also determined, finnaly leading to the determining of the biological activity of IFNs.

Kratka usmena priopćenja
Oral Presentations

OP-10
PRISUTNOST VISOKOPATOGENIH SOJEVA VIRUSA TRISTEZA U HRVATSKOJ

S. Černi[1], D. Škorić[1], M. Krajačić[1] i G. Nolasco[2]
[1]Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (scerni@botanic.hr, dijana@botanic.hr, mladen@botanic.hr), [2]CDCTPV, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal (gnolasco@ualg.pt)

Virus tristeza *(Citrus tristeza virus,* CTV) najrasprostranjeniji je i najrazorniji virusni patogen agruma. Ovisno o tipu podloge i plemke, visokopatogeni CTV-sojevi mogu uzrokovati simptom brzog propadanja i smrti inficiranog stabla ili simptom jamičavost drveta, tzv. *stem-pitting* (SP). U Hrvatskoj se najčešće komercijalno uzgaja mandarina Satsuma (*Citrus unshiu* Marc.) cijepljena na podlogu *Poncirus trifoliata* L.. Ova kombinacija uglavnom je CTV-tolerantna pa nema vidljivih simptoma infekcije. S ciljem biološke i molekularne karakterizacije, CTV-pozitivni uzorci nacijepljeni su na bioindikator slatku naranču (SwO) Madam Vinous. Četiri testirana uzorka dala su jasne SP-simptome na bioindikatorskim biljkama. Prisutnost virusa dokazana je iz kore inficiranih biljaka tzv. *immunocapture* RT-PCR metodom uz primjenu početnica za gen kapsidnog proteina (CP-gen). PCR-produkti ugrađeni su u plazmidni vektor, a klonovi s insertom odgovarajuće veličine sekvencirani su. Dva SwO-SP-izolata sadržavala su četiri varijante sekvence koje su se oko 2% razlikovale od visokopatogenog SP-soja SY568 iz Kalifornije te soja Nuaga iz Japana. Druga dva SwO-SP-izolata sadržavala su četiri varijante sekvence koje su se oko 1,6% razlikovale od visokopatogenih SP-sojeva iz Indije; CTV-Puna i CTV-Bangalore. Dosada na području Mediterana nije opisan spomenuti tip CTV-sojeva, a naši rezultati ukazuju da su SwO-SP-sojevi u Hrvatsku preneseni iz Japana inficiranim sadnim materijalom. Navedeni rezultati temeljeni na molekularnoj filogeniji ukazuju da bi postojeći epidemiološki scenarij širenja virusa tristeza na prostoru Mediterana trebalo revidirati.

OCCURRENCE OF SEVERE CITRUS TRISTEZA VIRUS STRAINS IN CROATIA

S. Černi[1], D. Škorić[1], M. Krajačić[1] and G. Nolasco[2]
[1]Department of Botany, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (scerni@botanic.hr, dijana@botanic.hr, mladen@botanic.hr), [2]CDCTPV, Universidade do Algarve, Campus de Gambelas, 8005-139 Faro, Portugal (gnolasco@ualg.pt)

Citrus tristeza virus (CTV) is a worldwide distributed pathogen that causes the most prevalent and destructive viral disease of citrus trees. Depending on a rootstock/scion combination, severe CTV-strains can cause decline or stem-pitting (SP) syndrome in infected plants. The major citrus species grown in Croatia is Satsuma mandarin (*Citrus unshiu* Marc.) grafted on *Poncirus trifoliata* L. rootstock, the combination which is mostly CTV-tolerant and displays no symptoms. During the course of a biomolecular characterization, CTV-positive samples collected from field-infected sources were graft transmitted to Madam Vinous sweet orange (SwO) bioindicators. Typical tristeza stem-pitting (SP) was observed for 4 tested samples. The bark from the infected sources was analyzed using immunocapture reverse transcription-polymerase chain reaction with primers targeting the whole CTV-coat-protein (CP) gene. The PCR-products of the expected size were T/A-cloned and clones harboring the CTV-CP gene were sequenced. Two of the SwO SP-isolates contained four genomic variants that differed 2.0% from the severe SP strains SY568 and Nuaga from California and Japan, respectively. The other two SwO SP isolates contained four variants that differed as little as 1.6% from the severe SP-isolates from India; CTV-Puna, and CTV-Bangalore. It has been generally believed that this kind of CTV strains do not exist in the Mediterranean basin. Our results suggest that SwO SP-strains were mostly introduced into Croatia from Japan and have been spreading for several decades. These findings on CTV molecular phylogeny suggest that epidemiological scenario for CTV spreading in the Mediterranean should be revised.

OP-11
AMINO ACIDS MODULATE THE BIOLOGICAL ACTIVITIES OF HUIFN-Á IN DIFFERENT WAYS

B. Filipič[1], S. Tóth [2], S. Sladoljev[3] and S. Koren[1]
[1]Institute of Microbiology and Immunology, Medical Faculty, Zaloska 4, 1105 Ljubljana, Slovenia (A_Stanonik@yahoo.com), [2]Blood Transfusion Unit, City Hospital, 5900 Könd u. 59, Orosháza, Hungary (yksi@freemail.hu), [3]Institute of Immunology, Rockefellerova 4, HR-10000 Zagreb, Croatia (Ssladoljev@imz.hr)

Natural HuIFN-á represent a heterologous mixture of several subtypes with more or less predominant biological activities. Among them antiviral activity is one of the first which was considered specific for the interferons in general. Some other activities of IFNs worth to mention are antiproliferative, antitumor, cytocidal, immunomodulatory and radioprotective properties.It was reported that certain amino acids can modulate the antiviral activity of IFNs *in vitro*. The aim of the work presented here was to find out if and how the amino acids active in influencing antiviral activity can modulate the antiproliferative and cytocidal activities of the natural HuIFN-á. In the experiments natural HuIFN-á preparations from EGIS Pharmaceutical Factory (Budapest, Hungary) and different natural HuIFN-á production batches from the Institute of Immunology (Zagreb, Croatia) were used. The HuIFN-á samples were applied in two different concentrations: 1000 IU/ml and 10 IU/ml. The antiviral (AV) activity was determined on WISH cell cultures against Vesicullar Stomatitis Virus using an 500 IU/ml international standard reference. Modulation of the antiproliferative activity was measured on WISH and HAC3/T" cell lines, while the influence of the amino acids on the cytocidal activity was assayed on PLA (adult pig kidney) cell line. All cells were cultivated in Eagle's Minimal Essential Medium supplemented with 8% of SR-2.55P, a serum replacement based on bovine ocular fluid. Amino acids stock solutions were prepared in 2N HCl at a concentration of 10 mg/ml. Working concentration was achieved at 1 mg/ml by diluting stock solutions in physiological saline. Amino acids were added to the IFN samples at a 1 : 1 ratio and these mixtures were added to different cell cultures. It was found that L-asparagine and L-aspartic acid were able to augment the cytocidal (CY) activity of natural HuIFN-á by an 1 : 8 vs. 1 : 128 and 1 : 8 vs. 1 : 256 ratio respectively. L-cystein, L-serine and DL-threonin had minimal or no effect on this activity. L-asparagine and L-serine were the most effective in enhancing antiproliferative (AP) activity of the natural HuIFN-á followed by DL-threonin, L-aspartic acid and L-cystein in a decreasing order of influence. When different batches of natural HuIFN-á products were tested, different AV : AP : CY ratios were found. These ratios could be modulated at wish by applying different amino acids concomitantly with the natural HuIFN-á preparations.

OP-12
ODVAJANJE VIRUSNE SATELITNE dsRNA PRIMJENOM HPLC

S. Likić, G. Rusak i M. Krajačić
Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (slikic@botanic.hr, gordana@botanic.hr, mladen@botanic.hr)

Satelitne RNA molekule su biljni subviralni agensi čija replikacija i širenje ovise o virusu pomagaču. Satelitne RNA molekule koje dolaze s virusom mozaika krastavca mogu izazvati ekonomski značajne štete u poljoprivredi, naročito na rajčici. Replikacijom virusne i satelitne RNA u biljci nastaju dvolančane replikativne RNA forme (dsRNA). Ove stabilne strukture obično se izoliraju iz zaraženog biljnog materijala kromatografijom na stupcu CF-11 celuloze i razdvajaju i identificiraju upotrebom gel elektroforeze. S ciljem odvajanja satelitne dsRNA od virusne, standardnoj smo metodi pridružili odvajanje tekućinskom kromatografijom visoke moći razlučivanja (HPLC). Uzorci su razdvajani na Helix DVB koloni (3x50mm, Varian) uz linearni gradijent 44-80% otapala B tijekom 12 minuta pri temperaturi 30°C i protoku 0.45 ml/min te detekciji na 260nm (A=0.1M TEAA (trietilamonij acetat), 0.1mM EDTA; B=0.1M TEAA, 0.1mM EDTA, 25% ACN). Na temelju dobivenog kromatograma izolirana je frakcija satelitne dsRNA, a njena prisutnost u izdvojenoj frakciji potvrđena je gel elektroforezom i metodom RT-PCR uz upotrebu para specifičnih početnica. Rezultati pokazuju da je upotrebom HPLC moguće dokazati i jednostavno izolirati satelitnu dsRNA, pri čemu je izbjegnut korak taloženja i elektoforetskog razdvajanja dsRNA. Navedena metoda mogla bi imati preparativnu primjenu za izdvajanje satelitne dsRNA visoke čistoće koja bi se koristila za daljnje analize.

SEPARATION OF PLANT VIRAL SATELLITE dsRNA USING HPLC

S. Likić, G. Rusak and M. Krajačić
Department of Botany, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (slikic@botanic.hr, gordana@botanic.hr, mladen@botanic.hr)

Satellite RNAs are plant subviral agents which depend on their helper viruses for replication and spread. Those accompanied with cucumber mosaic virus are certainly most important in agricultural production inducing severe symptoms, particularly in tomato. Both virus and the satellite generate sufficient quantity of double-stranded replicative RNAs (dsRNAs). These stable replicative forms can be isolated from small amount of infected tissue by CF-11 cellulose chromatography and recognized in standard electrophoretic profile. The approach is often used in preliminary identification of this extremely harmful pathogen combination. In our investigation this standard method was followed by high-performance liquid chromatography (HPLC) for further separation of the satellite dsRNA. Samples were run on Helix DVB Column (3x50 mm, Varian) at linear gradient 44-80% B in 12 minutes at 30°C, flow rate 0.45 ml/min, detection at 260nm (A=0.1M TEAA (triethylammonium acetate),

0.1mM EDTA; B=0.1M TEAA, 0.1mM EDTA, 25% ACN). Separation resulted in chromatogram showing strong peak from which the fraction was collected and the satellite dsRNA was identified by electrophoresis and RT-PCR. HPLC offer clear evidence of satellite presence, without precipitation and electrophoresis. At the same time it can be used as a preparative approach resulting in very pure satellite for further analyses.

Posterska priopćenja
Posters

P-24
ODREĐIVANJE ANTIFUNGALNE AKTIVNOSTI ETANOLNIH EKSTRAKATA VRSTE *Helichrysum italicum* (ROTH) G. DON

B. Blažeković[1], S. Pepeljnjak[2], G. Stanić[1] i S. Vladimir-Knežević[1]
[1]Zavod za farmakognoziju, Farmaceutsko-biokemijski fakultet, Sveučilište u Zagrebu, Marulićev trg 20/2, HR-10000 Zagreb, Hrvatska (bblazekovic@pharma.hr, gordanas@pharma.hr, sanda@pharma.hr), [2]Zavod za mikrobiologiju, Farmaceutsko-biokemijski fakultet, Sveučilište u Zagrebu, Schrottova 39, HR-10000 Zagreb, Hrvatska (spep33@yahoo.com)

Helichrysum italicum (Roth) G. Don (primorsko smilje), višegodišnji aromatični polugrm iz porodice *Asteraceae*, karakteristična je vrsta Mediteranske flore. Dosadašnjim znanstvenim istraživanjima dokazano je protuupalno i antimikrobno djelovanje nekih vrsta roda *Helichrysum*. Cilj ovog rada bio je provesti fitokemijsku karakterizaciju i istražiti antifungalni učinak vrste *Helichrysum italicum*. Primjenom metoda difuzije i dilucije ispitano je djelovanje tekućih etanolnih ekstrakata cvata te stabljike s listovima na jedanaest standardnih i klinički izoliranih sojeva dermatofita, kvasaca i kvascima sličnih gljivica. Najsnažniji učinak zabilježen je na dermatofite roda *Trichophyton* i *Microsporum*. Izmjerene zone inhibicije (ZI) bile su u granicama od 15 mm do 30 mm, a minimalne fungicidne koncentracije (MFK) 0,5-1 vol%. Ostale vrste gljivica pokazale su manju osjetljivost na djelovanje ispitivanih ekstrakata (ZI: 7-10 mm, MFK: 2-5 vol%). Dobiveni rezultati ukazuju na primorsko smilje kao potencijalni izvor novih bioaktivnih tvari antifungalnih svojstava i upućuju na biomedicinski značaj te vrste.

DETERMINATION OF ANTIFUNGAL ACTIVITIES OF ETHANOLIC EXTRACTS FROM *Helichrysum italicum* (ROTH) G. DON

B. Blažeković[1], S. Pepeljnjak[2], G. Stanić[1] and S. Vladimir-Knežević[1]
[1]Department of Pharmacognosy, Faculty of Pharmacy and Biochemistry, University of Zagreb, Marulićev trg 20/2, HR-10000 Zagreb, Croatia (bblazekovic@pharma.hr, gordanas@pharma.hr, sanda@pharma.hr), [2]Department of Microbiology, Faculty of Pharmacy and Biochemistry, University of Zagreb, Schrottova 39, HR-10000 Zagreb, Croatia (spep33@yahoo.com)

Helichrysum italicum (Roth) G. Don is a perennial aromatic subshrub of *Asteraceae* family, and a typical representative of Mediterranean flora. Through the former scientific studies anti-inflammatory and antimicrobial activities of some species of the genus *Helichrysum* are proved. This study aimed to determine antifungal activities of fluid ethanolic extracts prepared from flowering tops, and stems with leaves of *Helichrysum italicum*. The plant material was also phytochemically investigated. Using the agar well-diffusion and dilution methods, antifungal testing was performed against eleven standard and clinical strains of dermatophytes and yeasts. The strongest effects were observed against *Trichophyton* and *Microsporum* species. The diameter of inhibition zones (ZI) ranged from 15 mm to 30 mm, while the minimal fungicidal concentrations (MFC) were 0,5-1 vol%. Other tested strains were less susceptible to the extracts (ZI: 7-10 mm, MFC: 2-5 vol%). Our results identify *Helichrysum italicum* as a potential source of new natural antifungal agents, and indicate its biomedical significance.

P-25

ANTIVIRUSNI UČINAK I SADRŽAJ FLAVONOIDA U PROPOLISU IZ HRVATSKE I BRAZILA

I. Kosalec[1], J. Serkedjieva[2], N. Oršolić[3], M. Bakmaz[4] i S. Pepeljnjak[1]
[1]Zavod za mikrobiologiju, Farmaceutsko-biokemijski fakultet Sveučilišta u Zagrebu, Schrottova 39, HR-10000, Zagreb, Croatia (ikosalec@pharma.hr), [2]Mikrobiološki institut, Bugarska Akademija znanosti, Acad. G. Bonchev Str. 26, BG-1113 Sofija, Bugarska (jserkedjieva@microbio.bas.bg), [3]Zavod za animalnu fiziologiju, Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (norsolic@yahoo.com) [4]Analitički laboratorij, Gradska ljekarna Zagreb, Karlovačka cesta 271, HR-10421 Rakov Potok (marina.bakmaz@zg.htnet.hr)

Flavonoidi i fenolne kiseline i njeni esteri u propolisu bogati su izvori kemopreventivnih tvari, jer posjeduju različite biološke učinke. Ispitali smo vodene i etanolne ekstrakte dva kemotipa propolisa (hrvatski tip topole i brazilski tip alekrima) te im odredili kemijski sastav i antivirusne učinke. Sadržaj flavonoida određen je koristeći dvije komplementarne spektrofotometrijske metode za flavone/flavonole i flavanone/dihidroflavonole. Uzorcima propolisa kao i glavnim sastavnicama u propolisu: naringeninu, kvercetinu, krizinu, galanginu i kavenoj kiselini ispitana je inhibitorna aktivnost replikacije virusa influence A/Germany/27, soj Weybridge (H7N7) i A/Aichi/2/68 (H3N2) u kulturi MDCK stanica i herpes virusa tipa (HSV-1) i tipa 2 (HSV-2) u kulturi MDBK stanica. Citopatski učinak je korišten kao mjerilo viralne replikacije

te je određena selektivnost inhibicije. Vodeni i etanolni ekstrakti brazilskog propolisa kao i naringenin i kavena kiselina značajno inhibiraju rast A/Weybridge s indeksima selektivnost (SI) 15, 10, 10 i 6. Niti jedan uzorak nije pokazao antivirusnu aktivnost na A/Aichi. Uzorci vodenog ekstrakta iz brazilskog i hrvatskog propolisa kao i galangin i kvercetin pokazuju protu-HSV-1 aktivnost sa SI 20, 16.7, 15 i 10. Vodeni ekstrakt brazilskog propolisa bio je manje učinkovit protiv HSV-2 no što je kvercetin, sa SI 7.1 odn. 4. Usporedbom sadržaja flavonoida i antivirusnog učinka nije utvrđena korelacija.

ANTIVIRAL ACTIVITY AND FLAVONOID CONTENT OF PROPOLIS FROM CROATIA AND BRAZIL

I. Kosalec[1], J. Serkedjieva[2], N. Oršolić[3], M. Bakmaz[4] and S. Pepeljnjak[1]
[1]Department of Microbiology, Faculty of Pharmacy and Biochemistry, University of Zagreb, Schrottova 39, HR-10000, Zagreb, Croatia (ikosalec@pharma.hr), [2]Institute of Microbiology, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. 26, BG-1113 Sofia, Bulgaria (jserkedjieva@microbio.bas.bg), [3]Department of Animal Physiology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (norsolic@yahoo.com), [4]Analytical Laboratory, Zagreb City Pharmacy, Zagrebačka cesta 271, HR-10421 Zagreb, Croatia (marina.bakmaz@zg.htnet.hr)

The flavonoids and phenolic acids and their esters present in propolis are considered to be a rich source of chemopreventive agents, since they possess various biological activities. We investigated water and ethanolic extracts of two chemotypes of propolis (poplar-type from Croatia, and alecrim-type from Brazil) with respect to their chemical composition and antiviral effects. The flavonoid content was anlyzed using two complementary colorimetric methods for flavones/flavonols and flavanones and dihydroflavonols. The samples as well as the main compounds present in propolis: naringenin, quercetin, chrysin, galangin and caffeic acid were tested for inhibitory activity on the replication of influenza viruses A/Germany/27, strain Weybridge (H7N7) and A/Aichi/2/68 (H3N2) in MDCK cells and herpes simplex viruses type 1 (HSV-1) and type 2 (HSV-2) in MDBK cells. Cytopathic effect was used as a measure of viral replication and the selectivity of inhibition was evaluated. The water and ethanolic extracts from Brazilian propolis as well as naringenin and caffeic acid significantly inhibited the growth of A/Weybridge with selectivity indices (SI) 15, 10, 10 and 6 respectively. None of the tested compounds showed antiviral activity against A/Aichi. Both water propolis extracts from Croatian and Brazilian sources as well as galangin and quercetin exhibited strong anti-

HSV-1activity, with SI 20, 16.7, 15 and 10 respectively. The Brazilian water extract of propolis was less effective towards HSV-2 as was quercetin with SI 7.1 and 4 respectively. No correlation between flavonoids content and antiviral activity was observed.

P-26

ZDRAVSTVENO STANJE AUTOHTONIH KULTIVARA VINOVE LOZE U ISTRI

D. Poljuha[1], B. Sladonja[1], M. Bubola[1] i Đ. Peršurić[1]
[1]Zavod za poljoprivredu i prehranu, Institut za poljoprivredu i turizam Poreč, C. Huguesa 8, HR-52440 Poreč, Hrvatska (danijela@iptpo.hr)

Hrvatska je danas suočena s brzim propadanjem autohtonog genofonda vinove loze, većinom zbog širenja poznatih europskih kultivara. Program očuvanja genetskih resursa vinove loze i klonska selekcija ekonomski najznačajnijih autohtonih kultivara u Istri je u tijeku. U svrhu pronalaženja trsova zaraženih virusima, provedeno je trogodišnje istraživanje pomoću ELISA-testa na važnije viruse vinove loze. Test je proveden na sljedeće viruse: virus lepezastog lista vinove loze (*Grapevine fanleaf virus*; GFLV), virus mrljavosti listova loze (*Grapevine fleck virus*; GFkV), virus mozaika gušarke loze (*Arabis mosaic virus*; ArMV), virus jamičavosti drveta i plutavosti kore loze (*Grapevine virus A*; GVA) i virus uvijenosti lišća vinove loze 1 i 3 (*Grapevine leafroll associated viruses*; GLRaV-1, GLRaV-3). Otkrivena je prisutnost svih virusa osim ArMV, kao i učestala miješana infekcija. Rezultati su pokazali zabrinjavajuće zdravstveno stanje autohtonih istarskih kultivara i nešto bolje stanje zemljopisno izoliranih trsova, što ukazuje na nužnost provođenja efikasnih selekcijskih programa i proizvodnju zdravog sadnog materijala.

SANITARY STATUS OF AUTOCHTHONOUS GRAPEVINE VARIETIES IN ISTRIA

D. Poljuha[1], B. Sladonja[1], M. Bubola[1] and Đ. Peršurić[1]
[1]Department of Agriculture and Nutrition, Institute of Agriculture and Tourism Poreč, C. Huguesa 8, HR-52440 Poreč, Croatia (danijela@iptpo.hr)

Croatia is at present faced with rapid erosion of the autochthonous grapevine germplasm due to introduction of the famous European cultivars. A program for conserving grapevine genetic resources as well as clonal selection of the most commercially important Istrian autochthonous varieties is ongoing. In

order to detect the vines affected by severe virus diseases we have provided the three years ELISA screening. Viruses tested by ELISA were: grapevine fanleaf virus (GFLV), grapevine fleck virus (GFkV), Arabis mosaic virus (ArMV), grapevine virus A (GVA) and grapevine leafroll associated viruses 1 and 3 (GLRaV 1 and GLRaV 3). All these viruses except ArMV were detected and mixed infections were also identified. Results revealed the worrying health condition of autochthonous Istrian cultivars, and a better sanitary state of older and geographically isolated vines have emerged. This underlines the necessity of efficient selection programs and producing of virus-free grapevine propagation material.

P-27
MOLEKULARNA DETEKCIJA I KARAKTERIZACIJA HRVATSKOG IZOLATA VIRUSA ZARAZNE NEKROZE GUŠTERAČE IZ MLAĐI UZGOJENE KALIFORNIJSKE PASTRVE

I. Vardić, D. Kapetanović, B. Kurtović, D. Valić, Z. Teskeredžić i E. Teskeredžić
Laboratorij za istraživanje i razvoj akvakulture, Zavod za istraživanje mora i okoliša, Institut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (ivardic@irb.hr, kada@irb.hr, bkurtovic@yahoo.com, dvalic@irb.hr, ztesker@irb.hr, etesker@irb.hr)

Virus zarazne nekroze gušterače (IPNV) je predstavnik roda *Aquabirnavirus* unutar porodice *Birnaviridae*. Ovaj uzročnik izaziva bolest nekroze gušterače, koja rezultira visokom stopom smrtnosti uzagajanih salmonidnih vrsta, te velikim ekonomskim gubicima. IPNV je virusna čestica bez ovojnice, sa dvolančanim RNA genomom podijeljenim u 2 segmenta. Iako do sada nije zabilježena pojava IPNV-a u pastrvskom uzgoju u Hrvatskoj, njegova široka rasprostranjenost i neprestano unošenje na nezaražena područja potaknuli su nas na istraživanja o raširenosti IPNV-a u našoj zemlji. S tri hrvatska uzgajališta izvršeno je uzorkovanje mlađi kalifornijske pastrve. RT-PCR u jednom koraku u kombinaciji s "nested" PCR metodom je upotrijebljen za detekciju IPNV-a direktno u skupnim i pojedinačnim tkivnim uzorcima (jetra, slezena, srce, bubreg, mozak). Radi usporedbe s poznatim izolatima akvabirnavirusa, načinjeno je sekvenciranje VP2/NS regije. Izmjereni su fizikalno-kemijski parametri vode na uzgajalištu, te je napravljena njena mikrobiološka analiza. Rezultati istraživanja su potvrdili prisustvo IPNV-a na jednom hrvatskom uzgajalištu. Zaražene ribe nisu pokazivale karakteristične kliničke znakove bolesti, te nije bilo značajnijeg povećanja smrtnosti. Nukleotidni slijed VP2/NS regije omogućio je genotipiziranje virusa i ukazao na njegov odnos prema

europskim, američkim i japanskim izolatima. Predstavljeno istraživanje prikazuje otkriće prvog IPNV izolata kod salmonidnog uzgoja u Hrvatskoj. Analiza nukleotidnog slijeda kratke regije IPNV-a pokazala se vrlo korisnom metodom za molekularnu karakterizaciju hrvatskog IPNV izolata. Lošija kvaliteta vode sa zaraženog uzgajališta ukazuje da su poremećeni okolišni uvjeti važan predispozicijski čimbenik za pojavu IPNV.

MOLECULAR DETECTION AND CHARACTERIZATION OF CROATIAN INFECTIOUS PANCREATIC NECROSIS VIRUS ISOLATE FROM REARED RAINBOW TROUT FRY

I. Vardić, D. Kapetanović, B. Kurtović, D. Valić, Z. Teskeredžić and E. Teskeredžić
Laboratory for research and development of aquaculture, Department for marine and environmental research, Rudjer Boskovic Institute, Bijenička c. 54, HR-10000, Zagreb, Croatia (ivardic@irb.hr, kada@irb.hr, bkurtovic@yahoo.com, dvalic@irb.hr, ztesker@irb.hr, etesker@irb.hr)

Infectious pancreatic necrosis virus (IPNV) is the prototype species of the genus *Aquabirnavirus* within the family *Birnaviridae*. This pathogen causes serious pancreatic necrosis disease, with high mortality rate among rearing salmonids and huge economic losses in fish industry. IPNV is a non-enveloped virion containing the bisegmented, double-stranded RNA genome. Although IPNV has not been previously reported in trout aquaculture in Croatia, its broad distribution and continuous spreading to the non-infected areas encouraged us to carry out investigation of IPNV occurence in Croatia. Rainbow trout fry were sampled at three Croatian fish farms. One step RT-PCR combined with "nested" PCR was applied directly on pooled and individual (liver, spleen, heart, kidney and brain) tissue samples for IPNV detection. Determination of VP2/NS region sequence was performed for comparison with the known aquabirnavirus sequences. Physico-chemical and microbiological analysis of water from farms was accomplished. Our results confirmed IPNV occurence at one Croatian trout farm. Infected fish were asymptomatic, without increased mortality. Determined nucleotide VP2/NS sequence enabled Croatian isolate genotyping and designated its relationship to European, American and Japanese isolates. This study presents the first record of IPNV in trout aquaculture in Croatia. Nucleotide sequence analysis of IPNV short region proved to be a valuable method in molecular characterization of Croatian IPNV isolate. Infected fish farm had poor water quality, indicating that disturbed environmental conditions are important predisposing factors for IPNV occurence.

P-28

IZOLACIJA SALMONELLA VRSTA UPOTREBOM MODIFICIRANOG SELENIT BUJONA

I. Zurak
Kosorova 13, HR-10000 Zagreb, Hrvatska (ivica.zurak@zg.htnet.hr)

Infekcija salmonelama kod ljudi i životinja je u porastu, to je jedno od svijtski najznačajnijih zoonoznih oboljenja. Salmoneloze su oboljenja sa visokom incidencijom i morbiditetom, ali relativno niskog mortaliteta. Javni su zdravstveni problem, sa više od 2.200. seroloških tipova. Selenit bujon se koristi za umnožavanje salmonela vrsta, kada ih želimo izolirati iz kliničkog uzorka. Međutim, selenit bujon nije dovoljno toksičan za kompletno inhibiranje koliformnih bakterija, jer nakon 18 sata inkubacije tako naglo porastu da suprimiraju porast salmonella vrstama. Fiziološki je koncentracija žuči u žučnom mjehuru nekoliko puta veća, od one u probavnom sustavu, a epidemiološki nam je poznato da se salmonela vrste zadržavaju u žučnom mjehuru. Sulfonamidi inhibiraju porast bakterija inhibirajući metabolizam PABA i sintezu folne kiseline. Zato je i bio cilj ovog rada da ispitati mogučnost modificiranja selenit bujona, dodacima kojim bi ga načinili mnogo selektivnijim. Sinergističkim djelovanje sulfonamide, žučnih soli i agara onemogučimo umnažanje bakterijskim vrstama iz uzorka, suprimirajući nepokretne vrste, a da pri tome ne spriječavamo umnažanje salmonela vrstama. Ako koristimo selenit bujonom veće selektivnosti autor preporuča korištenje selektivnog dodatka, a to je: sulfonamid (Sigma: S-9251.) 0,8g/L i oksidirane žučne soli (Sigma: B-8256.) 0,2g/L. Još bolji rezultati se postižu dodatkom 3,5g/L agara (kao pokretni medij). U perijodu od 1992. do 2003. godine ovaj je bujon pokazao visoku specifičnost i osjetljivost u usporedbi sa selenit bujnom, prilikom bakteriološke obrade kliničkih uzoraka stolica (KBC-Zagreb).

ISOLATING SALMONELLA SPECIES WITH MODIFYING SELENITE BROTH

I. Zurak
Kosorova 13., HR-10000 Zagreb, Croatia (ivica.zurak@zg.htnet.hr)

Salmonellosis of man and animal has increased in the world, and it is one of the world's most important zoo noses-diseases. Salmonellosis are disease of high incidence and high morbidity, but relatively low mortality, and remain a public health problem, with more than 2.200. Serotypes. Selenite broth is as enriching medium for of the *Salmonella spp*. when isolating these

organisms from infectious materials. But, selenite broth was not sufficiently toxic to inhibit fecal coli forms bacteria completely, and after 18 hours these bacteria increased rapidly and suppress *Salmonella spp.* Physiologically, the concentration of bile in the gall bladder is several times higher than in the intestinal lumina, and epidemiologically the *Salmonella spp.* lodge in the gall bladder. Sulphanilamide inhibited growth by inhibiting PABA metabolism and synthesis folic acid among the bacteria's. The object of this study is to modification the original selenite broth formula, elaborate more selective broth media, synergistically anti-metabolism effect of the sulphonamide, bile salts and agar inhibited bacterial contaminants of specimens, whereas they did not affect the growth of *Salmonellae spp.* If we used pre-enrichment selenite broth, the author wants to suggest to adding selective supplements "Sigma": sulfanilamide (S-9251) 0,8g/L and bile acid-oxidized (B-8256) 0,2g/L. The best results were realized with add 3,5g/L agar (salmonella-motility procedure). This medium showed a high specificity and sensitivity when compared with selenite broth, in microbiological testing stools from 1992. to 2003. in clinical microbiological laboratory (Zagreb University Hospital).

P-29

RESISTANCE OF SOME ORIENTAL TOBACCOS TO TOBACCOMOSAIC VIRUS (TMV)

P. Tashkoski, B. Gveroska, M. Dimitrieski and G. Miceska
Tobacco Institute-Prilep, Prilep, Republic of Macedonia

The virus mosaic of tobacco (*Tobacco mosaic virus*) is a very stable virus, which stability remains in fermented tobacco many months and years and the smokers in the field can transver the virus to tobacco with touch. Its transfer is easy with mechanical way over cultural practise in tobacco production and the yield of tobacco can be decreased with 30-35%. Infected tobacco leaves have bad quality and the low taste characteristics. Having in mind the biological significance of concept resistance/tolerance, selection and introducing resistant varieties against this virus is contemporary measure in the Integrated control of tobacco. The aim of this investigation is the examination resistance of some domestic and foreign varieties obtained with generative intraspecies hybdizations between foreign resistant and domestic nonresistant tobacco varieties. Inoculation of tobacco plants is made using method of Terenovskiñ (1965), cit. Tran~eva (1995) and the estimations of resistance is made by visually, based on shown symptoms of disease. All varieties where there were not find neither one infected plant were determined as resistant and the varieties with infected plants were determined as sensitive, without

percentage of infection. Investigations were made in 2005 in Tobacco Institute - Prilep in field conditions, including some new varieties and lines of the types Prilep and Yaka and varieties P 12-2/1 and Yv 125/3 as a standard. Harvested and non-harvested plants were used and two estimations were made on the occurrence of symptoms of the virus in leaves and suckers. Disease intensity on the first estimation in standard varieties P 12-2/1 was 30.17% and 8.18% in harvested and non-harvested plants, respectively, while in Yv 125/3 it was 54.80% and 3.20% in harvested and non-harvested plants, respectively. On the second estimation, disease intensity in P 12-2/1 was 31.03% and 9.09% in harvested and non-harvested plants, respectively, while in Yv 125/3 it was 72.11% and 4.80% in harvested and non-harvested plants, respectively. In both estimations, varieties P 11-46/65, P 301DH and P301/N of the type Prilep, and MB 123-82/1 and Yaka 123/7, Yaka 65-81/1, Yaka 301/23 of the type Yaka developed no symptoms of the disease, i.e. in field conditions they revealed complete resistance to TMV. The fact the higher percentage of disease in the variant harvested plants is a confirmation for easy transfer of virus over mechanical way. We estimate that the varieties with resistance to TMV will have application in tobacco production in the future.

P-30

USE OF DIFFUSER "DALMACIJA+40%" FOR NITRIFICATION OF SYNTHETIC WASTEWATER

I. Kungulovski [1], Dz. Kungulovski [1], N. Atanasova-Pancevska[1], M. Milosevski[2] and J. Bossert[3]
[1]Microbiology Lab, Faculty of Natural Sciences and Mathematics, Gazi baba bb, MK-1000 Skopje Macedonia (dzokok@yahoo.com), [2]Institute of Inorganic Technology, Faculty of Technology and Metallurgy, Rudzer Boskovic 16,MK-1000 Skopje, Macedonia, [3]Materials Science Institute of Materials Science & Technology (IMT), Friedrich-Schiller-University Jena, Löbdergraben 32 D-07743 Jena, Germany

The method of biological removal of the organic compounds from the wastewater is based on the laws of the aerobic degradation- biological oxidation. The organic maters present in the wastewater are often soluble in water, like the carbohydrates, amino acids, alcohols, and often they cannot be soluble in water, like: starch, celluloses, lipids that can create one complex substrate, which is used by the heterotrophic microorganisms as an food and energy source. With the help of these microorganisms the processes of biological wastewater treatment are being conducted. As a result from the co-metabolism, the microorganisms can use different kinds of organic

compounds simultaneously, or separately, which means that the products from the microorganisms metabolism represent a food source for different kind of microorganisms. The aim of the conducted research was to define the correlation of the aeration (input oxygen concentration of 3,96 mg/l, 4,5 mg/l, 5.15 mg/l and 5,9 mgO_2/l, which correlates with 6,10,15 and 20 Nl/h air), and the velocity of nitrogen compound removal from previously prepared synthetic water. Previously prepared diffusers perform the aeration process. A microbial mixed culture, previously isolated from bioactive sludge, is used in the experiments for biological removal of nitrogen compounds from synthetic wastewater. The nitrification and denitrification bacteria were isolated from the bioactive sludge, than selected and adapted to high nitrogen concentrations, and returned into the bioactive sludge. Experiments for nitrogen compounds removal from the examined synthetic water, projected in the contract program, are conducted with the usage of mixed microbial cultures, in aerated conditions of 3,96 $mg0_2$/l, 4,5 $mg0_2$/l, 5,15 $mg0_2$/l and 5,9 $mg0_2$/l. The activity tests of the mixed microbial culture, under different aerating conditions, are performed on the synthetic wastewater (table 1), under optimal surrounding conditions: temperature 22°C; pH 6,8 – 7,7; microbe biomass concentration 3 g/l; NH_4 concentration 1000 mg/l. During the aeration of the synthetic wastewater in conditions of 3,96 mgO_2/l, the microbial mixed culture decreased NH_4-N by 41%. During the aeration of the synthetic wastewater in conditions of 4,5 mg O_2/l the results show that 58% of the present NH_4-N has been decreased, while the NO_3 concentration in the wastewater has increased from 36mg/l to 365mg/l. The amount of 5,15 mgO_2/ dissolved oxygen as a result of the autotrophic nitrification caused significant increase in the bacterial biomass to 0,4 mg/l, and the reduction of the starting 968 mg/l ammonia, decreased to 255 mg/l, which means 74%.

P-31
CELLULOLYTIC ENZYMES OF RUMEN ANAEROBIC FUNGUS *Neocallimastix frontalis* STRAIN J3

N. Atanasova-Pancevska and Dz. Kungulovski
Microbiology Lab, Faculty of Natural Sciences and Mathematics, Gazi baba bb, MK-1000 Skopje Macedonia (atanasovan@yahoo.com)

Anaerobic fungi were not discovered until 1975. Most of the isolated anaerobic fungi are capable of growth on plant cell wall polysaccharides. This ability is attributed to their production of a number of highly active hydrolytic enzymes. Work in our laboratory focuses on the morphology, physiology, ecology and taxonomy of the zoospore-producing fungi that normally inhabit the GI tract

of herbivores. We have isolated and characterized one species of these fungi from dung of tibetian yak from Skopje ZOO, Macedonia. The rumen anaerobic fungus *Neocallimastix frontalis* strain J3 was grown on Avicel, Whatman^{o}1 and CMC. Fungal enzymes was observed as extracellular, and assayed for enzyme activity. Enzyme activity was the highest in medium with CMC regardless of the substrate used.

P-32

THE EFFECT OF NUTRIENT MEDIUM UPON THE GROWTH OF *Alternaria alternata* IN TOBACCO

B. Gveroska, P. Taskoski[1] and P. Jovancev[2]
[1]Tobacco Institute-Prilep, Kicevski pat bb, MK-7500 Prilep, R. Makedonija (gveroska@mt.net.mk), [2]Faculty of Agricultural sciences and food, Bul. Aleksandar Makedonski bb, MK-1000 Skopje, R. Makedonija (jovancev@ucim.edu.mk)

The brown spot disease, caused by the pathogen fungus *A. alternata*, has become more and more actual on tobacco in R. Macedonia, especially with leaving the traditional way of production, which creates favorable conditions for development of numerous disease agents on tobacco. *A. alternata* was isolated on infected tobacco leaves by a standard methodology. After the pure culture was obtained, monitoring was made on its development, properties of the colony and dry mass yield in various nutrient media. In a period of 15 days, daily measurings of the colony diameter were made on solid media and dry mass yield in liquid media was estimated after this period. Investigations included the folloing media: potato dextrose agar, oat agar, Chapek's agar, V-8 juice medium, pea agar, carrot and garlic. The best development of the fungus was observed on potato dextrose agar, and its diameter at the end of investigation was 109.37 mm. Good development was also observed on the oat and carrot agars. The lowest diameter of the colony (73.81 mm) was recorded on the pea agar. Dry mass yield was the lowest in the oat agar (30.00 mg) and the highest in the Chapek's agar (202.00 mg). These investigations will contribute to study the effect of ecological factors on development of Alternaria alternata and on pathology of the brown spot disease on tobacco. They will also have a significant contribution to the methodological approach of solving various problems in the field of phytopathology.

P-33

ZASTUPLJENOST REZISTENTNIH FENOTIPOVA NA FUNGICIDE U

POPULACIJAMA FITOPATOGENE GLJIVE *Botrytis cinerea* NA VINOVOJ LOZI I JAGODAMA

T. Miličević, D. Ivić i B. Cvjetković
Zavod za fitopatologiju, Agronomski fakultet Sveučilišta u Zagrebu, Svetošimunska 25, HR-10000 Zagreb, Hrvatska (tmilicevic@agr.hr)

Fitopatogena gljiva *Botrytis cinerea* Pers. et Fr. (teleomorf *Botryotinia fuckeliana* (de Bary) Whetz.) je kao anamorf uzročnik vrlo raširene bolesti «siva plijesan» na preko 235 kultiviranih i samoniklih biljnih vrsta. U našoj zemlji najčešće parazitira na grožđu vinove loze i plodovima jagode. Patogena gljiva pokazuje ekstremni genotipski i fenotipski varijabilitet i izuzetnu adaptabilnost u gotovo svim ekološkim uvjetima. Fenotipska varijabilnost se ogleda u velikoj morfološkoj varijabilnosti svih struktura anamorfnog stadija (sklerocija, micelija, konidija i dr.), kao i vrlo brzom razvoju rezistentnih fenotipova na gotovo sve djelatne tvari fungicida iz različitih kemijskih skupina. Kako razvoj rezistentnosti na fungicide uvelike onemogućuje učinkovito suzbijanje ove gljive, važno je poznavati zastupljenost rezistentnih fenotipova na djelatne tvari fungicida koji se koriste u praksi. Testiranjem rezistentnosti velikog broja izolata patogene gljive s vinove loze i jagode, in vitro metodom «rasta micelija» na 10 djelatnih tvari fungicida (dietofenokarb, benomil, vinklozolin, iprodion, diklofluanid, tolilfluanid, pirimetanil, ciprodinil, fludioksonil i fenheksamid), utvrđeni su brojni rezistentni fenotipovi i različit nivo njihove rezistentnosti. Najviše je bio zastupljen rezistentni fenotip na diklofluanid (DicR), zatim na vinklozolin (VinR) i benomil (BenR), dok su rezistentni fenotipovi na ostale fungicide bili vrlo rijetki. Između djelatnih tvari fungicida iz istih kemijskih skupina kao vinklozolina i iprodiona (dikarboksimidi), zatim diklofluanida i tolilfluanida (fenilsulfamidi) te pirimetanila i ciprodinila (anilinopirimidini) utvrđena je također unakrsna ili cross rezistentnost kod svih ispitivanih izolata. Nije bilo značajnijih razlika u zastupljenosti rezistentinih fenotipova unutar populacija patogene gljive na vinovoj lozi i jagodama.

PRESENCE OF RESISTANT PHENOTYPES TO FUNGICIDES IN POPULATIONS OF PLANT PATHOGENIC FUNGUS *Botrytis cinerea* ON GRAPEVINE AND STRAWBERRY

T. Miličević, D. Ivić and B. Cvjetković
Department of Plant pathology, Faculty of Agriculture, University of Zagreb, Svetošimunska 25, HR-10000 Zagreb, Croatia (tmilicevic@agr.hr)

Plant pathogenic fungus *Botrytis cinerea* Pers. ex Fr. (teleomorph *Botryotinia*

fuckeliana (de Bary) Whetz.) as anamorph causes world-wide distributed "gray mould" disease, on more than 235 cultivated and native plant species. In our country the fungus is found mostly as a parasite of grapevine berries and strawberry fruits. *B. cinerea* exibits extreme genotypic and phenotypic variability and remarkable adaptability in various ecological conditions. Its phenotypic variability is expressed in great morphological variability of all structures of anamorph stage (sclerotia, micelium, conidia, etc.), as well as in fast development of resistant phenotypes to almost all fungicide active ingredients from different chemical groups. As fungicide resistance development makes effective control of this fungus difficult, it is important to know the presence on resistant phenotypes to fungicide active ingredients used in agriculture. Resistance testing of *B. cinerea* isolates from grapevine and strawberry using in vitro "micelia growth" method with ten fungicide active ingredients (diethofenocarb, benomyl, vinclozolin, iprodione, dichlofluanid, tolylfluanid, pyrimethanil, cyprodinil, fludioxonil and fenhexamid) revealed numerous resistant phenotypes and different levels of their resistance. Phenotype resistant to dichlofluanid (DicR) was the most frequent, followed by phenotypes resistant to vinclozolin (VinR) and benomyl (BenR), while phenotypes resistant to other fungicides were very rare. Cross resistance between fungicide active ingredients from the same chemical groups, like vinclozolin and iprodion (dicarboximides), dichlofluanid and tolylfluanid (phenylsulphamides) and pyrimethanil and cyprodinil (anilinpyrimidines), was found in all the isolates tested. There was no significant differences in distribution of resistant phenotypes among populations of fungus from grapevine and strawberries.

P-34

SABOURAUD MUCIN MIKOLOŠKI AGAR

I .Zurak
Kosorova 13, HR-10000 Zagreb, Hrvatska (ivica.zurak@zg.htnet.hr)

Najpogodnija metoda u gljivičnoj dijagnostici je kultivacija uzoraka na umjetnim hranjivim podlogama. Gljivice rastu sporije od bakterija, koje će brže porasti i osiromašiti hranjivost medija, pa nam gljivice više neće porasti. Da savladamo ove probleme, trebalo je pronaći nove mogučnosti sa takovim selektivnim dodacima bez antibiotika u hranilištu, kojima će se spriječiti porast bakterija. Bakterije ne mogu razviti rezistenciju prema nekim solima, bojama i sa ovima možemo uspješno zamjeniti antibiotike u selektivnim hranilištima. Cilj ovog rada bio ispitati mogučnost izrade takvog pogodnog selektivnog dodatka za izolaciju gljivica, koji je kontaminiran s bakterijama, po formuli bez

upotrebe antibiotika. Materijal i metode: Kao uzorak poslužile su nam stolice, i najbolji selektivan dodatak u Sabouraud agaru, za izolaciju vrsta gljivica iz uzoraka stolica, koje su prirodno kontaminirane sa bakterijskim vrstama, bio bi: mucin (Sigma M-4778), kalijev metabisulfita (Sigma P-2522), bakreni klorid i magnezijev sulfat. Od indikatora smo koristili kombinaciju bromokrezol zeleno i bromokrezol ljubičasto. Hranjivu podlogu je bilo dovoljno prokuhati, bez autoklaviranja. Sve kolonije gljivica i plijesni porasle su bez bakterija kroz 36/72 sata inkubacije na 37°C. Rezultati su pokazali da je opravdana upotreba ovog selektivnog Sabouraudovog agara bez antibiotika i bez autoklaviranja, u usporedbi sa Sabouraud agarom s antibiotikom. Ova studija prikazuje novu mogučnost pripreme hranjivih podloga u dijagnostici, kojim treba utrti put nove strategiji, jer je ekonomičnija i ekološki prihvatljivija.

SABOURAUD MUCIN MYCOLOGY MEDIUM

I. Zurak
Kosorova 13, HR-10000 Zagreb, Croatia (ivica.zurak@zg.htnet.hr)

The single best tool advisable of fungal diagnosis is the fungal culture on the culture media. Fungi have longer generation times than most bacteria, which growth fast and suppression fungi. To overcome this problem there was a need for a new category's of selective additives to media without antibiotics, which suppress bacterial growth. Bacteria don't develop resistance to chemical, salts and with this can successful substitute antibiotics in selective media for isolation in mycology. The aim and objective of this study and work is general purpose media, were to examine for primary isolation of fungal, from natural contaminated specimen with bacteria, where is the formulation of medium without antibiotics. Materials and methods: Specimens is fresh stool and the best selective supplement in the Sabouraud agar for isolation of fungi species from stools specimen, that is heavily natural contaminated with bacteria is: Mucic acid (Sigma M-4778), Potassium metabisulfite (Sigma P-2522), Cuprum bichloratum, Magnesium sulfate, and indicators: Bromocresol green and Bromocresol purple. Medium heat to boiling and don't autoclave. All fungal colony growth without bacterial on the 37°C in the course of 36/72 hours. The result showed that using selective medium without antibiotics and without autoclave is better, in comparison with Sabouraud agar with antibiotics. This study demonstrates these new culture media and diagnostic have paved the way for a new strategy, which are economical and ecological acceptable.

BILJNA BIOLOGIJA
BIOLOGIA PLANTARUM
PLANT BIOLOGY

Uvodna tematska predavanja
Introductory Lectures

IL-6

PRIJEDLOG HRVATSKOG NACIONALNOG STANDARDA I KRITERIJA ZA TRETIRANJE AUTOHTONE I ALOHTONE FLORE

B. Mitić[1], I. Dobrović[1], I. Boršić[1], M. Milović[2], S. Bogdanović[1], P. Cigić[1], I. Rešetnik[1] i T. Nikolić[1]
[1]Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Marulićev trg 20, HR-10000 Zagreb, Hrvatska (bozena@botanic.hr,idobro@botanic.hr,iborsic@botanic.hr,sandro@botanic.hr, pcigic@botanic.hr, isoco@botanic.hr, toni@botanic.hr,), [2]Medicinska i kemijska škola, ulica Ante Šupuka b.b., HR-22000 Šibenik, Hrvatska (mmilovic@inet.hr)

Kako je problem invazivnih vrsta postao svjetski, porastao je i broj studja o invazivnim biljnim vrstama, što je uzrokovalo i porast terminološke konfuzije. S obzirom da smo 2006. godine započeli nacionalni projekt o invazivnim biljkama Hrvatske, pripremili smo prijedlog nacionalnog standarda, kriterija i terminologije, za tretiranje autohtone i alohtone flore. Takav prijedlog uključuje standardnu terminologiju, svjetski prihvaćenu od većine botaničara, ali i posebno usklađenu s europskim standardima za tretiranje alohtone flore. Posebna pažnja posvećena je definiranju kriterija za utvrđivanje statusa potencijalno invazivnih vrsta u Hrvatskoj, kao što je podrijetlo, datum i način unosa, te status svojte.

PROPOSAL FOR CROATIAN NATIONAL STANDARD AND CRITERIA FOR AUTOCHTHONOUS AND ALOCHTHONOUS FLORA TREATMENT

B. Mitić[1], I. Dobrović[1], I. Boršić[1], M. Milović[2], S. Bogdanović[1], P. Cigić[1], I. Rešetnik[1] and T. Nikolić[1]

[1]Department of Botany, Division of Biology, Faculty of Science, University of Zagreb, Marulićev trg 20, HR-10000 Zagreb, Croatia (bozena@botanic.hr, idobro@botanic.hr, iborsic@botanic.hr, sandro@botanic.hr, pcigic@botanic.hr, isoco@botanic.hr, toni@botanic.hr,), [2]Medical and Chemical School, Ante Šupuka Street (no number), HR-22000 Šibenik, Croatia (mmilovic@inet.hr)

As a result of global problem of invasions the number of studies dealing with plant invasions is increasing, which is also causing increasing confusion about terminology used. As we started with national project about invasive Croatian flora since the beginning of 2006, we prepared a proposal for national standard and criteria, as well as terminology, for both autochthonous and alochthonous flora treatment. This proposal includes regular terminology globally accepted in most botanical communities, but it is particularly harmonized with European standards for alien flora treatment. Special attention was paid for defining the criteria for status of plant species potentially invasive in Croatia, such as origin status, residence status and invasion status.

Kratka usmena priopćenja
Oral Presentations

OP-13
INVAZIVNE VRSTE U HRVATSKOJ – PRELIMINARNI IZVJEŠTAJ

I. Dobrović[1], I. Boršić[1], M. Milović[2], S. Bogdanović[1], P. Cigić[1], I. Rešetnik[1], T. Nikolić[1] i B. Mitić[1]
[1]Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Marulićev trg 20, HR-10000 Zagreb, Hrvatska (idobro@botanic.hr, iborsic@botanic.hr, sandro@botanic.hr, pcigic@botanic.hr, isoco@botanic.hr, toni@botanic.hr, bozena@botanic.hr), [2]Medicinska i kemijska škola, ulica Ante Šupuka b.b., HR-22000 Šibenik, Hrvatska (mmilovic@inet.hr)

Invazivne vrste se globalno smatraju najvećom prijetnjom za floističku bioraznolikost i njezinu zaštitu. Zbog toga, u Hrvatskoj je početkom 2006. godine započet prvi nacionalni projekt za standardizaciju kriterija invazivnih vrsta i stvaranje liste invazivnih vrsta. Nacionalna botanička zajednica stoljećima je prikupljala različite botaničke podatke (horološke, taksonomske, vegetacijske i dr.) te nedavno razvijena CROFlora baza podataka (http://hirc.botanic.hr/fcd/search.aspx) predstavlja taksonomsku okosnicu za sva floristička istraživanja i standarde kartiranja. Kako je većina povijesnih podataka za invazivne vrste dostupna ili će uskoro biti dostupna, zahvaljujući spomenutoj bazi podataka i njezinim mogućnostima, dobivena je preliminarna lista invazivnih vrsta u Hrvatskoj, kao i prve karte rasprostranjenosti za neke od invazivnih vrsta u Hrvatskoj.

INVASIVE ALIEN SPECIES IN CROATIA – PRELIMINARY REPORT

I. Dobrović[1], I. Boršić[1], M. Milović[2], S. Bogdanović[1], P. Cigić[1], I. Rešetnik[1], T. Nikolić[1] and B. Mitić[1]
[1]Department of Botany, Division of Biology, Faculty of Science, University of Zagreb, Marulićev trg 20, HR-10000 Zagreb, Croatia (idobro@botanic.hr, iborsic@botanic.hr, sandro@botanic.hr, pcigic@botanic.hr, isoco@botanic.hr, toni@botanic.hr, bozena@botanic.hr), [2]Medical and Chemical School, Ante Šupuka Street (no number), HR-22000 Šibenik, Croatia (mmilovic@inet.hr)

Alien invasive plants are considered to be the greatest threat to flora biodiversity and its conservation everywhere. For this reason first national project for plant invaders standards in Croatia started at the beginning of 2006, together with the creation of the invasive species inventory. The national botanical community has collected diverse botanical data (distribution, taxonomy, vegetation etc.) for centuries and in the recent times, CROFlora Database (http://hirc.botanic.hr/fcd/search.aspx) was developed as a taxonomic frame for all floristic researches and mapping standards. As the most of historical data for invasive species are available or will be very soon, thanks to mentioned Database and its possibilities, we produced preliminary list of invasive alien species in Croatia, as well as first distribution maps for some invasive species in Croatia.

OP-14
VEGETACIJA STIJENA KANJONA RIJEKE CETINE KOD OMIŠA (HRVATSKA)

J. Kamenjarin[1], I. Trinajstić[2] i I. Petričević[3]
[1]Zavod za biologiju, Fakultet prirodoslovno-matematičkih znanosti i kineziologije, Sveučilište u Splitu, Teslina 12, HR-21000 Split, Hrvatska (juraj.kamenjarin@st.t-com.hr), [2]Prilaz Gj. Deželića 44, HR-10000 Zagreb, Hrvatska, [3]Sukoišanska 21, HR-21000 Split, Hrvatska (imela@net.hr)

Duž Hrvatskog primorja, ovisno o reljefu, razvijeni su različiti oblici vegetacije. Vegetacija koja se razvija u pukotinama okomitih stijena duž istočnojadranske obale pripada redu *Centaureo-Campanuletalia*, unutar kojeg se, ovisno o klimi, razvijaju dvije endemične sveze – u sjevernom dijelu Hrvatskog primorja je to sveza *Centaureo-Campanulion* a u srednjem i južnom je to sveza *Centaureo-Portenschlagiellion*. Na okomitim, jugu eksponiranim stijenama kanjona rijeke Cetine, kod Omiša, razvijena je vegetacija sveze *Centaureo-Portenschlagiellion* i tu je zastupljena s endemičnom asocijacijom *Campanulo-Moltkeetum petraeae*. Ta je biljna zajednica ovdje bez konkurencije i tu, na okomitim, jugu eksponiranim stijenama nalazi za svoj razvoj optimalne uvjete. U radu će spomenuta endemična biljna zajednica biti dokumentirana fitocenološkim snimkama.

ROCK VEGETATION OF CETINA RIVER CANYON NEAR OMIŠ (CROATIA)

J. Kamenjarin[1], I. Trinajstić[2] and I. Petričević[3]
[1]Department of Biology, Faculty of Natural Science and Kinesiology,

University of Split, Teslina 12, HR-21000 Split, Croatia (juraj.kamenjarin@st.t-com.hr), [2]Prilaz Gj. Deželića 44, HR-10000 Zagreb, Croatia, [3]Sukoišanska 21, HR-21000 Split, Croatia (imela@net.hr)

Along Croatian coastline, depending on the climate, different typs of vegetation has developed. Vegetation developed in cracks of vertical cliffs along the East Adriatic coast belongs to order *Centaureo-Campanuletalia*, within which, depending on the climate, developed two endemic alliance – in the Northern part of the Croatian coastline is alliance *Centaureo-Campanulion* and in the middle and Southern parts alliance *Centaureo-Portenschlagiellion*. On the vertical, to the south exposed, cliffs of Cetina river canyon, near Omiš, an alliance *Centaureo-Portenschlagiellion* has developed and represented by endemic association *Campanulo-Moltkeetum petraeae*. This plant association is without competition there and there, on the vertical to the south exposed cliffs, finds its optimal conditions for development. In this paper mentioned endemic plant associations will be documented by phytocenological records.

OP-15
ENDEMIČNE BILJKE NA TRAVNJACIMA OBITELJSKIH GOSPODARSTAVA U ISTRI

I. Vitasović Kosić, M. Britvec i I. Ljubičić
Zavod za poljoprivrednu botaniku, Agronomski fakultet, Sveučilište u Zagrebu, Svetošimunska cesta 25, HR-10000 Zagreb, Hrvatska (ivitasovic@agr.hr, mbritvec@agr.hr, iljubicic@agr.hr)

Samonikla vaskularna flora travnjaka (pašnjaka i livada košanica) istraživana je na lokalitetima sedam obiteljskih poljoprivrednih gospodarstava koja imaju ovčarsku proizvodnju i smještena su od sjevera do juga istarskog poluotoka. Tijekom istraživanja 2003. i 2004. godine na travnjacima u Istri ustanovljeno je 517 vrsta, podvrsta i varijeteta biljaka u okviru 258 rodova i 51 porodice. Većina biljaka pripadala je porodicama *Asteraceae*, *Poaceae*, *Fabaceae*, *Lamiaceae* i *Caryophyllaceae*. Na istraživanim travnjacima utvrđene su sljedeće endemične biljke: Achillea virescens (Fenzl) Heimerl, Anthyllis vulneraria L. subsp. rubiflora (DC.) Arcang., Erysimum carniolicum Dolliner, Helleborus multifidus Vis. subsp. istriacus (Schiffn.) Merxm. et Podl., Knautia illyrica Beck, Leucanthemum atratum (Jacq.) DC. subsp. platylepis (Borbás) Heywood, te Melampyrum fimbriatum Vandas. To su biljke imaju središte rasprostranjenja na području ilirskih zemalja, tj. u pojasu istočno-mediteranskog primorja, te većinom pripadaju skupini ilirsko-jadranskih endemičnih biljaka. S porastom nadmorske visine, od juga prema

sjeveru Istre, slabi utjecaj mediteranskog flornog elementa, dok istovremeno jača utjecaj ilirskog flornog elementa, te se na travnjacima obiteljskih gospodarstava povećava broj endemičnih biljaka. Naša istraživanja samonikle vaskularne flore travnjaka na obiteljskim poljoprivrednim gospodarstvima u Istri pokazala su da su livade košanice i pašnjaci staništa koja jako obogaćuju biljnu i krajobraznu raznolikost u Hrvatskoj.

ENDEMIC GRASSLAND PLANTS ON THE FAMILY FARMS IN ISTRIA

I. Vitasović Kosić, M. Britvec and I. Ljubičić
Department of Agricultural Botany, Faculty of Agriculture, University of Zagreb, Svetošimunska 25, HR-10000 Zagreb, Croatia (ivitasovic@agr.hr, mbritvec@agr.hr, iljubicic@agr.hr)

Autochthonous vascular grasslands flora (pastures and meadows) was researched at the locality of seven family owned farms which breed sheep, situated from south to north of the Istrian Peninsula, Croatia. During research in 2003 and 2004, a total of 517 plant taxa (468 species, 46 subspecies and 3 varieties) were found. The taxa belonged to 258 genera and 51 families. The most dominant families are: *Asteraceae*, *Poaceae*, *Fabaceae*, *Lamiaceae* and *Caryophyllaceae*. On the researched family farms, it was establish presence of following endemic plants: Achillea virescens (Fenzl) Heimerl, Anthyllis vulneraria L. subsp. rubiflora (DC.) Arcang., Erysimum carniolicum Dolliner, Helleborus multifidus Vis. subsp. istriacus (Schiffn.) Merxm. et Podl., Knautia illyrica Beck, Leucanthemum atratum (Jacq.) DC. subsp. platylepis (Borbás) Heywood and Melampyrum fimbriatum Vandas. Those plants have centre of their spreading all over the Illyrian territories, namely in East-Mediterranean coast zone. The most plants belong to Illyrian-Adriatic endemical plants group. With the increasing of altitude from south to north of Istria, percentage of Mediterranean floral element is reduced. At the same time, percentage of Illyrian floral element is increasing. On the other side, the number of endemical plants on grasslands on the family farms is increasing too. Our research on autochthonous vascular flora on family farms in Istria showed that these meadows and pastures are habitats which substantially enrich the plant and landscape diversity in Croatia.

OP-16

PCR-RFLP ANALIZA cpDNA RODA *Hypericum* (Clusiaceae)

K. Hazler Pilepić, M. Balić, F. Orač, M. Morović, M. Šantor i V. Vejnović
Zavod za farmaceutsku botaniku Farmaceutsko-biokemijskog fakulteta Sveučilišta u Zagrebu, Schrott-ova 39, HR-10000 Zagreb, Hrvatska (tina@pharma.hr)

Provedena je RFLP (restriction fragment length polymorphism) analiza tri nekodirajuća fragmenta velike jednostruke regije kloroplastnog genoma s ciljem proučavanja filogenetičkih odnosa između 9 vrsta roda Hypericum. Produkti lančane reakcije polimerazom regija psaA-trnS, trnC-trnD i psbC-trnS pocijepani su odvojeno sa 5 restrikcijskih endonukleaza. Restrikcijski produkti očitani sa gelova prikazani su u binarnom obliku, te je na temelju dobivenih podataka provedena Wagnerova analiza parsimonije. Uočena je varijabilnost u veličini i broju fragmenata između vrsta, dok polimorfizam između jedinki iste vrste nije nađen. Dobiveni rezultati ukazuju na izdvojenost vrsta H. calycinum L. i H. androsaemum L. kao najprimitivnijih u ovom uzorku, kao i na grupiranje dviju srodnih vrsta, H. perforatum L. i H. tetrapterum Fries. Također, prema dobivenim rezultatima odnosi između vrsta H. olympicum L. i H. adenotrichum Spach. bliži su nego na temelju dosadašnje filogenetske podjele, dok je vrsta H. richeri subsp. grisebachii (Boiss.) Nyman. udaljenija. Vrsta H. montanum L. je srodnija naprednijim vrstama dok je odnos vrste H. hirsutum L. sa drugim vrstama nedovoljno razlučen. Dobivenim rezultatima identificirana su tri međugenska područja kloroplastnog genoma koja su korisna za filogenetička ili filogeografska istraživanja roda Hypericum.

PCR-RFLP ANALYSIS OF cpDNA IN THE GENUS *Hypericum* (Clusiaceae)

K. Hazler Pilepić, M. Balić, F. Orač, M. Morović, M. Šantor and V. Vejnović
Department of Pharmaceutical Botany, Faculty of Pharmacy and Biochemistry,University of Zagreb, Schrott-ova 39, HR-10000 Zagreb, Croatia (tina@pharma.hr)

The restriction fragment length polymorphism (RFLP) analysis of three non-coding regions within a large single copy of chloroplast genome are used to examine the phylogenetic relationships among 9 species of genus *Hypericum.* The PCR-amplified products of regions psaA-trnS, trnC-trnD and psbC-trnS were digested separately with five restriction endonucleases. Gels were

scored in a binary format. Wagner parsimony analysis has been performed on the obtained data matrix. A high level of the interspecific variation was detected while intraspecific was not observed. The obtained results indicate discrimination of *H. calycinum* L. and *H. androsaemum* L. as the most primitive species in this sample as well as grouping of two related species *H. perforatum* L. and *H. tetrapterum* Fries. Also, relation between *H. olympicum* L. and *H. adenotrichum* Spach. is closer in terms of the cpDNA analysis than on morphological grounds, while *H. richeri* subsp. *grisebachii* (Boiss.) Nyman. is more distant. *H. montanum* L. is more related to advanced species while relationships of *H. hirsutum* L. with the other taxa was not resolved completely. The obtained results identifies three intragenic chloroplast DNA regions useful for phylogenetic or phylogeographical analysis in Hypericum.

OP-17
OBTAINING A RESISTANCE TO BLACK SHANK (*Phytophthora parasitica var.nicotianae*)

M. Mitreski, J. Aleksoski and A. Korubin-Aleksoska
Tobacco Institute-Prilep, Prilep, Republic of Macedonia

From the diallel between four tobacco varieties (oriental and semi-oriental type), three F1 hybrids were selected, in which one of the parents was the Florida 301, bearing resistance to black shank disease (*Phytophthora parasitica var.nicotianae*) in tobacco. Six back-crossings were performed to develop resistance to the disease. Each year, in BC generations susceptible individuals were eliminated and, finally, selection among the resistant individuals was made, using the scheme of Emanuel Sanchez-Monge (1974). The trial, hybridizations and selection of resistant lines were made at the Experimental field of Tobacco Institute-Prilep (in previously contaminated surface), in a period of nine years, starting from 1995. As a result of these investigations three resistant lines were developed.

OP-18
TEKATNI DINOFLAGELATI SLATKOVODNIH EKOSUSTAVA HRVATSKE

M. Gligora[1], K. Kralj[1], A. Plenković-Moraj[1], I. Grigorszky[2], K. T. Kiss[3], E. Acs[3], G. Borics[4] i J. Makk[5]
[1]Sveučilište u Zagrebu, Prirodoslovno-matematički fakultet, Biološki odsjek, Botanički zavod, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska

(mgligora@zg.biol.pmf.hr, korkralj@croatica.botanic.hr, aplenk@zg.biol.pmf.hr), [2]University of Debrecen, Faculty of Science, Egyetem square 1, H-4010 Debrecen, Hungary (gege@puma.unideb.hu), [3]Hungarian Danube Research Station of the Hungarian Academy of Sciences, Jávorka S. u. 14. H-2131 Göd, Hungary (kis7972@ella.hu acs@ludens.elte.hu), [4]Trans-Tiszanian Region Envariomental, Nature Protection and Water, Inspectorate, Hatvan u. 16. H-4025 Debrecen, Hungary (borics@tktvf.kvvm.hu), [5]Eötvös Loránd University, Faculty of Science, Department of Microbiology, Pázmány Péter sétány 1/c. H-1117 Budapest, Hungary (makkj@ludens.elte.hu)

Dinoflagelati s 21 lokaliteta na području Republike Hrvatske istraživani su u razdoblju od 1995. do 2006. godine. Uzorci fitoplanktona za kvalitativne i kvantitativne analize uzimani su u krškim, baražnim jezerima, akumulacijama, rijekama, povremeno plavljenim područjima i malim stajačicama (lokve, bare). Provedena istraživanja po prvi puta daju sustavan popis slobodno živućih oklopljenih (tekatnih) vrsta dinoflagelata slatkovodnih ekosustava Hrvatske. Sustavni popis dinoflagelata za istraživano područje Hrvatske uključuje 20 vrsta (izuzevši podvrste, varijetete i forme) koje pripadaju rodovima: *Ceratium*, *Peridinium* i *Peridiniopsis*. Za istraživane lokalitete na području Hrvatske po prvi puta su zabilježeni nalazi 12 vrsta i to sedam novih vrsta roda *Peridiniopsis /Peridiniopsis borgei* Lemmermann, *Peridiniopsis cunningtonii* Lemmermann, *Peridiniopsis elpatiewskyi* (Ostenfeld) Bourrelly, *Peridiniopsis kevei* Grigorszky et Vasas, *Peridiniopsis penardiforme* (Linderman) Bourrelly, *Peridiniopsis penardii* (Lemmermann) Bourrelly, *Peridiniopsis polonicum* (Woloszyńska) Bourrelly/ i pet vrsta roda *Peridinium /Peridinium lomnickii,* Woloszyńska, *Peridinium palatinum* Lauterborn*, Peridinium gatunense* Nygaard*, Peridinium umbonatum* Stein, *Peridinium volzii* Lemmermann/. Rezultati istraživanja daju uz taksonomiju, temeljenu na fotodokumentaciji SEM i svjetlosnoj mikroskopiji, uvid u prostornu i sezonsku distribuciju te utjecaj fizičko-kemijskih čimbenika na ekologiju pojedinih vrsta.

ARMOURED DINOFLAGELLATES IN CROATIAN FRESHWATER ECOSYSTEMS

M. Gligora[1], K. Kralj[1], A. Plenković-Moraj[1], I. Grigorszky[2], T. K. Kiss[3], E. Acs[3], G. Borics[4] and J. Makk[5]
[1]University of Zagreb, Faculty of Science, Division of Biology, Department of Botany, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (mgligora@zg.biol.pmf.hr, korkralj@croatica.botanic.hr, aplenk@zg.biol.pmf.hr), [2]University of Debrecen, Faculty of Science, Egyetem square 1, H-4010 Debrecen, Hungary (gege@puma.unideb.hu), [3]Hungarian Danube Research Station

of the Hungarian Academy of Sciences, Jávorka S. u. 14. H-2131 Göd, Hungary (kis7972@ella.hu, acs@ludens.elte.hu), [4]Trans-Tiszanian Region Envariomental, Nature Protection and Water, Inspectorate, Hatvan u. 16. H-4025 Debrecen, Hungary (borics@tktvf.kvvm.hu), [5]Eötvös Loránd University, Faculty of Science, Department of Microbiology, Pázmány Péter sétány 1/c. H-1117 Budapest, Hungary (makkj@ludens.elte.hu)

Dinoflagellates were investigated during last decade (1995-2006) on 21 localities in Croatia. Qualitative and quantitative phytoplankton samples were taken in Croatian karstic, barrage, and soft lakes, reservoirs, rivers, marshes, flooded areas, and pools. Research presents first annotated checklist of free-living armored dinoflagellates of the Croatian freshwater systems. According to the checklist, dinoflagellates in Croatia include three genera (*Ceratium*, *Peridinium* and *Peridiniops*is) with 20 species (excepting subspecies, varieties and forms). First records of 12 dinoflagellate species are reported for the investigated waterbodies: seven new species of genus *Peridiniopsis* / *Peridiniopsis borgei* Lemmermann, *Peridiniopsis cunningtonii* Lemmermann, *Peridiniopsis elpatiewskyi* (Ostenfeld) Bourrelly, *Peridiniopsis kevei* Grigorszky et Vasas, *Peridiniopsis penardiforme* (Linderman) Bourrelly, *Peridiniopsis penardii* (Lemmermann) Bourrelly, *Peridiniopsis polonicum* (Woloszyńska) Bourrelly/, and five new of genus *Peridinium* /*Peridinium lomnickii* Woloszyńska, *Peridinium palatinum* Lauterborn, *Peridinium gatunense* Nygaard, *Peridinium umbonatum* Stein, *Peridinium volzii* Lemmermann/. Research offers taxonomical observation based on SEM and light micrographs, species-specific ecological preference and/or tolerance, distribution and particular species seasonal succession patterns.

Posterska priopćenja
Posters

P-35
VARIJABILNOST OSKORUŠE (*Sorbus domestica* L.) IZ BALKANSKOG DIJELA AREALA, NA OSNOVI MORFOMETRIJSKE ANALIZE LIŠĆA

D. Ballian[1], F. Bogunić[1], M. Idžojtić[2], R. Brus[3] i T. Mikić[4]
[1]Šumarski fakultet u Sarajevu, Zagrebačka 20, 71000 Sarajevo, Bosna i Hercegovina (ballian.dalibor@bih.net.ba), [2]Šumarski fakultet, Sveučilište u Zagrebu, Svetošimunska 25, HR-10000 Zagreb, Hrvatska (marilena.idzojtic@post.htnet.hr), [3]Biotehniška fakulteta, Univerza v Ljubljani, Oddelek za gozdarstvo, Večna pot 83, 1000 Ljubljana, Slovenija (robert.brus@bf.uni-lj.si); [4]Institut za nizijsko šumarstvo i životnu sredinu, Antona Čehova 13, 21000 Novi Sad, Srbija

Oskoruša (Sorbus domestica L.) je vrsta drveća iz porodice Rosaceae zastupljena u kserotermnim šumama, a u uzgoju je kao voćkarica. Rasprostranjena je u južnoj i srednjoj Europi, sjevernoj Africi, na Krimu i u Maloj Aziji. U većini europskih zemalja vrlo je rijetka i ugrožena vrsta koja zaslužuje zaštitu i čije je očuvanje prepoznato kao prioritet. Prikazani su rezultati istraživanja varijabilnosti oskoruše iz dijela areala u zapadnom i srednjem dijelu Balkanskog poluotoka, na osnovi morfometrijske analize lišća. Lišće je sakupljeno sa po 30 stabala iz tri geografska područja (populacije iz Slovenije, Bosne i Srbije), a analiza je rađena na osnovi osam obilježja. Za određivanje unutarpopulacijske i međupopulacijske varijabilnosti korištene su univarijatna (ANOVA) i multivarijatna (MANOVA) analiza varijance. Za utvrđivanje sličnosti, odnosno različitosti 90 analiziranih stabala, na osnovi morfoloških obilježja lišća, korištena je cluster analiza. Rezultati istraživanja pokazuju da je unutarpopulacijska varijabilnost veća je nego međupopulacijska. S obzirom na grupiranje pojedinih stabala, može se zaključiti da nema jasne geografske diferencijacije. Pretpostavljamo da je osnovni čimbenik slabe diferencijacije antropogeni utjecaj kroz povijest, jer je oskoruša u ovome dijelu areala korištena, uzgajana i prenošena za ljudske potrebe. Dobiveni rezultati mogu poslužiti za buduću selekciju i uzgajanje, na individualnoj i populacijskoj razini.

VARIABILITY OF SERVICE TREE (*Sorbus domestica* L.) FROM THE BALKAN AREA BASED ON THE MORPHOMETHRIC LEAF ANALYSIS

D. Ballian[1], F. Bogunić[1], M. Idžojtić[2], R. Brus[3] and T. Mikić[4]
[1]University of Sarajevo, Faculty of Forestry, Zagrebačka 20, 71000 Sarajevo, Bosnia and Herzegovina (ballian.dalibor@bih.net.ba), [2]University of Zagreb, Faculty of Forestry, Svetošimunska 25, HR-10000 Zagreb, Croatia (marilena.idzojtic@post.htnet.hr), [3]University of Ljubljana, Biotechnical Faculty, Večna pot 83, 1000 Ljubljana, Slovenia (robert.brus@bf.uni-lj.si); [4]Institute of Lowland Forestry and Environment, Antona Čehova 13, 21000 Novi Sad, Serbia.

The service tree (Sorbus domestica L.) is a tree species from the Rosaceae family growing in xerothermic forests and cultivated as a fruit-tree. It is distributed in south and central Europe, North Africa, on the Crimea and in Asia Minor. In most European countries it is a very rare and threatened species which deserves protection and whose conservation has been recognized as a priority. This paper presents the research results of service tree variability from part of the west and central area of the Balkan peninsula, based on the morphometric leaf analysis. Leaves were collected from 30 trees in three geographical regions respectively (populations in Slovenia, Bosnia and Serbia), and the analysis was carried out on the basis of eight characters. To estimate the intra- and interpopulational variability the univariate (ANOVA) and multivariate (MANOVA) analysis of variance was used. To determine the similarities, i.e. differences of 90 analysed trees, based on leaf characters, the cluster analysis was used. The research results showed that the intrapopulational variability was greater than the interpopulational one. Due to the grouping of trees in clusters, it is obvious that there was no distinct geographical pattern. We assume that the anthropogenic influence through history is the main cause of such weak differentiation, because the service tree was cultivated and transferred in different regions for human needs. The obtained results could be used for future selection and planting, at both individual and populational level.

P-36
LIJEČENJE BILJEM U HOMEOPATIJI

D. Dujmović Purgar[1], T. Kunštek – Kučanda[2] i J. Babić Čegelj[3]
[1]Zavod za poljoprivrednu botaniku, Agronomski fakultet Sveučilišta u Zagrebu, Svetošimunska 25, HR–10000 Zagreb, Hrvatska (dpurgar@agr.hr), [2]Bernarda Vukasa 5, HR–10000 Zagreb, Hrvatska, [3]Dravska 1, HR–42208 Cestica, Hrvatska

Homeopatija je 250 godina stara metoda liječenja koja svakim danom postaje

sve popularnija diljem svijeta. Homeopatska medicina se temelji na zakonu sličnosti: tvar koja u velikim količinama izaziva simptome u zdrave osobe, u minijaturnim će dozama pomoći ozdravljanju bolesne osobe koja pati od sličnih simptoma. Homeopatski pripravci su potpuno prirodni proizvodi biljnog, životinjskog ili mineralnog porijekla. Ovim radom analizirane su biljne vrste koje se najčešće koriste u homeopatskoj medicini, te njihove botaničke karakteristike. Navode se informacije o simptomima i tijeku bolesti za koje se koriste, te način liječenja koji se primjenjuje. Zanimljivo je istaknuti korištenje primjerice aeroalergogene vrste *Ambrosia artemisiifolia* L. u svrhu liječenja peludne alergije. U okviru ovog rada opisuju se i druge biljne vrste koje se najčešće koriste u liječenju homeopatskom medicinom. Primjerice to su vrste: *Arnica montana* L., *Calendula officinalis* L., *Chamomilla recutita* (L.) Rausch., *Colchicum autumnale* L., *Hypericum perforatum* L., *Phytolacca americana* L., *Symphytum officinale* L. i *Urtica urens* L. Može se zaključiti da među biljnim vrstama koje se koriste u liječenju homeopatskom medicinom ima mnogo vrsta koje su inače čovjeku nepoželjne vrste. Stoga je potrebno više istraživanja posvetiti pozitivnom djelovanju ovih biljnih vrsta na ljudsko zdravlje.

THE PLANTS TREATMENT IN HOMEOPATHY

D. Dujmović Purgar[1], T. Kunštek – Kučanda[2] and J. Babić Čegelj[3]
Department of Agricultural Botany, Faculty of Agriculture, University of Zagreb, Svetošimunska 25, HR–10000 Zagreb, Croatia (dpurgar@agr.hr), [2]Bernarda Vukasa 5, HR–10000 Zagreb, Croatia, [3]Dravska 1, HR–42208 Cestica, Croatia

Homeopathy is 250 years old method of treatment, which is, day after day, more and more popular all around the world. The foundation of homeopathic medicine is the code of similarity. The substance in large amount causes the illness of healthy person, but the same substance in miniature amount can cause the recovery of the sick person. Homeopathic preparations are completely natural products of plants and animals or the ones of mineral origin. Most common plant species in homeopathic medicine and their botanic characteristics are represented in this paper. Information about symptoms and course of disease as well as methods of treatment are also represented in this study. It is interesting to point out the using of aeroallergenic species *Ambrosia artemisiifolia* L. for pollen allergy treatment. Other plant species that are used in homeopathic medicine are also represented in this work, for example: *Arnica montana* L., *Calendula officinalis* L., *Chamomilla recutita* (L.) Rausch., *Colchicum autumnale* L., *Hypericum perforatum* L., *Phytolacca*

americana L., *Symphytum officinale* L. and *Urtica urens* L. We can come to the conclusion that a lot of undesirable plant species for a man are used in homeopathic medicine treatment. The positive influence of these plant species need to be researched further.

P-37

KOROVNA FLORA VRTOVA PLEŠIVIČKOG PRIGORJA (SZ Hrvatska)

D. Dujmović Purgar i N. Hulina
Zavod za poljoprivrednu botaniku, Agronomski fakultet Sveučilišta u Zagrebu, Svetošimunska 25, HR–10000 Zagreb, Hrvatska (dpurgar@agr.hr, hulina@agr.hr)

Vrtovi Plešivičkog prigorja uključuju manje obradive površine na kojima se sadi povrće i cvijeće za potrebe malih obiteljskih gospodarstava i "vikendaša". Svi edafsko – klimatski faktori koji pogoduju uzgoju kultura omogućavaju i razvoj korova. Korovna flora vrtova Plešivičkog prigorja istraživana je tijekom dviju vegetacijskih sezona (2002,2003) na 7 nalazišta. Primijenjene su uobičajene metode bilježenja biljaka, prikupljanja i identifikacije. Nomenklatura svojti je usklađena prema Tutinu (1964-1980, 1993). Istraživanjem korovne flore vrtova Plešivičkog prigorja zabilježena je 81 korovna vrsta u okviru 27 porodica. Prema brojnosti vrsta najzastupljenije bile su porodice *Asteraceae* i *Poaceae*, što odražava utjecaj autohtone flore, te biološko-ekološke karakteristike samih porodica. Među zabilježenim vrstama se ističu okopavinski tj. izrazito nitrofilni korovi, kao npr. *Aegopodium podagraria* L., *Amaranthus retroflexus* L., *Chenopodium album* L., *Ch. polyspermum* L., *Lamium purpureum* L., *Polygonum lapathifolium* L., *P. persicaria* L., *Sonchus arvensis* L., *S. oleraceus* L., *Stellaria media* (L.) Vill, i *Veronica persica* Poir. Posebno zanimljiv je nalaz vrste *Nigella arvensis* L. koja je inače u uzgoju kao kultura, a ovdje je zabilježena kao korovna vrsta. U istraživanim vrtovima karakteristična je dominacija jednogodišnjih vrsta i terofita. Međutim, istraživani vrtovi Plešivičkog prigorja većinom su u sklopu staračkih domaćinstava te su stoga neprikladno održavani i omogućavaju razvoj ruderalnih i livadnih vrsta poput *Althea officinalis* L., *Ambrosia artemisiifolia* L., *Brachypodium sylvaticum* (Hudson) Beauv., *Chelidonium majus* L., *Conyza canadensis* (L.) Cronq, *Erigeron annuus* (L.) Pers., *Hypericum perforatum* L., *Lactuca serriola* L., *Lepidium ruderale* L. i *Plantago media* L. Naime, redukcijom plijevljenja, okopavanja i košnje dolazi do postepenog prevladavanja višegodišnjih biljnih vrsta. Najviše korovnih vrsta je euroazijskog porijekla, te vrste široke rasprostranjenosti.

THE GARDENS WEED FLORA OF PLEŠIVICA HILLS (NW Croatia)

D. Dujmović Purgar and N. Hulina
Department of Agricultural Botany, Faculty of Agriculture, University of Zagreb, Svetošimunska 25, HR–10000 Zagreb, Croatia (dpurgar@agr.hr, hulina@agr.hr)

The gardens of Plešivica hills are planted with vegetables and flowers respecting the needs of small family estates and week-enders. All the edaphic-climatic factors suitable in cultivation of vegetables and flowers are favorable in development of weeds as well. The gardens weed flora of Plešivica hills was explored during two vegetational seasons (2002, 2003) at 7 locations. Usual methods of plant recording, collecting and identification were applied in the research of the gardens weed flora. The nomenclature of plants is according to Tutin et al. (1964-1980, 1993). 81 taxa of gardens weed flora were noted that belonged to 27 families. The most represented families were *Asteraceae* and *Poaceae* which reflects the influence of the indigenous flora and biological - ecological characteristics of these families. Row crop weeds for example *Aegopodium podagraria* L., *Amaranthus retroflexus* L., *Chenopodium album* L., *Ch. polyspermum* L., *Lamium purpureum* L., *Polygonum lapathifolium* L., *P. persicaria* L., *Sonchus arvensis* L., *S. oleraceus* L., *Stellaria media* (L.) Vill, and *Veronica persica* Poir. distinguish themselves among the noted species. Finding of the species *Nigella arvensis* L., that is usually cultivated in gardens, is extremely interesting because in this case it is noted as the weed species. Therophytes and annual plants were dominant in the gardens that were the subject of this research. The majority of the researched gardens, which were not properly cared for, were the parts of the old households. That made the development of the ruderal and meadow species like *Althea officinalis* L., *Ambrosia artemisiifolia* L., *Brachypodium sylvaticum* (Hudson) Beauv., *Chelidonium majus* L., *Conyza canadensis* (L.) Cronq, *Erigeron annuus* (L.) Pers., *Hypericum perforatum* L., *Lactuca serriola* L., *Lepidium ruderale* L. and *Plantago media* L. possible. Less of weeding, hoeing up and mowing enable the gradual domination of the perennial herbaceous plants. Most of the species were of the Euroasian origin and also widespread cosmopolites.

P-38

SOME TREES AND SHRUBS FROM BITOLA AND NEIGHBOUR WHICH IS NEED TO BE PROTECTED

N. Hristovski, Dz.Tomovska and E. Jovanova-Hristovska
Faculty of Biotechnical Sciences,7000 Bitola, Macedonia (hristovski_fbn@yahoo.com)

Bitola is located in SW part of Macedonia and during the historical time it was pathway between Asia Minor and Adriatic Coast . The pathway Via Egnatia was connected Istanbul (Bizanth) ,Thessaloniki over Bitola to Drach on the Adriatic Coast.That pathway have influence in introduced flora in this region and town.So here were introduced many plants in town from neighbour environment to Mediterranean and wide side.So in the town there is tradition to be planted from many years and centuries ago.It is need to be protected the oldest trees and shrubs such as the following:*Sambucus nigra* L.,Querqus coccifera ,in Smolevo*, Cercis siliquastrum* L., *Gleditshia triacanhos* L., *Magnolia lilliflora*,M.cobus and new planted M. *grandiflora* L., *Ficus carica* L., *Morus nigra* L., *Cedrus atlantica* Man.,C.*libani Loud*., C.*deodara , Pinus* strobus,*Platanus orientalis* L.,(the oldest tree are some centuries also there is avenue of this trees), *Wistaria chinesis D.C.* It is need to mentioned that in Flora of Macedonia *Querqus coccifera* from the locality Smolevo near Bitola is under question.In fact in this locality existed two trees old near a century with a well developed *habitus*,so we again confirm the founding of Todorovski,1954 for this locality.A very old tree of *Magnolia grandiflora* L., in Bitola existed till 1967 when was cated by man.That tree was planted in the period of Turkish Imperia in XVII century. We think that is need in near future in Bitola neighbour environment such as in the South exposition of the hill "Tumbe Kafe" and part of the town park to be founded Botenical Garden. There will be planted those and other plant which have long tradition of planting in this region on open field.

P-39
UTJECAJ KLIMATSKIH PROMJENA NA DINARSKE BUKOVO-JELOVE ŠUME

S.D. Jelaska[1], T. Nikolić[2] i V. Kušan[1]
[1]OIKON d.o.o. – Institut za primijenjenu ekologiju, Prekratova 20, HR-10020 Zagreb, Hrvatska (sjelaska@oikon.hr, vkusan@oikon.hr), [2]Botanički zavod, PMF, Marulićev trg 20/2, HR-10000 Zagreb, Hrvatska (toni@botanic.hr)

Dinarske bukovo-jelove šume (*Omphalodo-Fagetum*) sadrže većinu prašumskih kompleksa na području RH te pružaju stanište za sve tri velike zvijeri (medvjed, vuk i ris) što je rijetkost u europskim okvirima. Oboje ukazuje na njihovu posebnu vrijednost s obzirom na biološku raznolikost, što ih uz njihovu klimatogenost čini dobrim modelom za sagledavanje utjecaja klimatskih promijena na kopnene ekosustave. Koristeći IPCC-SRESA1 klimatski scenarij promjene temperature te WWF procjenu promjena količine oborina u zimskom i ljetnom razdoblju, analizirali smo

promjene u rasprostranjenosti subasocijacija zajednice *Omphalodo-Fagetum*, te nekoliko biljnih vrsta čije je recentno rasprostranjenje dobro objašnjeno korištenim klimatskim parametrima. Procjene smo napravili za 2050. (dva scenarija s različitim promjenama količine oborina) i 2080. godinu. Uočen je kontinuirani trend povećanja udjela subasocijacije *asaretosum* i smanjivanja udjela subasocijacija *homogynetosum* i *aceretosum*, dok su kod ostale tri subasocijacije promjene različite ovisno o različitim kombinacijama promjene količine oborina i temperature. Jednostavan model promjene areala zajednice (temperaturno uvjetovan vertikalni pomak) pokazuje smanjenje od 15% u 2050. godini, odnosno od 42% u 2080. godini. Na razini pojedinačnih biljnih vrsta, jasan trend uočen je jedino kod kopitnjaka *Asarum europaeum*, koji pokazuje povećanje svog areala na promatranom području, dok kod ostalih modeliranih vrsta (*Acer obtusatum, Daphne laureola* i *Prenanthes purpurea*) smjer promjena oscilira ovisno o korištenom modelu promjene količine oborina. Dobiveni rezultati ukazuju na značajan utjecaj predviđenih klimatskih promjena na dinarske bukovo-jelove šume, no za točnije procjene poželjna je upotreba prostorno preciznih lokalnih klimatskih scenarija.

IMPACT OF CLIMATE CHANGE ON DINARIC SILVER FIR – BEECH FORESTS

S.D. Jelaska[1], T. Nikolić[2] and V. Kušan[1]
[1]OIKON Ltd. – Institute for Applied Ecology, Prekratova 20, HR-10020 Zagreb, Croatia (sjelaska@oikon.hr; vkusan@oikon.hr), [2]Department of Botany, Faculty of Science, Marulićev trg 20/2, HR-10000 Zagreb, Croatia (toni@botanic.hr)

Majority of virgin forests in Croatia can be found in silver fir – beech forests (*Omphalodo-Fagetum*) that are also habitats for three large carnivores (bear, wolf and lynx) that is rarity in the Europe. All this indicates great importance these forests have in preserving biodiversity. As these forests are vegetation climax under present climate conditions they represent a good model for evaluation of climate changes impact on terrestrial ecosystems and their biodiversity. Using IPCC-SRESA1 climate scenario, and WWF estimations of changes in summer and winter precipitation, we have analysed alterations in spatial distribution of *Omphalodo-Fagetum* sub-associations and several vascular plant species whose recent distribution was well explained with used climatic parameters. Three scenarios were calculated, two for years 2050 and one for year 2080. Sub-association *asaretosum* has constant tendency of increasing its proportion, while *homogynetosum* and *aceretosum* has shown constant decrease in their proportions. Remaining three sub-associations has

shown various directions of changes in the dependence of used scenarios. Simple model (vertical shift based on temperature increase) has shown 15% areal reduction of *Omphalodo-Fagetum* forest in year 2050 and 42% in year 2080. Among modelled species, one directional changes was observed only for *Asarum europaeum* which increased its distribution, while remaining species (i.e. *Acer obtusatum, Daphne laureola* and *Prenanthes purpurea*) had various shift in its distributions depending upon used climate change scenarios. We can conclude that predicted climate change will have significant impact on these forests but for more accurate estimations use of spatially precise, local climate change scenarios are needed.

P-40
HYBRIDIZATION BETWEEN DIFFERENT TYPES OF TOBACCO

A. Korubin-Aleksoska
Tobacco Institute-Prilep, Prilep, Republic of Macedonia

Investigations included 9 oriental tobacco cultivars in a role of father, representing the types Prilep (P 12-2/1, P-84, PV 156/1, P-23 and P-7), Yaka (YV 125/3 and YK -23) and Djebel (Dj No 1 and Pobeda P-2); 2 semioriental varieties in a role of mother (Otlia O-87 and Floria Fl-breeding line) and their 18 F_1 hybrids. The investigated characters were: height of the stalk with inflorescence, number of leaves per stalk, length and width of middle belt leaves and their relative area. Crossings were made in the course of 2002. The experiment was set up in 2003, on the field of Tobacco Institute-Prilep in a randomized block with three replications. Measurings were made in the beginning of flowering. Based on the average values obtained, standard deviation, parents and hybrids variability and the way of inheritance of investigated characters were estimated. Investigations revealed the existence of significant differences between parents and their F_1 hybrids. Cultivars and their hybrid progenies apppeared to be highly uniform. The inheritance of stalk height is intermediary and partially dominant, except for the hybrids O-87 x P-84 and Fl x Dj No 1, which showed dominance of the higher parent, and Fl x YK -23 where positive heterosis was observed. Inheritance of leaf number per stalk is intermediary and partially dominant. Dominance of the parent with higher leaf number was observed in O-87 x PV 156/1, negative heterosis was present in: O-87 x P 12-2/1, Fl x P12-2/1 and Fl x P-2 and positive heterosis in O-87 x P-2. The way of inheritance of leaf area is intermediary, partially dominant and dominant and no presence of heterotic effect was observed. The investigations can be used as a basis for further selection work.

P-41

UTJECAJ NADMOSRKE VISINE I RAZVOJNOG STADIJA NA HLAPLJIVE KOMPONENTE KADULJE (*Salvia officinalis* L.) S PROSTORA HERCEGOVINE

S. Marić[1] i M. Miloš[2]
[1]Fakultet prirodoslovno-matematičkih i odgojnih znanosti, Odjel kemije, Sveučilište u Mostaru, Matice hrvatske bb, 88000 Mostar, Bosna i Hercegovina (stanislavamaric@net.hr), [2]Kemijsko-tehnološki fakultet, Zavod za biokemiju i kemiju hrane, sveučilište u Splitu, Teslina 10/V, HR-21000 Split, Hrvatska (milos@ktf-split.hr)

Eterična ulja iz svježeg biljnog materijala kadulje (*Salvia officinalis* L.) bila su predmet GC/MS analize u cilju određivanja utjecaja nadmorske visine i sezonskih varijacija na sastav hlapljivih komponenti. Biljni materijal kadulje sakupljan je na dva različita lokaliteta (nadmorske visine 110 i 400 m) u središnjoj Hercegovini, u blizini Mostara. Kadulja je prikupljana u četiri različita razvojna stadija: vegetativni period (listovi i stabljika, siječanj), prije cvatnje (listovi i stabljika, travanj) u vrijeme cvatnje (listovi, cvjetovi i stabljika, svibanj) i nakon cvatnje (listovi i stabljika, kolovoz). Prinos eteričnog ulja varirao je od 0,29% do 1,7%. Pojavljuje se konstantan kvalitativni sastav komponenti. Međutim, zabilježene su različitosti u sadržaju nekih komponenti ovisno o razvojnom stadiju biljke. Glavne sastojci su α-tujon (9.3-35.6%), kamfor (6.9-29.1%) i veridiflorol (6.0-24.0%). Ostalo važne komponente su α-humulen (3.1-13.6), manol (3.0-13.3%), 1,8-cineol (8.6-12.7%) i borneol (2.0-5.5%).

THE IMPACT OF THE LOCALITY ALTITUDES AND STAGES OF DEVELOPMENT ON THE VOLATILE CONSTITUENTS OF *Salvia officinalis* L. FROM HERZEGOVINA

S. Maric[1] and M. Milos[2]
[1]Faculty of Science and Education, Department of Chemistry, University of Mostar, Matice hrvatske bb, 88000 Mostar, Bosnia and Herzegovina (stanislavamaric@net.hr) , [2]Faculty of Chemical Technology, Department of Biochemistry and Food Chemistry, University of Split, Teslina 10/V, HR-21000 Split, Croatia (milos@ktf-split.hr)

The essential oils from fresh plant materials of *Salvia officinalis* L. (sage) were subjected to GC/MS analysis in order to determine the impact of the locality altitudes and seasonal variations on their volatile constituents. The

sage plant materials were collected from two different localities (altitudes 110 and 400 m) in central Herzegovina near Mostar and at four different stages of development: vegetative period (leaves and stalks, January), prior to flowering (leaves and stalks, April), in the course of flowering (flowering tops, leaves and stalks, May) and after flowering (leaves and stalks, August). The oil yields varied from 0.29% to 1.07%. The qualitative composition of the components appeared to be constant. However, there were notable differences in the amounts of several compounds depending at the stages of plant development. The main components were α-thujone (9.3-35.6%), camphor (6.9-29.1%) and viridiflorol (6.0-24.0%). Other important components were α-humulene (3.1-13.6), manool (3.0-13.3%), 1,8-cineole (8.6-12.7%) and borneol (2.0-5.5%).

P-42

TOBACCO PRODUCTION IN R. MACEDONIA AS A RESULT OF THE EFFECT OF NATURAL AND SOCIO-ECONOMIC FACTORS

T. Miceski
Tobacco Institute-Prilep, Kicevski pat bb, MK-7500 Prilep, R. Macedonia (miceski_t@mail.net.mk, miceski_t@freemail.com.mk)

A great number of factors affect the production of tobacco (Nicotiana tabacum L.), one of the most frequently represented agricultural-industrial crops in the Republic of Macedonia. They are of both natural and socio-economic origin, including: geographic area, relief, climate, soil, hydrography, labour, tradition, culture and also the existential needs and improving the family budget. The relief of R. Macedonia is mountainous. From the total territory of 25.713 km^2, 488 km^2 are water areas, 4.900 km^2 - plains and 20.325 km^2 - hilly terrain. Of about 650 hectares arable agricultural area, 25 hectares (3.5%) are grown with tobacco. Almost 10% of the total population is engaged in tobacco production. Having in mid the total population, with production of cca 12 kg oriental tobacco per inhabitant, R. Macedonia is among the leading countries in the world. The favorable conditions allowed a production of over 25.000 tons, mainly of oriental aromatic type of tobacco. Information on the factors and trends in tobacco production in R. Macedonia will be presented in this paper.

P-43
URBANA FLORA U MOSTARU

A. Mijatović
Odjel za Biologiju, Fakultet prirodoslovno-matematičkih i odgojnih znanosti, Sveučilište u Mostaru,
Ul. Matice hrvatske bb, BiH-88000 Mostar, Bosna i Hercegovina (anelamijatovic@yahoo.com)

U radu je istraživana urbana flora u Motaru. Terensko istraživanje je provedeno u razdoblju od listopada do prosinca 2003. godine na 22 lokaliteta u užem gradskom središtu. Utvrđeno je ukupno 106 vrsta i podvrsta biljaka, svrstanih u 93 roda i 38 porodica. Najzastupljenija je porodica *Asteraceae* s 19 vrsta, zatim slijede *Cichoriaceae i Poaceae* sa po 10 vrsta. Najveća je zastupljenost biljaka široke rasprostranjenosti, a među životnim oblicima prevladavaju hemikriptofiti. Zabilježeno je 17 neofitskih vrsta.

URBAN FLORA OF MOSTAR, BOSNIA AND HERZEGOVINA

A. Mijatović
Department of Biology, Faculty of Science and Education, University of Mostar, Matice hrvatske bb,
BiH-88000 Mostar, Bosnia and Herzegovina (anelamijatovic@yahoo.com)

The urban flora of Mostar has been investigated from October to December 2003. Altogether, 22 localities in center of town were chosen. It has been found a total of 106 plant taxa (species and lower units) ranking in 93 genera and 38 families. *Asteraceae* (19 taxa), *Cichoriaceae* and *Poaceae* (10 taxa) are the families characterized by the highest number of taxa. Wide-spread plants and hemicryptophytes dominated among the floral elements and life-forms, respectively. It has been noted 17 neophytic taxa.

P-44
PHYTOPLANKTON AS BIOLOGICAL PARAMETER OF THE WATER QUALITY OF LAKE OHRID

V. Mitic and S. Patceva
Hidrobiological Institute, Naum Ohridski 50, 6000 Ohrid, R. Macedonia (vasamitic@yahoo.com)

The phytoplankton composition in oligotrophic Lake Ohrid is poor for

species and the phytoplankton quantity is very low. The phytoplankton in the pelagic zone comprise a small number of species (about 30) which belong to the following group of algae: Cyanophyta, Chrysophyta, Bacillariophyta, Pyrrophyta and Chlorophyta. In the pelagic zone of the lake, the largest number of species, especially the dominant species are indicators of oligotrophic waters. As result of larger or smaller anthropogenic influence of the urban, rural and tourist settlements in the Lake Ohrid coast, the qualitative phytoplankton composition in the littoral was richer in contrast to the pelagic zone. There were represented larger number of species and some of them are indicators of mesotrophic and eutrophic waters. In particular very loaded regions with allochtonous organic and inorganic matters was registered massive growth of the phytoplankton with million quantity and minimal species diversity from two to six species of algae. This appearance was registered in Ohrid Bay, in the littoral region of River Velgoska inflow and in the south littoral region near to Albanian border. In the all registered situations the green alga Pandorina morum was dominant species and according to chlorophyll *a* content based on water trophic classifications lake water was in mesotrophic and eutrophic state. In the paper are presented obtained results from the phytoplankton and chlorophyll *a* investigations in the littoral and pelagic zone of Lake Ohrid in the summer period 2004 and 2005.

P-45
MOLEKULARNA FILOGENIJA DINARSKIH ZVONČIĆA (CAMPANULACEAE)

G. Nikšić[1], I. Pongrac[2], S. Kovačić[3] i Z. Liber[3]
[1]Naselje "Andrija Hebrang" 5/2; HR-35000 Slavonski Brod (marsonia2258@yahoo.com), [2]Božidara Magovca 39, HR-10000 Zagreb (misko.pongrac@zg.t-com.hr), [3]Botanički zavod i Botanički vrt PMF-a, Sveučilište u Zagrebu, Marulićev trg 9, HR-10000 Zagreb, Hrvatska (sanja@botanic.hr, zlatko.liber@botanic.hr)

Glavni predmet ovog istraživanja je određivanje srodstvenih odnosa među svojtama roda *Campanula* razvojnih krugova Dinarske regije. Radi ovog cilja proučene su kloroplastne DNA sekvence i ITS sekvence jezgrinih ribosomskih DNA 35 svojti roda *Campanula*. Ostvareni rezultati upućuju na razdvajanje heterofilnih i izofilnih svojti, kao i jasno odvajanje "izofiloidne" skupine. Unatoč tome što su se heterofilne vrste (agregat *Rotundifolia*) okupile u čvrstu i jasno prepoznatljivu skupinu, raspored vrsta unutar skupine je snažno ovisio o istraživanoj DNA regiji. Budući da su vrste sekcije *Rapunculus* pokazale vrlo malu međusobnu srodnost, a neke se od njih smjestile unutar sekcije

Campanula, nije podržano tradicionalno ograničavanje ovog roda na dvije sekcije.

MOLECULAR PHYLOGENY OF DINARIC CAMPANULAS (CAMPANULACEAE)

G. Nikšić[1], I. Pongrac[2], S. Kovačić[3] and Z. Liber[3]
[1]Naselje "Andrija Hebrang" 5/2; HR-35000 Slavonski Brod (marsonia2258@yahoo.com), [2]Božidara Magovca 39, HR-10000 Zagreb (misko.pongrac@zg.t-com.hr), [3]Department of Botany and Botanical Garden, Faculty of Science, University of Zagreb, Marulićev trg 9, HR-10000 Zagreb, Croatia (sanja@botanic.hr, zlatko.liber@botanic.hr)

The main interest of this study was identification of the relationships among *Campanula* taxa and lineages from Dinaric region. For this purpose, different chloroplast DNA sequences and ITS sequences of nuclear ribosomal DNA from 35 *Campanula* taxa have been studied. The obtained results pointed towards separation of the heterophyllous and isophyllous taxa, as well as a clear isolation of the "isophylloid" group. Although heterophyllous taxa (*Rotundifolia* agg.) have assembled compact and easily recognized group, the composition of the species within group strongly depended on the researched DNA region. Since the species of the sect. *Rapunculus* have shown little mutual relations, and some of them have been settled into the sect. *Campanula,* traditional delimitation of this genus in two sections has not been supported.

P-46
COMPARATIVE ANALYSIS OF THE PHYTOPLANKTON COMPOSITION IN LAKES OHRID AND PRESPA

S. Patceva and V. Mitic
Hidrobiological Institute, Naum Ohridski 50, 6000 Ohrid, R. Macedonia (spatceva@hio.edu.mk)

Lake Ohrid and Lake Prespa are situated in southeastern Europe and the largest parts belong to R. Macedonia. They are two large lakes of extraordinary ecological values and they are one of the oldest lakes in the world. Although the upstream Lake Prespa has no surface outflow its waters reach the 160 m lower Lake Ohrid by underground hydrological connection. The last investigations showed that Lake Prespa is in process of eutrophication and Lake Ohrid is in an oligotrophic state. The goal of this research was to obtain information

about the differences of phytoplankton composition between these lakes in dependence of their different trophic state. The investigative period of this study took place over the years 2001, 2002, 2003. Samples were collected with "Niskin" water sampler from the pelagic zone of Lake Ohrid and Lake Prespa. Population quantity of the particular phytoplankton groups was determined using inverted microscope. Large changes in phytoplankton composition in Lake Prespa was determined, in addition, percentage participation of Cyanophyta and Bacillariophyta were increased. These algal groups was the main mark of the phytoplankton community, comprised approximately 95% of the total phytoplankton density. Participation of the other taxonomic groups of algae, particulary Chrysophyta and Chlorophyta were drastic decreased and definite number of species from these groups were found in small numbers or were completely absent. Phytoplankton composition and distribution in Lake Ohrid was typical for the oligotrophic lakes, with considerably participation of Chrysophyta and Chlorophyta. Cyanophyta and Bacillariophyta comprised approximately 65% of the total phytoplankton density.

P-47

FLORA I VEGETACIJA GROMAČA, SUHOZIDA I ŠKRAPARA RIJEČKOGA PODRUČJA

M. Randić[1] i Ž. Modrić[2]
[1]Primorsko-goranska županija, Adamićeva 10, HR–51000 Rijeka, Hrvatska (marko.randic@zavod.pgz.hr), [2]Prirodoslovni muzej Rijeka, Lorenzov prolaz 1, HR – 51000 Rijeka, Hrvatska (zeljka@prirodoslovni.com)

Dosadašnjim florističkim i vegetacijskim istraživanjima nisu sustavno obrađena kamenita staništa gromača, suhozida i škrapara na riječkom području. Istraživanja na susjednim područjima (okolica Trsta, Dalmacija) ukazuju na raznolikost flore i vegetacije takvih staništa. Ovim istraživanjem su potvrđene vrste čije je postojanje u Hrvatskom primorju bilo upitno (*Arabis verna*). Vegetacijske snimke na gromačama, suhozidima i škraparima napravljene su standardnom metodom prema Braun-Blanquetu tijekom vegetacijske sezone 2006. godine, a njihova statistička analiza pokazuje heterogenost sintaksonomskih jedinica takvih staništa. Gromače, suhozidi i škrapari predstavljaju staništa nekih rjeđih i zanimljivih vrsta u Primorju (pr. vrsta tipičnih za točila *Drypis jacquiniana, Peltaria alliacea, Rumex scutatus, Viola adriatica* i dr.).

FLORA AND VEGETATION OF KARST STONE HEAPS, DRY STONE WALLS AND KARREN FIELDS OF THE RIJEKA REGION

M. Randić[1] and Ž. Modrić[2]
[1]The County of Primorje - Gorski kotar, Adamićeva 10, HR-51000 Rijeka, Croatia (marko.randic@zavod.pgz.hr), [2]Natural History Museum Rijeka, Lorenzov prolaz 1, HR-51000 Rijeka, Croatia (zeljka@prirodoslovni.com)

Flora and vegetation of karst stone heaps, dry stone walls, and karren fields of the Rijeka region were not sistematicaly researched. Nevertheless, similar researches in the vicinity of Trieste and in Dalmatia showed considerable floristical and vegetational diversity of those habitats. Research was conducted by applying sigmatistic method (Braun-Blanquet 1964) during the vegetation season 2006. From the syntaxonomic point of view, analysis showed rather heterogenous floristical composition. Karst stone heaps, dry stone walls, and karren fields served as imporant habitats for some interesting and rare taxa (e.g. *Drypis jacquiniana, Peltaria alliacea, Rumex scutatus, Viola adriatica* etc.). Present resesarch also confirmed existance of *Arabis verna*, which was formerly thought to be doubtful record for the region.

P-48

QUANTITATIVE CHARACTERISTICS OF TOBACCO PRODUCTION IN THE REPUBLIC OF MACEDONIA

S. Stojanoska[1] and L. Stojanoski[2]
[1]Tobacco Institute – Prilep, Kicevski pat, bb, 7500 Prilep, Republic of Macedonia, [2]Faculty of Economy – Prilep, 7500 Prilep, Republic of Macedonia

Knowledge on the quantitative characteristics is of a special importance in tobacco breeding. It offers a possibility for taking the proper direction in tobacco selection in order to develop varieties that will be more superior than the existing ones. All of this imposes another problem; to present the quantitative characteristics of tobacco production itself. Today, in a period of transition, when various changes occur, there are big oscillations in tobacco production, too. In this paper we'll try to make clear presentation of some major quantitative properties which characterize tobacco production in the Republic of Macedonia as a whole. This is the only way to increase the production and to obtain a high-quality tobacco raw. For this reason, it would be necessary to develop a concept and a strategy for solving the problems that detain the development of tobacco production in the Republic of Macedonia.

P-49

RUDERALNA I KOROVNA FLORA ŽUMBERKA

M. Vrbek i S. Buzjak
Hrvatski prirodoslovni muzej, Botanički odjel, Demetrova 1, HR-10000 Zagreb, Croatia (Mirjana.Vrbek@hpm.hr)

U radu je prikazana ruderalna i korovna flora Žumberka. Ovo područje je bilo do sada slabo floristički istraženo. Postojeći podaci su oskudni i rezultat su starijih općenitijih florističkih istraživanja šireg ili užeg područja pa ne obrađuju ruderalnu i korovnu floru. Ranijim istraživanjima zabilježeno je 57 vrsta. Ovim istraživanjem je zabilježeno 433 taksona (416 vrsta i 17 podvrsta) vaskularne flore u okviru 233 roda i 64 porodice. Izvršena je taksonomska i fitogeografska analiza, zatim ekološke analize koje su obuhvatile spektar životnih oblika i indekse ekoloških parametara (F, R, N, H, D, L, T, K) kao i analiza pridošlica prema vremenu dolaska te je prikazana njihova rasprostranjenost prema UTM kartama (kvadranti 10 x 10 km).

RUDERAL AND WEED FLORA OF ŽUMBERAK

M. Vrbek and S. Buzjak
Croatian Natural History Museum, Department of Botany, Demetrova 1, HR-10000 Zagreb, Croatia (Mirjana.Vrbek@hpm.hr)

This paper presents the ruderal and weed flora of Žumberak. This region has not been well floristically researched to date. Existing data are scarce and are the result of older and more general floristic researches of broader or narrower region, so they do not deal with ruderal and weed flora. Earlier researches noted 57 species.
This research noted 433 taxa (416 species and 17 subspecies) of vascular flora within 233 genera and 64 families. Taxonomic and phytogeographic analysis has been carried out. It was followed by ecological analyses which included the spectrum of life forms and indices of ecological parameters (F, R, N, H, D, L, T, K) as well as analyses of newcomers according to time of introduction and their distribution according to UTM maps (quadrants 10 x 10 km) is given.

BILJNA BIOLOGIJA
3. SIMPOZIJ HRVATSKOG DRUŠTVA
ZA BILJNU FIZIOLOGIJU

PLANT BIOLOGY
3rd SYMPOSIUM OF THE CROATIAN SOCIETY
OF PLANT PHYSIOLOGY

Uvodna tematska predavanja
Introductory Lectures

IL-7
REDOKS REGULACIJA FOTOSINTEZE – ZA Z-SHEMU POTREBAN JE TROL

H. Fulgosi[1], S. Jurić[1], H. Lepeduš[2], K. Hazler-Pilepić[3] i T. Bionda[1]
[1]Zavod za molekularnu biologiju, Institut Ruđer Bošković, Bijenička 54, HR-10000 Zagreb, Hrvatska (fulgosi@irb.hr), [2]Odjel za biologiju, Sveučilište J.J. Strossmayer, Gajev trg 6, HR-31000 Osijek, Hrvatska (hlepedus@yahoo.com), [3]Farmaceutsko-biokemijski fakultet, HR-10000 Zagreb, Hrvatska

Molekularni mehanizmi uključeni u regulaciju temeljnog procesa oksigene fotosinteze mnogo su složeniji nego što se to prvobitno pretpostavljalo. Primjerice, mnogi pomoćni proteini koji povezuju fotosintezu s fiziološkim odgovorima još uvijek su nepoznati. U novije vrijeme otkrivene su protein-kinaze koje fosforiliraju komponente fotosustava II te su uključene u prilagodbe fotosinteze. Pretpostavlja se da su ovi procesi regulirani redoks statusom tilakoidnih membrana. Koristeći tehnike *antisense* utišavanja gena i insercijske inaktivacije gena utvrdili smo postojanje dosad nepoznatog proteina stroma tilakoida, na koji se veže feredoksin-NAD(P)$^+$ oksidoreduktaza, enzim koji katalizira završni prijenos elektrona oksigene fotosinteze. Gubitak ovog integralnog membranskog proteina nazvanog TROL (od thylakoid rhodanese-like protein) uzrokuje prekomjernu redukciju fotosintetskog aparata u uvjetima svjetlosti povišenog intenziteta. TROL je stoga neophodan za održavanje linearnog toka elektrona kao i za redoks regulaciju ključnih sustava prijenosa signala na tilakoidnim membranama.

REDOX REGULATION OF PHOTOSYNTHESIS – Z-SCHEME REQUIRES TROL

H. Fulgosi[1], S. Jurić[1], H. Lepeduš[2], K. Hazler-Pilepić[3] and T. Bionda[1]
[1]Department of Molecular Biology, Ruđer Bošković Institute, Bijenička 54, HR-10000 Zagreb, Croatia (fulgosi@irb.hr), [2]Department of Biology, J.J. Strossmayer University, Gajev trg 6, HR-31000 Osijek, Croatia (hlepedus@yahoo.com), [3] Faculty of Pharmacy and Biochemistry, HR-10000 Zagreb, Croatia

Molecular mechanisms involved in regulation of the fundamental process of oxygenic photosynthesis appear to be much more complex then previously

anticipated. Particularly, various auxiliary proteins linking photosynthesis with physiological responses are still missing. Recently, several protein kinases involved in photosystem II phosphorylation and photosynthetic acclimation have been characterized. It has been proposed that those processes are regulated via redox-state of the thylakoid membrane. By using antisense and gene inactivation strategies we have identified a novel component of non-apressed thylakoid membranes which is responsible for anchoring of ferredoxin-$NAD(P)^+$ oxidoreductase, the enzyme which catalyses the final electron transfer of oxygenic photosynthesis from ferredoxin to NAD(P). Depletion of this integral membrane protein entitled TROL (thylakoid rhodanese-like protein) leads to an over-reduction of photosynthetic machinery in conditions of elevated light intensity. Thus, TROL is necessary for sustaining of linear electron flow, as well as for redox-regulation of key thylakoid signal-transduction pathways.

IL-8
FUNKCIONALNA ANALIZA PROTEINA S DOMENAMA MATH/BTB EKSPRIMIRANIH U JAJNOJ STANICI I RANOJ EMBRIOGENEZI PŠENICE

D. Leljak-Levanić[1], T. Dresselhaus[2,3], I. Šumanovac[1] i S. Sprunck[2]
[1]Prirodoslovno-matematički fakultet Zagreb, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (dunja@zg.biol.pmf.hr), [2]Biocentar Klein Flottbek, Sveučilište u Hamburgu, Ohnhorststraße 18, 22609 Hamburg, Njemačka (sprunck@botanik.uni-hamburg.de), [3]Molekularna, stanična biologija i biljna fiziologija,, Sveučilište u Regensburgu, Universitätsstrasse 31, 93040 Regensburg, Njemačka (thomas.dresselhaus@biologie.uni-regensburg.de)

Konzervirane proteinske domene MATH i BTB zastupljene su u različitim proteinima u jednoj kopiji, zajedno ili u kombinacij sa drugim tipovima domena. Poznate uloge proteinske domene BTB su utišavanje transkripcije, regulacija staničnog skeleta kao i ubikvitinizacija/razgradnja. Za ubikvitinizaciju/razgradnju važna je prisutnost domene MATH N-terminalno od domene BTB. MATH domena određuje specifičnost prema supstratu. Iako uloga MATH/BTB proteina nije potpuno jasna, njihova široka rasprostranjenost i konzerviranost ukazuju na važne stanične funkcije. Pretraživanjem cDNA biblioteke izoliraih neoplođenih jajnih stanica i dvostaničnih proembrija pšenice pronašli smo prisutnost nekoliko potpuno novih transkripata. Dva od njih kodiraju proteine koji sadrže obje domene, MATH i BTB i pronađeni su ili u jajnoj stanici (*TaMATH/BTB-Ec*) ili u dvostaničnom proembriju (*TaMATH/BTB-2c*). Treći transkript koji kodira MATH/BTB protein (*TaMATH/BTB*) pokazuje

homologiju sa već poznatim transkriptima. Ekspresija gena koji kodiraju MATH/BTB proteine analizirana je u različitim vegetativnim tkivima, jajnoj stanici, zigoti i tijekom razvoja embrija. Gen *TaMATH/BTB* eksprimiran je u svim ispitivanim tkivima, dok su transkripti *TaMATH/BTB-Ec* i *TaMATH/BTB-2c* zastupljeni specifično, *TaMATH/BTB-Ec* u jajnoj stanici a *TaMATH/BTB-2c* u dvostaničnom embriju. Lokalizacija produkta *TaMATH/BTB-2c* u stanici analizirana je nakon fuzije sa zeleno-fluorescirajućim proteinom (GFP). Osim potpunog kodirajućeg slijeda, slijedovi dobiveni nakon delecije domene MATH ili BTB također su fuzionirani sa GFP-om. Rezultati analize ekspresije i lokalizacije *TaMATH/BTB-2c* zajedno ukazuju na njegovu moguću važnost za polarnost stanica.

FUNCTIONAL ANALYSIS OF MATH/BTB DOMAIN PROTEINS SPECIFICALLY EXPRESSED IN EGG CELLS AND AT THE ONSET OF WHEAT (*Triticum aestivum* L.) EMBRYOGENESIS

D. Leljak-Levanic[1], T. Dresselhaus[2,3], I. Šumanovac[1] and S. Sprunck[2]
[1]Faculty of Sciences Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia (dunja@zg.biol.pmf.hr), [2]Biocenter Klein Flottbek, University of Hamburg, Ohnhorststraße 18, 22609 Hamburg, Germany (sprunck@botanik.uni-hamburg.de), [3]Molecular Cell Biology & Plant Physiology, University of Regensburg, Universitätsstrasse 31, 93040 Regensburg, Germany (thomas.dresselhaus@biologie.uni-regensburg.de)

The conserved BTB and MATH domains are presented in a variety of proteins as a single copy domain, together or in combination with other types of domains. Different functional roles have been identified for BTB proteins such as transcription repression, cytoskeleton regulation as well as protein ubiquitination/degradation in which amino-terminal MATH domain is responsible for substrate specificity. Althoug the function of MATH/BTB proteins is not clear, distribution of these proteins from yeast to human and domain conservation suggest that they are critical in some cellular functions. By screening cDNA libraries of isolated unfertilized egg cells and two-celled proembryos of wheat we have identified several ESTs (expressed sequence tags) which represent completely novel transcripts. Among these, two transcripts encoding proteins with MATH/BTB domains have been identified in egg cells (*TaMATH/BTB-Ec)* and 2-celled proembryos (*TaMATH/BTB-2c*), respectively. A third transcript encoding a MATH/BTB protein (*TaMATH/BTB*) revealed similarity to published ESTs. Expression of the MATH/BTB genes was analyzed in different vegetative tissues, egg cells and zygotes and during embryo development. *TaMATH/BTB* was found to be expressed

ubiquitously, while transcript of *TaMATH/BTB-Ec* is only present in the egg cell. *TaMATH/BTB-2c* is induced after fertilization, with the highest expression level in 2-celled stage proembryo. Subcellular localization of TaMATH/BTB-2c was analyzed after generating GFP-fusion proteins. Besides the complete coding region, deletions of either MATH or BTB domain were fused to GFP. Expression and subcellular localization indicates a putative role of TaMATH/BTB-2c in cell polarity.

IL-9
AUKSIN-AMIDOHIDROLAZAIZPŠENICE–REGULATORAKTIVNOSTI AUKSINA U BILJAKA

B. Salopek-Sondi, A. Tomašić i V. Magnus
Zavod za molekularnu biologiju, Institut Ruđer Bošković, HR-10002 Zagreb, P. O. Box 180, Hrvatska (salopek@irb.hr, atomasic@irb.hr, magnus@irb.hr,)

Istražen je enzim auksin-amidohidrolaza iz pšenice (*Ta*IAR3). TaIAR3 cDNA je izolirana iz ozime pšenice (*Triticum aestivum* L. cv Caledonia) i dobivena zahvaljujući Dr. James Campanella, Montclair State University, NJ, USA i Dr. Jutta Ludwig-Muller, Institut fuer Botanik, Dresden, Germany. Gen za auksin-amidohidrolazu pšenice ukloniran je u ekspresijski vector pGEX4T-1 i ekspresija proteina postignuta je u *E. coli*. Rekombinantni protein GST-*Ta*IAR3 pročišćen je kromatografijom na glutathione-sepharose-i 4B i korišten za biokemijske reakcije s aminokiselinskim konjugatima auksina kao potencijalnim substratima. Rezultati reakcije praćeni su visokotlačnom tekućinskom kromatografijom (HPLC). Dokazano je cijepanje biološki neaktivnog konjugata alanina i indol-maslačne kiseline (IBA-Ala) u fiziološki aktivnu slobodnu IBA. Ovi rezultati ukazuju na važnost auksin-amidohidrolaze u održavanju homeostaze auksina u biljaka.

WHEAT AUXIN-AMIDOHYDROLASE: A REGULATOR OF AUXIN ACTIVITY IN PLANTS

B. Salopek-Sondi, A. Tomašić and V. Magnus
Department of Molecular Biology, Ruđer Bošković Institute, HR-10002 Zagreb, P.O. Box 180, Croatia (salopek@irb.hr, atomasic@irb.hr, magnus@irb.hr)

The wheat auxin-amidohydrolase, *Ta*IAR3, was investigated. *Ta*IAR3 cDNA was isolated from winter wheat (*Triticum aestivum* L. cv. Caledonia) and was obtained by courtesy of Dr. James Campanella, Montclair State University, NJ,

USA and Dr. Jutta Ludwig-Muller, Institut fuer Botanik, Dresden, Germany. The wheat auxin-amidohydrolase gene was cloned into the pGEX4T-1 expression vector and protein expression was obtained in *E. coli*. The GST-*Ta*IAR3 protein was purified by glutathione sepharose 4B chromatography and was processed for biochemical reaction with auxin-amino acid conjugates as putative substrates, and the auxin formed was monitored by HPLC. HPLC separation showed cleavage of the, biologically inactive, alanine conjugate of indolebutyric acid (IBA-Ala) to form the, physiological active, free IBA. This fact suggests that wheat auxin-amidohydrolase is involved in auxin homeostasis in plants.

Kratka usmena priopćenja
Oral Presentations

OP-19
POJAČANA EKSPRESIJA FENILALANIN-AMONIJ-LIJAZE I SINTEZA RUŽMARINSKE KISELINE U TRANSGENOM KORIJENJU UKRASNE KOPRIVE *Coleus blumei* Benth.

N. Bauer[1], H. Fulgosi[2] i S. Jelaska[1]
[1]Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (nbauer@zg.biol.pmf.hr), [2]Zavod za molekularnu biologiju, Institut Ruđer Bošković, Bijenička cesta 54, HR-10000 Zagreb, Hrvatska

Ružmarinska kiselina (RA) je prirodni antioksidans. U velikim količinama nakuplja se u biljkama porodice Lamiaceae i Boraginaceae. Prvi korak biosinteze je deaminacija L-fenilalanina pri čemu nastaje t-cimetna kiselina. Reakciju katalizira enzim fenilalanin-amonij-lijaza (PAL). Glavna kontrolna točka regulacije aktivnosti PAL-a je na razini poticanja transkripcije. U staničnoj kulturi ukrasne koprive utvrđeno je da pojačnoj sintezi RA prethodi pojačana aktivnost PAL-a. Učinak pojačane ekspresije enzima PAL na nakupljanje RA bio je istražen u transgenom korijenju ukrasne koprive transformiranom s genom *PAL1* iz uročnjaka *Arabidopsis thaliana*. Lisni eksplantati ukrasne koprive transformirani su posredstvom agrobakterija, a transgenic korijenčići selekcionirani na podlozi MS s amonijevim glufozinatom. Selekcionirano je 13 korijenskih linija s transgenom *PAL1*. U tkivu je aktivnost enzima PAL određena spektrofotometrijski, a sadržaj RA visokotlačnom tekućinskom kromatografijom. Sve transgene linije imale su aktivnost PAL-a veću od normalnog korijenja. U osam transgenih linija povećana aktivnost enzima PAL uzrokovala je povećano nakupljanje RA. Jedna transgena linija nakupljala je manje RA od normalnog korijenja, a pojačano je nakupljala klorogensku kiselinu.

PHENYLALANINE AMMONIA-LYASE OVEREXPRESION AND ROSMARINIC ACID PRODUCTION IN TRANSGENIC ROOTS OF *Coleus blumei* Benth.

N. Bauer[1], H. Fulgosi[2] and S. Jelaska[1]
[1]Department for Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia

(nbauer@zg.biol.pmf.hr), [2]Department of Molecular Biology, Ruđer Bošković Institute, Bijenička cesta 54, HR-10000 Zagreb, Croatia

Rosmarinic acid (RA) is a natural antioxidant found in the plant kingdom. In plants it acts as a preformed constitutively accumulated defense compound. It is biosynthesized via the phenyl-propanoid pathway. The eight enzymes involved in the biosynthesis are known and characterized. Precursor for the caffeic acid moiety of RA is L-phenylalanine. The first step in RA biosynthesis, oxidative desamination of L-phenylalanine, catalyzes phenylalanine ammonia-lyase (PAL). Previous results indicate that induction of PAL activity is the consequence of transcriptional activation of *PAL* genes. The correlation of the PAL activity with RA synthesis is noticed. To get more knowledge on that correlation, activity of phenylalanine ammonia-lyase, in transgenic roots of *Coleus blumei* Benth. was perturbed by introduction of an *Arabidopsis thaliana PAL1* gene controlled by the CaMV 35S promoter. Thirteen transgenic root lines resistant to gluphosinate ammonium (selective marker) were established and maintained on MS medium supplemented with 5.4 µM NAA. The content of RA in root cultures was quantified by HPLC, and PAL activity was measured spectrophotometricaly on 300 nm with L-phenylalanine as a substrate. Comparing with control-normal root line, all 13 transgenic lines had strong enhancement of PAL activity that was reflected on induction of phenolic production. Rosmarinic acid accumulation was significantly induce in 8 lines. In one transgenic root line RA production was diminished and greater amount of chlorogenic acid was noticed.

OP-20

ULOGA RODANAZE CIJANOBAKTERIJE *Synechocystis* sp. PCC 6803 U UVJETIMA NEDOSTATKA SUMPORA

S. Bosak[1], M. Grgić[1], B.Viljetić[2] i H. Fulgosi[1]
[1]Zavod za molekularnu biologiju, Institut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (suncica.bosak@gmail.com, miraos16@yahoo.co.uk, fulgosi@irb.hr), [2]Medicinski fakultet Sveučilišta u Osijeku, J.Huttlera 4, HR-31000 Osijek, Hrvatska (bviljetic@yahoo.co.uk)

Rodanaze su široko rasprostranjeni enzimi koji kataliziraju *in vitro* reakciju prijenosa atoma sumpora od tiosulfata do cijanida. Još se raspravlja o njihovoj točnoj biološkoj ulozi budući da se identifikacija njihovih bioloških supstrata pokazala otežana. U genomu cijanobakterije *Synechocystis* sp. PCC 6803 identificiran je gen *slr0192* koji kodira za hipotetski protein od 12 kDa. Analiza aminokiselinskog slijeda pokazala je sličnost s funkcionalnim rodanaznim

domenama iz drugih organizama. Cilj ovog rada bio je karakterizirati potencijalnu cijanobakterijsku rodanazu i odrediti njezinu ulogu *in vivo* u stanicama *Synechocystis* sp. U tu svrhu konstruiran je metodom insercijske inaktivacije mutantni soj s nefunkcionalnim genom *slr0192*. Uspješnost transformacije i potpune segregacije potvrđena je lančanom reakcijom polimerazom i metodom hibridizacije po Southernu. Namjera je bila utvrditi utjecaj nedostatka odgovarajućeg proteina na fiziologiju organizma usporedbom divljeg tipa i Ä*slr0192* mutantnog soja analizom fotoautotrofnih krivulja rasta, elektronske mikroskopije stanica te snimanjem apsorpcijskog spektra i autofluorescencije klorofila. Utvrđena je i rodanazna aktivnost u sirovom staničnom proteinskom ekstraktu. Pokusi nisu pokazali značajnu razliku između divljeg i mutantnog tipa u normalnim uvjetima. Potencijalna uloga istraživana je i u uvjetima nedostatka sumpora. Primijećena je razlika u fenotipu što se manifestiralo u dužem preživljavanju mutantnih stanica. Dobiveni rezultati osnova su za daljnje istraživanje točne funkcije gena *slr0192* cijanobakterije *Synechocystis* sp. PCC 6803 u uvjetima nedostatka sumpora.

THE FUNCTION OF A RHODANESE UNDER SULFUR LIMITATION CONDITIONS IN CYANOBACTERIUM *Synechocystis* sp. PCC 6803

S. Bosak[1], M. Grgić[1], B. Viljetić[2] and H. Fulgosi[1]
[1]Department of Molecular Biology, Ruđer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (suncica.bosak@gmail.com, miraos16@yahoo.co.uk, fulgosi@irb.hr), [2]Faculty of Medicine, J.J. Strossmayer University of Osijek, J.Huttlera 4, HR-31000 Osijek, Croatia (bviljetic@yahoo.co.uk)

Rhodaneses are widespread enzymes that catalyze the transfer of a sulfane sulfur atom from thiosulfate to cyanide *in vitro*. Their biological role is still largely debated, since the identification of their biological substrates has proven to be elusive. In the genome of cyanobacteria *Synechocystis* sp. PCC 6803 gene *slr0192* that encodes putative 12 kDa protein has been identified. Sequence analysis showed similarity to the rhodanese-like domains from other organisms. The subject of this work has been the characterization of a potential rhodanese and the determination of its function *in vivo* in the cyanobacterium *Synechocystis* sp. PCC 6803. For that purpose, the mutant strain with a disrupted gene *slr0192* has been constructed by method of an insertional gene inactivation. Southern blot and polymerase chain reaction analysis showed that the mutant had completely segregated. The aim was to define the influence of the matching protein on the physiology of an organism by comparing mutant and wild type strains. Analysis of photoautotrophic growth curves, electron

microscopy of the cells, apsorption spectra and chlorophyll autofluorescence did not show any significant difference between wild type strain and Ä*slr0192* mutant under normal conditions. Rhodanese activities were obtained for crude enzyme extract of cyanobacterial cells. Potential role has been also examined under sulfur deprivation conditions. A difference in phenotype was observed that manifested in longer viability of mutant cells. This report is a base for further studies of *slr0192* exact role under the conditions of sulfur deprivation in cyanobacteria *Synechocystis* sp. PCC 6803.

OP-21

OKSIDACIJSKI STRES U LISTOVIMA BILJKE *Kalanchoe daigremontiana* NAKON INFEKCIJE BAKTERIJOM *Agrobacterium tumefaciens*

D. Car, J. Gospočić, I. Križaić, M. Tkalec, Ž. Vidaković-Cifrek i B. Pevalek-Kozlina
Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb (dicar@botanic.hr, iva.krizaic@zg.htnet.hr, mtkalec@zg.biol.pmf.hr, zcifrek@biol.pmf.hr, bpevalek@biol.pmf.hr)

Bakterija *Agrobacterium tumefaciens* upotrebljava se kao vektor za unos stranih gena u biljni genom odnosno stvaranje transgenih biljaka. Istraživanje interakcije između biljaka i ove bakterije značajno je zbog poboljšanja učinkovitosti transformacije biljnih stanica. Da bi se utvrdilo u kojoj mjeri ranjavanje biljke kao nužni preduvjet infekcije te infekcija biljnog tkiva bakterijom *Agrobacterium tumefaciens* uzrokuju oksidacijski stres određivani su pokazatelji oksidacijskog stresa u listovima biljke *Kalanchoe daigremontiana* na samom mjestu ranjavanja odnosno infekcije te u tkivu u neposrednoj blizini. Pokazatelji oksidacijskog stresa bili su aktivnost antioksidacijskih enzima pirogalol i gvajakol peroksidaze te katalaze, sastav njihovih izoenzima te količina vodikovog peroksida. U tumorskom tkivu utvrđen je porast aktivnosti enzima pirogalol i gvajakol peroksidaze tijekom tri tjedna. Također, uočena je i pojava novih izoenzima tih peroksidaza. U ozlijeđenom tkivu je samo pirogalol peroksidaza pokazala značajno povišenu aktivnost tjedan dana nakon ranjavanja dok je u naredna dva tjedna njezina aktivnost bila na razini aktivnosti tog enzima u zdravom tkivu. Katalaza nije pokazala značajnu razliku u aktivnosti između tumorskog i ostalog tkiva, a nije utvrđen ni povećan broj izoenzima. Količina vodikovog peroksida u zdravom i ozlijeđenom te tumorskom tkivu nije se značajno razlikovala. U tkivu u neposrednoj blizini ozljeđivanja i infekcije nisu utvrđene značajne promjene pokazatelja oksidacijskog stresa. Dobiveni rezultati ukazuju da infekcija

bakterijom *Agrobacterium tumefaciens* ne uzrokuje izrazitiji oksidacijski stres u biljci *Kalanchoe daigremontiana*. Povećanje aktivnosti peroksidaze u ozlijeđenom i tumorskom tkivu može se povezati s ulogom tog enzima u procesima rasta koji dovode do zacijeljivanja ozljede odnosno rasta tumora na listu biljke.

OXIDATIVE STRESS IN *Kalanchoe daigremontiana* CAUSED BY *Agrobacterium tumefaciens*

D. Car, J. Gospočić, I. Križaić, M. Tkalec, Ž. Vidaković-Cifrek and B. Pevalek-Kozlina
Department of Botany, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (dicar@botanic.hr, iva.krizaic@zg.htnet.hr, mtkalec@zg.biol.pmf.hr, zcifrek@biol.pmf.hr, bpevalek@biol.pmf.hr)

Agrobacterium tumefaciens can be used as a vector for transferring foreign genes into the plant genome as a way of creating transgenic plants. Studying interactions between plants and bacteria is significant for improving the efficiency of plant cell transformation. In order to determine to which extent plant wounding as a necessary requirement for infection as well as infection process by *Agrobacterium tumefaciens* itself are causing oxidative stress, parameters of oxidative stress was determined in leaves of *Kalanchoe daigremontiana* plant. Activity and isoenzyme pattern of antioxidant enzymes pyrogallol and guaiacol peroxidase and catalase as well as hydrogen peroxide content were measured in plant tissue at sites of infection and wounding as well as at the sites near them. In tumor tissue significant increase of pyrogallol and guaiacol peroxidase activity was observed during three weeks. Moreover, new isoenzymes appeared. In wounded tissue pyrogallol peroxidase showed significant increase in activity only during the first week after wounding. There was neither considerable difference in activity nor in isoenzyme pattern of catalase between tumor and other tissues. The hydrogen peroxide content was similar in healthy, tumor and wounded tissue. In tissues near the infection or wounding no significant changes that would indicate the presence of oxidative stress were noticed. Obtained results suggest that the infection of plant tissue by *Agrobacterium tumefaciens* did not cause prominent oxidative stress in *Kalanchoe daigremontiana*. Increase in peroxidase activity observed in wounded and tumor tissue could be connected with the role of peroxidase in growth processes during tissue regeneration and tumor growth.

OP-22

BIOAKTIVNI GIBERELINI U PLODNICI I PLODU BIJELOG KUKURIJEKA (*Helleborus niger* L.)

V. Magnus[1], B. Ayele[2], S. Mihaljević[1], D.M. Reinecke[2], J.A. Ozga[2] i B. Salopek-Sondi[1]
[1]Zavod za molekularnu biologiju, Institut Ruđer Bošković, HR-10002 Zagreb, pp 180, Hrvatska (magnus@irb.hr, mihaljev@irb.hr, salopek@irb.hr), [2]Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta, T6G 2P5, Canada (bayele@ualberta.ca, dennis.reinecke@ualberta.ca, jocelyn.ozga@ualberta.ca).

U cvijetu bijelog kukurijeka (*Helleborus niger* L.), ispočetka bijeli ili ružičasti periant pozeleni nakon oplodnje. Taj proces ovisi o prisutnosti plodova u razvoju, a ako ih nema, može se inducirati primjenom giberelina. U ovom radu istražili smo zastupljenost uobičajenih bioaktivnih giberelina: GA_1, GA_3, GA_4, i GA_7 u plodnici i plodu. Ekstrakt liofiliziranog biljnog materijala, pripremljen uz dodatak deuterijem obilježenih internih standarda, pročišćen je u nekoliko stupnjeva (ekstrakcija u tekućoj i krutoj fazi, HPLC) a ostatak je preveden u hlapive derivate (priprava metilnih estera GA-trimetilsililetera) i analiziran plinskom kromatografijom u kombinaciji s masenom spektrometrijom uz praćenje odabranih karakterističnih fragmentnih iona. Sva četiri giberelina identificirana su na temelju indeksa retencije po Kováts-u i prisutnosti odgovarajućeg molekularnog iona i dvaju karakterističnih fragmenata. GA_4 je najzastupljeniji; slijedi GA_1, a GA_3 i GA_7 su od sekundarnog značaja. Ukupna količina ovih četiriju giberelina u plodu bitno poraste kad započinje akumulacija klorofila u periantu, što ukazuje na ulogu giberelina iz ploda u indukciji i održavanju fotosintetskog sustava u periantu. Koncentracija GA_4 najveća je na početku cvijetanja i u početnoj fazi razvitka embrija, a nakon toga se tek donekle smanjuje, što može biti posljedica usporenog razvoja embrija koji u fazi odbacivanja sjemenke s matične biljke dostiže početni kotiledorani stadij. Koncentracija GA_1 najveća je neposredno nakon oprašivanja, smanjuje se u početnoj fazi razvitka embrija, a ponovno raste pri kraju zriobe plodova. Ovi podaci pokazuju da su GA_1 i GA_4 najvažniji giberelini u plodovima kukurijeka te ukazuju na specifične funkcije giberelina u definiranim stadijima razvoja.

BIOACTIVE GIBBERELLINS IN CARPELS AND FRUIT OF THE CHRISTMAS ROSE (*Helleborus niger* L.)

V. Magnus[1], B. Ayele[2], S. Mihaljević[1], D.M. Reinecke[2], J.A. Ozga[2] and B. Salopek-Sondi[1]

[1]Department of Molecular Biology, Ruđer Bošković Institute, HR-10002 Zagreb, P.O.Box 180, Croatia (magnus@irb.hr, mihaljev@irb.hr, salopek@irb.hr), [2]Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta, T6G 2P5, Canada (bayele@ualberta.ca, dennis.reinecke@ualberta.ca, jocelyn.ozga@ualberta.ca).

In Christmas rose (*Helleborus niger* L.) flowers, the initially white or rose perianth turns green after fertilization, a process which depends on the presence of developing fruit, or in their absence can be induced by application of gibberellins. In the present study, developing pistils and fruit were analyzed for the presence of common bioactive gibberellins: GA_1, GA_3, GA_4, and GA_7. Extracts of freeze-dried plant material, prepared in the presence of deuterium-labeled internal standards, were passed through a series of purification and derivatization steps (solvent partition, solid-phase extraction, HPLC, preparation of GA methyl ester-trimethylsilyl ethers) and analyzed by gas chromatography-mass spectrometry-selected ion monitoring. Kováts retention indices and the presence of the respective molecular ions and two characteristic fragment ions suggested the presence of all four gibberellins. GA_4 was most abundant, followed by GA_1, while GA_3 and GA_7 were of minor significance. The overall pool size for these four gibberellins in the fruit started to increase markedly when chlorophyll formation in the perianth was initiated, suggesting a role for fruit-derived gibberellins in the induction and maintenance of photosynthetic capacity in the perianth. GA_4 concentrations peaked during early anthesis and embryo initiation, and decreased slightly thereafter, possibly because embryo development continued to the initial cotyledonary stage by the time seeds were shed. GA_1 levels peaked after pollination, decreased during embryo initiation, and rose again as the fruit approached maturity. These data identify GA_1 and GA_4 as major gibberellins in Christmas rose fruit and suggest a role for gibberellins in specific stages of development.

OP-23
POSSIBILITIES FOR APPLICATION OF NEW METHODS IN CREATION OF ORIENTAL TOBACCO VARIETIES RESISTANT TO *Phytophthora parasitica var.nicotianae* IN CONDITIONS *in vitro*

G. Miceska, M. Dimitrieski, P. Taskoski and B. Gveroska
Tobacco Institute-Prilep Kicevski pat bb., Republic of Macedonia (miceskag@mail.net.mk)

Infectious diseases caused by viruses, mycoplasma, bacteria and fungi are very hard to control and it is almost impossible to eliminate them with chemicals.

This is the case with fungal disease *Phytophthora parasitica var.nicotianae*, which in some regions causes serious economic losses to tobacco production, depending on the year and climate conditions. The method of tissue culture *in vitro* gives possibilities to obtain a greater number of genetically identical and virusless transplants. The method of Slavov (2002) used for investigation of infectivity of *Ppn* selective agents was also applied in creation of tobacco varieties resistant to this disease in conditions *in vitro*. The inoculum of the fungus in various rates was added into the medium for explants risogenesis (Murashige & Skoog, 1961). The test revealed that two of investigated tobacco lines showed resistance to the disease.

OP-24
RAST, POTROŠNJA GLUKOZE I EKSKRECIJA PROTEINA U TRI EMBRIOGENE LINJE BUNDEVE (*Cucurbita pepo* L.)

S. Mihaljević[1], R. Garić[1], H G orvat[2], D. Leljak Levanić[3] i S. Jelaska[3]
[1]Institut Ruđer Bošković, Bijenička cesta 54, HR-10000 Zagreb (mihaljev@irb.hr, rgaric@net.hr), [2]Zavod za javno zdravstvo, Mirogojska cesta 16, HR-10000 Zagreb (horvatgordana@yahoo.com), [3] Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet Zagreb, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb (dunja@biol.pmf.hr, sibila@hazu.hr).

Ispitan je učinak hranidbene podloge na rast, metabolizam i ekskreciju proteina u kulturama tri embriogene linije bundeve, s ciljem pojašnjavanja uloge nitrata u regulaciji razvoja somatskih embrija bundeve. Svi parametri praćeni su 4., 8., 11., i 15. dana kultiviranja tkiva u suspenziji. Kinetika rasta tkiva određena je usporedbom svježe i suhe mase tkiva s potrošnjom glukoze i promjenom vrijednosti pH u podlozi. Podloga s amonijevim ionima kao jedinim izvorom dušika usporavala je rast i razvoj embriogenog tkiva, a uočeno je i značajno zakiseljavanje podloge tijekom kultivacije. Dodatkom MES-a vrijednost pH podloge je stabilizirana, što je potaklo rast tkiva i izlučivanje ekstracelularnih proteina. Razvio se manji postotak globularnih embrija, ali nije došlo do razvoja kasnijih razvojnih stadija. Sazrijevanje embrija postignuto je samo na podlogama koje su sadržavale reduciran (NH_4^+) i nereduciran (NO_3^-) oblik dušikovih soli. Ponovno snabdjevanje nitratima pojačalo je rast embriogenog tkiva, prethodno kultiviranog na podlozi s amonijevim ionima kao jedinim izvorom dušika. Uočena je pojačana potrošnja glukoze i pojačano izlučivanje ekstracelularnih proteina. Usporednom analizom profila ekstracelularnih proteina iz embriogenih linija bundeve utvrđene su razlike uzokovane hranjivima iz podloge, potencialno vezane i uz stadij razvoja.

GROWTH PARAMETERS, GLUCOSE UPTAKE AND PROTEIN EXCRETION OF THREE EMBRYOGENIC LINES OF PUMPKIN (*Cucurbita pepo* L.)

S. Mihaljević[1], R. Garić[1], H G orvat[2], D. Leljak Levanić[3] and S. Jelaska[3]
[1]Ruđer Bošković Institute, Bijenička cesta 54, HR-10000 Zagreb (mihaljev@irb.hr, rgaric@net.hr), [2]Zagreb Public Health Institute, Mirogojska cesta 16, HR-10000 Zagreb (horvatgordana@yahoo.com), [3]Department of Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb (dunja@biol.pmf.hr, sibila@hazu.hr).

The effects of culture media on the growth, metabolism and protein excretion of three embryogenic lines grown in suspension culture were studied as a step towards elucidating the role of nitrogen supply in the regulation of developmental transitions of pumpkin somatic embryos. All parameters were measured over a 15-day culture period on days 0, 4, 8, 11 and 15. Fresh- and dry weight were compared with the glucose uptake and pH of the culture media in order to assess growth kinetics. Ammonium, used as the sole source of nitrogen, negatively influenced embryogenic tissue growth and morphogenesis and caused a significant decrease in the media pH. Buffering ammonium-only medium with MES stabilized the pH, enhanced tissue proliferation and facilitated protein excretion. Globular embryos were formed at a low frequency and no further differentiation into late-stage embryos was observed. Maturation of embryos proceeded only when a combination of reduced (NH_4^+) and unreduced (NO_3^-) forms of nitrogen was provided in the medium. A noticeable effect of NO_3^- re-supply of cultures previously maintained on the NH_4-containing medium reflected through increased growth, glucose uptake and protein excretion in the culture medium. A comparative analysis of extracellular proteins in pumpkin embryogenic tissue lines was performed with the intention to detect some nutrient-dependent changes related to the stage of development.

OP-25

„SUGAR SENSING“ U STANIČNIM LINIJAMA ŠEĆERNE REPE (*Beta vulgaris* L.)

D. Pavoković[1], D. Hagege[2] i M. Krsnik-Rasol[1]
[1]Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102A, HR-10000 Zagreb, Hrvatska, [2]Laboratoire de biologie des ligneux et des grandes cultures, UPRES EA 1207, Faculté des Sciences, Université d’Orléans- BP6749, 45067 Orléans cedex 2

Karakteristika biljnog razvoja je izuzetna plastičnost koja je uvjetovana vanjskim i unutarnjim signalima. Ugljikohidrati su važni čimbenici biljnog razvoja. Biljke mogu osjetiti ugljikohidrate kao disaharide ili monosaharide. Osjet monosaharida može biti ili ovisan ili neovisan o heksokinazi. Nastali signal se prenosi do jezgre gdje utječe na ekspresiju gena. Da li osjet šećera i prijenos signala ovisi o diferencijacijskom stupnju stanice nije poznato. Da bi testirali tu hipotezu, analizirali smo tri stanične linije šećerne repe koje se nalaze na različitim stupnjevima diferencijacije: N – diferencirana, bez morfogeneze; HO – diferencirana i morfogenetska, i HNO – dediferencirana. Stanične suspenzije dobivene iz kalusa tretirali smo s raznim šećerima i analozima: glukoza, saharoza, 3-O-metilglukoza, 2-deoksiglukoza, manoza i manitol. Pratili smo odgovor nekoliko enzima: invertaze, fenilalanin-amonij lijaze (PAL), i peroksidaze. Rezultati pokazuju da su invertaza stanične stijenke i PAL pogodni za testiranje osjeta šećera u staničnim linijama. Aktivnost tih enzima povisila se u stanicama N i HNO tretiranih s glukozom i saharozom, ali ne i s analozima šećera. Slična aktivacija nije pronađena u stanicama HO. Da bi testirali put prijenosa signala šećera, stanice smo tretirali s inhibitorima proteinskih fosfataza i kinaza te mjerili aktivnost invertaze i PAL. Nije nađena nikakva razlika u odgovoru. U konačnici, podatci govore da postoji veza između stupnja diferencijacije stanice šećerne repe i osjeta šećera, dok je put prijenosa signala šećera u sve tri stanične linije istovjetan.

SUGAR SENSING IN SUGAR BEET CELL LINES (*Beta vulgaris* L.)

D. Pavoković[1], D. Hagege[2] and M. Krsnik-Rasol[1]
[1]Department of Molecular biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102A, HR-10000 Zagreb, Croatia, [2]Laboratoire de biologie des ligneux et des grandes cultures, UPRES EA 1207, Faculté des Sciences, Université d'Orléans- BP6749, 45067 Orléans cedex 2

Plant development is characterized by extreme plasticity influenced by external and internal stimuli. Carbohydrates are important factors in plant development. Plants can sense carbohydrates as disaccharides or monosaccharides. Monosaccharide sensing can occur via hexokinase independent or hexokinase dependent pathway. The signal generated is transmitted to the nucleus and can affect expression of genes. Whether sugar sensing and signaling are in relation with differentiation state of plant cells is not known. To test this hypothesis, three sugar beet cell lines on distinct levels of differentiation were analyzed (N – differentiated nonmorphogenic, HO – differentiated and morphogenic, and HNO – dedifferentiated). Cell suspensions were initiated from the corresponding calli and cells were treated with sugars and sugar analogs:

glucose, sucrose, 3-O-methylglucose, 2-deoxyglucose, mannose and mannitol. The response of several enzymes (invertases, phenylalanine ammonium lyase (PAL), peroxidases) was measured. The data showed cell wall invertase and PAL as suitable markers for testing sugar sensing in sugar beet cell lines. The N and HNO cell wall invertase and PAL activity was upregulated by glucose and sucrose, but not by non-metabolizable sugars. In HO line no upregulation was detected. To test sugar signaling, cells were treated with protein phosphatase and kinase inhibitors. No differences in response were observed. Generally, data suggest that sugar sensing in sugarbeet cell lines is related to differentiation state of the cell, while sugar signaling pathways seem to be conserved.

OP-26

RAZVOJNO SPECIFIČNI SASTAV PROTEINA I GLIKOPROTEINA U KULTURI TKIVA HRENA *Armoracia lapathifolia* Gilib.

P. Peharec, B. Balen i M. Krsnik-Rasol
Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (ppeharec@zg.biol.pmf.hr, bbalen@zg.biol.pmf.hr, mrasol@zg.biol.pmf.hr)

Biljka, tumor i teratom hrena (*Armoracia lapathifolia* Gilib.) koji rastu u uvjetima *in vitro*, uspoređeni su s obzirom na sastav proteina i glikoproteina. Tumor vrata korijena induciran je na fragmentima lista divljim oktopinskim sojem B6S3 bakterije *Agrobacterium tumefaciens*. Od istog primarnog tumora uspostavljene su dvije linije transformiranoga tkiva: tumorska linija TN, koja raste kao neorganizirani kalus i teratomska linija TM, koja razvija izdanke zadebljalih listova. Stanični proteini lista, teratoma i tumora razdvojeni su elektroforezom u SDS-poliakrilamidnom gelu te 2D elektroforezom. i obojeni bojom Coomassie brilliant blue ili srebrovim nitratom. Reakcija glikoproteina s lektinom ConA (konkanavalin A-peroksidaza) otkrila je glikoproteine s D-manozom i D-glukozom u njihovoj glikanskoj komponenti. Daljnja karakterizacija glikanske komponente provedena je lektinima koji su konjugirani s digoksigeninom: GNA, DSA, PNA, MAA i SNA. Elektroforezom u SDS-poliakrilamidnom gelu otkriveni su sljedeći razvojno specifični proteini lista od približno: 110, 70, 38 i 23 kDa. Tkivo teratoma i tumora sadrži specifične proteine od 115, 33 i 20 kDa dok je onaj od 65 kDa karakterističan za tkivo teratoma. Glikoprotein od oko 66 kDa otkriven lektinom Con A utvrđen je u listu i tumoru, dok je u tkivu teratoma i tumora kvantitativno najjače izražena vrpca na položaju od 45 kDa. Svi glikoproteini koji su reagirali s Con A, reagirali su i s GNA koji prepoznaje terminalnu D-manoznu grupu, posebno

onu koja sadrži Man-á(1-3)-Man jedinicu karakterističnu za visoko manozni tip glikana. Dvodimenzionalna elektroforeza (2D) otkrila je neke tkivno specifične proteinske grupe koje ćemo pobliže analizirati.

DEVELOPMENTALLY SPECIFIC PROTEIN AND GLYCOPROTEIN PATTERNS IN HORSE-RADISH *Armoracia lapathifolia* Gilib. TISSUE CULTURE

P. Peharec, B. Balen and M. Krsnik-Rasol
Department of Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a 6, HR-10000 Zagreb, Croatia (ppeharec@zg.biol.pmf.hr, bbalen@zg.biol.pmf.hr, mrasol@zg.biol.pmf.hr)

In vitro grown horse-radish (*Armoracia lapathifolia* Gilib.) plantlets, tumour and teratoma tissues were compared with regard to protein and glycoprotein patterns. Crown-gall tumours were induced on the leaf fragments with wild octopine strain B6S3 of *Agrobacterium tumefaciens*. From the same primary crown-gall tumour two tissue lines were established: the shoot producing teratoma line (TM) and unorganised tumour line which never expressed any morphogenic capacity (TN). Leaf, teratoma and tumour cellular proteins were separated by SDS-PAGE as well as by 2D electrophoresis and stained with Coomassie brilliant blue or with silver-nitrate. Concavalin A-peroxidase staining detected cellular glycoproteins with D-mannose and D-glucose in their glycan component on 1D protein blots. For further characterisation of glycan component, digoxigenin-labeled lectins GNA, DSA, PNA, MAA and SNA were applied. Developmentally specific proteins of different horse-radish tissue lines were detected by SDS-PAGE, which revealed the 110, 70, 38 and 23 kDa polypeptides only in leaf extracts. Teratoma and tumour tissues had specific proteins of 115, 33 and 20 kDa while the 65 kDa polypeptide was characteristic for teratoma tissue. The glycoprotein of about 66 kDa detected by Con A was present in the leaf and tumour while the 45 kDa one was quantitatively dominant in the teratoma and tumour tissues. All of the Con A-reacting glycoproteins were also detected with GNA, which recognizes terminal D-mannose groups, especially those possessing Man-á(1-3)-Man units present in high-mannose type glycans. The 2D electrophoresis revealed some tissue specific protein groups that have to be closer analyzed.

OP-27

UČINAK SUŠE I POVIŠENOG SALINITETA NA DUBROVAČKU ZEČINU (*Centaures ragusina* L.) U UVJETIMA *in vitro*

S. Radić i B. Pevalek-Kozlina
Botanički zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (sandra@zg.biol.pmf.hr, bpevalek@zg.biol.pmf.hr)

Dubrovačka zečina (*Centaurea ragusina* L.) je endemična hrvatska biljna vrsta s kseromorfnim osobinama koje su nastale kao posljedica njenog prirodnog okoliša – okomite vapnenačke stijene iznad Jadranskog mora. Vodni status, sadržaj iona, malondialdehida (MDA) i prolina, aktivnost katalaze (KAT) i askorbat peroksidaze (APOX) analizirani su u biljkama uzgojenim u uvjetima *in vitro* izloženim solnom i osmotskom stresu. Zakorijenjene biljčice koje su rasle na MS ½ hranjivoj podlozi uz dodatak 150, 300, 450 ili 600 mM soli (NaCl) i 300 mM manitola istražene su nakon 5, 10 i 15 dana. Sve koncentracije NaCl i manitola uzrokovale su smanjenje vodnog statusa biljaka i povišenje mase suhe tvari.. Biljke dubrovačke zečine nakupljale su velike količine natrijevih i kloridnih iona sukladno rastućim koncentracijama soli. Sadržaj prolina povećao se na svim tretmanima i u izdanku i u korijenu biljaka. Porast sadržaja MDA zamijećen je desetog dana u izdanku i korijenu biljaka na svim koncentracijama soli, kao i u izdanku biljaka uzgajanih na manitolu. Aktivnost APOX se u izdancima biljaka izloženih soli smanjila, dok se u korijenu povećala na nižim, a smanjila na višim koncentracijama soli. Manitol je uzrokovao znatno povećanje aktivnosti APOX u izdanku i korijenu tijekom cijelog pokusa. Povećanje aktivnosti KAT zamijećeno je na nižim koncentracijama NaCl i manitola, a smanjenje na višim koncentracijama NaCl. Prikazani rezultati pokazuju da je dubrovačka zečina tolerantnija na solni nego na vodni stres pri čemu je bolja prilagodba omogućena velikom sposobnošću nakupljanja iona.

RESPONSE OF *in vitro* CULTURED ENDEMIC PLANT SPECIES *Centaurea ragusina* L. TO DROUGHT AND SALINITY

S. Radić and B. Pevalek-Kozlina
Department of Botany, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (sandra@zg.biol.pmf.hr, bpevalek@zg.biol.pmf.hr)

Centaurea ragusina L. is an endemic Croatian plant species adapted to life in arid and salt-affected environments. Relative water status, proline, malondialdehyde (MDA) and ion contents as well as ascorbat peroxidase (APOX) and catalase (CAT) activities of *C. ragusina* plants cultured *in vitro* under stress conditions were measured. Rooted plantlets grown on MS ½

nutrient medium supplemented with 150, 300, 450 or 600 mM NaCl and 300 mM mannitol were investigated after 5, 10 or 15 days. Relative water content markedly decreased while dry weight increased under both NaCl and mannitol stresses. *C. ragusina* plants accumulated sodium and chloride ions according to increasing NaCl concentrations. Proline content showed significant increase in *C. ragusina* shoots and roots exposed to both stresses. MDA content showed markedly increased after 10 days both in shoots and roots of salt stressed plants and in shoots of mannitol stressed plants. Inhibition of shoot APOX activity was observed under salt stress while APOX activity in roots increased under lower saline concentrations and decreased under higher NaCl concentrations. Mannitol-stressed plants showed significant increase of APOX activity in both shoots and roots. Activity of CAT was elevated under lower saline concentrations and mannitol, but decreased under higher NaCl concentrations. Presented data confirm better adaptation of *C. ragusina* plants to salinity than drought, indicating its tolerance toward moderate salinity through ion accumulation.

Posterska priopćenja
Posters

P-50
UČINAK TAME NA DIFERENCIJACIJU KROMOPLASTA U LATICAMA KRASTAVCA

T. Prebeg, N. Ljubešić i M. Wrischer
Zavod za molekularnu biologiju, Institut «Ruđer Bošković», Bijenička c. 54, HR-10002 Zagreb, Hrvatska

Iako je svjetlost kod većine biljaka nužna za izgradnju fotosintetskih struktura kloroplasta, smatra se da nije neophodna za morfogenezu kromoplastnih substruktura. Međutim, neka istraživanja ukazuju da svjetlost u procesu kromoplastogeneze može imati regulatornu ulogu. U ovom je radu istražen učinak tame na sadržaj plastidnih pigmenata i diferencijaciju fibrilarnog tipa kromoplasta u laticama krastavca (*Cucumis sativus* L. 'Vert Petit de Paris'). U istraživanjima su korištene latice svježe sakupljenih zelenih (veličine 6 mm) i žuto-zelenih cvjetnih pupova (veličine 8, 10 i 12 mm), a spektrofotometrijske i ultrastrukturne analize načinjene su nakon 2 odnosno 4 dana uzgoja pupova na 150 mM otopini saharoze. Analize plastidnih pigmenata pokazale su da u zelenim pupovima tama potiče nakupljanje karotenoida: količina karotenoida po vjenčiću je nakon 2 dana tretmana bila 37% veća od one u kontrolnim pupovima. U laticama starijih pupova, u kojima je već počela diferencijacija kromoplasta, rast u tami nije pokazivao učinak na karotenogenezu ili je na ovaj proces djelovao inhibitorno. Ultrastrukturnim analizama utvrđeno je da plastidi u tretiranim zelenim pupovima nakon 4 dana sadrže više plastoglobula i fibrila nego kontrolni pupovi, dok kod starijeg stadija nije bilo razlike u stupnju diferencijacije kromoplasta u tretiranim i kontrolnim pupovima. Provedenim istraživanjima utvrđeno je da učinak tame na diferencijaciju kromoplasta u laticama krastavca ovisi o njihovom razvojnom stadiju: u vrlo ranim stadijima tama ima pozitivan učinak na diferencijaciju kromoplasta, dok u starijim pupovima može djelovati i inhibitorno.

THE EFFECT OF DARKNESS ON CHROMOPLAST DIFFERENTIATION IN CUCUMBER PETALS

T. Prebeg, N. Ljubešić and M. Wrischer
Department of Molecular Biology, Ruđer Bošković Institute, Bijenička c. 54, HR-10002 Zagreb, Croatia

Although, in most plants, light is indispensable for the development of chloroplast photosynthetic structures, it is believed that it is not necessary for morphogenesis of chromoplast substructures. However, some studies indicated the regulatory role of light in chromoplastogenesis. In this work, we studied the effect of darkness on the content of plastid pigments as well as on the differentiation of fibrillar type chromoplasts in the petals of cucumber (*Cucumis sativus* L. 'Vert Petit de Paris'). Experiments were performed on freshly collected green flower buds (6 mm in size) and yellow-green buds (8, 10 and 12 mm in size). Spectrophotometric and ultrastructural analyses were carried out after 2 and 4 days of bud growth on 150 mM sucrose solution. Analyses of plastid pigments showed that darkness increased carotenoid accumulation in green flower buds: after 2 days of treatment the content of carotenoids per corolla was 37% higher than in the control buds. In the petals of older buds, in which chromoplast differentiation had already started, darkness had no effect on carotenogenesis or was even inhibitory. Ultrastructural studies showed that the plastids in young green buds treated for 4 days contained more plastoglobules and fibrils than control buds, while there were no differences in the level of chromoplast differentiation between control and treated buds, in older developmental stages. Our studies indicated that the effect of darkness on chromoplast differentiation depends on their developmental stage: darkness has a positive effect on chromoplast differentiation in very young buds, while in older buds it could even be inhibitory.

P-51

AKTIVNOST PEROKSIDAZA U ZDRAVIM I OŠTEĆENIM PLODOVIMA MANDARINE UNSHIU NAKON DVA RAZLIČITA NAČINA SKLADIŠTENJA – SKLADIŠTENJE NA STALNOJ NISKOJ TEMPERATURI I SKLADIŠTENJE NA NISKOJ TEMPERATURI UZ CIKLIČKO PREKIDANJE SKLADIŠTENJEM NA SOBNOJ TEMPERATURI

M. Skendrović[1], H. Lepeduš[2], N. Pavičić[1] i V. Cesar[2]
[1]Zavod za voćarstvo, Agronomski fakultet, Sveučilište u Zagrebu, Svetošimunska 25, HR-10000 Zagreb, Hrvatska (mskendrovic@agr.hr, npavicic@agr.hr), [2]Odjel za Biologiju, Sveučilište J. J. Strossmayer u Osijeku, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska (hlepedus@yahoo.com, vcesarus@yahoo.com)

U radu je istraživan utjecaj skladištenja na stalnoj niskoj temperaturi (CS – 8 tjedana na +1°C), te uz ciklično prekidanje skladištenjem na sobnoj temperaturi (IW – 2 tjedna na +1°C i 1 tjedan na sobnoj temperaturi, 18-

20°C, naizmjence) na pojavu ozljeda uzrokovanih hladnoćom i aktivnost peroksidaza u kori plodova Unshiu mandarine (*Citrus unshiu* Marc.). Prije skladištenja plodovi mandarine bili su uronjeni u vruću vodu (52°C) na 3 minute. Nakon skladištenja mogle su se razlikovati tri klase: zdravi, slabo oštećeni i jako oštećeni plodovi. Skladištenje IW tretmanom dalo je veći udio zdravih plodova (62,5%) za razliku od CS tretmana (26,0%). Udio slabo oštećenih (26,0%) i jako oštećenih (11,5%) bio je manji u IW nego u CS tretmanu (54,2 i 19,8% slabo i jako oštećenih plodova). U oba tretmana (CS i IW) izmjereno je povećanje aktivnosti gvajakol peroksidaza u odnosu na vrijednosti prije početka skladištenja. Peroksidazna aktivnost u zdravim i slabo oštećenim plodovima mandarina bila je veća u onih pod IW nego pod CS tretmanom. U jako oštećenim plodovima mandarina nije bilo razlike u aktivnosti peroksidaza obzirom na primijenjeni tretman skladištenja. Na tretiranim uzorcima provedene su i anatomske analize kore plodova. Može se zaključiti da bi tolerancija plodova Unshiu mandarine na stres uzrokovan pothlađivanjem, koja je inducirana prekidanim izlaganjem plodova sobnoj temperaturi (IW tretman) djelomično mogla biti regulirana aktivnošću gvajakol peroksidaza.

PEROXIDASE ACTIVITY IN THE PEEL OF HEALTHY AND DAMAGED FRUITS OF UNSHIU MANDARIN AFTER THE TWO DIFFERENT APPROACHES OF POSTHARVEST STORAGE –CONTINUOUS CHILLING AND INTERMITTENT WARMING

M. Skendrović[1]*, H. Lepeduš[2], N. Pavičić[1] and V. Cesar[2]
[1]Department of Pomology, Faculty of Agriculture, University of Zagreb, Svetošimunska 25, HR-10000 Zagreb, Croatia, (mskendrovic@agr.hr, npavicic@agr.hr), [2]Department of Biology, University of J. J. Strossmayer, Trg Ljudevita Gaja 6, HR-31000 Osijek, Croatia (hlepedus@yahoo.com, vcesarus@yahoo.com)

The effects of continuous storage at low temperature (CS - 8 weeks at +1 ºC) and intermittent warming cycles (IW - 2 weeks at +1 ºC followed by 1 week at room temperature, 18-20 ºC) on chilling injury appearance and guaiacol peroxidase activity (GPOD) in the peel of Unshiu mandarin (Cirtus unshiu Marc.) fruits were investigated. Previous to the storage, all fruits were dipped in hot water (52 ºC) for 3 minutes. After the storage experiment, three classes of fruits appeared: healthy, slightly damaged and severely damaged fruits. The IW storage yielded the greater percentage of healthy fruits (62.5 %) in respect to the CS (26.0 %). Also, the IW treatment resulted in decreased number of slightly damaged fruits (26.0 %) as well as severely damaged ones (11.5 %) in comparison to the CS (54.2 and 19.8 % of slightly and severely damaged

fruits, respectively). For both treatment types (CS and IW) the increase of the GPOD activity was measured in respect to the initial value. The peroxidase activity in healthy and slightly damaged fruits was higher in the IW than in CS treated samples. In severely damaged fruits, however, there was no difference in peroxidase activity between the two storage treatments. Anatomical analysis of mandarine peel treated samples was performed. It can be concluded that chilling-stress tolerance of Unshiu mandarin fruits induced by intermittent warming might be, at least partly, regulated by GPOD activity.

P-52

VEZANJE DERIVATA INDOL-3-OCTENE KISELINE NA SERUMSKI ALBUMIN

M. Šoškić[1] i V. Magnus[2]
[1]Zavod za kemiju, Agronomski fakultet, Sveučilište u Zagrebu, Svetošimunska c. 25, HR-10000 Zagreb, Hrvatska (msoskic@agr.hr), [2]Institut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (magnus@irb.hr)

Auksini, u koordinaciji s drugim biljnim hormonima, reguliraju praktično sve aspekte rasta i razvoja biljaka. No o načinu njihova djelovanja na molekulskoj razini zna se razmjerno malo. Cilj ove studije bio je istražiti interakcije indol-3-octene kiseline i njenih derivata s ljudskim serumskim albuminom kao modelnim proteinom. Poznato je da serumski albumini specifično vežu indolske spojeve, a u aminokiselinskom slijedu uočene su određene sličnosti s nekim biljnim proteinima koji vežu auksine. Analizom kvantitativnih odnosa između kemijske strukture i relativnih konstanti vezanja indol-3-octenih kiselina na serumski albumin utvrđeno je da hidrofobne interakcije bitno utječu na afinitet. U pravilu, lipofilniji se auksini vežu jače od polarnijih analoga. Alkilne skupine u poziciji 2 indolskog prstena sterički ometaju optimalnu orijentaciju molekule unutar veznog mjesta, dok supstituenti u položaju 6, ako su voluminozniji od fluora, omogućuju snažno vezanje za protein. Supstituenti s elektron-akceptorskim svojstvima pojačavaju vezanje supstituiranih indol-3-octenih kiselina na albumin. Esterifikacija karboksilne skupine, kao ni metiliranje dušika indolskog prstena, ne dovodi do smanjenja afiniteta za protein. Usporedba konstanti vezanja indol-3-octenih kiselina na serumski albumin s njihovim učinkom na rast koleoptile zobi pokazuje da bi receptorsko mjesto u biljaka moglo biti sterički zahtjevnije.

BINDING OF INDOLE-3-ACETIC ACID DERIVATIVES TO SERUM ALBUMIN

M. Šoškić[1] and V. Magnus[2]
[1]Department of Chemistry, Faculty of Agronomy, University of Zagreb, Svetošimunska c. 25, HR-10000 Zagreb, Croatia (msoskic@agr.hr), [2]Department of Molecular Biology, Ruđer Bošković Institute, Bijenička 54, HR-10002 Zagreb, Croatia (magnus@irb.hr)

Auxins, in coordination with other plant hormones, regulate practically all aspects of plant growth and development. However, the mechanism of auxin action is still poorly understood. The main goal of this study was to explore the interactions of indole-3-acetic acid and its derivatives with human serum albumin as a model protein. It is known that serum albumins specifically bind indolic compounds and, in their amino acid sequences, share certain analogies with some auxin-binding proteins of plant origin. Correlation of the relative binding constants of indole-3-acetic acids to serum albumin with structural and physico-chemical descriptors reveals that affinities are dominantly influenced by hydrophobic interactions. As a rule, more lipophilic auxins bind more strongly than more polar analogues. Alkyl groups at indole ring position 2 obstruct proper orientation of the molecules within the binding site, while substituents at position 6, if they are more voluminous than fluorine, favor strong binding to the protein. Electron withdrawing substituents enhance the binding affinities of these compounds for the protein. Esterification of the carboxyl group as well as methylation of the indole-ring nitrogen does not lead to reduced binding affinities. Comparison of the binding constants of indole-3-acetic acids to human serum albumin with their growth promoting activities in *Avena* coleoptiles indicates that the putative plant receptor is sterically more demanding.

P-53

VEZANJE AMINOKISELINSKIH KONJUGATA AUKSINA NA SERUMSKI ALBUMIN

A. Tomašić[1], M. Šoškić[2] i V. Magnus[1]
[1]Zavod za molekularnu biologiju, Institut Ruđer Bošković, HR-10002 Zagreb, pp 180, Hrvatska (atomasic@irb.hr, magnus@irb.hr), [2]Zavod za kemiju, Agronomski fakultet, Svetošimunska cesta 25, HR-10000 Zagreb, Hrvatska (msoskic@agr.hr)

Biljni hormon (auksin), indol-3-octena kiselina (IAA), također nastaje

u metabolizmu bakterija, životinja i čovjeka i, u svim tim organizmima, aminokiselinski konjugati su njeni uobičajeni metaboliti. Njihova interakcija s ljudskim serumskim albuminom (HSA) zaslužuje pažnju *1.* kao osnova za kromatografske metode izolacije iz prirodnog materijala, *2.*kao jednostavni model za interakciju auksinskih konjugata s teško pristupačnim biljnim proteinima, *3.* kao nužni korak prema boljem razumjevanju farmakodinamike auksina u ljudskom organizmu, što je od interesa jer su slobodni auksini perspektivni eksperimentalni lijekovi u terapiji raka, a klinička primjena dolazi u obzir samo ako uspijemo zaobići štetne nuspojave koje nastaju dugotrajnim izlaganjem. Vezanje liganada na HSA istraživali smo viskotlačnom tekućinskom kromatografijom (HPLC) uz upotrebu stupca u kojem je taj protein vezan na silikagel kao nosač.Ispitali smo IAA, njene više homologe indol-3-propionsku kiselinu i indol-3-maslačnu kiselinu, i njene konjugate s 11 proteinskih aminokiselina i 10 njihovih izomera. Svi ti spojevi pokazuju veća retencijska vremena nego KNO_3 koji prolazi s 'mrtvim' ('praznim') volumenom otapala. To dokazuje reverzibilno vezanje na HSA. Retencijska vremena ovise o razmaku između terminalne karboksilne skupine i centra lipofilnog ostatka. Sve dok se taj parametar ne mijenja, postoji očita korelacija s ukupnom lipofilnošću, koju smo procijenili na temelju kromatografskih svojstava na stupcu silikagela koji nosi stacionarnu C_{18}-fazu, i računskim metodama. U nekim slučajevima se na stupcu HSA razdvajaju konjugati IAA s L-aminokiselinama od njihovih izomera koji sadrže odgovarajuće D-aminokiseline.

BINDING OF AUXIN-AMINO ACID CONJUGATES TO SERUM ALBUMIN

A. Tomašić[1], M. Šoškić[2] and V. Magnus[1]
[1]Department of Molecular Biology, Ruđer Bošković Institute, HR-10002 Zagreb, P.O.Box 180, Croatia (atomasic@irb.hr, magnus@irb.hr), [2]Department of Chemistry, Faculty of Agronomy, Svetošimunska cesta 25, HR-10000 Zagreb, Croatia (msoskic@agr.hr)

The plant auxin, indole-3-acetic acid, also arises in bacterial, animal, and human metabolism and, in all these organisms, amino acid conjugates are its common metabolites. Their interaction with human serum albumin (HSA) is of interest *1.* as a base for chromatographic separation methods, *2.* as a readily available model helping to comprehend the interaction of auxin conjugates with plant proteins which are difficult to access, *3.* as a step towards better understanding of auxin pharmacodynamics in humans, which is required because free auxins are promising experimental cancer therapeutics, but their clinical application can only be considered if the adverse effects of long-term

exposure can be circumvented. Ligand-binding to HSA was investigated by high-pressure liquid chromatography (HPLC) using a column in which this protein was immobilized on a silica gel support. IAA, its higher homologues, indole-3-propionic acid and indole-3-butyric acid, and its conjugates with 11 protein amino acids and 10 of their isomers were tested. All these compounds had larger retention times than KNO_3 which is eluted with the void volume. This proves their general affinity to HSA. Retention times were dependent on the distance between the acidic head group and the center of the lipophilic residue. When this was kept constant, there was an obvious correlation with overall lipophilicity as estimated from chromatographic properties on a column of C_{18}-coated silica gel and by computational methods. In some cases, the HSA column separated IAA conjugates with L-amino acids from their isomers containing the corresponding D-amino acid moieties.

BIOLOGIJA ŽIVOTINJA
BIOLOGIA ANIMALIUM
ANIMAL BIOLOGY

Kratka usmena priopćenja
Oral Presentations

OP-28
HRVATSKA ENDEMIČNA STIGOBIONTSKA SLATKOVODNA SPUŽVICA NE PRIPADA RODU *Eunapius*

M. Harcet[1], H. Bilandžija[2], J. Bedek[2] i V. Gamulin[1]
[1]Zavod za molekularnu biologiju, Institut Ruđer Bošković, Bijenička cesta 54, HR-10000 Zagreb (matija.harcet@irb.hr, gamulin@irb.hr) [2]Hrvatsko biospeleološko društvo, Demetrova 1,HR-10000 Zagreb, Hrvatska (helena_bilandzija@yahoo.com, jana.bedek@inet.hr)

Slatkovodna spužvica koja nastanjuje kraške špilje u okolici Ogulina, opisana još 1986 godine kao *Eunapius subterraneus* (Sket i Velikonja, 1986, Stygologia 2, 254-266), je do sada jedini poznati obligatni stanovnik podzemnih voda iz koljena Porifera, pa je stoga jedinstvena u svijetu. Dvadeset godina star taksonomski položaj endemične stigobiontske spužve temeljen je ponajviše na morfologiji spikula. U svrhu bolje karakterizacije spužve *E. subterraneus*, proveli smo genetičke analize i odredili primarne strukture 18S rDNA, ITS2 (internal transcribed region 2) i mitohondrijskog gena za citokrom oksidazu I (COI), te usporedili s poznatim podacima za slatkovodne spužve iz obitelji *Spongillidae*. Genetičke analize nedvojbeno isključuju pripadnost ove spužve rodu *Eunapius*. *E. subterraneus* pokazuje daleko veću genetičku srodnost sa spužvama iz roda *Ephydatia.* Zbog jedinstvenih promjena u primarnoj strukturi dijagnostičkih regija DNA, smatramo da je hrvatska endemična špiljska spužva jedini do sada opisani pripadnik novog roda i predlažemo da se nazove *Croatospongia subterranea*.

CROATIAN ENDEMIC STYGOBITIC FRESHWATER SPONGE DOES NOT BELONG TO THE GENUS *Eunapius*

M. Harcet[1], H. Bilandžija[2], J. Bedek[2] and V. Gamulin[1]
[1]Ruđer Bošković Instutute, Bijenička c. 54, HR-10000 Zagreb, Croatia (matija.harcet@irb.hr, gamulin@irb.hr) [2]Croatian Biospeleological Society, Demetrova 1, HR-10000 Zagreb, Croatia (helena_bilandzija@yahoo.com, jana.bedek@inet.hr)

Freshwater sponge which inhabits karst caves around Ogulin was described in 1986 as *Eunapius subterraneus* (Sket and Velikonja (1986) Stygologia 2, 254-

266). So far it is the only known obligatory inhabitant of underground waters from the phylum Porifera and is therefore unique in the world. Twenty years old taxonomic position of this endemic stygobitic sponge is based primarily on the morphology of spicules. In order to better characterize this sponge, we have performed genetic analysis and determined primary structures of 18S rDNA, ITS2 (internal transcribed region 2) and cytochrome oxidase I (COI) mitochondrial gene. DNA sequences of the 3 diagnostic DNA regions were compared with the same DNA sequences from freshwater sponges belonging to the family *Spongilidae*. Our genetic analyses undoubtedly exclude this sponge from the genus *Eunapius*. *E. subterraneus* shows much higher genetic similarity with sponges from the genus *Ephydatia*. However, due to the unique changes in the primary structure of diagnostic DNA regions, this unique Croatian endemic sponge should be considered as the only known member of a new genus. We therefore propose to be renamed to *Croatospongia subterranea*.

OP-29

ŠIRENJE AZIJSKOG TIGRASTOG KOMARCA, *Stegomyia albopicta* (*Aedes albopictus*) U HRVATSKOJ

A. Klobučar[1], N. Benić[1], D. Krajcar[1], V. John[1], E. Merdić[2], I. Boca[2], N. Landeka[3], T. Žitko[4] i J. Čulig[1]
[1]Zavod za javno zdravstvo grada Zagreba, Mirogojska c. 16, HR-10000 Zagreb, Hrvatska (ana.klobucar@publichealth-zagreb.hr), [2]Zavod za biologiju, Sveučilište J. J. Strossmayera u Osijeku, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska (enrih@ffos.hr), [3]Zavod za javno zdravstvo Istraske županije, Nazorova 21, HR-52100 Pula, Hrvatska (ddd@zzjziz.hr), [4]IZavod za javno zdravstvo Splitsko-dalmatinske županije, Vukovarska 46, HR-21000 Split, Hrvatska (tzitko@yahoo.com)

Stegomyia albopicta (*Aedes albopictus*) (Skuse, 1894), ili azijski tigrasti komarac, biološki je i zdravstveno značajna vrsta komaraca čije se širenje u svijetu pažljivo prati u poslijednjih dvadesetak godina. Prisutna je u susjednoj Italiji (15 godina) i Crnoj Gori (5), stoga je širenje na područje Hrvatske bilo očekivano. Vrsta *St. albopicta* zabilježena je u Hrvatskoj prvi put u Zagrebu u listopadu 2004. Ličinke vrste prikupljene su iz umjetnog legla u šumi. Novi nalaz u Zagrebu slijedio je godinu dana kasnije kada su kukuljice i odrasle jedinke uzorkovane iz rabljenih guma u skladišnom prostoru tvrtke koja uvozi gume iz sjeveroistočne Italije. U istom razdoblju, u rujnu i listopadu 2005., azijski tigrasti komarac pronađen je u brojnim mjestima duž Jadranske obale. U Istri je pronađen u osam gradova na zapadnoj obali poluotoka. Ličinke su

pronađene u različitim umjetnim leglima uključujući rabljene gume dovežene iz Slovenije i Italije ili morskim putem iz drugih zemalja. U Dalmaciji, vrsta *St.albopicta* je pronađena u Zadru, Splitu i Dubrovniku. U gradovima Dalmacije mjesta pronalaska su smještena u blizini gradskih luka što upućuje na dolazak komarca morskim prijevozom. Kako bi zaustavili širenje azijskog tigrastog komarca, Zavodi za javno zdravstvo pojedinih županija i grada Zagreba, te Odjel za biologiju Osječkog Sveučilišta pripremili su programe daljnjeg istraživanja i suzbijanja, te upoznavanja građana o ovoj napasnoj vrsti. U radu će biti prikazani rezultati istraživanja tijekom 2006. godine.

SPREADING OF THE ASIAN TIGER MOSQUITO, *Stegomyia albopicta* (*Aedes albopictus*) IN CROATIA: AN OVERVIEW

A. Klobučar[1], N. Benić[1], D. Krajcar[1], V. John[1], E. Merdić[2], I. Boca[2], N. Landeka[3], T. Žitko[4] and J. Čulig[1]
[1]Zagreb Institute of Public Health, Mirogojska c. 16, HR-10000 Zagreb, Croatia (ana.klobucar@publichealth-zagreb.hr), [2]University of J.J. Strossmayer, Department of Biology, Trg Ljudevita Gaja 6, HR-31000 Osijek, Croatia (enrih@ffos.hr), [3]Institute of Public Health, Nazorova 21, HR-52100 Pula, Croatia (ddd@zzjziz.hr), [4]Institute of Public Health, Vukovarska 46, HR-21000 Split, Croatia (tzitko@yahoo.com)

Stegomyia albopicta (*Aedes albopictus*) (Skuse, 1894), also known as the Asian tiger mosquito, is a species whose spreading has been carefully monitored during the recent years due to its biological and health importance. Since the species has been observed during the past 15 years in neighbouring countries Italy and Monte Negro, the spread of the Asian tiger mosquito to Croatia has been expected. In Croatia, *St. albopicta* was first recorded in Zagreb in October 2004. The larvae were collected in an artificial breeding site in a forest. In October 2005 both adults and pupae of *St. albopicta* were sampled in used tires imported from the northeastern Italy. In September and October 2005, the mosquito was recorded at a number of locations along the coast. In Istria, the species was found at eight locations on the western coast. The larvae were found in different types of artificial breeding sites including used tires transported either from Slovenia and Italy or by the sea traffic. In Dalmatia, *St. albopicta* was recorded in Zadar, Split and Dubrovnik. In all cases detection sites were located near the city harbours, suggesting the arrival of mosquito by the oversea traffic. In order to keep the spread of the Asian tiger mosquito under control, Public Health and University Institutes have been preparing research and educational programs and strengthening measures for the mosquito control. Finally, overview of *St. albopicta* discoveries and mosquito control activities in 2006 is presented.

OP-30

MORFOMETRIJSKE ZNAČAJKE I RAST U VRSTE *Austropotamobius torrentium* SCHRANK

I. Maguire, G. Klobučar, J. Lajtner, A. Lucić, A. Štambuk i R. Erben
Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (imaguire@public.srce.hr)

Rak kamenjar (*Austropotamobius torrentium* Schrank) je jedna od četiri autohtone vrste rakova iz porodice Astacidae koja živi u slatkovodnim ekosustavima Hrvatske. Ugrožen je i zakonom zaštićen, a kako se ne zna dovoljno o njegovoj morfometriji i rastu na našim područjima, svrha istraživanja je bila proučiti ih. Izabrana je populacija koja živi u potoku Kraljevec (južni obronci Medvednice). Rakovi su lovljeni posebno izrađenim vršama s mamcem 2 puta mjesečno (od listopada 1998. do travnja 2000). Kako bi mogli procijeniti prirast raka kamenjara ulovljenim životinjama je određivan spol, mjerene su neke dužinske značajke, kao i težina, zatim su obilježavane i puštane natrag u potok. U istraživanom razdoblju ulovljeno je ukupno 653 životinja (306 ženki i 347 mužjaka). Utvrđena je jaka pozitivna korelacija između težine i dužinskih značajki u oba spola, kao i značajna razlika u dužinskim značajkama i težini između mužjaka i ženki što je posljedica spolnog dimorfizma kod spolno zrelih životinja. Utvrđeno je da su mužjaci narasli pri presvlačenu prosječno 0,53 cm, a ženke 0,51cm. Prosječni prirast u težini za mužjake je bio 2,9 g, a za ženke 1,78 g. Dobiveni rezultati oprskbljuju informacijama koje se mogu iskoristiti u budućim planovima zaštite.

MORPHOLOGICAL CHARACTERISTICS AND GROWTH OF *Austropotamobius torrentium* SCHRANK

I. Maguire, G. Klobučar, J. Lajtner, A. Lucić, A. Štambuk and R. Erben
Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (imaguire@public.srce.hr)

Stone crayfish (*Austropotamobius torrentium* Schrank) is the smallest species in Astacidae family that is native to the freshwater habitats in Croatia. It is highly endangered and it is protected by the Law. Since little is known about it's morphometrics and growth in this region, ~~so~~ the aim of our research was to study it. The chosen population lives in the Kraljevec Stream (southern slope of the Mount Medvednica). The sampling of the animals was carried with

baited traps twice a month (from October 1998 until April 2000). In order to estimate the growth rates, caught crayfish were sexed, weighted, measured and marked, and then released back into the stream. In the period of sampling we caught 653 animals (306 females and 347 males). We found strong positive correlation between weight and size for both males and females. Males and females differed significantly in their weight and size what is a consequence of sexual dimorphism between sexually mature individuals. The average length growth per moult was 0,53 cm and 0,51 cm, for males and females, respectively. The average weight gain per moult was 2,9 g and 1,78 g , for males and females, respectively. The obtained results could be used for future protection management.

OP-31
MONITORING ZIMSKIH KOLONIJA ŠIŠMIŠA

I. Pavlinić[1], K. Čivić[2] i R. Topić[2]
[1]Zoološki odjel, Hrvatski prirodoslovni muzej, Demetrova 1, HR-10000 Zagreb, Hrvatska (igor.pavlinic@hpm.hr), [2]Državni zavod za zaštitu prirode, Savska 41/23, HR-10000 Zagreb, Hrvatska (kristijan.civic@dzzp.hr; ramona.topic@dzzp.hr)

Tijekom zime 2005/2006 praćeno je stanje zimskih kolonija šišmiša u tri podzemna objekta: Vištičinoj jami, Matešića špilji i špilji Kuštrovki. Vištičina jama i špilja Kuštrovka staništa su najvećih zimskih kolonija dugokrilog pršnjaka (*Miniopterus schreibersi*) u Hrvatskoj. Ove kolonije ujedno su i među najvećima u Europi, a njihov monitoring od izuzetnog je značaja za utvrđivanje povoljnog statusa zaštite ovih vrsta, kao i za utvrđivanje vrijednosti ovih objekata u europskim razmjerima. U Matešića špilji praćena je zimska kolonija velikog potkovnjaka (*Rhinolophus ferrumequinum*), vrste koja je u Hrvatskoj prema IUCN kriterijima kategorizirana kao potencijalno ugrožena (NT). Tijekom redovnih obilazaka sve tri špilje procjenjivana je brojnost praćenih kolonija te utvrđivane dodatne vrste šišmiša koje koriste objekt tijekom perioda hibernacija, na temelju čega su napravljene i procjene bioraznolikosti faune šišmiša pomoću Shannon-ovog indeksa. Dodatno, redovito su prikupljani podaci o temperaturi i relativnoj vlažnosti unutar objekata na mjestima blizu kolonija kako bi se utvrdile vrijednosti praćenih parametara ključne za korištenje objekata, kao i njihove eventualne promjene.

MONITORING OF THE BAT HIBERNATION SITES

I. Pavlinić[1], K. Čivić[2] and R. Topić[2]
[1]Department of Zoology, Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia (igor.pavlinic@hpm.hr), [1]State Institute for Nature Protection, Savska cesta 41/XXIII, HR-10000 Zagreb, Croatia (kristijan.civic@dzzp.hr; ramona.topic@dzzp.hr)

During the winter 2005/2006 wintering bat colonies in three underground objects have been monitored: Vištičina Pit, Matešića Cave and Kuštrovka Cave. Vištičina Pit and Kuštrovka Cave are sites inhabited by the biggest wintering colonies of the Schreiber's bat (*Miniopterus schreibersi*) in Croatia. These colonies are amongst the biggest European colonies, and their monitoring is of great importance for determining the favourable conservation status of species concerned, as well as for evaluation of these underground objects in European context. In Matešića cave wintering colony of the Greater Horseshoe bat (*Rhinolophus ferrumequinum*) has been monitored, a species categorized as Nearly Threatened (NT) in Croatia according to the IUCN criteria. During regular visits of all three caves number of individuals in monitored colonies has been assessed and other bat species which use these objects for hibernation have been determined as well. Based on these data bat-fauna diversity has been assessed using Shannon Index. Data on temperature and relative humidity in the vicinity of colonies has been collected on a regular basis, in order to determine parameter values crucial for use of these objects by bats, as well as their possible changes.

OP-32

RAZNOLIKOST OBALČARA (INSECTA: PLECOPTERA) NA PODRUČJU NP PLITVIČKA JEZERA TE RIJEKA CETINE, KRKE, ZRMANJE, KRUPE I UNE

A. Popijač[1] i I. Sivec[2]
[1]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (apopijac@zg.biol.pmf.hr), [2]Prirodoslovni muzej Slovenije, Prešernova 20, p.p. 290, SI-1001 Ljubljana, Slovenija (isivec@pms-lj.si)

Obalčari pripadaju vodenim kukcima koji kao ličinke žive u vodi, a kao odrasle jedinke žive na kopnu. Pošto se njihove ličinke smatraju među najosjetljivijima na zagađenje i promjenu konfiguracije kopnenih voda, obalčari predstavljaju jednu od najvažnijih skupina indikatorskih makrozoobentoskih organizama u

biološkim metodama procjene stupnja onečišćenja prirodnih voda. Da bi se te metode mogle ispravno primjenjivati potrebno je istražiti i kartirati faunu obalčara u Hrvatskoj. Ovim radom htjeli bi doprinijeti ostvarenju toga cilja i potaknuti detaljnija istraživanja obalčara u Hrvatskoj. Rasprostranjenost i zoogeografija europskih obalčara dosta su istražene, ali to nije slučaj za sva područja bivše Jugoslavije. Relativno su dobro poznati obalčari u Sloveniji, Bosni i Hercegovini te Makedoniji, dok su samo fragmentarni podaci dostupni za ostala područja bivše Jugoslavije. Skoro nikakvih objavljenih znanstvenih podataka nema s područja Hrvatske. Temeljita i sistematična obrada te skupine kukaca do sada je izostala s ovih prostora. Odsutnošću materijala pokazalo se nemogućim revidirati neke rijetke starije podatke pa ih zato možemo i zanemariti, zajedno s novijim podacima ekoloških istraživanja temeljenih samo na problematičnoj determinaciji ličinačkih stadija. Trenutno je za područje Hrvatske u znanstvenoj literaturi potvrđena prisutnost samo 28 vrsta obalčara. To je najvjerojatnije samo manji dio stvarno prisutnih vrsta u Hrvatskoj, pošto je npr. za susjednu Sloveniju poznato oko 100 vrsta obalčara. Ta brojka ju, obzirom na površinu, uvrštava među općenito najbogatija i najraznolikija područja u Europi. Pošto se i Hrvatska nalazi na dodiru više limnogeografskih regija Europe, može se očekivati pronalazak još mnogih za Hrvatsku nezabilježenih vrsta obalčara, a možda i nekih novih i endemskih vrsta. Najnovija istraživanja potvrđuju takve pretpostavke.

DIVERSITY OF STONEFLIES (INSECTA: PLECOPTERA) IN THE AREA OF NP PLITVIČKA JEZERA AND RIVERS CETINA, KRKA, ZRMANJA, KRUPA AND UNA

A. Popijač[1] and I. Sivec[2]
[1]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (apopijac@zg.biol.pmf.hr), [2]Slovenian Museum of Natural History, Prešernova 20, p.p. 290, SI-1001 Ljubljana, Slovenia (isivec@pms-lj.si)

Stoneflies are ecologically important order of aquatic insects widely used by the environmental monitoring agencies as bioindicators to assess water quality. Their aquatic larvae are very sensitive to water pollution but their terrestrial adults are also important for proper species identification. Aim of this work is to investigate the diversity and the distribution of stoneflies in Croatia, and to induce numerous future stonefly researches. Distribution and the zoogeography of European stoneflies are relatively well known but this is not the case for all parts of former Yugoslavia. For Slovenia, Bosnia and Herzegovina and Macedonia we have relatively good data, whereas only fragmentary data are

available from the other regions of former Yugoslavia and almost none from the territory of Croatia. Due to lack of material, it is practically impossible to revise several old records. We have therefore ignored them together with recent data of ecological studies based only on the unreliable determination of larval stages. Stonefly fauna of Croatia is poorly known with only 28 species of Plecoptera so far officially recorded. Most likely, this number represents just a small part of actually present species in Croatia because e.g. for neighboring Slovenia about 100 stonefly species are known. By this number, Slovenia is one of the areas with richest and most diverse stonefly fauna in Europe. As Croatia contacts to several Limno-geographical regions (Illies, 1978) too, many additional stonefly species for Croatia should be found, as maybe some endemic species and new to science too. Most recent investigations of stoneflies in Croatia confirm these assumptions.

OP-33

FAUNA I EKOLOGIJA LAŽIŠTIPAVACA (PSEUDOSCORPIONES) U HRVATSKOJ

R. Ozimec
Hrvatsko biospeleološko društvo (HBSD), Demetrova 1, HR-10000 Zagreb, Hrvatska (roman.ozimec@zg.t-com.hr)

Istraživanja lažištipavaca Hrvatske provode se od 1846. godine kroz 4 razdoblja. U 160 godina djelovala su 92 sakupljača i 20 arahnologa, a radove je publicirao 41 autor s ukupno gotovo 100 referenci. Analiza faune izrađena je obradom publiciranih i nepubliciranih literaturnih podataka, popisa, osobnih kontakata, obradom postojećih zbirki, te vlastitim terenskim istraživanjem i analizom zbirke od preko 1100 primjeraka lažištipavaca iz više od 250 speleoloških objekata i epigejskih nalazišta. Uz nove biogeografske podatke, utvrđene su svojte nove za faunu Hrvatske, mnoge su nađene prvi puta nakon opisa, a svojte nove za znanost, nisu uključene u ovu analizu. Utvrđeno je 109 svojti svrstanih u 5 nadporodica, 10 porodica i 26 rodova. Za svaku su utvrđeni sinonimi, tipsko nalazište, opća rasprostranjenost i rasprostranjenost na području Hrvatske, endemizam, ekologija i IUCN kategorija. Čak 83 % svojti pripada porodicama Chthoniidae i Neobisiidae, što ističe Hrvatsku kao jednog od centara razvoja ovih porodica. Gotovo 55 % su špiljski oblici, a od 43 svojte opisane iz Hrvatske 80 % je špiljskih. Gotovo 80 % svojti ima higrofilan karakter. Regionalni raspored lažištipavaca je izrazito neravnomjeran i najveći se udio od 85 % svojti nalazi na području Mediteranske makroregije u kojoj se kao centar bioraznolikosti i endemizma ističe Biokovo. Prema IUCN kategorizaciji oko 8 % svojti je kritično ugroženo ili najvjerojatnije

izumrlo, dok je oko 25 % svojti rizično i ugroženo. U Hrvatskoj obitava preko 3 % svjetske faune lažištipavaca, koja sadrži čak 1 % endema Hrvatske, što je jedinstveno za našu faunu.

FAUNA AND ECOLOGY OF PSEUDOSCORPIONS (PSEUDOSCORPIONES) IN CROATIA

R. Ozimec
Croatian Biospeleological Society (CBS), Demetrova 1, HR-10000 Zagreb, Croatia (roman.ozimec@zg.t-com.hr)

The research of pseudoscorpions in Croatia since 1846 year is divided into four periods. In 160 years it was performed by 92 collectors and 20 arachnologists, with almost 100 references published by 41 authors. Analyses have been performed according to all available published and unpublished references, lists, personal contacts and taxonomical survey of collections, same as field work. Pseudoscorpion Collection from more than 250 speleological and epigeic localities with more than 1100 specimens has been establishing. Beside many new biogeographically data, some taxa first time after description have been find, same as taxa new for Croatian fauna. Taxa new for science have been find too, but not included into analyses. Totally, 109 taxa have been established, distributed into 5 Super families, 10 Families and 26 genera. For all taxa are detected: synonymy, typical locality, general distribution and distribution for Croatia, endemism, ecology and IUCN category. Even 83 pct belong to two Families only: Chthoniidae and Neobisiidae, what indicated Croatia as one of develop centre of these Families. Cave-dwelling taxa are represented with 55 pct. From Croatia 43 taxa are described, 80 pct of them cave-dwelling. Even 80 pct have hydrophilic character. Distribution is very unequal with 85 pct in Mediterranean makroregion, indicated Biokovo Mt. as centre of biodiversity. According IUCN categorisation 8 pct are Critically Endangered or Extinct, 25 pct are Vulnerable and Endangered. Croatia is populated with more than 3 pct of word fauna, contain more than 1 pct Croatian endems, what is unique in Croatian fauna.

OP-34
SUBTERRANEAN AND SPRINGS SNAILS (MOLLUSCA: GASTROPODA) FROM GORJANCI AND ŽUMBERAČKA GORA

R. Slapnik
Institute of Biology, The Scientific Research Centre of the Slovenian Academy

of Sciences and Arts, Novi trg 2, p. box 306, SI-1001 Ljubljana, Slovenia (RajkoSl@zrc-sazu.si)

The Slovene Gorjanci and the Croatian Žumberačka Gora represent a uniform plateau of hills stretching 45 km from the south-west towards the northeast along the border with Croatia. Large subterranean karst objects are located on them, such as caves, abysses and karst springs. In them live land (troglobiont) and water (stigobiont) subterranean and spring snails. Malacological research in the caves and springs during 2003-2004 for the first time embraced the entire area of Žumberačka gora and the Gorjanci. Twenty-six caves and abysses, of which a fair number were newly discovered, and 68 springs were sampled. The fauna of subterranean and spring snails (Gastropoda) in the area of Žumberačka gora and the Gorjanci is rich. Six stigobiont species (Hydrobiidae: Prosobranchia) were ascertained: *Bythiospeum (Paladilhiopsis) grobbeni grobbeni* (Kuščer 1928), *Bythiospeum (Paladilhiopsis) kostanjevicae* (SCHÜTT 1970), *Iglica (Iglica) gracilis* (Clessin 1882), *Iglica (Iglica) langhofferi* A.J. WAGNER 1928, *Hauffenia media* Bole 1961 and Hadziella thermalis Bole 1992. Of troglobiont species (Carychiidae: Pulmonata) *Zospeum isselianum* Pollonera 1886 and *Zospeum subobesum* Bole 1974 were found. The malacofauna in the numerous springs sampled is richest. Certain species of the families *Belgrandiella* A. J. WAGNER 1928, *Graziana* RADOMAN 1975, *Sadleriana* CLESSIN 1890, *Marstoniopsis* VAN REGTEREN ALTENA 1936 and *Bythinella* MOQUIN-TANDON 1856 are dominant species in individual springs.

Posterska priopćenja
Posters

P-54
MEIOFAUNA U ZAJEDNICAMA RAZLIČITIH TIPOVA MAKROFITA U SPOROTEKUĆEM KANALU

I. Bogut, J. Vidaković, G. Palijan i D. Čerba
Odjel za biologiju, Sveučilišta Josipa Juraja Strossmayera, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska, (ibogut@ffos.hr, javidako@inet.hr, gpalijan@ffos.hr, dcerba@vip.hr)

Svrha istraživanja bila je utvrditi utjecaj različitih tipova makrofita (obzirom na razlike u arhitekturi listova), na brojnost i raznolikost fitofilne meiofaune. Istraživane su asocijacije meiofaune i zajednice četiri različita tipa makrofitske vegetacije (*Nymphoides peltata, Ceratophyllum demersum, Polygonum amphibium* i *Carex* sp.), u kanalu Čonakut, u Parku prirode Kopački rit, Hrvatska, tijekom dvije vegetacijske sezone: od lipnja do listopada 2001. i od travnja do srpnja 2002. godine. Brojnost meiofaune kretala se od najveće (24266.9 jed. 100 g^{-1} suhe biomase makrofite) u zajednici sa *C. demersum* - submerznom biljkom tankih rascijepljenih listovia; zatim 21424.8 jed. 100 g^{-1} suhe biomase makrofite u zajednici s *P. amphibium*, amfibijskom vrstom cjelovitih listova, koja se tijekom provedenog istraživanja nalazila pod vodom; slijedeća po brojnosti bila je associjacija makrofaune sa *Carex* sp. (10067.1 jed. 100 g^{-1} suhe biomase makrofite), emerznom vrstom dugih cjelovitih listova koja je također bila pod vodom za vrijeme uzorkovanja; te najmanja u asocijaciji s *N. peltata* (samo 3759.2 jed. 100 g^{-1} suhe biomase makrofite), flotantnom vrstom cjelovitih listova. Statistički značajna razlika (k-krivulje dominantnosti, ANOVA i LSD post-hoc test, df=3.60, F=1.626, $p<0.05$) u brojnosti meiofaune utvrđena je između zajednica *C. demersum* i *N. peltata*. Ukupno je zabilježeno 15 taksonomskih grupa meiofaune (sedam privremenih i osam stalnih). Najmanja raznolikost, 12 grupa, zabilježena je u asocijaciji sa *C. demersum*, dok je u ostale tri zjednice zabilježena jednaka brojnost, 14 grupa. Predstavnici privremene meiofaune - ličinke kukaca, većinom hironomidne ličinke (30% -40%) i maločetinaši (24%-47%), skupine karakteristične za eutrofne vode, bile su dvije najbrojnije skupine u svim zajednicama tijekom cijelog razdoblja istraživanja, osim u zajednici s *N. peltata*, gdje su dominirali predstavnici rašljoticalaca (67%), a potom ličinke kukaca i maločetinaši.

MEIOFAUNA IN PURE STANDS OF VARIOUS MACROPHYTE TYPES IN A SLOW-FLOWING CHANNEL

I. Bogut, J. Vidaković, G. Palijan and D. Čerba
Department of Biology, University of Josip Juraj Strossmayer, Trg Ljudevita Gaja 6, HR-31000 Osijek, Croatia, (ibogut@ffos.hr, javidako@inet.hr, gpalijan@ffos.hr, dcerba@vip.hr)

The purpose of the study was to determine the influence of various macrophyte types, i. e. different macrophyte arhitecture on the abundance and diversity of phytophilous meiofauna. The meiofauna communities in association with pure stands of four different macrophyte types (*Nymphoides peltata, Ceratophyllum demersum, polygonum amphibium* and *Carex* sp.) were studied in the slow-flowing, eutrophicated Čonakut Channel, within the Kopački rit Nature Park, Croatia, during two vegetation seasons: between June and October 2001, and between April and July 2002. Meiofaunal densities in order of magnitiude were: in association with *C. demersum* (21424.8 ind. 100 g^{-1} d.w.), submerged species with fine dissected leaves; with *P. amphibium* (21424.8 ind. 100 g^{-1} d.w.), amphibian species with undissected, willow-like leaves, which stands of were under water during the investigation period; with *Carex* sp. (10067.1 ind. 100 g^{-1} d.w.), emerged species, with long undissected leaves, which was also completely below water surface during the sampling period; and with *N. peltata* (only 3759.2 ind. 100 g^{-1} d.w.), flotant species with undissected leaves. The meiofaunal densities for different macrophyte types showed a significant variation between *N. peltata* and *C. demersum* stands according to k-dominance curves and ANOVA, followed by LSD post-hoc test ($df = 3,60$, $F = 1.626$, $p < 0.05$). A total of 15 meiofauna groups (seven temporary and eight permanent) was found. The lowest diversity, 12 groups, was recorded in the association with *C. demersum*, whereas 14 meiofauna groups were found in all other stands. Representatives of temporary meiofauna – Insecta larvae, mostly representatives of the family Chironomidae (between 30% and 46%) and Oligochaeta (between 24% and 47%), characteristic meiofaunal groups for eutrophic waters, were the most abundant groups recorded during entire investigated period in all stands of macrophytes, except in *P. amphibium* where permanent meiofaunal group – Cladocera (67%) dominated, and Insecta larvae (11%) and Oligochaeta (10%) were second in dominance.

P-55

BROJNOST I RAZNOLIKOST FITOFILNE MAKROFAUNE U KANALU ČONAKUT, PARK PRIRODE KOPAČKI RIT, HRVATSKA

I. Bogut, J. Vidaković, D. Čerba i G. Palijan
Odjel za biologiju, Sveučilišta Josipa Juraja Strossmayera, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska, (ibogut@ffos.hr, javidako@inet.hr, gpalijan@ffos.hr, dcerba@vip.hr)

U kanalu Čonakut, u Parku prirode Kopački rit, tijekom dvije vegetacijske sezone (lipanj-listopad 2001. i travanj-srpanj 2002.), istraživani su brojnost i sastav makrofaune u asocijaciji sa četiri različita tipa makrofitske vegetacije (*Nymphoides peltata, Ceratophyllum demersum, Polygonum amphibium* i *Carex* sp.). Ukupno su utvrđene 33 taksonomske skupine makrofaune. Najmanja raznolikost (18 taksonomskih skupina) zabilježena je u makrofitskoj zajednici emerzne vrste dugih cjelovitih listova - *Carex* sp., koja je tijekom uzorkovanja bila u cijelosti pod vodom. Najveća raznolikost makrofaune (24 skupine) utvrđena je u asocijaciji sa submerznom vrstom rascijepljenih listova - *C. demersum.* Zajednica *N. peltata*, flotantne makrofite cjelovitih listova, podržavala je najmanju brojnost makrofaune (1973 jed. 100 g^{-1} suhe biomase makrofite), dok je najveća brojnost makrofaune od 12573 jed. 100 g^{-1} suhe biomase makrofite, zabilježena u zajednici sa *C. demersum*. Iako ne statistički značajne, pokazale su se razlike u sastavu, brojnosti i biomasi zajednica makrofaune između četiri vrste makrofita s različitom morfologijom listova. Hironomidne ličinke (49.1% - 80.9%) i maločetinaši (14.1% - 46.2%), predstavnici makrofaune karakteristični za eutrofne vode, su bili skupine s najvećom brojnošću tijekom cjelokupnog razdoblja istraživanja, u uzorcima sva četiri tipa makrofitske vegetacije. Fluktuacije razine vode, s obzirom na njihov utjecaj kako na pojavu, tako i na opseg razvoja zajednica vodene vegetacije, kao i eutrofno stanje vode unutar makrofitskih zajednica, pokazali su se glavnim čimbenicima koji su utjecali na taksonomski sastav i brojnost makrofaune.

PHYTOPHILOUS MACROFAUNA ABUNDANCE AND DIVERSITY IN THE ČONAKUT CHANNEL, KOPAČKI RIT NATURE PARK, CROATIA

I. Bogut, J. Vidaković, D. Čerba and G. Palijan
Department of Biology, University of Josip Juraj Strossmayer, Trg Ljudevita Gaja 6, HR-31000 Osijek, Croatia, (ibogut@ffos.hr, javidako@inet.hr, gpalijan@ffos.hr, dcerba@vip.hr)

Macrofauna composition and abundance in four various stands of macrophyte types (*Nymphoides peltata, Ceratophyllum demersum, Polygonum amphibium* and *Carex* spp.) were investigated during two vegetation seasons (June-October 2001 and April-July 2002) in the slow-flowing, eutrophicated Čonakut Channel

in the Kopački rit Nature Park. A total of 33 macrofauna groups were found. The lowest diversity (18 groups) was recorded in the association with emerged species, with long undissected leaves – *Carex* spp. (which was complitly below water surface during the sampling period), and the highest, 24 groups, with submerged species with dissected leaves - *C. demersum*. Flotant species with undissected leaves, *N. peltata* harboured the lowest abundance of macrofauna (1973 ind. per 100 g dry weight) and submerged *C. demersum* the highest abundance of 12573 ind. per 100 g dry weight. Macrofauna communities showed differences in their composition, abundance and biomass between the four macrophyte species with different architecture, but these differences were not statistically significant. Chironomidae (49.1%-80.9%) and Oligochaeta (14.1%-46.2%), characteristical macrofaunal groups for eutrophic waters, were the most abundant groups recorded during the whole investigated period and in all stands of various macrophyte types.

P-56

AKTIVNOST VUKOVA BILJEŽENA GPS OGRLICOM I TUMAČENA PROMATRANJEM AKTIVNOSTI PASA S GPS OGRLICOM

P. Čolig, J. Kusak i Đ. Huber
Zavod za biologiju, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (kusak@vef.hr)

Aktivnost dvije vučice (Eva; dob 2 godine iz Dalmacije i Kyra; dob 0.6 godina iz Gorskog kotara) praćena je upotrebom GPS-UHF-VHF ogrlica koje, pored GPS lokacija, mjere i ubrzanje ogrlice po x i po y osi, te svakih 5 minuta bilježi njenu prosječnu vrijednost kao relativni broj u rasponu od 0 do 255. Za interpretaciju tih brojeva napravljen je pokus na psima koji su bili opremljeni istim tipom ogrlice kao i vukovi, a istovremeno su bili i vizuelno praćeni. Bilježeno je vrijeme kada su psi bili u kojem od tri predodređena oblika aktivnosti: mirovanje, hodanje ili trčanje, te su po tome interpretirani i podaci iz njihove ogrlice. Za sva tri oblika aktivnosti pasa sakupljeno je ukupno 241 očitanje. U pasa su statistički značajne razlike (t-test) mirovanja (n=112, $\bar{x}$=6.14), od hodanja (n=63, $\bar{x}$=48.65) $p<0.01$ i hodanja od trčanja (n=66, $\bar{x}$=121.17), $p<0.01$, omogućile interpretaciju podataka s vučjih ogrlica. Vučica Eva praćena je tijekom 157 dana kada je zabilježeno ukupno 44626 očitanja aktivnosti (prvih 8241 zapisa nije korišteno za analize jer se vučica oporavljala od ozljeda od zamke krivolovca), dok je u 88 dana praćenja vučice Kyre sakupljeno 24310 očitanja aktivnosti. U ukupno 60695 petominutnih

intervala vukovi su mirovali 46937 puta (77.3% vremena), hodali 10743 puta (17.7% vremena) i trčali u 3015 puta (4.9% vremena). Vučica Kyra provela je statistički značajno više vremena od vučice Eve (χ^2=519.9, df=1, p<0.001) hodajući i trčeći. Vučiva Eva je bila značajno više (χ^2=9391.4, df=1, p<0.001) aktivna noću (n= 6434) nego danju (n = 661), dok je vučica Kyra bila podjednako aktivna i noću (n=3107) i danju (n = 3556).

WOLF ACTIVITY MONITORED BY THE USE OF GPS COLLAR AND INTERPRETED BY MONITORING OF DOGS WITH GPS COLLARS

P. Čolig, J. Kusak and Đ. Huber
Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (kusak@vef.hr)

Activity of two female wolves (Eva; 2 years from Dalmatia and Kyra; 0.6 years from Gorski kotar) was monitored by the use of GPS-UHF-VHF collars which, beside GPS locations, measure collar acceleration on x and y axis, then calculates and records averages as relative number in array from 0 to 255 in 5 minutes intervals. To interpret this data, we put the same kind of collar on dogs and observed periods when they were in one of three predefined types of activity: laying/sitting, walking and running. We collected a total of 241 5-minute-intervals of dog activities. Significant differences (t-test) between laying/sitting (n=112, $\bar{x}$=6.14), and walking (n=63, $\bar{x}$=48.65) p<0.01, then between walking and running (n=66, $\bar{x}$=121.17), p<0.01, enabled us to interpret the data from wolf collars. Eva wolf was monitored during 157 days, and a total of 44626 activity reading were recorded, before the wolf was shot. First 8241 records were omitted from the analysis because wolf was recovering from a wound inflicted by poacher's snare which caught it at first. A total of 24310 activity readings of Kyra wolf were collected during 88 days of radiotracking, when the signal disappeared. During the total of 60695 5-minute intervals wolves were laying/sitting in 46937 intervals (77.3% of time), walking during 10743 intervals (17.7% of time) and running in 3015 intervals (4.9% of time) Kyra wolf spent significantly more than Eva wolf (χ^2=519.9, df=1, p<0.001) in walking and running. Eva wolf was significantly more active (χ^2=9391.4, df=1, p<0.001) at night (n= 6434) compared with her day activity (n = 661), while Kyra wolf was equally active during the night (n=3107) and day (n = 3556).

P-57
KLASIFIKACIJA POVRŠINSKIH VODA PREMA BIOLOŠKIM POKAZATELJIMA

R. Ćuk, S. Kovačević, M. Vrsalović i I. Vučković
Hrvatske vode, Sektor zaštite voda, Glavni vodnogospodarski laboratorij, Žitnjak bb, HR-10000 Zagreb

Mnogi vodeni organizmi dolaze samo pri određenoj koncentraciji organske tvari i otopljenog kisika. Prema tome, takve organizme smatramo indikatorima za određenu vrstu vode. Prema količini organske tvari u vodi koristi se indeks saprobnosti za klasifikaciju površinskih voda. Saprobnost je intenzitet razgradnje odumrle organske tvari, tj. ukupna suma svi metabolički procesa koji su antiteza proizvodnji organske tvari. Indeks saprobnosti kreće se u rasponu 1-4, gdje 1 označava oligosaprobne, odnosno vode s najmanje organske tvari a 4 označava polisaprobne vode s velikom količinom organske tvari. Klase boniteta s indikatorskim organizmima i kemijskim pokazateljima bit će prikazane na posteru.

CLASSIFICATION OF SURFACE WATERS ACCORDING TO BIOLOGICAL INDICATORS

R. Ćuk, S. Kovačević, M. Vrsalović and I. Vučković
Croatian waters, Žitnjak bb, HR-10000 Zagreb

Many of aquatic organisms are present at certain concentrations of organic material and dissolved oxygen. Therefore, such organisms are concidered to be indicators for defined water type. Regarding to quantity of organic material in water, saprobic index is beeing used for classification of surface waters. Saprobity is an intensity of degradation of the organic material, i.e. total sum of all metabolic proccesses which are antithesis to primary organic production. Saprobic index is ranged between 1 and 4, where 1 regards to oligosaprobic waters (minimum organic material) and 4 regards to polysaprobic waters (maximun organic material). Classes of bonitet with indicator organisms and chemical values will be shown on the poster.

P-58
BIOSPELEOLOŠKA ISTRAŽIVANJA ĐUROVIĆA ŠPILJE U KONAVLIMA

M. Cukrov, R. Ozimec, J. Bedek i B. Jalžić
Hrvatsko biospeleološko društvo, Demetrova 1, HR-10000 Zagreb (marijana.cukrov@min-kulture.hr, roman.ozimec@zg.t-mobile.hr, jana.bedek@hpm.hr, branko.jalzic@hpm.hr)

Hrvatsko biospeleološko društvo je provelo istraživanje Đurovića špilje u Čilipima (Konavle) u razdoblju od lipnja 2003. do prosinca 2005. godine. Uslijed izgradnje zračne luke Čilipi 1963. godine ulaz u špilju je zatvoren, a površina iznad špilje je asfaltiranjem i betoniranjem devastirana. Izmjereni su ekološki i mikroklimatski parametri špilje, izrađen je popis podzemne faune špilje, primjerci vrsta su fotografirani *in situ*, utvrđen je stupanj ugroženosti te potencijalni i stvarni uzročnici ugroženosti špilje i podzemne faune. Đurovića špilja je vrlo toplo kavernikolno stanište s kolebanjem temperature tla od 16,8 do 17,0°C te temperature zraka od 17,0 do 17,6°C. Relativna vlaga zraka iznosi 91-99 %. U analiziranom biološkom materijalu ističu se nalazi puževa (Gastropoda), rakova (Crustacea), stonoga (Myriapoda), paučnjaka (Arachnida)-osobito lažištipavaca (Pseudoscorpiones), pauka (Araneae), grinja (Acari) i lažipauka (Opiliones), zatim skokuna (Collembola) i kornjaša (Coleoptera). Najvažniji biološki nalazi za Đurovića špilju su špiljski lažipauk *Abasola troglodytes* (Roewer, 1915) i kornjaš pselafid *Troglamaurops scheibeli* (Müller, 1944) za koje je Đurovića špilja tipsko nalazište (*locus typicus*). Zanimljivo je da nakon opisa nijedna od ove dvije vrste nije više pronađena. Od ukupno do sada određenih svojti, 26 je endema Dinarida, što čini 62 % udjela.

BIOSPELEOLOGICAL INVESTIGATION OF ĐUROVIĆA CAVE IN KONAVLE

M. Cukrov, R. Ozimec, J. Bedek and B. Jalžić
Croatian Biospeleological Society, Demetrova 1, HR-10000 Zagreb (marijana.cukrov@min-kulture.hr, roman.ozimec@zg.t-mobile.hr, jana.bedek@hpm.hr, branko.jalzic@hpm.hr)

Croatian Biospeleological Society performed the investigation of Đurovića cave in Čilipi (Konavle) in period from June 2003 to December 2005. The entrance of the cave was closed because of construction of Čilipi airport in 1963 and the area over the cave was devastated after paving. Ecologic and microclimate parameters of the cave were measured, list of underground faunal species was made, the specimens were photographed *in situ*, the extent, potential and real causes of cave and underground fauna endanger were determined. Đurovića cave is very warm cavernous locality with the range of soil temperature from 16.8 to 17.0°C and air temperature from 17.0 to 17.6°C. Relative humidity

is 91-99 %. In the analysed biological material we point out the records of gastropods (Gastropoda), crustaceans (Crustacea), milipedes (Myriapoda), arachnids (Arachnida)-especially pseudoscorpions (Pseudoscorpiones), spiders (Araneae), mites (Acari) i harvestmans (Opiliones), than springtails (Collembola) and coleopterans (Coleoptera). The most important biological records for Đurovića cave are cave harvestman *Abasola troglodytes* (Roewer, 1915) and coleopteran *Troglamaurops scheibeli* (Müller, 1944). Đurovića cave is typical locality (*locus typicus*) for these two species. It is interesting that since these records none of these two species has been found. From the total of described taxa, 26 are endemic of Dinarids, what is 62 % in proportion.

P-59

KONTROLNA REGIJA MITOHONDRIJSKE DNA EUROAZIJSKOG RISA (*Lynx lynx*) IZ HRVATSKE

T. Gomerčić[1], Ž. Gottstein[2], I. Sadarić[3], J. Sadarić[3], M. Đuras Gomerčić[4], A. Galov[5] i Đ. Huber[1]
[1]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr, djuro.huber@vef.hr), [2]Zavod za bolesti peradi, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (zeljko.gottstein@vef.hr), [3]Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska, [4]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (martina.duras@vz.htnet.hr), [5]Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (agomercic@yahoo.com)

Nakon više od 70 godina ne obitavanja euroazijskog risa (*Lynx lynx*) na prostorima Hrvatske, 1973. godine reintroducirane su u Kočevje (Slovenija) tri mužjaka i tri ženke risa s prostora Slovačke. Veličina današnje hrvatske populacije procjenjuje se na oko 60 jedinki a nastala je od reintroduciranih životinja. Zbog malog broja životinja, a time i male genske baze važno je istražiti genetske karakteristike risova u Hrvatskoj. Cilj ovog rada je istražiti razlike redoslijeda nukleinskih baza u dijelu kontrolne regije mitohondrijske DNA između populacije euroazijskog risa iz Hrvatske i populacija risova iz drugih zemalja, te sljedećih vrsta porodice mačaka: iberijskog risa (*Lynx pardinus*), divlje mačke (*Felis silvestris*) i domaće mačke (*Felis catus*). DNA je izolirana iz tkiva dvaju riseva iz Hrvatske, te je sekvencionirana kontrolna regija mitohondrijske DNA . Dobiveni nalaz uspoređen je s 13 sekvenci drugih populacija euroazijskog risa i navedenim vrstama preuzetih iz genske

baze podataka, GenBank. Dio kontrolne regije mitohondrijske DNA risova iz Hrvatske dug 184 baze istog je haplotipa kao i kod euroazijskih risova iz Švedske, a u usporedbi s iberijskim risom (*Lynx paradinus*) postoje znatne razlike. Pronađena su specifična mjesta u kontrolnim regijama za razlikovanje risova od domaće i divlje mačake. Zaključujemo da je na temelju izmeta ili dlake ovom metodom moguće utvrditi prisustvo euroazijskog risa na nekom području, ali za određivanje strukture populacija euroazijskih riseva potrebna su daljnja istraživanja.

CONTROL REGION OF THE MITOCHONDRIAL DNA OF EURASIAN LYNX (*Lynx lynx)* FROM CROATIA

T. Gomerčić[1], Ž. Gottstein[2], I. Sadarić[3], J. Sadarić[3], M. Đuras Gomerčić[4], A. Galov[5] and Đ. Huber[1]
[1]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr, djuro.huber@vef.hr), [2]Department of Avian Diseases, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (zeljko.gottstein@vef.hr), [3]Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia, [4]Department of Anatomy, Histology and Embriology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (martina.duras@vz.htnet.hr), [5]Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia(agomercic@yahoo.com)

After more than 70 years since the last Eurasian lynx (*Lynx lynx)* lived in Croatia, in 1973 three male and three female lynxes from Slovakia were reintroduced in Kočevje (Slovenia), close to Croatian border. The present Croatian lynxes are descendants of these reintroduced animals and their number is estimated at approximately 60 individuals. It is of great importance to investigate genetic variability of lynx in Croatia, because of its small population size and small genetic pool. The objective of this study was to investigate the differences of nucleotides control region of mitochondrial DNA between Croatian population of Eurasian lynx and Eurasian lynx populations from other countries, and other cat species: the Iberian lynx (*Lynx pardinus*), wild cat (*Felis silvestris*) and domestic cat (*Felis catus*). DNA was extracted from tissues of two lynx carcasses and control region of mitochondrial DNA was sequenced. The sequence 184 bp long was compared to 13 sequences from other populations of Eurasian lynx and other species we took from gene database on Internet , GenBank. Lynxes from Croatia share the same

haplotype as the lynxes from Sweden. There are considerable differences between that sequence and sequence of Iberian lynx (*Lynx pardinus*). Specific polymorphic sites in control regions which could be used to differentiate lynx and cat species have been found. In conclusion, it is possible to determine lynx presence in certain region using this method, if faecal or hair samples are found. Further studies are needed for elucidation of population structure of Eurasian lynxes.

P-60

HELMINTOFAUNA OF *Rana kurtsmulleri* GAUDA, 1940 SYN. *Rana balcanica* SHNEIDER ET SINISH, 1992 (ANURA RANIDAE) FROM DOJRAN LAKE, MACEDONIA AND GREECE

N. Hristovski[1], S. Smilkov[2], Dz. Tomovska[1], E. Popovich[3] and D. Kostich[3]
[1]Faculty of Biotechnical Sciences,7000 Bitola, Macedonia, [2]Faculty of Sciences Department of Biology,1000 Skopje , Macedonia, [3]Faculty of Science,Department of Biology, 21000 Novi Sad, Serbia and Montenegro

The frog *Rana kutsmulleri* Gayda,1940 syn.*Rana balcanica* Shneider et Sinish,1992 is widespread in SE part of Macedonia Greece and Albania. During the examination of frogs from Dojran Lake from Macedonian part (Achikot,Mrdaja,Nikolich,Old Dojran,New Dojran) and Greece part (Dojrani and Chanel Golaja) we have examined *Rana kurtsmulleri* Gayda,1940 a Macedonian , Greece and Albanian endemic species.We have found the following species of endohelminths:Gorgodera cygnoides (Zeder,1800)*Ceph alogonimus retusus* (Dujardin,l845),*Diplodiscus subclavatus* (Goeze,1782),*D iphyllobothrium erinacei* (plarocerkoid),*Rhabdias bufonis* Schrank, 1788,*R. sphaerocephala* Goday,1924,*Chabaudgolvania terdentatum* (Linstow,l890), *Oswaldocruzia filiformis* (Goeze,1782) , (Dujardin,1845), (Diesing,1851), *Aplectana acuminata* Railliet et Henry,1916, *Neoxysomatium brevicaudatum* (Zeder,1800), *Icosiella neglecta* (Diesing,1851)and *Acanthocephalus ranae* (Schrank,1788). All founded endohelminths are new to this species for the science and also are new to the helminh fauna of Dojran Lake (Greek and Macedonian part).*Gorgodera cygnoides* (Zeder,1800), *Cephalogonimus retusus* (Dujardin,1845)and *Diphyllobothrium erinacei* (plerocerkoid) are new to the fauna of Macedonia and Greece. *Diplodiscus subclavatus* (Goeze,1782), *Rhabdias sphaerocephala* Goday,1924, *Chaboudgolvania terdentatum* (Linstow,1890), *Oswaldocruzia goezei* Skjabin et Schultz,1952 are new species to the fauna of Greece.

P-61

HELMINTH FAUNA OF *Bufo viridis* (ANURA BUFONIDAE) FROM ISLAND OF HVAR, CROATIA

N. Hristovski[1], Dz. Tomovska[1] and S. Stojanovski[2]
[1]Faculty of Biotechnical Sciences,7000 Bitola, Macedonia, [2]Hydrobiological Institute, Naum Ohridski 50, 6000 Ohrid, Macedonia

During the examination of helminth fauna of *Bufo viridis* from Island of Hvar (enviroiment of Hvar and Jelsa)we found the following endohelminths. *Nematotaenia dispar* (Goeze),*Rhabdias bufonis Schrank*, 1788,*Cosmocerca commutata* (Diesing,1851), *C.ornata* (Dujardin,1845),*Aplectana acuminata* Railliet et Henry,1916, *Neoxysomatium brevicaudatum* (Zeder,1800), *Oswaldocruzia filiformis* (Goeze,l782) and *Neyriaplectana linstowi.* All founded endohelminths are new to the fauna od Island of Hvar until *Neyriaplectana linstowi* is new to the fauna of Croatia.Namely this species is found only in the Island of Corffu , Greece. The founded helminths are common to the family of Bufonidae except the species *N.linstowi* which is rare species.

P-62

VODENE MUHE PLESAČICE (DIPTERA, EMPIDIDAE: CLINOCERINAE; HEMERODROMIINAE) RIJEKE CETINE

M. Ivković[1] i B. Horvat[2]
[1]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (marija_ivkovic@yahoo.co.uk) [2] Prirodoslovni muzej Slovenije, Prešernova 20, SI-1001 Ljubljana, Slovenija (bogdanhorvat01@yahoo.com)

Istraživanje faune vodenih muha plesačica rijeke Cetine rađeno je tijekom svibnja, lipnja, srpnja, kolovoza i rujna 2005. godine i tijekom ožujka i travnja 2006. godine. Uzorci su sakupljani ekshaustorom i entomološkom mrežicom na 10 različitih lokacija na cijelom toku rijeke Cetine te na izvorima dvije pritoke, rijeke Rude i rijeke Grab. Cilj istraživanja je bio ustanoviti raznolikost skupine vodenih muha plesačica (Diptera, Empididae: Clinocerinae, Hemerodromiinae) i utvrditi koja od istraživanih lokacija ima najveću raznolikost. Unutar dvije potporodice zabilježeno je 20 vrsta iz 5 različitih rodova, 3 roda pripadaju potporodici Clinocerinae (*Clinocera*, *Wiedemannia*, *Dolichocephala*) i 2 roda pripadaju potporodici Hemerodromiinae (*Hemerodromia*, *Chelifera*). Lokacija sa najvećom raznolikošću je bila lokacija Radmanove mlinice blizu

samoga ušća rijeke Cetine gdje je zabilježeno čak 10 vrsta, od toga 9 vrsta iz 3 roda potporodice Clinocerinae (*Clinocera*, *Wiedemannia*, *Dolichocephala*) i 1 vrsta iz roda *Hemerodromia* potporodice Hemerodromiinae.

AQUATIC DANCE FLIES (DIPTERA, EMPIDIDAE: CLINOCERINAE; HEMERODROMIINAE) OF THE RIVER CETINA

M. Ivković[1] and B. Horvat[2]
[1]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (marija_ivkovic@yahoo.co.uk), [2]Slovenian Museum of Natural History, Prešernova 20, SI-1001 Ljubljana, Slovenia (bogdanhorvat01@yahoo.com)

The research of aquatic dance flies fauna on the river Cetina was conducted during May, June, July, August and September 2005 and during March and April 2006. The samples were collected with an aspirator and entomological net on 10 different locations through the whole flow of the river Cetina and on the springs of two tributaries, river Ruda and river Grab. The purpose of the research was to determine the diversity of the aquatic dance flies (Diptera, Empididae: Clinocerinae, Hemerodromiinae) and to determine which of the researched locations has the biggest diversity of aquatic dance flies. In two subfamilies 20 species of aquatic dance flies were recorded from 5 different genera, 3 of which belong to the subfamily Clinocerinae (*Clinocera*, *Wiedemannia*, *Dolichocephala*) and 2 to the subfamily Hemerodromiinae (*Hemerodromia*, *Chelifera*). Location with the biggest diversity is location Radmanove mlinice, near the mouth of the river Cetina, 10 species were recorded, 9 species from 3 genera of the subfamily Clinocerinae (*Clinocera*, *Wiedemannia*, *Dolichocephala*) and 1 species from the genus *Hemerodromia* of the subfamily Hemerodromiinae.

P-63

MIKROFLORA I PARAZITI PROBAVNOG SUSTAVA BJELOGLAVOG SUPA (*Gyps fulvus*; Hablizl, 1783.) U HRVATSKOJ

I. Kocijan[1], E. Prukner-Radovčić[2], R. Beck[3], A. Marinculić[4] i G. Sušić[5]
[1]Zavod za animalnu fiziologiju, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (ivnatom@yahoo.com), [2]Zavod za bolesti peradi s klinikom, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (prukner@vef.hr), [3,4]Zavod za parazitologiju i invazijske bolesti, Sveučilište

u Zagrebu, Veterinarski fakultet, Heinzelova 55, HR-10000 Zagreb, Hrvatska (reljab@vef.hr, albert@vef.hr), [5]Ornitološka postaja Cres, Hrvatska akademija znanosti i umjetnosti, Beli 4, HR-51559 Beli, Hrvatska (orlov-let@ri.t-com.hr)

Bjeloglavi sup (*Gyps fulvus*; Hablizl, 1783.) je ugrožena i zakonom zaštićena vrsta ptica u RH koja broji oko 90 gnijezdećih parova. Za vrijeme markiranja mladih supova na otoku Cresu, prikupili smo uzorke izmeta i želučanog sadržaja 12 različitih jedinki za mikrobiološku i parazitološku pretragu. Svi uzorci pretraženi su bakteriološki uobičajenim postupkom na prisutnost aerobnih bakterija, te mikološki. Izdvojene kolonije bakterija i gljivica identificirane su kulturelno, mikroskopski i po potrebi biokemijski. Za parazitološku pretragu primijenjena je metoda centrifugalne flotacije. Najčešće je izdvojena bakterija *E. coli* (11 uzoraka), a po učestalosti slijede *Aeromonas salmonicidia* (4), *Proteus sp.* (2), *Escherichia fergusonii* (1), *Providencia alcalifaciens* (1) i *Micrococcus spp* (1). Mikološkom pretragom najčešće smo dokazali prisutnost kvasnice *Candida spp.* te u jednom slučaju iz izmeta *Rhodotorula rubra.* Parazitološkim pretragama smo dokazali prisustvo jajašaca strongilida u nekoliko uzoraka. Zanimljivo je da su u većini uzoraka izmeta nađena askaridna jajašca tipa *Toxocara*. Od jajašaca trakavica, u jednom uzorku su nađena jajašca tipa *Moniezia*. Ovakav mikrobiološki i parazitološki nalaz najvjerojatnije je posljedica načina prehrane bjeloglavih supova. Naše istraživanje doprinosi spoznajama o statusu populacije bjeloglavog supa u Hrvatskoj i naporima koji se ulažu za njezino očuvanje.

MICROFLORA AND PARASITES OF THE DIGESTIVE TRACT OF CROATIAN GRIFFON VULTURES (*Gyps fulvus*; Hablizl, 1783.)

I. Kocijan[1], E. Prukner-Radovčić[2], R. Beck[3], A. Marinculić[3] and G. Sušić[4]
[1]Department of Animal Physiology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (ivnatom@yahoo.com), [2]Department of Poultry Diseases with Clinic, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (prukner@vef.hr), [3]Department of Parasitology and Parasitic Diseases with Clinic, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (reljab@vef.hr, albert@vef.hr), [4]Ornithological station Cres, Croatian Academy of Sciences and Arts, Beli 4, HR-51559 Beli , Croatia (orlov-let@ri.t-com.hr)

Griffon vulture (*Gyps fulvus*; Hablizl, 1783.) is an endangered and legally protected bird species in Croatia which numbers about 90 breeding pairs.

Griffon vulture nestlings were sampled during ringing activities on the island of Cres, Croatia. Fecal and vomit samples were collected from 12 different individuals and examined for microbiological culture and parasites. All samples were examined bacteriologically in a standard way for the presence of aerobic bacteria as well as mycologically. Isolated bacterial anf fungal colonies were identified in the culture, microscopically and biochemically where required. Centrifugal flotation method was used for parasitological examination. The most common bacteria was *E. coli* (11 samples), followed by *Aeromonas salmonicidia* (4)*, Proteus sp. (2), Escherichia fergusonii* (1)*, Providencia alcalifaciens* (1) and *Micrococcus spp* (1). Mycological cultures revealed the presence of *Candida* spp. and in one case *Rhodotorula rubra* in a fecal sample. Strongyle eggs were found in several samples. Interestingly, in most fecal samples ascarid eggs of Toxocara type were found. Among tapeworm eggs, Moniezia type was present in one sample. Both microbiologic and parasitic findings are most likely the result of the feeding habits of griffon vultures. This research brings insight into fitness status of the croatian griffon vulture population and contributes to the efforts made for its preservation.

P-64

FORENZNIČNA ENTOMOLOGIJA U SPLITU I HRVATSKOJ

B. Kokan[1], M. Definis-Gojanović[2], D. Sutlović[2] i B. Milošević[3]
[1]Prirodoslovni muzej i zoološki vrt, Split, Hrvatska, (boze.kokan@st.t-com.hr), [2]Medicinski fakultet Sveučilišta u Splitu, Hrvatska (marija.definis-gojanovic@st.htnet.hr, dsutlov@kbsplit.hr), [3]Hrvatsko entomološko društvo, Zagreb, Hrvatska, (bogomir.milosevic@zg.htnet.hr)

U Hrvatskoj je razvijena forenzična znanost i praksa na Medicinskim fakultetima Sveučilišta u Zagrebu, Rijeci, Splitu i Osijeku, te na Veterinarskom fakultetu u Zagrebu i nekim drugim institucijama. Prikazana je današnja situaciju i očekivane mogućnosti uvođenja tehnika i metoda forenzične entomologije. Većina entomologa radi u području poljoprivredne i šumarske zaštite bilja. Neki rade u muzejima. Njihove su dužnosti čuvanje zbirki i edukacija posjetitelja. Relativno mali dio vremena namijenjen je istraživanju faune. Forenzičari u Hrvatskoj postižu zapažene rezultate na različitim poljima ali nisu dovoljno educirani i opremljeni za primjenu svih metoda forenzične entomologije. U Splitu je uspostavljena suradnja entomologa kustosa Prirodoslovnog muzeja te forenzičara patologa i toksikologa Medicinskog fakulteta. Analizirane su mogućnosti uvođenja forenzične entomologije. U nekoliko prirodoslovnih muzeja, kao npr. u Splitu, postoje zbirke u kojima su i nekrofilne vrste potrebne za edukaciju i uspoređivanje. Važno je upoznati pravosude organe

s mogućnostima i djelotvornošću ove metode, kao i edukacija kriminalista, sudskih medicinara i entomologa. Potrebno je istražiti inventar vrsta i ponašanje kukaca i srodnih svojti koje sudjeluju u procesu dekompozicije leša. Predlaže se suradnja s Europskom udrugom za forenzičnu entomologiju (EAFE) i druge aktivnosti.

FORENSIC ENTOMOLOGY IN SPLIT AND CROATIA

B. Kokan[1], M. Definis-Gojanović[2], D. Sutlović[2] and B. Milošević[3]
[1]Natural History Museum and Zoo, Split, Croatia (boze.kokan@st.t-com.hr), [2]Medical Faculty, University of Split, Croatia (marija.definis-gojanovic@st.htnet.hr, dsutlov@kbsplit.hr), [3]Croatian Entomological Society Zagreb, Croatia (bogomir.milosevic@zg.htnet.hr)

Forensic science and practical work in Croatia are well established at Medical Faculties of Universities in Zagreb, Rijeka, Split and Faculty of veterinary medicine in Zagreb and some other institutions. Present situation is reviewed as well as the possibilities and expected advancement by introducing the techniques and methods of forensic entomology. Mayority of the entomologists is engaged in the agricultural and forest plant protection. Some are working in the museums. Their duties are the collections care and visitors education. Relatively short period of time is spent in research into the fauna. Forensic experts in Croatia are obtaining the outstanding results in various fields but are not sufficiently educated and equipped for applying all the methods of forensic entomology. In the city of Split co-operation among entomologist curator in Natural History Museum, forensic pathologists and toxicologist from Faculty of Medicine started. Possibilities for forensic entomology were analysed. In several natural history museums as e.g. in Split, there are collections with the necrophorous species necessary for education and comparing. It is important to inform legal medicine authorities about possibilities of that method as well as to educate criminalists, court physicians and entomologists. It is necessary to examine inventory of species and behaviour of insect and allied forms which are taking part in the carcase decomposition process. Co-operation with European Association for Forensic Entomology (EAFE) and other activities are proposed.

P-65
HISTOLOŠKA ANALIZA VRSTE *Dreissena polymorpha* (MOLLUSCA, BIVALVIA) ZARAŽENE METILJIMA

J. Lajtner , A. Lucić, I. Maguire, I. Krulik i R. Erben
Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (jlajtn@zg.biol.pmf.hr, andreja@zg.biol.pmf.hr, imaguire@public.srce.hr, ikrulik@zg.biol.pmf.hr, rerben@zg.biol.pmf.hr)

Prisutnost i učinak metilja na školjkaše *Dreissena polymorpha* istraživani su u populacijama iz hidroakumulacije Dubrava i iz rijeke Drave. Istraživanja na terenu i u laboratoriju trajala su jednu godinu. Na preparatima napravljenim klasičnim histološkim tehnikama utvrđene su tri vrste metilja: *Bucephalus polymorphus* (Digenea, Bucephalidae), *Echinoparyphium recurvatum* (Digenea: Echinostomatidae) i *Aspidogaster* sp. (Aspidogastrea: Aspidogastridae). Riječna populacija školjkaša više je zaražena (11,3%) od populacije iz hidroakumulacije (2,5%). Najveći broj školjkaša iz rijeke zaražen je vrstom *B. polymorphus* (10,6 %), dok je zaraza vrstom *Aspidogaster* sp. bila znatno manja (0,7%). U hidroakumulaciji Dubrava 1,3% školjkaša zaraženo je vrstom *B. polymorphus*, 0,6% vrstom *E. recurvatum* i isto toliko vrstom *Aspidogaster* sp. Sporociste s cerkarijama vrste *B. polymorphus* smještene su prvenstveno u gonadama školjkaša, metacerkarije vrste *E. recurvatum* u epitelu utrobne vreće i vezivnom tkivu između gonada i probavne žlijezde, a odrasli metilji vrste *Aspidogaster* sp. nalazili su se u želucu i probavnoj žlijezdi. Primjenom računalne analize slike (LUCIA G 4.81) utvrđene su razlike u volumenima pojedinih organa utrobne vreće zaraženih i nezaraženih školjkaša, a izmjeren je i volumen metilja. Dokazano je da vrsta *B. polymorphus* ima negativan učinak na reproduktivni ciklus školjkaša budući da je gonadni volumen zaraženih životinja bio statistički značajno manji u usporedbi s nezaraženim ($p<0,0001$, Wilcoxonov test sume rangova). Školjkaši zaraženi vrstom *Aspidogaster* sp. imali su značajno manje sve mjerene volumene, dok kod školjkaša zaraženog vrstom *E. recurvatum* nisu utvrđene značajne razlike.

HISTOLOGICAL ANALYSIS OF ZEBRA MUSSEL, *Dreissena polymorpha* (MOLLUSCA, BIVALVIA) INFECTED WITH TREMATODES

J. Lajtner , A. Lucić, I. Maguire, I. Krulik and R. Erben
Department of Zoology, Division of Biology, Faculty of Science, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (jlajtn@zg.biol.pmf.hr, andreja@zg.biol.pmf.hr, imaguire@public.srce.hr, ikrulik@zg.biol.pmf.hr, rerben@zg.biol.pmf.hr)

The presence and effect of trematodes on the zebra mussel, *Dreissena polymorpha* were studied in populations from the dam reservoir Dubrava and

from the Drava River. Investigations were conducted in the field and in the laboratory during one year. On the histological sections of the mussel three species of the trematodes were observed: *Bucephalus polymorphus* (Digenea, Bucephalidae), *Echinoparyphium recurvatum* (Digenea: Echinostomatidae) and *Aspidogaster* sp. (Aspidogastrea: Aspidogastridae). The river population was much more infected (11,3%) than the reservoir population (2,5%). Most of the mussels from the river were infected with *B. polymorphus* (10,6%) and only one animal was infected with *Aspidogaster* sp. (0,7%). In the dam reservoir Dubrava 1,3% of mussels were infected with *B. polymorphus*, 0,6% with *E. recurvatum* and 0,6 % with *Aspidogaster* sp. Sporocysts with cercariae of the *B. polymorphus* were located in the gonads, metacercariae of the *E. recurvatum* were in the visceral sack epithelium and in connective tissue while adult specimens of the *Aspidogaster* sp. were in stomach and digestive gland. Computer image analysis applied on the histological sections of the mussels (programme LUCIA G 4.81) indicated differences in volumes of visceral sack organs among infected and uninfected mussels. Volumes of the trematodes were also measured. Species *B. polymorphus* had negative effect on the reproductive cycle of the zebra mussel which was confirmed by statistically significantly decreased gonad volume ($p<0,0001$, Wilcoxon rank sum test). Mussels infected with the *Aspidogaster* sp. had significantly decreased all measured volumes while in mussels infected by *E. recurvatum* no significant differences were found.

P-66

FAUNA VRETENACA (ODONATA) PARKA PRIRODE „ŽUMBERAK I SAMOBORSKO GORJE„

M. Ljuština[1] i B. Vitas[2]
[1]Trnsko 48B, HR-10000 Zagreb, Hrvatska (masa.ljustina@zg.htnet.hr), [2]Sportska 4, HR-52420 Buzet, Hrvatska (bvitas@net.hr)

Glavni cilj istraživanja bio je utvrditi faunu vretenaca (Odonata) Parka prirode „Žumberak i Samoborsko gorje“ obzirom na njenu neistraženost. Istraživanja su vršena tijekom 2002. i 2003. godine u svrhu izrade diplomskih radova, pod mentorstvom M. Kerovec i I. Ternjej s Biološkog odsjeka, PMF te uz M. Franković kao vanjskog suradnika. Od ukupno 46 odabranih postaja različitih ekoloških obilježja, 20 lokaliteta je okarakterizirano kao stajaćice (lokve), dok su ostali lokaliteti protočni. Na 5 lokvi nije utvrđena prisutnost vretenaca. Fauna vretenaca praćena je u svim stadijima njihovog životnog ciklusa. Vretenca su prikupljana uz pomoć mreže za bentos (ličinke), te mrežice za imaga. Također su sakupljani svlakovi. Nije uzimano više primjeraka iste vrste, niti primjerci

koje je bilo moguće odrediti na terenu. Sörensenovim indeksom sličnosti (1948) brojčano su određene sličnosti faune vretenaca između promatranih postaja. Za zajednički prikaz Sörensenovog indeksa sličnosti opredijelili smo se za vrste koje smo zabilježili kao sigurne i vrlo vjerojatne (determinacijom svlakova, ličinaka, te imaga koji su viđeni u tandemu ili ovipoziciji). Utvrđena je najveća sličnost između protočnih, poluprotočnih lokaliteta te između stajaćica, a najmanja između tekućica i stajaćica što je bilo za očekivati obzirom na ekologiju vretenaca. Ukupno je zabilježeno 28 vrsta vretenaca za područje Parka, svrstanih u 18 rodova, 9 porodica i 2 podreda što je oko 40% od ukupnog broja vrsta zabilježenih za RH. 6 nađenih vrsta ujedno imaju status rijetkih vrsta za Hrvatsku (*Pyrrhosoma nymphula*, *Lestes dryas, Coenagrion pulchellum, Cordulegaster heros, Libellula fulva, Epitheca bimaculata*).

FAUNA OF ODONATA IN NATURE PARK «ŽUMBERAK - SAMOBORSKO GORJE»

M. Ljuština[1] and B. Vitas[2]
[1]Trnsko 48B, HR-10000 Zagreb, Croatia (masa.ljustina@zg.htnet.hr), [2]Sportska 4, HR-52420 Buzet, Croatia (bvitas@net.hr)

The first systematic investigations of Odonata fauna in the Nature Park "Žumberak - Samoborsko gorje" have been conducted from April 2002 to September 2003 in the purpose of making Graduation Theses with mentors from the Department of Biology, Faculty of Science, M. Kerovec and I. Ternjej and an expert associate, M. Franković. 46 localities with different ecological characteristics (stagnant (ponds) and running water) were established. On 5 localities (ponds) species of Odonata were not found. Odonata fauna was monitored in all of the stages of their life cycle. The following methods were used: the method of collecting by entomological nets (imago, larva and exuviae) and the method of observing. We did not take more then one specimen per species or the specimens that we were able to determine on sight. The similarities of locations were established according to the method of SØRENSEN (1948) using only certain or almost certain species through determination of exuviae, larvae, and adult seen in tandem or oviposition. The most similar were localities of running water compared one to another, as well as localities of stagnant water. The least similar were localities of running compared to stagnant water, which was expected considering the dragonfly species ecology. A total of 28 species, 18 genuses, 9 families and 2 suborders of the order Odonata were established, which is ~40% of the total number of species in Croatia. *Pyrrhosoma nymphula*, *Lestes dryas, Coenagrion pulchellum, Cordulegaster heros, Libellula fulva, Epitheca bimaculata* are classified as rare species in Croatia.

P-67

FAUNA DANJH LEPTIRA (INSECTA:LEPIDOPTERA:RHOPALOCERA) PARKA PRIRODE LONJSKO POLJE

V. Micetić, P. Durbešić i M. Kučinić
Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (vlatkamicetic@net.hr, kucinic@biol.pmf.hr)

Istraživana je fauna danjih leptira Parka prirode Lonjsko polje tijekom 2004. godine. Odabrano je 9 lokaliteta: Bukovica, Čigoč, Livada Orlinci, Lonja, Mužilovčica, Poganovo polje, Repušnica, Spomen područje Jasenovac i Trebež. Željelo se utvrditi faunističke i zoogeografske zanačajke te raznolikost danjih leptira u Parku prirode. Pronađeno je 45 vrsta danjih leptira. Utvrđeno je da se svaki istraživani lokalitet odlikuje osobitošću faune danjih leptira što ukazuje na djelovanje različitih ekoloških čimbenika. Uspoređujući istraživane lokalitete zaključuje se da je najveća raznolikost faune na lokalitetu Trebež, najmanja na lokalitetu Poganovo polje. Uspoređujući lokalitete zaključuje se da je najveća sličnost faune danjih leptira između lokaliteta Livada Orlinci i Čigoč, a najmanja između Spomen područja Jasenovac i Poganovog polja te Bukovice. Zoogeografska analiza ukazuje na dominatni udio eurosibirskih vrsta (57,7%) iz čega se zaključuje da kontinentalna klima ima dominantan utjecaj.

FAUNA OF BUTTERFLIES (INSECTA:LEPIDOPTERA:RHOPALOCERA) OF NATURE PARK LONJSKO POLJE

V. Micetić, P. Durbešić and M. Kučinić
Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (vlatkamicetic@net.hr, kucinic@biol.pmf.hr)

During 2004. butterfly fauna of Nature park «Lonjsko polje» was researched. Nine localities were selected: Bukovica, Čigoč, Livada Orlinci, Lonja, Mužilovčica, Poganovo polje, Spomen područje Jasenovac and Trebež. The objective of research was to find out faunistical and zoogeographical characteristics and diversity of butterflies. 45 species of butterflies were recorded. It was concluded that each researched locality had specific butterfly fauna because of different ecological factors. Comparing localities we can conclude that the best diversity of butterflies is on locality Trebež and the smallest, on locality Poganovo polje. The most similar fauna is between Livada Orlinci and Čigoč while the least similar fauna is between Spomen

područje Jasenovac and Bukovica with Poganovo polje. Zoogeographical analysis shows the dominant share of eurosibiric species (57,7%) as a result of continental and alpine climate.

P-68

DOPRINOS STUDENTSKIH ISTRAŽIVAČKIH KAMPOVA UDRUGE STUDENATA BIOLOGIJE "BIUS" POZNAVANJU I KARTIRANJU FAUNE VRETENACA (INSECTA: ODONATA) HRVATSKE.

N. Mihoković[1], M. Ljuština[2], B. Vitas[3], V. Zlatar[4], N. Horvat[5], A. Slavikovski[6], A. Melnjak[7], P. Falamić[8], K. Kovačec[9], L. Malović[10], M. Jelić[11], D. Dubravčić[12] i M. Franković[13]

[1]Ivana pl. Zajca 43, HR-40000 Čakovec, Hrvatska (nino.mihokovic@inet.hr), [2]Trnsko 48 B, HR-10000 Zagreb, Hrvatska (masa.ljustina@zg.t-com.hr), [3]Sportska 4, HR-52420 Buzet, Hrvatska (bvitas@net.hr), [4]Aleja Pomoraca 23, HR-10000 Zagreb, Hrvatska (vesna.zlatar@zg.t-com.hr), [5]Vladimira Nazora 36, Štefanec, HR-40000 Čakovec, Hrvatska (natasahorvat@net.hr), [6]Vida Došena 41, HR-10000 Zagreb, Hrvatska (ana_slavikovski@net.hr), [7]Vladimira Nazora 9, Gojanec HR-42205 Vidovec, Hrvatska (amelnjak@gmail.com), [8]Dubrava 24, HR-10040 Zagreb, Hrvatska (petrafalamic@yahoo.com), [9]Sopnička 50, HR-10360 Sesvete, Hrvatska (kreso.kovacec@yahoo.com), [10]Petrova 15a, HR-10000 Zagreb, Hrvatska (lanamalovic@yahoo.com), [11]Kolodvorska 14, HR-31540 Donji Miholjac, Hrvatska (m.jelich@gmail.com), [12]Miroslava Krleže 1, HR-47000 Karlovac, Hrvatska (darja.dubravcic@gmail.com), [13]Barutanski breg 30, HR-10000 Zagreb, Hrvatska (matija@ppzsg.org)

Rad je rezultat sedmogodišnjih istraživanja sekcije za vretenca Udruge studenata biologije "Bius". Kartografski su prikazano 45 vrsta sa 414 nalaza vrsta/lokalitet/datum. Istraživani lokaliteti su smješteni na području Paklenice, Dugog otoka, Mljeta, Biokova, Sjevernog Velebita, Istre, Papuka i Visa. Uspoređuje se vrijednost nalaza s podacima iz Crvenog popisa vretenaca Hrvatske. Uspoređuje se broj nalaza sa dosadašnjim projektima kartiranja faune vretenaca, te se kvantificira doprinos rada poznavanju faune vretenaca Hrvatske.

CONTRIBUTION OF STUDENTS' RESEARCH CAMPS ORGANIZED BY THE BIOLOGY STUDENTS' ASSOCIATION "BIUS" TO THE KNOWLEDGE AND MAPPING OF CROATIAN DRAGONFLIES (INSECTA: ODONATA).

N. Mihoković[1], M. Ljuština[2], B. Vitas[3], V. Zlatar[4], N. Horvat[5], A. Slavikovski[6], A. Melnjak[7], P. Falamić[8], K. Kovačec[9], L. Malović[10], M. Jelić[11], D. Dubravčić[12] and M. Franković[13]
[1]Ivana pl. Zajca 43, HR-40000 Čakovec, Croatia (nino.mihokovic@inet.hr), [2]Trnsko 48 B, HR-10000 Zagreb, Croatia (masa.ljustina@zg.t-com.hr), [3]Sportska 4, HR-52420 Buzet, Croatia (bvitas@net.hr), [4]Aleja Pomoraca 23, HR-10000 Zagreb, Croatia (vesna.zlatar@zg.t-com.hr), [5]Vladimira Nazora 36, Štefanec, HR-40000 Čakovec, Croatia (natasahorvat@net.hr), [6]Vida Došena 41, HR-10000 Zagreb, Croatia (ana_slavikovski@net.hr), [7]Vladimira Nazora 9, Gojanec HR-42205 Vidovec, Croatia (amelnjak@gmail.com), [8]Dubrava 24, HR-10040 Zagreb, Croatia (petrafalamic@yahoo.com), [9]Sopnička 50, HR-10360 Sesvete, Croatia (kreso.kovacec@yahoo.com), [10]Petrova 15a, HR-10000 Zagreb, Croatia (lanamalovic@yahoo.com), [11]Kolodvorska 14, HR-31540 Donji Miholjac, Croatia (m.jelich@gmail.com), [12]Miroslava Krleže 1, HR-47000 Karlovac, Croatia (darja.dubravcic@gmail.com), [13]Barutanski breg 30, HR-10000 Zagreb, Croatia (matija@ppzsg.org)

Seven years of odonatological research through the Biology students' association "Bius" are summarized and presented. They consist of 45 recorded species and 414 species/locality/date data types. Researched localites are situated within the Paklenica, Dugi otok, Mljet, Biokovo, Sjeverni Velebit, Istra, Papuk and Vis island area. The value of the data is discussed comparing it to the Red list of Croatian Dragonflies. Data contribution of the research is quantified and correlated with existing mapping projects of Croatian Dragonflies.

P-69

GENETSKA RAZLIKA VUKA I PSA USPOREDBOM KONTROLNIH REGIJA MITOHONDRIJSKE DNA

L. Pađen[1], M. Maurić[1], T. Gomerčić[2], Ž. Gottstein[3], M. Đuras Gomerčić[4], A. Galov[5], J. Kusak[2] i Đ. Huber[2]
[1]Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (elun5@net.hr, sovrhan@yahoo.com), [2]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr, josip.kusak@vef.hr, djuro.huber@vef.hr), [3]Zavod za bolesti peradi, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (zeljko.gottstein@vef.hr), [4]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (martina.duras@vz.htnet.hr), [5]Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-

matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (agomercic@yahoo.com)

Vuk (*Canis lupus*) zaštićena je vrsta u Hrvatskoj, te je za štete koje vuk napravi stanovništvu država dužna isplatiti odštetu. Kod utvrđivanja štete na stoci, u mnogim slučajevima je teško odrediti da li je počinitelj bio vuk ili pas (*Canis lupus familiaris*), a često se na mjestu gdje je šteta počinjena može naći biološki materijal počinitelja. Nadalje, u nekim slučajevima je na temelju morfoloških karakteristika pronađenih lešina vrlo teško razlikovati vuka i psa. U ovom radu smo željeli razviti molekularnu metodu razlikovanja vuka od pasa, korištenjem kontrolne regije mitohondrijske DNA. Iz četiri uzorka (vuk, dva psa i jedan sumnjivi, za koji se nije znalo da li je vuk ili pas) izolirali smo DNA, sekvencirali dio kontrolne regije mitohondrijske DNA (235 bp dugačke), te ih usporedili zajedno s još četiri sekvence (tri vuka i jedne psa) uzete iz genske baze podataka, GenBank. Za analizu sekvenci koristili smo programe BioEdit i Mega3. Pronašli smo specifična mjesta u kontrolnim regijama u kojima se vuk i pas razlikuju, na temelju kojih je utvrđeno da je majka sumnjivog uzorka bila vuk. Ovom metodom moguće je iz tkiva ili nekog drugog biološkog materijala, primjerice iz izmeta ili korijena dlake, razlikovati vukove iz Hrvatske od pasa, a time utvrditi i prisutnost vukova u određenom području ili eventualno dokazati počinitelja štete na stoci.

GENETIC DIFFERENCE BETWEEN WOLF AND DOG COMPARING THE CONTROL REGION OF THE MITOCHONDRIAL DNA

L. Pađen[1], M. Maurić[1], T. Gomerčić[2], Ž. Gottstein[3], M. Đuras Gomerčić[4], A. Galov[5], J. Kusak[2] and Đ. Huber[2]
[1]Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (sovrhan@yahoo.com, elun5@net.hr), [2]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr, josip.kusak@vef.hr, djuro.huber@vef.hr), [3]Department of Avian Diseases, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (zeljko.gottstein@vef.hr), [4]Department of Anatomy, Histology and Embriology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (martina.duras@vz.htnet.hr), [5]Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (agomercic@yahoo.com)

Grey wolf (*Canis lupus)* is protected species in Republic of Croatia and the government is obliged to compensate for the damage done by wolves. However,

very often it is difficult to determine whether the damage is done by a wolf or a dog *(Canis lupus familiaris)*. Moreover, in some cases it is impossible to differentiate wolf and dog based on morphological traits, but distinction between them is of great importance for management of wolf population. The objective of this study was to define the genetic difference between wolf and dog using the control region of mitochondrial DNA sequence variation. In analysis we compared eight control regions of different animals; four grey wolves, three dogs and one suspicious sample (wolf or dog). We extracted DNA and sequenced part of control region of mitochondrial DNA of four samples and we used four additional sequences obtained from gene database on Internet, GenBank. We compared part of control region of mitochondrial DNA that is 235 bp long using programes BioEdit and Mega3.,. We found specific polymorphic sites in control regions for differentiation of wolf and dog, and according to that we were able to determine that the mother of the suspicious sample was a wolf. We conclude that we can distinguish wolves from Croatia and dogs using this method, when we have a tissue sample or any other biological material.

P-70

SPATIAL VARIATION OF TERRESTRIAL MACROFAUNA ALONG AN URBAN-RURAL GRADIENT IN THE CITY OF SKOPJE (PRELIMINARY RESULTS)

D. Prelik, A. Cvetkovska - Gjeorgievska, M. Kostadinovski, A. Stojanov, M. Milev and M. Gjorgjievski
Institute of Biology, Faculty of Natural Sciences, Gazi Baba bb P.O.box 1000 Skopje, R. of Macedonia

The taxonomically structure of the terrestrial macrofauna is parameter that can be used as indicator of faunal change along urbanization gradients. Main aim of this investigation was to evaluate the influence of urbanization on terrestrial macrofauna in the city of Skopje and his surrounding and to confirm or eject existing independent urban malacocenosis indicators of anthropogenic environmental changes. The preliminary results obtained during six month period (from July-December 2004) are presented. The investigation was conducted in the center of the city Skopje and his surrounding by using pitfall traps placed on a linear transects in three localities Urban - U (the area around the Army Hospital), Suburban – S (the area of the market “Techometal”) and Rural – R (meadow in the village Mralino, near the main road), along an Urban – Rural gradient. The community qualitative and quantitative composition has been determinate as well as floristic composition and hidrotermical conditions

of the soil. The existing of 11 groups was confirmed (Hymenoptera, Homoptera, Hemiptera, Diptera, Coleoptera, Lepidoptera, Orthoptera, Isopoda, Myriapoda, Aranea and Gastropoda). The results showed differences in appearing, without continuum of different groups along the gradient. Orthoptera, Isopoda, Aranea and Gastropoda were most abundant in the rural locality. The other groups (Hymenoptera, Homoptera, Hemiptera, Diptera, Coleoptera, Lepidopera and Myriapoda) showed differences in appearens in all three localities. Because of the preliminary character of this investigation, in the future is expected obtaining the results of the species diversity, trophical structure of the species and other parameters, which will give clear view of the urbanization influence to the living world in the city of Skopje.

P-71

SEZONSKA DINAMIKA I RAZNOLIKOST STANIŠTA MEDICINSKI VAŽNIH KOMARACA U DALMACIJI

M. Romanović
Odjel za epidemiologiju i zdravstvenu ekologiju, Institut pomorske medicine Split, Šoltanska 1, HR-21000 Split, Hrvatska

Komarci (por. Culicidae) su značajni molestanti, ali mogu biti i nosioci uzročnika različitih bolesti. Obalno područje Hrvatske je bilo endemsko područje malarije u prvoj polovici XX stoljeća. Usprkos eradikaciji malarije šezdesetih godina prošlog stoljeća, komarci koji mogu biti nosioci plazmodijuma još uvijek predstavljaju potencijalnu opasnost u urbanim i ruralnim sredinama. Faunistička istraživanja (2000-2004) pokazala su prisustvo 28 vrsta komaraca u Dalmaciji. Obrađena je 41 postaja (od Maslenice do Prevlake) a istraživanja su vršena od travnja do studenog svake godine. Upotrebljavane su CDC klopke sa suhim ledom kao atraktantom. Cilj istraživanja je bio dobiti bolji uvid u rasprostranjenost i vrste komaraca osobito onih koji imaju medicinski značaj. Od 28 determiniranih vrsta, deset su medicinski značajne. To su: *Anopheles messeae*; An. Maculipennis; An. Saccharovi; An. Claviger; *Culex pipiens*; *Ochlerotatus cantans*; Och. *Caspius caspius*; Och. Detritus; *Aedes vexans* i *Conquillettidia richiardii*. Neke od njih igrale su važnu ulogu kao vektori malarije u Dalmaciji. Staništa ličinaka mogu biti prirodna ili umjetna kao što su rubni dijelovi jezera, močvare, naplavna područja, napuštene kuće, kontejneri, gume i sl. Voda je stajaća, slatka ili boćata, ponekad bogata organskim tvarima. Razvoj komaraca ovisi o tipu staništa koje odabiru, njegovim ekološkim i klimaktološkim uvjetima. Najrasprostranjenija je vrsta Culex pipiens. Kao i ostale dvije vrste (*Anopheles claviger*; *Ochlerotatus cantans*) koje preferiraju umjetan tip staništa urbanih i suburbanih sredina,

gustoća dostiže svoj vrhunac u lipnju i rujnu. Ostale medicinski značajne vrste koje preferiraju gotovo isključivo prirodna staništa ruralnih sredina pokazuju manje oscilacije u gustoći tijekom istraživanog razdoblja od vrsta koje za svoj razvoj odabiru umjetna staništa.

SEASONAL DYNAMICS AND BREEDING HABITAT DIVERSITY OF MEDICALLY IMPORTANT MOSQUITOES IN THE COASTAL AREA OF CROATIA

M. Romanović
Department of Epidemiology and Health Ecology, Institute of Maritime Medicine Split, Šoltanska 1, HR-21000 Split, Croatia

Mosquitoes (fam. Culicidae) are significant molestants, but are also capable of carrying different diseases. Coastal region of Croatia were original (autochthonous) areas of malaria during the first half of XX century. Despite malaria eradication in the 1960-ies, mosquitoes capable to carry plasmodium still represent a potential treat to human and animals in rural as well as in urban regions. Faunistical researches (2000-2004) showed presence of 28 species in Dalmatia (part of coastal area of Croatia). From Maslenica Bridge to Prevlaka we controlled 41 localities. The researches are carried out from April to November each year. We used CDC traps with dry ice as an attractant. The goal was to obtain better insight into composition and distribution of mosquito species, especially those of particular medical importance. Among 28 species present in investigated area, 10 of them have a medical importance. These species are: *Anopheles messeae*, *Anopheles maculipennis*, *Anopheles saccharovi*, *Anopheles claviger*, *Culex pipiens*, *Ochlerotatus cantans*, *Ochlerotatus caspius caspius*, *Ochlerotatus detritus*, *Aedes vexans* and *Coquillettidia richiardii*. Some of these species had played an important role as a vector of malaria in Dalmatia. Breeding sites are quite varied (natural and artificial): edges of the lakes, marshes, ponds, flooded meadows, abandoned houses, containers, tires etc. Water was mostly stagnant, sometimes rich in organic matter**.** These breeding sites can be either permanent or temporary, either shaded or sunny with fresh or brackish water. The development rate of each mosquito species depended on breeding types of habitat. The most abundant and constant species was Culex pipiens. The peak of larval population was found in June and September for Cx. pipiens as well as the other species who prefers artificial habitats urban and suburban areas (*Anopheles claviger*, *Ochlerotatus cantans*). The other medically important species prefers mostly natural habitats of rural areas and theirs larval population densities showed less oscillation than those who prefers artificial breeding habitats.

P-72

KALCIJ U TLU, LISTINCU I TRČCIMA U ŠUMSKOM EKOSUSTAVU

L.Šerić Jelaska[1], M. Blanuša[2], P. Durbešić[1] i G. Gregorović[1]
[1]Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, Zoologijski zavod, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (slucija@zg.biol.pmf.hr, paula.durbesic@zg.tel.hr, gregorov@zg.biol.pmf.hr), [2]Institut za medicinska istraživanja i medicinu rada, Ksaverska cesta 2, HR-10001 Zagreb, Hrvatska (mblanusa@imi.hr)

S obzirom da neke vrste trčaka preferiraju staništa s povećanim koncentracijama kalcija u tlu, istražena je povezanost između koncentracije kalcija u tlu, listincu i trčcima (Carabidae, Coleoptera) na četiri lokacije u šumskom ekosustavu. Istraživane plohe smještene su u šumskoj zajednici *Lamio orvalae – Fagetum* na području Parka prirode Medvednica. Trčci su uzorkovani metodom lovnih posuda i određeni do vrste. Za svaki uzorak tla izmjerena je kiselost i količina organske tvari. Srednja vrijednost izmjerene količine kalcija u tlu, listincu i trčcima iznosila je redom 1,56, 14,1 i 1,26 mg/g suhe tvari. Usporedbom mjerenja po plohama statistički značajno veća količina organske tvari u tlu , te kalcija u tlu i trčcima zabilježena je na istoj plohi (P3). Rezultati mjerenja za svaku vrstu analizirani su ovisno o spolu, veličini tijela, tipu ishrane i periodu razmnožavanja. Utvrđene su značajne razlike u koncentraciji kalcija među vrstama. Najveća koncentracija metala zabilježena je za vrstu *Cychrus attenuatus*, a najniža za vrstu *Carabus intricatus*. Također je značajna razlika utvrđena u koncentracijama između mužjaka i ženki.

CALCIUM CONCENTRATION IN GROUND BEETLES, SOIL AND LEAF LITTER OF A FOREST ECOSYSTEM

L.Šerić Jelaska[1], M. Blanuša[2], P. Durbešić[1] and G. Gregorović[1]
[1]Faculty of Science, Department of Zoology, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (slucija@zg.biol.pmf.hr, paula.durbesic@zg.tel.hr, gregorov@zg.biol.pmf.hr), [2]Institute for Medical Research and Occupational Health, Ksaverska cesta 2, HR-10001 Zagreb, Croatia (mblanusa@imi.hr)

Because of the affinity of some carabid species for habitats with higher limestone content in the soil, the objective of this study was to quantify the relationship between calcium concentrations in soil, leaf litter and ground beetles (Carabidae, Coleoptera) in a forest ecosystem. Four sampling sites were located in *Lamio orvalae - Fagetum* forest in Medvednica Nature Park. The ground beetles were sampled by pitfall trapps and determined on species

level. Acidity and percentage of organic matter content were measured in soil samples. Calcium concentration in soil, litter and beetles were 1.56, 14.1 and 1.26 mg/g dry weight respectively. Significantly higher organic matter content in soil and metal concentrations were recorded in soil and ground beetles on plot P3 than in the other three plots. Results were analysed according to sex, body size, feeding strategies and breeding period of the ground beetle species. Significant differences in calcium concentrations between species were recorded. The highest concentration was recorded for *Cychrus attenuatus*, and the lowest for *Carabus intricatus*. Significantly higher concentration of calcium was found in females.

P-73

DOMINANT SPECIES OF THE GASTROPOD FAUNA FROM THE LITTORAL REGION IN LAKE OHRID OF R.MACEDONIA

S. Smiljkov[1], B. Budzakoska-Gjoreska[2], J. Shapkarev[1] and S. Trajanovski[2]
[1]Institute of Biology, Faculty of Natural Sciences and Mathematics, Skopje, Republic of Macedonia (stoe@iunona.pmf.ukim.edu.mk), [2]Hydrobiological Institute-Ohrid, Ohrid, Republic of Macedonia

The class of Gastropoda is one of the Lake Ohrid' macrozoobenthic groups, which characterize highest level of endemism. Since the first published references until now, studying the Lake Ohrid's snail fauna represents huge scientific challenge for many malacologists from the world. The high percent of endemic as well as relic forms among the lake's gastropods could be explained by the processes of intralacustric speciation during the history and evolution of this aquatic ecosystem. These processes no doubt have been enabled by the complexity and stability of the Lake' basin. This work, represents the results of the dominant species, from both qualitative and quantitative sense of the gastropod fauna from 19 investigated littoral localities of Lake Ohrid. The results from the investigations on gastropod fauna has shown that following species: *Chilopyrgula sturanyi, Radix relicta* and *Valvata stenotrema* qualitatively predominates in the samples from the littoral region of the Macedonian part of Lake Ohrid. The quantitative analyses (according to their presence on m^{-2}), has shown that the following species predominate: *Chilopyrgula sturanyi* (6879 ind m^{-2}), *Theodoxus fluviatilis dalmaticus* (6412 ind·m^{-2}), *Pyrgohydrobia grochmalickii* (5504 ind m^{-2}) and *Valvata stenotrema* (5009 ind m^{-2}).

P-74

RAZNOLIKOST I SEZONSKA DINAMIKA FAUNE TULARA (*Trichoptera, Insecta*) SREDIŠNJEG DIJELA HERCEGOVINE

S. Stanić[1], M. Kučinić[2] i P. Durbešić[2]
[1]Fakultet prirodoslovno-matematičkih i odgojnih znanosti, Sveučilište u Mostaru, Matice hrvatske bb, 88000 Mostar, Bosna i Hercegovina (svjetlana.stanic@pincable.net), [2]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (kucinic@zg.biol.pmf.hr, paula.durbesic@zg.t-com.hr)

U središnjem dijelu Hercegovine prikupljani su tulari od ožujka 2003. do ožujka 2004. godine metodom svjetlosne klopke. Istraživanje je obuhvatilo sedam postaja na četiri rijeke: Neretvi, Lištici, Bunici i Radobolji. Analizom prikupljenih uzoraka zabilježene su ukupno 52 vrsta tulara iz petnaest porodica. Vrste *Hydroptila angulata* Mosely, *Hydroptila tineoides* Dalman, *Agraylea sexmaculata* Curtis i *Athripsodes dalmatinus* Malicky nove su za faunu Bosne i Hercegovine. Od ukupno prikupljena 14.822 primjerka najbrojnije vrste su bile *Odontocerum albicorne* Scopoli, *Silo piceus* Brauer, *Hydroptila sparsa* Curtis i *Hydropsyche instabilis* Curtis. Najveća raznolikost i brojnost tulara zabilježena je tijekom toplih proljetnih i ljetnih mjeseci (od svibnja do kolovoza). Za svaku prikupljenu vrstu prikazan je period letenja imaga. Najveći stupanj raznolikosti faune utvrđen je, pomoću Brillouinovog, Shannon-Wienerovog i Simpsonovog indeksa bioraznolikosti, za izvorišni dio rijeke Lištice, a najmanji na Neretvi uzvodno od Mostara. Bray-Curtisov indeks sličnosti ukazuje na najveću sličnost faune tulara na Neretvi nizvodno od Mostara i rijeci Bunici.

DIVERSITY AND SEASONAL DYNAMICS OF CADDISFLIES (*Trichoptera, Insecta*) IN THE CENTRAL HERZEGOVINA

S. Stanić[1], M. Kučinić[2] and P. Durbešić[2]
[1] Faculty of Science and Education, University of Mostar, Matice hrvatske bb, 88000 Mostar, Bosnia and Herzegovina (svjetlana.stanic@pincable.net), [2]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (kucinic@zg.biol.pmf.hr, paula.durbesic@zg.t-com.hr)

Adult Trichoptera were collected at the seven sites using light trap from March 2003 to March 2004 in the central part of Hercegovina. The research was included four rivers: Neretva, Lištica, Bunica and Radobolja. A total catch

included fifty-two species from fifteen families. *Hydroptila angulata* Mosely, *Hydroptila tineoides* Dalman, *Agraylea sexmaculata* Curtis and *Athripsodes dalmatinus* Malicky were new to the fauna of Bosnia and Herzegovina. From the total of 14.822 specimens caught, the most abundant species were *Odontocerum albicorne* Scopoli, *Silo piceus* Brauer, *Hydroptila sparsa* Curtis and *Hydropsyche instabilis* Curtis. Greatest diversity and numbers of adult Trichoptera were collected during the warmer spring/summer months (from May to August). The flight periodicity is given for each species. Diversity, expressed as Brillouin, Shannon-Wiener and Simpson indices, was highest at the spring of river Lištica and lowest at the Neretva upstream of Mostar. The highest similarities (calculated by the help of Bray-Curtis index) was between Neretva downstream of Mostar and river Bunica.

P-75

PRIVREMENE LOKVE KAO STANIŠTA VODENIH KORNJAŠA (COLEOPTERA) NA PODRUČJU PARKA PRIRODE LONJSKO POLJE

M. Temunović, L. Šerić Jelaska i P. Durbešić
Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (slucija@zg.biol.pmf.hr)

Vodeni kornjaši su dobri bioindikatori promjene kvalitete vodenih staništa. Privremene i trajne stajačice predstavljaju najvažnije stanište za ovu skupinu kukaca. Istraživanje sastava i brojnosti kornjaša skupine Hydradephaga ovisno o hidroperiodu i zasjenjenosti šest privremenih lokava provedeno je na području Parka prirode Lonjsko polje. Kornjaši su uzorkovani semikvantitativnom metodom poteza D-mrežicom od svibnja do prosinca 2004. godine. Pri svakom uzorkovanju zabilježene su dimenzije lokava te temperatura vode, količina kisika otopljenog u vodi, pH vrijednosti te konduktivitet za svaku lovku. Zabilježeno je 30 vrsta Hydradephaga, od toga su za područje Hrvatske zabilježene dvije nove vrste. Vrstama najbrojnija je porodica Dytiscidae s 26 vrsta, zatim porodica Haliplidae s 3 vrste i porodica Noteridae sa samo jednom vrstom *Noterus crassicornis*. Utvrđene su razlike u sastavu i brojnosti Hydradephaga između lokava. Na lokvi Trebež zabilježen je najveći broj vrsta (76,7 % svih vrsta) uz najveću brojnost jedinki (84,79 %), pri čemu je 16 vrsta zabilježeno isključivo na lokvi Trebež, dok niti jedna vrsta nije zabilježena u svim lokvama. Utvrđeno je da kornjaši preferiraju trajnije lokve, te otvorena i nezasjenjena staništa. Čak 10 vrsta zabilježeno je samo jednom tijekom uzorkovanja, što ukazuje na izraženu sezonsku dinamiku s obzirom na nestalne uvjete na staništu i potrebu za čestim kolonizacijama drugih prostora. Manja

zasjenjenost staništa okolnom vegetacijom pozitivno utječe na kolonizaciju. Promjene sastava i brojnosti vrsta u sukcesijskim stadijima lokava koreliraju s promjenama temperature, količinom otopljenog kisika i soli u vodi.

TEMPORARY PONDS AS HABITATS FOR AQUATIC BEETLES (COLEOPTERA) IN NATURE PARK LONJSKO POLJE

M. Temunović, L. Šerić Jelaska and P. Durbešić
Department of Zoology, Division of Bilogy, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (slucija@zg.biol.pmf.hr)

Water beetles are considered to be good bioindicators of habitat quality in freshwater environments. Temporary and permanent standing waters represent the most important habitat for this group of insects. Research of species composition and abundance of Hydradephaga depending on water permanence (hydroperiod) and shading was conducted in six temporary ponds in Lonjsko polje Nature Park. Aquatic coleoptera were collected using semiquantitative method of sweeping D-frame pond net from May to Decembre 2004. For each pond, dimensions, water temperature, dissolved oxygen concentration, pH and conductivity were measured at each sampling date. Thirty species of Hydradephaga were identified, two of which are new records for Croatian area. Species richness is the highest for the familiy Dytiscidae with 26 species recorded, followed by the family Haliplidae with 3 species and family Noteridae with only one species *Noterus crassicornis.* Differences in species composition and abundance of Hydradephaga between ponds were observed. The highest species richness (76,7 % of all species) as well as abundance (84,79 % of all specimens) were recorded for pond Trebež. Sixteen species were recorded exclusively in this pond, while none species were in common for all six ponds. It is observed that water beetles prefer more permanent ponds with longer hydroperiod and open, less shaded habitats. Ten species were recorded just once during sampling period which clearly points out seasonal dynamics regarding variable conditions in these type of habitats and a need for more frequent colonization of other environments. Habitats less shaded with surrounding vegetation have positive infuence on colonization. Changes in species composition and richness in different succession stages of ponds are correlated with changes in water temperature, dissolved oxygen concentration, pH and conductivity of water.

P-76

SOCIO-KULTURNO I ZDRAVSTVENO ZNAČENJE HRANJENJA GRADSKIH GOLUBOVA (*Columba livia* FORMA *domestica*) U GRADU ZAGREBU

K. Vlahović, M. Popović i R. Resanović
Zavod za biologiju, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (vlahovic@vef.hr, mpopovic@vef.hr)

U radu prikazujemo vlastite spoznaje o razlozima zbog kojih ljudi hrane gradske golubove, kao i znanstve spoznaje koje govore o problemima vezanih uz zajednički život golubova i ljudi u gradu Zagrebu. Nedavni slučajevi ptičje gripe ukazali su na visok stupanj osjetljivosti javnosti spram pitanja interakcije ptica i ljudi. Stoga je cilj ovih istraživanja bio napraviti monitoring u onim djelovima grada gdje golubovi u čovjekovom životnom okolišu predstavljaju određeni zdravstveno-sanitarni, ekonomski i ekološki problem. Glavno mjesto istraživanja bili su: parkovi, trgovi i glavne gradske ulice na prostoru grada Zagreba i to područja s većom koncentracijom stanovništva (uže gradsko središte) kao i izgrađena nova naselja te njihovi međuprostori što su po svom karakteru pretežito još neizgrađeni. Tijekom proljeća 2006. godine terenskim obilascima utvrđeni su lokaliteti hranjenja te dinamika i motivi ljudi koji su hranili navedenu populaciju istraživanih ptica. Zabilježena je učestala pojava, da ljudi u gradu Zagrebu i to posebice na lokacijama užeg gradskog središta, redovito hrane ovu vrstu ptica što je zasigurno jedan od mogućih razloga za stalno povećanje brojnog trenda populacije golubova u gradu. Golubovi su divlje ptice i hranjenje od strane ljudi mnijenja njihov odnos i mogućnosti za pronalaženje hrane u prirodi što nužno stvara ovisnost o ljudima. Pokazalo se da postoje različiti motivi osoba koje hrane ptice. Prvenstveno su to bili motivi hranjenja ptica iz ljubavi, dosade, igre, turističke atrakcije kao i vjerski razlozi, a hranjenje se je pokazalo kao jedan od najznačajnijih psihofizičkih oblika dodira čovjeka i gradskih golubova kao i jedna vrlo ukorijenjena navika.

SOCIO-CULTURAL AND HEALTH MEANING OF FERAL PIGEONS FEEDING (*Columba livia* FORMA *domestica*) IN THE CITY OF ZAGREB.

K. Vlahović, M. Popović and R. Resanović
Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, RH-10000 Zagreb, Croatia (vlahovic@vef.hr, mpopovic@vef.hr)

In this work we present our previous knowledge about the reasons why people feed feral pigeons, as well as scientific knowledge that discuss the problems that are related to cohabitation of pigeons and people in the city of Zagreb. Recent cases of bird flu showed a high sensitivity level of public related to interaction between birds and people. So, the purpose of this research was to do a monitoring in those parts of town where pigeons represent a certain health, sanitary, economic and ecologic problem in human surroundings. Main research parts of those areas were the parks and squares in Zagreb at areas with higher population (city centre), as well as new settlements and their interspaces, that are not yet finished. During the spring of 2006, with field visits, the localities, dynamics of feeding and motivation of people for feeding of mentioned population of researched birds were registered. Frequent phenomena was registered, that people in the city of Zagreb, and especially in parks and squares of city centre regularly feed this bird species, which is for certain on of the possible reasons for increasing number of pigeon population in town. It showed that people feed pigeons for different reasons. Primary, it was because of love for birds, boredom, play, tourist attraction as well as for religious reasons, and the feeding turned out to be one of the most significant psychophysical way of contact between people and feral pigeons, as well as an old habit.

P-77

NALAZ NOVE VRSTE KOMARCA U FAUNI HRVATSKE

T. Žitko[1] i E. Merdić[2]
[1]Zavod za javno zdravstvo Splitsko-dalmatinske županije, Vukovarska 46, HR-21000 Split, Hrvatska (tzitko@yahoo.com), [2]Zavod za biologiju, Sveučilište J. J. Strossmayera u Osijeku, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska

Pronađena je nova vrsta komarca u Hrvatskoj. Njena fauna sada broji 50 vrsta komaraca. Mediteranska vrsta *Culex laticinctus,* Edwards 1913 pronađena je na otoku Visu u srednjoj Dalmaciji u rujnu 2003. godine. Praćenjem populacije tijekom ljetnih i jesenskih mjeseci 2005. godine zabilježeno je njeno pojavljivanje u kasno ljeto i porast brojnosti populacije do jesenskih dana.

FINDING OF A NEW MOSQUITO SPECIES IN CROATIAN FAUNA

T. Žitko[1] and E. Merdić[2]
[1]Public Health Institute of Split and Dalmatia County, Vukovarska 46, HR-21000 Split, Croatia (tzitko@yahoo.com), [2]Department of biology, University of J. J. Strossmayer in Osijek, L. Jägera 9, HR-31000 Osijek, Croatia

A new mosquito species has been found in Croatia, the Mediterranean species *Culex laticinctus,* Edwards 1913. It is 50th mosquito species in the Croatian fauna. It was found on the island of Vis in Dalmatia in September 2003. During the summer and autumn of 2005 we were monitoring the population of this species, and found out that it appears in late summer, its abundance increasing until autumn.

Uvodna tematska predavanja
Introductory Lectures

IL-10
MUKOZNA IMUNOST I IMUNOMODULACIJA U ENTERIČKIM INFEKCIJAMA SVINJA IZAZVANIM SOJEVIMA BAKTERIJE *E. coli*

I. Valpotić[1], D. Kezić[1] i H. Valpotić[2]
[1]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (valpotic@vef.hr dkezic@vef.hr), [2]Zavod za hranidbu, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (hrvoje.valpotic@vef.hr)

Enteričke bolesti svinja kao što su kolidijareja (KD) i kolienterotoksemija (KE) odbijene prasadi izazvane fimbrijskim enterotoksigenim (F4ac+ ili F18ac+) i verotoksigenim (F18ab+) sojevima bakterije *E. coli* (ETEC/VTEC) i dalje su od velikog zdravstvenog i gospodarstvenog značaja unatoč opsežnim istraživanjima i inovativnim proizvodnim tehnologijama. Ti sojevi mogu izazvati bolest u prasadi od rođenja do 10 tjedana starosti, ali su najčešći uzročnici u odbijene prasadi. Premda KD i KE odbijene prasadi uzrokuju znatne gubitke u prasadi, još uvijek nema sigurnih i djelotvornih vakcina protiv tih bolesti. Poduzeta su opsežna istraživanja radi iznalaženja znanstvene osnove za utvrđivanje alternativnih strategija (prekomjernoj nekliničkoj uporabi antibiotika) za djelotvornu imunoprofilaksu KD/KE. Ovdje će pregledno biti izneseni podaci o temeljnim imunosnim markerima i kriterijima zdravlja probavnog sustava praseta, postignuća glede karakterizacije i stimulacije crijevne mukozne imunosti, te u iznalaženju pokusnih vakcinalnih sojeva. Naša je hipoteza, da će F4ac^{+} autentični ili rekombinantni ne-ETEC sojevi i F18ac^{+}/F18ab^{+} genetski modificirani ne-ETEC/VTEC soj, uporabljeni za oralnu imunizaciju odbijene prasadi: (1) stimulirati stanične mukozne imunosne odgovore, (2) potaknuti lučenje pretežito imunosnih, a manje upalnih citokina, (3) uspostaviti zaštitne razine sIgA protutijela, (4) djelovati sinergistički u kombinaciji s imunomodulatorima i/ili nutraceuticima, (5) prevenirati/kontrolirati pokusno izazivanje i prirodno izbijanje KD/KE u prasadi iz intenzivnog uzgoja. S obzirom da je naš krajnji cilj pripravljanje sigurnih i djelotvornih mukoznih vakcina protiv ovih enteričkih bolesti, te da se primijene opravdani postupci vakcinacije, bit će također prikupljeni podaci o nasljedno otpornim rasplodnim linijama svinja bez crijevnog receptora za adheziju pokusnih vakcinalnih sojeva.

MUCOSAL IMMUNITY AND IMMUNOMODULATION IN PORCINE ENTERIC INFECTIONS DUE TO *E. coli* STRAINS

I. Valpotić[1], D. Kezić[1] and H. Valpotić[2]
[1]Department of Biology, Veterinary Faculty University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (valpotic@vef.hr dkezic@vef.hr), [2]Department of Animal Nutrition, Veterinary Faculty University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (hrvoje.valpotic@vef.hr)

Enteric diseases of swine such as postweaning colidiarrhea (PWCD) and colienterotoxemia (PWCE) caused by fimbriated enterotoxigenic (F4ac$^+$ or F18ac$^+$) and verotoxigenic (F18ab$^+$) *E. coli* strains (ETEC/VTEC) are of great health/economical significance in spite of extensive research and innovative production techniques. These strains can seriously affect pigs from birth to 10 weeks of age, but the most often are associated with weaned pigs. Although, PWCD and PWCE account for significant losses among pigs there are no safe and effective vaccines as yet. Comprehensive studies were undertaken to provide a scientific basis for the development of alternative strategies (to wide spread non-clinical use of antibiotics) for efficient immunoprophylaxis of PWCD/PWCE. This study will review the basic immunologic markers and criteria of healthy pig gut, progress regarding characterization and potentiation of intestinal mucosal immunity and searching for vaccine candidate strains. Our hypothesis that F4ac$^+$ either authentic or recombinant non-ETEC strains and F18ac$^+$/F18ab$^+$ genetically modified non-ETEC/VTEC strain when used for the oral immunization of weaned pigs will: (1) stimulate cellular mucosal immune responses, (2) induce secretion of rather immune than inflammatory cytokines, (3) establish protective levels of sIgA antibodies, (4) act synergistically when applied with the immunomodulators and/or nutraceuticals, and (5) prevent/control experimentally and naturally occurring PWCD/PWCE in intensively reared pigs. Since our final goal is to develop safe and effective mucosal vaccines against both enteric diseases and to apply rational vaccinal regimes we will also provide data on genetically resistant breeding swine lacking the small intestinal receptors for the adhesion by vaccinal strains.

IL-11
SELEKTIVNI UČINAK PROPOLISA I NJEGOVIH POLIFENOLNIH SASTAVNICA NA PRIMARNU KULTURU STANICA TUMORA MOKRAĆNOG MJEHURA I NORMALNIH EPITELNIH STANICA U LJUDI

N. Oršolić[1], D. Štajcar[2], L. Šver[3], I. Kosalec[4], M. Bakmaz[5], S. Terzić[6] i I. Bašić[1]

[1]Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (norsolic@yahoo.com), [2]Opća bolnica, Odjel za Urologiju, Meštrovićeva b.b. HR-42000 Varaždin, Hrvatska, [3]Laboratorij za biologiju i genetiku mikroorganizama, Prehrambeno-biotehnološki fakultet, Sveučilište u Zagrebu, Kršnjavoga 25, HR-10000 Zagreb, Hrvatska, [4]Zavod za mikrobiologiju, Farmaceutsko-biokemijski fakultet, Sveučilište u Zagrebu, Schrottova 39, HR-10000, Zagreb, Hrvatska, [5]Analitički laboratorij, Gradska ljekarna Zagreb, Karlovačka cesta 271, HR-10421 Rakov Potok, Hrvatska, [6]Hrvatski Veterinarski Institut, Savska cesta 143, HR-10000 Zagreb, Hrvatska

Brojni epidemiološki podaci potpomažu hipotezu da povećana uporaba voća i povrća smanjuje pojavnost tumora. Flavonoidi nazočni u propolisu su značajan izvor kemoterapeutskih tvari budući da posjeduju brojne biološke aktivnosti. Ovim istraživanjem željeli smo doznati da li propolis i njegove polifenolne/flavonoidne sastavnice mogu prouzročiti citotoksični učinak na primarnu kulturu stanica tumora mokraćnog mjehura u ljudi. U istraživanjima smo rabili tkivo tumora mokraćnog mjehura u različitim histopatološkim stadijima (stadij G1, G2, G3) te normalno epitelno tkivo stijenke mjehura. Pojedinačne stanice smo pripravili standardnom laboratorijskom procedurom te nasadili u mediju RPMI-1640 uz dodatak 20% FCS te inkubirali na 37˚C uz 5% CO_2 u zraku sa ili bez nazočnosti različitih koncentracija (75, 150 i 300 µg/ml) propolisa (vodena i alkoholna otopina propolisa; WSDP, EEP) i/ili polifenolnih sastavnica (kafeinska kiselina, naringin, krizin i kvercetin). Rezultati ukazuju da je alkoholna otopina propolisa najviše učinkovita u inhibiciji proliferacije stanica tumora mokraćnog mjehura ljudi u odnosu na pojedine polifenolne sastavnice nazočne u propolisu. Propolisni pripravci i njihove polifenolne satavnice nisu prouzročili citotoksični učinak na normalnim epitelnim stanicama u kulturi, što ukazuje na selektivni učinak isth na stanice tumora mokraćnog mjehura u odnosu na normalne stanice. Ovi rezultati ukazuju na moguću primjenu EEP u supresiji i pojavnosti tumora mokraćnog mjehura nakon operacijskog zahvata te mogući učinak u kontroli rasta tumora. Budući da primjena BCG može poboljšati rezultate nakon operacijskog zahvata, smatramo da obrada s EEP može biti dobra zamjena za mikobakterijsku obradu budući da propolis ne pokazuje popratne štetne učinke. Točne mehanizme kemoprevencije i učinkovitosti propolisa trebalo bi istražiti.

THE SELECTIVE EFFECT OF PROPOLIS AND ITS POLYPHENOLIC COMPOUNDS ON PRIMARY CULTURE OF HUMAN URINARY BLADDER CANCER AND NORMAL EPITHELIAL CELLS

N. Oršolić[1], D. Štajcar[2], L. Šver[3], I. Kosalec[4], M. Bakmaz[5], S. Terzić[6] and I. Bašić[1]
[1]Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (norsolic@yahoo.com), [2]General Hospital, Urology Department, Meštrovićeva b.b. HR-42000 Varaždin, Croatia, [3]Faculty of Food Technology and Biotechnology, Laboratory for Biology and Microbial Genetics, University of Zagreb, Kršnjavoga 25, HR-10000 Zagreb, Croatia, [4]Institute of Microbiology, Faculty of Pharmacy and Biochemistry, University of Zagreb, Schrottova 39, HR-10000 Zagreb, Croatia, [5]Analytical Laboratory, Zagreb City Pharmacy, HR-10412 Rakov Potok, Croatia, [6]Croatian Veterinary Institute, Savska cesta 143, HR-10000 Zagreb, Croatia

Large amounts of epidemiological data have supported the inverse relation between the consumption of fruits and vegetables and the incidence of cancer. The flavonoids present in propolis are considered to be rich source of chemopreventive agents, since they have various therapeutic biological activities. This study was carried out to find whether propolis and its polyphenolic/flavonoids compounds may induce cytotoxicity in primary culture of human urinary bladder cancer cells as compared to normal urinary bladder epithelial cells. Pieces of urinary bladder cancer grown in the cavity of urinary bladder as well as normal epithelial tissue from urinary bladder wall were taken from patients in different stages (grade G1, G2, G3) of bladder carcinoma. Single cells suspension from pieces of either cancer or normal tissue was prepared according standard laboratory procedure. Incubation for cytotoxicity testing were carried out in RPMI-1640 medium with 20% FCS at 37 ˚C with 5% CO_2 with or without different concentration (50, 150, 300 µg/ml) of test components. The cytotoxicity of two preparations of propolis (water and ethanolic extract of propolis; WSDP or EEP) and its polyphenolic compounds (caffeic acid, naringin, chrysin, and quercetin) was determined using trypan blue exlusion assay. These findings suggest that EEP is the most effective in inhibition of urinary bladder cancer cell proliferation as compared to flavonoids derived from propolis. All test components have no cytotoxic effect on normal epithelial cells. The result of this study may provide great impact on the potential activity of EEP as an adjuvant to surgery, to suppress or prevent tumor recurrence in urinary bladder since only a few anti-cancer drugs have been effective in tumor control. Since immunomodulation by BCG has been used to improve the results of surgery it is likely that propolis preparation (EEP) as immunomodulating compound may be a substitute for mycobacterial treatment since propolis preparation have expressed no side effect after treatment. However, the exact cancer chemoprevention mechanisms of propolis effectiveness have to be elucidated.

Kratka usmena priopćenja
Oral Presentations

OP-35
MODULACIJA SVINJSKIH ILEALNIH M STANICA ŽIVIM ORALNIM VAKCINAMA PROTIV KOLIDIJAREJE I KOLIENTEROTOKSEMIJE ODBIJENE PRASADI

A. Kovšca[1], F. Božić[1], N. Vijtiuk[2], G. Lacković[3] i I. Valpotic[1]
[1]Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (ana.janjatovic.kovsca@vef.hr, bozic@vef.hr, valpotic@vef.hr), [2]Učiteljski fakultet Sveučilišta u Zagrebu, Savska cesta 77, HR-10000 Zagreb, Hrvatska (nada.vijtjuk@zg.htnet.hr), [3]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (gordanal@zg.biol.pmf.hr)

Enterotoksigeni sojevi bakterije *Escherichia coli* (ETEC) i dalje su glavni uzrok gospodarskih gubitaka u svinjogojstvu zbog pojave kolidijareje (KD) i kolienterotoksemije (KE) odbijene prasadi. U dizajniranju sigurne i djelotvorne imunoprofilakse tih enteričnih infekcija, najviše obećavaju žive atenuirane oralne vakcine. Interakcije između luminalnih bakterijskih antigena i specijaliziranih mikronaboranih (M) stanica značajno utječu na funkciju crijevne epitelne barijere i pripadajućeg limfoidnog tkiva. Aktivacija stečenog immunosnog odgovora na mukozne vakcine najviše ovisi o sposobnosti unosa antigena od M stanica u epitelu folikula (EF) iznad Peyerovih ploča. Stoga je istraživana brojnost i raspodjelu M stanica u ileumu prasadi imunizirane F4ac$^+$ ili F18ac$^+$ ne-ETEC sojevima, a potom izazivački inficirane homolognim ETEC sojem. U cilju utvrđivanja porasta unosa antigena iz lumena crijeva nakon inokulacije vakcinalnim ne-ETEC i virulentnim ETEC sojevima, procijenjene su promjene brojnosti M stanica u EF imunohistološkim metoda i analizom slike s pomoću računala. Morfometrijski je utvrđen porast brojnosti M stanica u prasadi imunizirane F4ac$^+$ ne-ETEC sojem u odnosu na neimuniziranu prasad. Kvantifikacija M stanica prasadi imunizirane F18ac$^+$ ne-ETEC sojem također pokazuje znatno povećanje broja tih stanica. Naši podaci pokazuju da regulaciju nastajanja i gustoće M stanica može potaknuti samo prisustvo oralno unesenih fimbrijskih antigena bakterije *E. coli* , što bi mogo biti od praktične vrijednosti pri poželjnoj modulaciji crijevnog mukoznog imunosnog odgovora na uzročnike KD i KE.

MODULATION OF PORCINE ILEAL M CELLS WITH LIVE ORAL VACCINES AGAINST POSTWEANING COLIDIARRHEA AND COLIENTEROTOXEMIA

A. Kovšca[1], F. Božić[1], N. Vijtiuk[2], G. Lacković[3] and I. Valpotic[1]
[1]Veterinary Faculty, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (ana.janjatovic.kovsca@vef.hr, bozic@vef.hr, valpotic@vef.hr), [2]Teachers Faculty, University of Zagreb, Savska cesta 77, HR-10000 Zagreb, Croatia (nada.vijtjuk@zg.htnet.hr), [3]Department of Zoology, Division of Biology, Faculty of Science, Universitiy of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (gordanal@zg.biol.pmf.hr)

Enterotoxigenic *Escherichia coli* (ETEC) strains remain major cause of economic losses in swine industry due to postweaning colidiarrhea (PWCD) and colienterotoxemia (PWCE). For designing of safe and effective immunoprophylaxis agains these enteric infections, live attenuated oral vaccines would be the most promising. The interactions between luminal bacterial antigens and specialized microfold (M) cells profoundly influence the function of intestinal epithelial barrier and underlying lymphoid tissues. Activation of adaptive immune responses to mucosal vaccines critically depend on ability of antigen uptake by M cells of the follicle-associated epithelium (FAE) that overlie Peyer's patches. Therefore, we have performed study of M cell abundancy/distribution in ileum of pigs immunized with either F4ac$^+$ or F18ac$^+$ non-ETEC strains and challenged with homologous ETEC strain. To verify that sampling of antigens from gut lumen was improved following inoculation with vaccinal non-ETEC and virulent ETEC strains we have estimated changes in the number of M cells within the FAE by immunohistology and digital image analyses. Morphomety revealed an increase in the number of M cells in the pigs immunized with F4ac$^+$ non-ETEC strains in comparison to nonimmunized pigs. Quantification of M cells in pigs immunized with F18ac$^+$ non-ETEC strain also showed a considerably higher number of these cells. Our data indicate that the genesis and density of intestinal M cells can be upregulated by the presence of orally delivered fimbrial antigens of *E. coli* which may be of a practical value for beneficial modulation of the gut mucosal immune responses to causative agents of PWCD and PWCE.

OP-36

DJELOVANJE Baypamun® N (BPNN) SA ŽIVIM ORALNIM CJEPIVOM PROTIV KOLIBACILOZE U ODBIJENE PRASADI

N. Vijtiuk[1], F. Božić[2], M. Popović[2], G. Lacković[3] i I. Valpotić[2]

[1]Učiteljski fakultet, Sveučilište u Zagrebu, Savska cesta 77, HR-10000 Zagreb, Hrvatska (nada.vijtiuk@uazg.hr), [2]Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova cesta 55, HR-10000 Zgreb, Hrvatska (valpotic@vef.hr) [3]Zavod za zoologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (gordanal@biol.pmf.hr)

Živi rekombinantni mikroorganizmi koji ispoljavaju antigene primijenjeni oralno, kandidati su za sprječavanje ETEC infekcije u odbijene prasadi. Međutim, antigeni predstavljeni na taj način stvaraju suprimirajući imunološki odziv. Ovo istraživanje je provedeno u cilju određivanja sposobnosti nadvladavanja takvog učinka primjenom oslabljenog Parapoxvirus ovis virusa, BPNN-a. U *in vivo* istraživanju BPNN je primijenjen intramuskularno prije specifične imunizacije potencijalnim cjepivom, ne-ETEC sojem 2407. Za *in vitro* istraživanje BPNN je primijenjen samo in vitro. Dva dana po odbiću, prasad u "in vitro" istraživanju intragastrično je inokulirana s F4ac$^+$ ne-ETEC sojem 2407 ili ETEC sojevima (M1823, 11-800/1/94). Prasad u "in vivo" istraživanju je inokulirana ne-ETEC sojem 2407 (Dan 0) i izložena infekciji ETEC sojem 11-800/1/94 (Dan 6). Kontrolne skupine prasadi primile su placebo. In vitro i in vivo učinci izraženi su povećanim odzivom crijevnih imunoloških stanica iz lamine proprie jejunuma (JLPL), Peyerovim pločama ileuma (IPPL) i mezenterijskog limfnog čvora (MLNL) nakon poticanja imunosti prasadi sojem 2407 ili sojevima M1823 i 11-800/1/94. Sukladno tim nalazima jest učinak ne-ETEC soja 2407 na porast broja CD4a$^+$, CD8a$^+$, CD21$^+$ i SWC5 ãð TCR$^+$ stanica u JLP, CD21$^+$ i SWC3a$^+$ stanica u MLN. Temeljem dobivenih rezultata, uporaba BPNN može se preporučiti za pojačavanje ne-specifičnog i specifičnog imunološkog odziva prasadi imunizirane potecijalnim cjepivom, ne-ETEC sojem 2407.

THE EFFECT OF Baypamun® N (BPNN) WITH LIVE ORAL VACCINE AGAINST POSTWEANING COLIBACILLOSIS IN PIGS

N. Vijtiuk[1], F. Božić[2], M. Popović[2], G. Lacković[3] and I. Valpotić[2]
[1]Teacher Faculty, University of Zagreb, Savska cesta 77, HR-10000 Zagreb, Croatia (nada.vijtiuk@uazg.hr), [2]Veterinary faculty, University of Zagreb, Heinzelova cesta 55, HR-10000 Zgreb, Croatia (valpotic@vef.hr) [3]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (gordanal@biol.pmf.hr)

Live recombinant microorganisms expressing antigens delivered orally are candidates for the prevention of postweaning ETEC infections in pigs.

However, the antigen presented this way generates a suppressor immune response. The current study was undertaken in an attempt to determine whether attenuated Parapoxvirus ovis, i. e. BPNN, is capable of overcoming that effect. For *in vivo* study BPNN was applied intramuscularly prior to the specific immunization with vaccine candidate non-ETEC strain 2407. For *in vitro* study BPNN was administered only in vitro. Two days after weaning, the pigs in the "in vitro" experiments were intragastrically inoculated with F4ac^{+} either non-ETEC strain 2407 or ETEC strain (M1823, 11-800/1/94). Pigs in the "in vivo" experiment were inoculated with non-ETEC strain 2407 (Day 0) and challenged with ETEC strain 11-800/1/94 (Day 6). Control groups of pigs were given placebo. The in vitro and in vivo effects were demonstrated by increased responsiveness of the gut immune cells from the jejunal lamina propria (JLPL), ileal Peyer's patches (IPPL), and the mesenteric lymph node (MLNL) after priming of pigs with either vaccine candidate strain (2407) or pathogenic strains (M1823, 11-800/1/94). Consistent with these findings is the priming effect of non-ETEC strain 2407 which induced an increase in the numbers of CD4a^{+}, CD8a^{+}, CD21^{+} and SWC5 ãð TCR $^{+}$ cells in JLP, CD21^{+} and SWC3a^{+} cells in MLN. Based on those results, the usage of BPNN could be recommended for enhancing both non-specific and specific immune responses of pigs immunized with vaccine candidate non-ETEC strain 2407.

Posterska priopćenja
Posters

P-78
HEMATOLOŠKE I BIOKEMIJSKE ODREDNICE KRVI POSKOKA (*Vipera ammodytes*)

D. Lisičić[1], Z. Tadić[1], D. Đikić[1], N. Oršolić[1], V. Benković[1], A. Horvat Knežević[1] i I. Bašić[1]
Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (dulisicic@net.hr)

Hematologija gmazova slabije je istražena u odnosu na hematologiju toplokrvnih životinja. Hematološke odrednice u različitih skupina gmazova znatno se razlikuju dok takve razlike nisu uočene u ptica i sisavaca. Hematološke odrednice također variraju kod gmazova unutar iste vrste ovisno o starosti, spolu, prehrani, bolesti, fiziološkom stanju jedinke. Cilj cjelokupnog istraživanja je odrediti neke hematološke odrednice poskoka (*Vipera ammodytes*) u svrhu boljeg poznavanja biologije ove vrste. Rezultati koje ovdje iznosimo odnose se na populaciju poskoka iz Hrvatskog zagorja, a dio su proučavanja hematologije gmazova u Hrvatskoj. Uz prikaz hematoloških odrednica (broj leukocita, trombocita i eritrocita, DKS, količina hemoglobina, hematokrit, sedimentacija, MCHC, MCH, MCV) navodimo i kemijske odrednice krvi (količina proteina, glukoze, kolesterola, urata i triglicerida). Baza podataka "Zoological Record" od 1967. godine do danas navodi samo pet podataka o biologiji poskoka, stoga bi dobiveni rezultati mogli poslužiti kao osnova za daljnja ekofiziološka istraživanja. Poznavanje hematologije poskoka omogućilo bi lakše dijagnosticiranje i liječenje bolesti ove i srodnih vrsta gmazova.

HEMATOLOGY AND PLASMA CHEMISTRY OF NOSE-HORNED VIPER (*Vipera ammodytes*)

D. Lisičić[1], Z. Tadić[1], D. Đikić[1], N. Oršolić[1], V. Benković[1], A. Horvat Knežević[1] and I. Bašić[1]
Departement of Animal Physiology, Division of Biology, Faculty of Science, Universety of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (dulisicic@net.hr)

Reptilian haematology was studied much less than haematology of warm blooded animals. Haematological values in different species of reptiles show greater variability then those in mammals and birds. Also there are difference in haematological values in single species depending of age, sex, food intake, decease and physiological state of an animal. The aim of the whole study was to determine some haematological values giving contribution to the biology of the Nose-horned Viper (*Vipera ammodytes*). This study was made on the population of the Nose-horned Viper from Hrvatsko zagorje, as part of the future haematology research of reptiles in Croatia. Results we shown here consider both haematological (thrombocites, red and white blood cells count, differential blood count, haemoglobin concentration, hematocrit and sedimentation) and some plasma biochemical values (contractions of total protein, glucose, cholesterol, uric acid and triglycerides). "Zoological record" database cite only five references involving biology of Nose-horned Viper. Considering that, results from this study could be used as a standard profile for future ecophysiological studies. Also, data of haematology of the Nose-horned Viper would made diagnosis and treatment easier for this and other close related reptilian species.

P-79

PRELIMINARNE BIOKEMIJSKE ODREDNICE KRVI ŠARE POLJARICE (*Hierophis gemonensis*)

D. Lisičić[1], Z. Tadić[1], R. Coz-Rakovac[2], I. Strunjak-Perović[2], M. Hacmanjek[2] i N. Topić Popović[2]
Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (dulisicic@net.hr), [2]Grupa za ihtiopatologiju – Biološki materijali, Odsjek za kemiju materijala, Institut Ruđer Bošković, Bijenička 54, HR-10000 Zagreb, Hrvatska (ntopic@irb.hr)

Krvna plazma gmazova čini 60 do 80 posto ukupnog volumena krvi. Kod nekih vrsta je bezbojna, kod drugih obojena žutozeleno, žuto ili narančasto. Plazma sadrži niz različitih sastavnica, od kojih se mnogi nalaze tek u tragovima. Kemijski, fiziološki i imunološki, gmazovi su se pokazali kao raznolika skupina. Ektotermnost gmazova ima za posljedicu velike varijacije u sastavu tjelesnih tekućina. Zbog ovih razloga ne postoji fiziološke odrednice koje bi se mogle primjeniti za sve gmazove. Šara poljarice (*Hierophis gemonensis*) je jedna od najčešćih zmija hrvatskog priobalja i otoka. Rezultati koje ovdje iznosimo odnose se na neke biokemijske odrednice krvi šare poljarice držane u zarobljeništvu, pod kontroliranim uvjetima (količina proteina, glukoze,

kolesterola, urata, triglicerida, albumina, ALP, Ca, P). Krajnji cilj ovog istraživnja je odrediti hematološke i biokemijske odrednice krvi šare poljarice zbog bolje razumjevnja biologije ove vrste.

PRELIMINAR BLOOD PLASMA BIOCHEMISTRY OF CAPTIVE BALKAN WHIP SNAKE (*Hierophis gemonensis*)

D. Lisičić[1], Z. Tadić[1], R. Coz-Rakovac[2], I. Strunjak-Perović[2], M. Hacmanjek[2] and N. Topić Popović[2]
Departement of Animal Physiology, Division of Biology, Faculty of Science, Universety of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (dulisicic@net.hr), [2]Ichthyopathology Group - Biological Materials, Division of Materials Chemistry, Ruđer Bošković Institute, Bijenička 54, HR-10000 Zagreb, Croatia (ntopic@irb.hr)

Blood plasma in reptiles is making up some 60 to 80 per cent of blood volume. It is colorless fluid in some species, greenish yellow or orange in others. Plasma contains great variety of different substances, most of them being present in trace quantities. Chemically, physiologically and immunological, reptiles are a variable group. Composition of body fluids shows great variations in reptiles, mostly because the whole group are ectothetms. There are no strictly basal conditions to define wide range of reptilian physiology. Balkan whip snake (*Hierophis gemonensis*) is one of most common snakes of costal Croatia and its islands. The results we have shown here consider some plasma biochemical values of captive Balkan whip snakes, in controlled environment (concentrations of total protein, glucose, cholesterol, uric acid and triglycerides, albumin, ALP, calcium, phosphorus). Final aim of this study is to determine haematological and biochemical reference ranges in blood for Balkan whip snake. Those results could be used for better understanding of biology for this species.

P-80
IZRAVNI ANTITUMORSKI UČINAK PČELINJEG OTROVA U UVJETIMA *in vitro* I *in vivo*

N. Oršolić i I. Bašić
Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (norsolic@yahoo.com, ibasic1@yahoo.com)

Naša prva istraživanja pokazala su da protutumorska i protumetastatska aktivnost pčelinjeg otrova može biti ovisna o načinu unosa i bliskom doticaju stanica tumora sa sastavnicama otrova. U ovom istraživanju željeli smo istražiti učinak pčelinjeg otrova uštrcanog izravno u tumor nakon 7 i/ili 14 dana nakon unosa stanica tumora te pojasniti mehanizme učinkovitosti pčelinjeg otrova. Rabili smo transplantabilni karcinom mliječne žlijezde miša CBA te HeLa i MCa stanice *in vitro.* Tumor smo prouzročili podkožnim (sc) uštrcavanjem $1x10^5$ vijabilnih tumorskih stanica. Učinkovitost pčelinjeg otrova *in vivo* praćena je inhibicijom rasta tumora (TIR%). Pčelinji otrov u dozi od 150, 300 i 600 µg/mišu odgađa rast tumora, smanjuje masu tumora te povećava preživljavanje životinja. Inhibicija rasta tumora je ovisna o dozi i vremenu obrade *in vivo* i *in vitro* kako pokazuju istraživanja na HeLa i MCa stanicama. Ova istraživanja zajedno s prvim istraživanjima ukazuju da apoptoza, nekroza i liza stanica tumora može biti mehanizam učinkovitosti pčelinjeg otrova na tumor. Nadalje, više pažnje treba posvetiti istraživanju prirodnih inhibitora rasta tumora poput pčelinjeg otrova i drugih proizvoda pčelinje košnice te s novim spoznajama omogućiti uporabu istih u kliničkoj praksi.

DIRECT ANTITUMOR ACTIVITY OF HONEY BEE VENOM *in vitro* AND *in vivo*

N. Oršolić and I. Bašić
Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (norsolic@yahoo.com, ibasic1@yahoo.com)

In our previous study we demonstrated that antitumour and antimetastatic effects of bee venom could be highly dependent on route of injection and on close contact between bee venom and tumour cells. Here we were particularly interested in antitumour activities of bee venom given intratumourally at different times after tumour cell inoculation and in clarification of the mechanisms by which bee venom produced these effects. Tumor was a transplantable mammary carcinoma (MCa) of spontaneous origin. Tumor in footpad was generated by *sc* injection of 1×10^5 tumor cells. In *in vitro* studies we used HeLa and MCa cells. Groups of 7 mice bearing mammary carcinoma tumors were treated with single injection of bee venom subcutaneously (*sc*) at doses of 150, 300, 600 µg/mouse after 7 and/or 14 days and effectiveness of bee venom on tumour growth was determined as tumour-growth inhibition rate (TIR%). When bee venom was injected intratumourally tumours decreased in size; some sort of shrinkage of tumours occurred, and the delay of tumour growth was evident. Survival of bee venom treated mice was prolonged

compared to control mice. Bee venom significantly inhibited tumour growth; tumour inhibition effect of bee venom was dose- and time depedent *in vivo* and *in vitro* as shown by studies with HeLa and MCa cells. In summary, this study together with previous one demonstrate that apoptosis, necrosis and lysis of tumor cells could be the possible mechanisms by which bee venom inhibited tumor growth. Furthermore, it is likely that more attention should be paid to natural inhibitor of tumor growth such as bee venom and other products of bee hive in testing their antitumor activity for future possible use in clinical practice.

P-81

PROPOLIS I NJEGOVE POLIFENOLNE SASTAVNICE KAO RADIOPROTEKTIVNE TVARI U MIŠA

N. Oršolić[1], V. Benković[1], A. Horvat-Knežević[1], N. Kopjar[2], D. Lisičić[1], D. Đikić[1] i I. Bašić[1]
[1]Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (norsolic@yahoo.com), 2Institut za medicinska istraživanja i medicinu rada, Ksaverska c. 2, HR-10000 Zagreb, Hrvatska

Poznato je da zračenje može prouzročiti veliku količinu slobodnih radikala. Komponente koje imaju sposobnost sakupljanja slobodnih radikala mogu reducirati oštećenja prouzročena zračenjem na molekularnoj i staničnoj razini te cijelom organizmu. Propolis sadrži polifenolne/flavonoidne satavnice s antioksidativnim osobitostima koje bi mogle imati zaštitni učinak od ionizirajućeg zračenja. Istražili smo radioprotektivni učinak i antioksidativnu sposobnost propolisai flavonoida nazočnih u propolisu na razini organizma. Zdrave odrasle Swis albino miševe injicirali smo s dva pripravka propolisa (vodena otopina propolisa, WSDP; alkoholna otopina propolisa, EEP) i/ili njihovim polifenolnim sastavnicama (kafeinska kiselina, naringin, krizin, kvercetin) u dozi od 100 mg/kg tjelesne težine i/ili s destiliranom vodom i 1% otopinom etanola kao kontrolom, tijekom tri dana u nizu prije ili poslije zračenja životinja s γ-zrakama (^{60}Co) dozom od 9 Gy.U studiji preživljavanja životinja kvercetin i naringin dati preventivno su pokazali najveću učinkovitost; broj preživjelih životinja obrađenih kvercetinom bio je 73% odnosno naringinom 45%. Kaplan-Meier-ova metoda, i log-rank test ukazuju na statistički značajno vrijeme preživljavanja miševa obrađenih s propolisnim pripravcima i/ili flavonoidnim sastavnicama u usporedbi s kontrolnom skupinom miševa: kvercetin, naringin, WSDP ($p<0.0001$), kafeinska kiselina, krizin ($p=0.0003$) i EEP ($p=0.0081$). Obrada životinja s istraživanim sastavnicama nakon zračenja

je bila neučinkovita.Rezultati ukazuju da propolis i njegove polifenolne sastavnice imaju značajan radioprotektivni učinak temeljen na stimulaciji i zaštiti hematopoetskog sustava bez naznaka toksičnosti čak u dozama većim od 200 mg/kg. Niska doza propolisa i njegovih flavonoida te visoka učinkovitost u zaštiti od zračenja obećavaju moguću primjenu istih u zaštiti ljudi od ionizirajućeg zračenja.

PROPOLIS AND ITS POLYPHENOLIC COMPOUNDS AS A RADIOPROTECTIVE AGENTS IN MICE

N. Oršolić[1], V. Benković[1], A. Horvat-Knežević[1], N. Kopjar[2], D. Lisičić[1], D. Đikić[1] and Ivan Bašić[1]
[1]Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia; [2]Institute for Medical Research and Occupational Health, Ksaverska c. 2, HR-10000 Zagreb, Croatia

Radiation is a well-known inducer of free radicals. Compounds that scan free radicals may reduce radiation-induced damages on macromolecular and cells level as well as damages on the level of organism itself. Propolis contains polyphenolic/flavonoids compounds with antioxidant properties which are belived to be protective against cellular damage caused by ionizing radiation. Radioprotectivni effect of two preparation of propolis (water and ethanolic extract of propolis; WSDP or EEP) and their polyphenolic compounds (caffeic acid, naringin, chrysin, quercetin) were investigated in the whole body γ-irradiated (WBI) mice exposed to 9 Gy of ^{60}Co γ-radiation. Each test component at dose of 100 mg kg^{-1} body weight was administered to Swiss albino mice intraperitoneally, daily for 3 days, before or after WBI and survival studies in mice were investigated. In surviving studies quercetin and naringin given to mice before lethal irradiation with 9 Gy were most effective; the number of survivors after 60 days post-irradiation was 73% or 45%, respecively. The Kaplan-Meier method, and the log-rank test have revealed that the surviving time of mice was as follows: quercetin, naringin, WSDP ($p<0.0001$), caffeic acid, chrysin ($p=0.0003$) and EEP ($p=0.0081$). Treatment with test comonents after irradiation was ineffective. The results from the present study suggest that the propolis and its polyphenolic compounds have a radioprotective role in stimulating/protecting the haematopoietic system and in protecting mice from lethal effects of acuteWBI. Neither flavonoid had any systemic toxicity, even at dose of 200 mg kg^{-1}. Considering the low dose needed for protection and the high margin between the effective and toxic dose, propolis and its polyphenolic compounds may be promising for human radiation protection.

P-82

ANTITUMORSKA AKTIVNOST MAKROFAGA AKTIVIRANIH VODENOM OTOPINOM PROPOLISA

N. Oršolić i I. Bašić
Zavod za animalnu fiziologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (norsolic@yahoo.com, ibasic1@yahoo.com)

Mnoga istraživanja podupiru hipotezu da makrofagi igraju važnu ulogu odbacivanju tumora. Tijekom ranijih istraživanja u našem laboratoriju, pokazali smo da makrofagi aktivirani vodenom otopinom propolisa (VOP) povećavaju otprnost organizma te odgađaju rast tumora u CBA miševa. Makrofagi posjeduju mogućnost uništavanja tumorskih stanica u različitim okolnostima. Kako bi zadobili izravnije dokaze vezane za utjecaj VOP na aktivnost makrofaga, istražili smo izravni i neizravni citotoksični utjecaj peritonealnih makrofaga normalnih CBA miševa i/ili Swiss albino miševa te miševa injiciranih VOP u *in vitro* i *in vivo* uvjetima. Izravna citotoksičnost određena je mjerenjem ugradnje ^{3}H-timidina u HeLa stanice ili utvrđivanjem sposobnosti stvaranja kolonija HeLa i V79 stanica u *in vitro* uvjetima. Uz to, mjerili smo proizvodnju interleukina-1 (IL-1) i dušikovog oksida (NO) u kulturi makrofaga sakupljenih u miševa obrađenih VOP. Naposlijetku, pokušali smo utvrditi je li izvanstanična citotoksičnost na tumorske stanice ovisna o NO ili drugim čimbenicima koje proizvode aktivirani makrofagi. Rezultati su pokazali da protutumorska aktivnost VOP uključuje jasnu imunomodulatornu aktivnost u miševa zbog povećanja nespecifične protutumorske obrane putem aktivacije makrofaga i proizvodnje topivih čimbenika koje izlučuju stanice koje mogu biti u doticaju sa stanicama imunološkog sustava ili direktno s tumorskim stanicama.

TUMORICIDAL ACTIVITY OF MACROPHAGES BY WATER SOLUBLE DERIVATIVE OF PROPOLIS

N. Oršolić and I. Bašić
Department of Animal Physiology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (norsolic@yahoo.com, ibasic1@yahoo.com)

Many investigations suport the hypothesis that macrophages play a vital function in tumor rejection. In previous experiments in our laboratory, we demonstrated that activated macrophages by water-soluble derivative of propolis (WSDP) are associated with resistance to tumor growth in CBA mice.

Macrophages are able to destroy tumor cells under a variety of circumstance. To obtain more direct evidence regarding the role of WSDP on macrophage activity, we undertook the studies described below. Peritoneal macrophages from normal CBA mice and/or Swiss albino mice and mice injected with WSDP were examined for direct and indirect cytotoxic effect to tumor cells in vitro and in vivo. Direct cytotoxicity was estimated by measurement of incorporation of ^{3}H-tymidine into HeLa cells or by colony forming ability of Hela or V79 cells in vitro. In addition, we measured the production of interleukin 1 (IL-1) and nitric oxide (NO) in culture of macrophages collected from mice treated with WSDP. Finally, we attempted to determine whether extracellular cytotoxicity to tumor cells is dependant on NO or other factors produced by activated macrophages. The results established that antitumor activity of WSDP includes pronounced immunomodulatory activity due to the augmentation of non-specific antitumor resistance in mice via macrophage activation and production of soluble factors by those cells which may interfere with either cells of immune system or directly with by tumor cells.

P-83

DJELOVANJE INTRAVENOZNE IMUNOGLOBULINSKE TERAPIJE NA FREKVENCIJU PREKURSORA POMOĆNIČKIH T LIMFOCITA (fTp) I RAZINU TNF-á KOD ŽENA S UČESTALIM SPONTANIM POBAČAJIMA

M. Puc[1], I. Humar[1], Ž. Duić[2] i V. Kerhin[1]
[1]Centar za tipizaciju tkiva, Klinički bolnički centar Zagreb, Hrvatska (maja.puc@bj.htnet.hr, ines.humar@kbc-zagreb.hr), [2]Klinika za ginekologiju i porodiljstvo, Sveučilišna bolnica Merkur, Zagreb, Hrvatska

Zadatak ovog rada je bio istražiti mogući utjecaj intravenozne imunoglobulinske terapije (IVIg) na frekvenciju prekursora pomoćničkih T limfocita (fTp) i na tumor nekrozis faktor alpha (TNF-á) kod pacijentica s učestalim spontanim pobačajima. 45 žena s tri i više učestalih spontanih pobačaja je dobivalo intravenoznu imunoglobulinsku terapiju, nakon začeća kao prevencija od pobačaja. Uzorci krvi od pacijentica su sakupljani u određenom slijedu, prije i nakon terapije. Kod 12 žena s učestalim spontanim pobačajima, koje su primile intravenoznu imunoglobulinsku terapiju ispitivala se frekvencija prekursora pomoćničkih T limfocita i razina TNF-á. Kontrolnu grupu za razinu TNF-á su činile zdrave žene (n=15),a za 5 žena iz te kontrolne grupe je ispitivana i frekvencija prekursora pomoćničkih T limfocita. Uspoređivali smo odnose vrijednosti prije i poslije uzimanja intravenozne imunoglobulinske terapije. Rođenje djeteta se smatra uspješnim ishodom terapije, a postotak uspješnosti

naših ispitanica je 76%. Kod grupe ispitivanih pacijentica primjećeno je značajno snižavanje frekvencije prekursora Tp nakon drugog intravenoznog primanja imunoglobulina (p=0,02). Primjećen je značajan porast koncentracije TNF-á kod žena s učestalim spontanim pobačajima u usporedbi sa zdravim ženama. Kod žena koje su imale spontane pobačaje, a uspjele su iznjeti trudnoću do kraja je pronađena niža koncentracija TNF-á, za razliku od žena koje nisu uspjele roditi. (p=0,017). Intravenozna imunoglobulinska terapija ima utjecaj na promjenu u aloimunološkom odgovoru, koji doprinosi pobačaju, kod žena s učestalim spontanim pobačajima. Potvrđujući da su Tp-1 vezani uz neuspješnost trudnoće, intravenozna imunoglobulinska terapija mijenja i povećava uspješnost trudnoće.

EFFECTS OF INTRAVENOUS IMMUNOGLOBULIN THERAPY ON THE PRECURSOR OF T HELPER FREQUENCIES (fTh) AND TNF-á LEVEL IN WOMEN WITH RECURRENT SPONTANEOUS ABORTIONS

M. Puc[1], I. Humar[1], Ž. Duić[2] and V. Kerhin[1]
[1]Tissue Typing Centre, University Hospital Zagreb, Croatia (maja.puc@bj.htnet.hr, ines.humar@kbc-zagreb.hr), [2]Clinic for Gynecology and Obstetrics, University Hospital Merkur, Zagreb, Croatia

The aim of this study was to investigate a possible effect of intravenous immunoglobulin therapy (IVIg) on the precursor of T helper frequencies (fThp) and TNF-alpha in RSA patients. 45 women with history of unexplained three and more recurrent spontaneous abortion (RSA) was treated with intravenous immunoglobulin (IVIg), after conception in the prevention of RSA. Peripheral blood samples were collected in serial order, before and after therapy. Study group for Thp frequencies and cytokine level consisted of 12 RSA treated women. Control group (n=15) of healthy women were compared for cytokine level and in that group 5 women were measured fThp. Ratios were compared between pre- and post- infusion in samples. The birth of child was considered a successful outcome. The success rates were 76% after therapy. A decrease of Thp frequencies were present in group of patients after second administration of IVIg at significant level (p=0,02). Significantly increased concentration of the TNF-alpha was found in RSA as compared with successful pregnancy. In abortion–prone women who had a successful pregnancy, lower concentrations of TNF-alpha were found as compared with abortion-prone women who had another abortion (p=0,017). We conclude that IVIg therapy have effect on alteration in alloimmune response which contributes pregnancy failure in RSA women. Supporting the notion that Th-1 is associated with unsuccessful pregnancy, IVIg administration modifies and enhances successful pregnancy.

BIOLOGIJA MORA
BIOLOGIA MARIS
MARINE BIOLOGY

Uvodna tematska predavanja
Introductory Lectures

IL-12
POGLEDI NA ENDEMIZAM U SREDOZEMNOJ I JADRANSKOJ IHTIOFAUNI

I. Jardas
Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (jardas@izor.hr)

Sredozemna ihtiofauna je novovjekog postanka i još uvijek je u razvoju.. Nakon propasti sredozemne paleofaune za vrijeme mesinske krize u miocenu i pliocenu (prije otprilike 5 – 6 mil. god.), kada dolazi do prekida morske veze između Sredozemnog mora i Atlantika i isušenja sredozemnog bazena, Sredozemno more je naseljeno ponovo u pliocenu, kada je uspostavljena trajna veza između tih dvaju bazena. Od tada Sredozemno more predstavlja konvergentnu točku za atlantsku , a u novije vrijeme (nakon prokopa Sueskog kanala 1869.) i indopacifičku (crvenomorsku ili lesepsijsku) ihtiofaunu i područje daljnje evolucije u smislu stvaranja novih vrsta i podvrsta. Endemizam, koji je rezultat toga, čini to more jedinstvenim u usporedbi s drugim morima. Danas je u sredozemnoj ihtiofauni, koja broji oko 664 vrste, 55 endemičnih vrsta Osteichthyes (9.5%) i 4 vrsta Chondrichthyes (4.6%). Osobito je velik broj endema iz porodice Gobidae (46%), koja je dominantna u tom moru. U jadranskoj ihtiofauni, koja broji oko 434 vrste i podvrste, 6 vrsta je endemičnih (1,4%). To su: *Acipenser naccarii*, *Syngnathus taenionotus* i gobidi *Knipowitschia panizzae*, *Pomatoschistus canestrinii*, *Speleogobius trigloides* i recentno opisana vrsta *Gobius kolombatovici*, sve živuće u plitkom priobalnom moru. Boljim poznavanjem geografske rasprostranjenosti „endemičnih“ vrsta njihov se broj konstantno smanjuje, za što je upravo Jadransko more dobar primjer.

ASPECTS ON ENDEMISM IN THE MEDITERRANEAN AND ADRIATIC ICHTHYOFAUNA

I. Jardas
Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (jardas@izor.hr)

Mediterranean ichthyofauna is of recent existence and even today it is still

evolving. After the destruction of the Mediterranean paleo-fauna during the messinian crisis in last Miocene (about 5 – 6 million years ago), when the interruption of communication between the Mediterranean and Atlantic and desiccation of the Mediterranean basin occurred, the Mediterranean Sea was recolonised in Pliocene when permanent communication between Mediterranean and Atlantic was restored. Since then the Mediterranean Sea became convergent point for Atlantic and recently (since the opening of the Sues Canal in 1869) for Indo-pacific (Red Sea or lessepsian) ichthyofauna and it is also the area where evolution continues to giving birth to numerous species and sub-species. Resulting endemism make this sea unique in comparison with other seas. Nowadays, in the Mediterranean fish community, which is evolved at 664 species, endemic species represent 8.8%; 55 species of the Osteichthyes classis (9.5%), mostly from the Gobidae family (46%), and 4 species of Chondrishthyes classis (4.6%). In the Adriatic Sea ichthyofauna, which is evolved at 446 species and sub-species, 6 species are endemic (1.4%). These are: *Acipenser naccarii*, *Syngnathus taenionotus*, and gobioids *Knipowitschia panizzae*, *Pomatoschistus canestrinii* and recentlly described *Gobius kolombatovici*, all living in the shallow coastal sea. Number of endemic species in both Mediterranean and Adriatic is in constant decrease due to better knowledge of its geographical distribution and Adriatic is a very good example for that.

Kratka usmena priopćenja
Oral Presentation

OP-37
BENTOSKE MORSKE ALGE REDA CERAMIALES (RHODOPHYTA) NA ISTOČNOJ OBALI JADRANA

B. Antolić i A. Žuljević
Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (antolic@izor.hr, zuljevic@izor.hr)

Posljednji kompletniji popis bentoskih algi Jadranskoga mora koji uključuje i red Ceramiales, najbrojniji red crvenih alga (odjeljak Rhodophyta) dao je Giaccone (1978). Temeljna manjkavost toga rada je nedostatak podataka o bentoskoj flori toga reda crvenih algi u južnom Jadranu. Ta se manjkavost u ovom radu pokušala izbjeći. Naime, u radu se iznose podaci o bentoskoj flori crvenih algi ovoga reda na istočnoj obali Jadranskoga mora s posebnim osvrtom na njegov sjeverni, srednji i južni dio. Lista se temelji na literaturnim podacima koji su objavljeni 1950 godine i kasnije. Ta je godina uzeta za graničnu jer su na sličan način oblikovane liste zelenih algi Sredozemlja (Gallardo *et al*, 1993) i istočne obale Jadrana (Antolić *et al*., 2001), smeđih algi Sredozemlja (Ribera *et al*., 1992), crvenih algi iz reda Ceramiales u Sredozemlju (Garetta *et al*., 2001). U radu je ukupno uključeno 168 svojti bentoskih crvenih algi reda Ceramiales koje su svrstane u porodice, rodove, vrste, podvrste, odlike i oblike. Najveći broj svojti (143) zabilježen je u srednjem Jadranu, manji u sjevernom (125 svojte) a najmanji u njegovom južnom dijelu (106 svojti).

BENTHIC MARINE ALGAE OF THE ORDER CERAMIALES (RHODOPHYTA) ON THE EASTERN ADRIATIC COAST

B. Antolić and A. Žuljević
Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (antolic@izor.hr, zuljevic@izor.hr)

The recent and more complete survey of benthic algae of the Adriatic Sea that includes the order Ceramiales, the most numerous order of the red algae (Rhodophyta), was given by Giaccone in 1978. The basic deficiency of the stated work was the lack of data regarding benthic flora of the order Ceramiales from the South Adriatic. We tried to avoid that lack in the present work. This paper deals with data of benthic flora of the red marine algae (order Ceramiales) on the eastern Adriatic coast with particular consideration of the

North, Middle and South Adriatic. The survey is based upon the data published from begining with 1950 and further on. The 1950 is taken as "border" year due to the similar way of listed Mediterranean green algae (Gallardo *et al*, 1993); the list of green algae on the eastern Adriatic coast (Antolić *et al*., 2001), the list of Mediterranean brown algae (Ribera *et al*., 1992); the list of Mediterranean red algae (order Ceramiales) (Garetta *et al*., 2001). In this work there is a total of 168 taxa of benthic red marine algae (order Ceramiales) that are classified into families, genera, species, subspecies, varieties and forms. The greatest number of taxa has been registered in the middle Adriatic (143), lower number in the northern Adriatic (125) and the lowest number (106) in the southern Adriatic.

OP-38

NOVAČENJE MLAĐI CIPLA DUGAŠA, *Liza saliens* (RISSO, 1810) NA PODRUČJU UŠĆA NERETVE

V. Bartulović i B. Glamuzina
Odjel za akvakulturu, Sveučilište u Dubrovniku, Ćira Carića 4, HR-20000 Dubrovnik, Hrvatska (vlasta@unidu.hr, glamuzina@yahoo.com)

Mlađ cipla dugaša, *Liza saliens* (Risso, 1810) je uzorkovana u razdoblju od srpnja 2003. do travnja 2004. godine na šest postaja (luka Ploče, Ušće Kanala, Ušće Neretve, Ušće Male Neretve, Crna Rijeka u Rogotinu i uvala Bistrina) šireg područja ušća Neretve. Radi različitih tipova dna na istraživanim postajama, korištene su dvije vrste ribolovnih alata; mreža potegača i «špurtilo». Ukupno je prikupljeno 3160 jedinki koje su pohranjivane u plastične bočice s 8%-tnim formalinom te naknadno obrađivane u laboratoriju. Mlađ cipla dugaša, ukupne dužine od 10-20mm prvi put se pojavljuje tijekom srpnja. Najveći broj jedinki je prikupljen u kolovozu te rujnu, kada počinju dominirati ribe veće od 20 mm. Razdoblje novačenja mlađi cipla dugaša na širem području ušća Neretve je od srpnja do rujna, s najvećim udjelom u kolovozu. Od listopada u uzorcima nisu zabilježene uzrasne kategorije manje od 15mm, što ukazuje da je novačenje novih jedniki završeno. Od šest istraživanih postaja tijekom kolovoza najviše mlađi je ulovljeno na postaji Ušće Kanala i ušće Male Neretve. Manji broj je ulovljen u luci Ploče i ušću Neretve. Mlađ cipla dugaša je uzorkovana i u zaljevu Bistrina, ali s malim brojem. Početak migracija mlađi u ekosustave nižih slanosti je zabilježen na slatkovodnoj postaji u Rogotinu tijekom kolovoza, kada je uzorkovana mlađ uzrasnih struktura od 10-25 mm. Najbrži rast mlađi je zabilježen na ušću Male Neretve te na ušću Kanala. Obje postaje obilježavaju visoke temperature, i do 32 °C. Rast je slabiji u luci Ploče, gdje temperatura ne prelazi 25 °C.

RECRUITMENT OF LEAPING GREY MULLET, *Liza saliens* (RISSO, 1810) FRY IN THE ESTUARY OF NERETVA RIVER

V. Bartulović and B. Glamuzina
Department of aquaculture, University of Dubrovnik, Ćira Carića 4, HR-20000 Dubrovnik, Croatia (vlasta@unidu.hr, glamuzina@yahoo.com)

Leaping grey mullet, *Liza saliens* (Risso, 1810) juveniles were sampled in the period July, 2003- April, 2004, on six sampling sites (port of Ploče, mouth of Kanal channel, mouth of Neretva River, mouth of Mala Neretva River, Crna rijeka River in Rogotin and Bay of Bistrina) of wider area of the Neretva River estuary. Two different sampling tools were used due to different habitat and bottom type of sampling sites: small beach seine and a small net mounted on a 2-m-long pole. In total, 3160 specimens were fished out, conserved in 8% formaldehyde and analysed in the laboratory later. Leaping grey mullet juveniles firstly appeared in July and total lengths were from 10 to 20mm. Highest number of juveniles was sampled in August, followed by September. In September length categories above 20mm started to dominate in samples. Period of leaping grey mullet juveniles recruitment in the area of Neretva River estuary is from July to September, with a peak in August. From October, specimens smaller then 15mm were not found in samples, showing that recruitment of newly juveniles is finished. The highest number of juveniles in August was fished out in the mouths of Kanal and Mala Neretva River. Smaller number was caught in port of Ploče and mouth of the Neretva River. Juveniles were caught in the Bay of Bistrina also, but in small quantities. Start of migration in areas with lower salinities was observed during August, when juveniles between 10-25mm of total length were caught on freshwater site in Rogotin. The growth rate was highest at Mala Neretva estuary and mouth of Kanal. Both sites are characterised with high temperatures, even up to 32 °C. The growth was slower in port of Ploče, where temperatures was bellow 25°C.

OP-39
RASPROSTRANJENOST BENTOSKIH ZAJEDNICA DUŽ SVJETLOSNOG GRADIJENTA UZ UVALU BRBINJŠĆICA, DUGI OTOK

H. Čižmek[1], M. Radolović[1], D. Petricioli[2], S. Dujmović[1], P. Kružić[1] i T. Bakran-Petricioli[1]
[1]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (hcizmek@yahoo.com, mirko_radolovic@net.hr, san@rovinj.net, pkruzic@zg.biol.pmf.hr, tatjana.bakran-petricioli@zg.t-com.hr), [2]D.I.I.V. d.o.o., HR-23281 Sali, Hrvatska (dpetricioli@oikon.hr)

Svjetlost je jedan od važnih čimbenika koji utječe na rasprostiranje bentoskih zajednica. Želeći utvrditi kako se mijenja sastav bentoskih zajednica obzirom na količinu dostupne svjetlosti od listopada 2004. do studenog 2005. godine usporedno smo istraživali podmorski prolaz i transekt okomit na obalu, sjeverozapadno od uvale Brbinjšćica, na Dugom otoku. Prolaz se pruža uz obalu, u smjeru JI-SZ, dugačak je 45 metara, najdublja točka je na 11 metara, a osim istočnog i zapadnog ulaza ima i otvor na stropu u središnjem dijelu. Zbog izraženog hidrodinamizma u prolazu je svjetlost ključni čimbenik koji utječe na rasprostiranje bentoskih zajednica, dok su ostali čimbenici ujednačeni. Transekt se pruža od istočnog otvora prolaza na 8 metara dubine do 48 metara, odnosno do pomičnog dna. Intenzitet svjetlosti mjeren je u razdoblju od 16 dana na izabranim točkama istovremeno u prolazu i na transektu. Također je mjerena temperatura kroz godinu na 9, 28 i 48 metara na transektu i na 9 metara u prolazu. Zabilježena je raznolikost vrsta u sastavu pojedinih zajednica. U prolazu su utvrđene: zajednica fotofilnih algi, koraligenska zajednica i zajednica polutamnih špilja, dok je na transektu uz prve dvije utvrđena još i zajednica vrste *Posidonia oceanica*, koja je slabije razvijena zbog prevladavajuće čvrste podloge i velike energije valova. Zbog nagle promjene količine svjetlosti u prolazu je utvrđen nagli prelazak iz jedne zajednice u drugu. Na transektu je promjena količine svjetlosti s dubinom postupna, te je prijelaz između zajednica postupan.

DISTRIBUTION OF BENTHIC COMMUNITIES ALONG THE LIGHT GRADIENT IN BRBINJŠĆICA COVE, DUGI OTOK

H. Čižmek[1], M. Radolović[1], D. Petricioli[2], S. Dujmović[1], P. Kružić[1] and T. Bakran-Petricioli[1]
[1]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (hcizmek@yahoo.com, mirko_radolovic@net.hr, san@rovinj.net, pkruzic@zg.biol.pmf.hr, tatjana.bakran-petricioli@zg.t-com.hr), [2]D.I.I.V. d.o.o., HR-23281 Sali, Croatia (dpetricioli@oikon.hr)

Light is an important factor influencing the dispersion of benthic communities. The aim of this study was to identify how the quantity of attainable light could change the composition of benthic communities. Research was undertaken from October 2004 until November 2005, exploring the Brbinjšćica cove on the island of Dugi otok. The study focused on both a submarine passage and a vertical transect on the NW side of the cove. The passage is located along the coast with a SE-NW orientation; it is 45 m long, and 11 m deep. Due to a considerable current, most abiotic factors are homogenous throughout

the passage, so the light can be considered as the key factor influencing the distribution of benthic communities. The transect was made from the eastern entrance at 8 m down to the sand bottom at 48 m. Light intensity was measured at the same time throughout 16 days on selected points in the passage and on the transect. Additionally temperature was measured throughout one year at a depth of 9, 28 and 48 m on the transect and at a depth of 9 m in the passage. Diversity in composition of benthic communities was recorded. Three different benthic communities were determined in the passage: a community of photophilic algae, a coralligenous community and a community of semi-dark caves. The first two communities were determined on the transect as well as an additional community of *Posidonia oceanica.* Rapid changes in the passage communities were recorded in relation to fast changes in light intensity. On the transect however, light intensity changed gradually, and thus the changes in communities was phased as well.

OP-40

NOVI DOPRINOS ISTRAŽIVANJU MNOGOLJUŠTURAŠA (Polyplacophora), ŠKOLJKAŠA (Bivalvia) I KOPONOŽACA (Scaphopoda) OTOKA RABA

M. Legac
Prirodoslovni muzej Rijeka, Lorenzov prolaz 1, HR-51000 Rijeka, Hrvatska

U dosad objavljenim istraživanjima litorala otoka Raba popisna lista, pored ostlaih skupina sadrži i po jednu vrstu mnogoljušturaša i koponožaca, te 101 vrstu školjkaša. Rezultati daljnjih istraživanja ukazuju na prisutnost pet vrsta mnogoljušturaša i četiri vrste koponožaca, te 121 vrstu školjkaša. Izvršena je revizija vrsta i usklađeno validno nazivlje. U priopćenju se razmatra ugroženost i smanjenje populacija nekih vrsta školjkaša u Loparskoj dragi, Supetarskoj dragi i zaljevu Sv. Eufemije, kao posljedica utjecaja ljudskih aktivnosti u obalnom području. Obrađen je materijal inventiran i pohranjen u malakološkoj zbirci Prirodoslovnog muzeja Rijeka.

NEW CONTRIBUTION TO THE RESEARCH OF CHITONS (Polyplacophora), BIVALVE (Bivalvia) AND SCAPHODS (Scaphopoda) OF THE RAB ISLAND

M. Legac
Natural History Museum Rijeka, Lorenzov prolaz 1, HR-51000 Rijeka, Croatia

So far, in the published research of the Rab Island littoral, a Check List, in addition to other groups, consists out of one species of chitons and one of scaphopods, as well as 101 species of bivalve. Results of the further research suggest the existence of five species of chitons and four species of scaphopods, as well as 121 species of bivalve. The revision of species was conducted and the valid terminology was adjusted. In the report, the endangerment and decrease in the population of some species of bivalve in Loparska draga, Supetarska draga and St. Euphemia Bay is analyzed, as a result of the influence of human activities in the littoral area. Processed material has been registered and archived in the Malacological Collection of the Natural History Museum Rijeka.

OP-41
MOGUĆNOST PROCJENE RASPODJELE, BROJNOSTI I VERTIKALNOG KRETANJA POPULACIJE MEDUZA VIDEO TEHNIKOM

T. Makovec[1], V. Onofri[2], A. Benović[2] i D. Lučić[2]
[1]Nacionalni institut za biologiju, Morska biološka postaja, Fornače 41, Slo-2330 Piran, Slovenija (Tihomir.Makovec@mbss.org), [2]Institut za more i priobalje, Sveučilište u Dubrovniku, Damjana Jude 12, HR-20000 Dubrovnik, Hrvatska (onofri@labdu.izor.hr, benović@labdu.izor.hr, lučić@labdu.izor.hr)

U radu se iznose: način konstrukcije, tehničke karakteristike i učinkovitost jednostavnog sistema podvodnog video nadzora. Koristili smo ga za indetifikaciju, utvrđivanja brojnosti i smjera kretanja meduza u pojedinim slojevima vodenog stupca u Velikom jezeru na otoku Mljetu. Dugi niz godina prije toga, koristila se tehnika autonomnog ronjenja, danju i noću što je imalo ograničavajuću mogućnosti s obzirom na dubinu jezera od 46 m. Koristila se i digitalna kamera opremljena dubinomjerom za određivanje dubine zarona. Konstrukcijom jednostavnog sistema sastavljenog od 6 web-videokamera opremljenog LED svijetlima, mogao se istovremeno kontrolirati čitavi vodeni stupac, danju i noću. Napajanje kamera je 9-12 V što dodatno olakšava rad na terenu. Moguće je istovremeno vizualno praćenje uz snimanje na videorekorderu ili laptopu, stanja na 6 dubina s mogućnošću uključivanja svake pojedinačne slike preko cijelog ekrana. U ovom radu se iznose tehničke karakteristike ovog jeftinog sistema za podvodni videonadzor kao i sama konstrukcija podvodnih kućišta za kamere i podvodno osvjetljenje.

POSSIBILITIES OF EVALUATION OF DISTRIBUTION, ABUNDANCE AND VERTICAL MIGRATION OF JELLYFISH POPULATIONS BY VIDEO TECHNIQUE

T. Makovec[1], V. Onofri[2], A. Benović[2] and D. Lučić[2]
[1]National Institute of Biology, Marine Biology Station, Fornače 41, Slo-2330 Piran, Slovenia (Tihomir.Makovec@mbss.org). [2]University of Dubrovnik, Institute for Marine and Coastal research, Damjana Jude 12, HR-20000 Dubrovnik, Croatia (onofri@labdu.izor.hr, benović@labdu.izor.hr, lučić@labdu.izor.hr)

In this work the following is presented: means of construction, technical characteristics and efficiency of a simple system of subaquatic video surveillance. We used it for identification of jellyfish and to determine the abundance and direction of movement of jellyfish in individual layers in the water column in Veliko jezero (the Great Lake) on the island of Mljet. For many years the tecnique of autonomous diving was used, in day- and nighttime, which exhibited a limited potential taking into account the depth of 46 m of the lake. A digital camera supplied with an echo sounder for the determination of the depth of the dive was also used. A construction of a simple system composed of 6 web videocameras supplied with LED lights made it possible to simultaneously control the whole water column, in day- as well as in nighttime. The power supply was 9-12 V, which in addition simplifies work in the field. It is possible to simultaneously visually monitor while taping on a videorecorder or a laptop the conditions on 6 depths with the possibility of activation of each individual picture on the whole screen. In this work the technical characteristics of this simple system for subaquatic video surveillance as well as the construction of subaquatic housings for cameras and subaquatic lighting is presented.

OP-42

NEKI ASPEKTI BIOLOGIJE SRDELE, *Sardina pilchardus* (WALB., 1792.), U ZADARSKOM PODRUČJU

B. Mustać[1] i G. Sinovčić[2]
[1]Adria d.d., HR-23000 Zadar, Hrvatska (bmustac@yahoo.com), [2]Institut za ocanografiju i ribarstvo, Šetalište I. Meštrovića 63, HR-21000 Split, Hrvatska (sinovcic@izor.hr)

U radu su prikazani neki aspekti biologije srdele, *Sardina pilchardus* (Walbaum, 1972): dužinski sastav, odnos spolova, reprodukcija, dužinsko-maseni odnos te kondicija ove, gospodarstveno najznačajnije vrste u Hrvatskoj. Analizirano je ukupno 1.219 jedinki tijekom razdoblja: ožujak 2004.-veljača 2005. iz uzoraka lovina plivarice, ostvarenih u obalnom (Virsko more) i otvorenom moru (područje Dugog otoka) zadarskog područja. Totalne dužine (*LT*)

svih jedinki su bile u rasponu od 13,0 do 19,0 cm, a srednja vrijednost je iznosila 16,0 cm. Odnos spolova je bio u korist mužjaka; iznosio je *m/ž* = 1,2. Mriješćenje srdele se odvijalo od listopada do kraja svibnja. U lipnju je započela faza mirovanja u spolnom ciklusu ove vrste. Utvrđen je alternacijski odnos između količine masnoće i spolnog ciklusa srdele. Rezultati ispitivanja njezina dužinsko-masenog odnosa ukazuju na negativnu alometriju (*b*=2,554). Koeficijent kondicije je pokazao najveće vrijednosti kod najmanjih jedinki smanjujući se s porastom dužine ribe.

SOME BIOLOGICAL ASPECTS OF SARDINE, *Sardina pilchardus* (WALB., 1792), IN THE MIDDLE ADRIATIC SEA

B. Mustać[1] and G. Sinovčić[2]
[1]Adria d.d., HR-23000 Zadar, Croatia (bmustac@yahoo.com), [2]Institute of oceanography and Fisheries, Šetalište I. Meštrovića 63, HR-21000 Split, Croatia (sinovcic@izor.hr)

This paper presents some biological aspects of sardine, *Sardina pilchardus* (Walbaum, 1792), from the catches of inshore (Virsko more) and offshore waters (Dugi otok) in the Zadar area. They were analysed (*N*=1,219) from March 2004 to February 2005. Total length (*LT*) varied from 13.0 to 19.0 cm, and the average length was 16.0 cm. Number of male specimens exceeded the number of female specimens (*m/f*=1.2). According to the results of this research, the spawning began in October and lasted until the end of May, when the inactive phase of maturity cycle started. The amount of fat content in the sardine body was in antagonistic relationship with the spawning season. The sardine length-weight relation indicated the negative allometric growth (*b*=2.554). The condition coefficient showed the highest amounts in the smallest specimens in comparison with the longer ones.

OP-43
ŠIRENJE INVAZIVNIH KAULERPI POMAŽE ŠIRENJU AUTOHTONIH ASKOGLOSNIH PUŽEVA

A. Žuljević, M. Despalatović, I. Cvitković i B. Antolić
Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (zuljevic@izor.hr, mare@izor.hr, antolic@izor.hr, cvitkovic@izor.hr)

Svi askoglosni puževi s kućicom hrane se isključivo algama roda *Caulerpa*. Kaulerpama se hrane isisavanjem njihove gigantske citoplazme. U

Sredozemnom moru žive dvije vrste endemičnih sredozemnih askoglosih puževa: *Lobiger serradifalci* i *Oyxnoe olivacea*. Do pojave invazivnih kaulerpi u Sredozemnom moru oni su se hranili jedino autohtonom sredozemnom algom *Caulerpa prolifera*. Pojavom alohtonih kaulerpi dobili su novi izvor hrane. U hrvatskom je podmorju *C. prolifera* do danas zabilježena na samo šest područja gdje je gradila mala i rijetka naselja. Zbog toga je i rasprostranjenost askoglosnih puževa mogla biti iznimno mala. Pojavom i širenjem invazivnih kaulerpi u Jadranskom moru, omogućeno je i širenje areala askoglosnim puževima. Puževi su pronađeni u naselju invazivne alge *Caulerpa taxifolia* u Starogradskom zaljevu i Malinskoj, a tek potom u naselju alge *C. prolifera* uz otočić Lokrum. Pretpostavlja se kako su puževi naselili ova naselja prijenosom planktonske ličinke iz Albanije, gdje su razvijena veća naselja alge *C. prolifera*.

THE SPREAD OF INVASIVE CAULERPAS CONTRIBUTES TO SPREADING OF NATIVE ASCOGLOSSANS

A. Žuljević, M. Despalatović, I. Cvitković and B. Antolić
Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (zuljevic@izor.hr, mare@izor.hr; antolic@izor.hr; cvitkovic@izor.hr)

All of the shelled ascoglossan seaslugs feed exclusively on algal species of the genus *Caulerpa*. They suck up a giant caulerpa's cytoplasm. Two species of endemic ascoglossans are living in the Mediterranean Sea: *Lobiger serradifalci* and *Oyxnoe olivacea*. Until the appearance of alochthonous caulerpas in the Mediterranean Sea, they have been feeding only on native alga *Caulerpa prolifera*. With the appearance of alochthonous *Caulerpa*, they got a new food source. *Caulerpa prolifera* was recorded only on six sites in Croatian part of the Adriatic Sea where it has developed small and scarce colonies. Therefore, the slugs distribution might have been exceptionally rare. Appearance and spread of the invasive *Caulerpa* species in the Adriatic Sea enabled the spread of native ascoglossans and extension of its areal. Ascoglossans were found in the colony of invasive *Caulerpa taxifolia* in Stari Grad Bay and Malinska and after that in *C. prolifera* colony near Lokrum Island. It was supposed that they colonized these areas by transporting of its plankton stage by currents from Albania where extensive colonies of *C. prolifera* are developed.

OP-44

HRANJENJE HRIDINSKOG JEŽINCA *Paracentrotus lividus* INVAZIVNIM ALGAMA *Caulerpa taxifolia* i *Caulerpa racemosa* var. *cylindracea*

V. Nikolić, A. Žuljević, M. Despalatović i B. Antolić
Laboratorij za bentos, Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (nikolic@izor.hr, zuljevic@izor.hr, mare@izor.hr, antolic@izor.hr)

Dvije invazivne vrste zelenih alga roda *Caulerpa*, *C. taxifolia* i *C. racemosa* var. *cylindracea*, šire se Sredozemnim morem s velikim utjecajem na bioraznolikost infralitoralnog dna. Vrste roda *Caulerpa* učinkovito se brane od biljojednih organizama proizvodeći niz otrovnih sekundarnih metabolita. Ove tvari kod vrste *C. taxifolia* u Sredozemnom moru odbijaju jednu od najvažnijih biljojednih vrsta, hridinskog ježinca *Paracentrotus lividus*. Izveden je *in situ* pokus hranjenja vrste *P. lividus* algama *C. taxifolia* i *C. racemosa* var. *cylindracea*. U pokusu s vrstom *C. taxifolia* srednje smanjenje mase alge iznosilo je 1,74±1,14 g. U pokusu s vrstom *C. racemosa* var. *cylindracea* ostaci alge pronađeni su samo u jednom pokusnom kavezu, a srednja pojedena masa alge iznosila je 7,86±1,16 g. Pokusi hranjenja pokazali su da se vrsta *P. lividus* može hraniti algom *C. racemosa* var. *cylindracea* u ljetnom razdoblju kada je koncentracija otrovnih metabolita alge najviša, dok ježinci u istom razdoblju gotovo u potpunosti izbjegavaju hranjenje algom *C. taxifolia*. Razlog je vjerojatno u koncentraciji metabolita kaulerpenina, čija je koncentracija kod vrste *C. racemosa* var. *cylindracea* 35 do 80 puta niža nego kod vrste *C. taxifolia*.

FEEDING OF THE SEA URCHIN *Paracentrotus lividus* WITH INVASIVE ALGAE *Caulerpa taxifolia* AND *Caulerpa racemosa* var. *cylindracea*

V. Nikolić, A. Žuljević, M. Despalatović and B. Antolić
Laboratory for benthos, Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (nikolic@izor.hr, zuljevic@izor.hr, mare@izor.hr, antolic@izor.hr)

Two invasive algae of the genus *Caulerpa*, *C. taxifolia* and *C. racemosa* var. *cylindracea*, are spreading throughout the Mediterranean Sea and drastically changing the biodiversity of the infralittoral bottom. Species of the genus *Caulerpa* have developed an efficient strategy against herbivory organisms by producing a number of toxic secondary metabolites. These substances in the species *C. taxifolia* in the Mediterranean Sea act as a reppelent on one of the main herbivory species, the sea urchin *Paracentrotus lividus*. An *in situ* experiment was conducted to establish the feeding rates of *P. lividus* with algae *C. taxifolia* and *C. racemosa* var. *cylindracea*. In the experiment with *C. taxifolia* average decrease of the algal wet mass was 1,74±1,14 g. In

the experiment with *C. racemosa* var. *cylindracea* the remains of the algae were found in only one experimental cage. Average consumed wet mass was 7,86±1,16 g. Feeding experiment has showed that *P. lividus* can feed on the *C. racemosa* var. *cylindracea* in the summer period when the concentration of the algal metabolites is the highest. In the same period, sea urchins almost completely avoid feeding on *C. taxifolia*. The most probable reason is the concentration of metabolite caulerpenyne in *C. racemosa* var. *cylindracea*, which is 35 to 80 times lower than in *C. taxifolia*.

OP-45
REPRODUKTIVNE ZNAČAJKE ALGE *Dictyopteris polypodioides*

Lj. Šimunić[1], B. Antolić[2], M. Despalatović[2] i A. Žuljević[2]
[1]Šibenska 25, HR-21000 Split, Hrvatska, [2]Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (ljerkas@net.hr, antolic@izor.hr, zuljevic@izor.hr)

Smeđa alga *Dictyopteris polypodioides* je jedina vrsta iz roda *Dictyopteris* koja živi u Sredozemnom moru. Naseljava stjenovito morsko dno od površine do dubine od 15 metara. Talus alge je uspravan, dihotomski razgranat, trakastog je oblika sa izraženim zadebljanim središnjim rebrom. Tijekom jednogodišnjeg razdoblja istraživan je razvoj tetrasporofita, te muških i ženskih gametofita u okolici Splita. Sakupljanjem uzoraka u prosječnim razmacima od dva tjedna te detaljnim pregledom dobiveni su podaci o reproduktivnim značajkama ove vrste. Reproduktivni su se organi na tetrasporofitu (tetrasporangiji) razvijali gotovo cijele godine, dok su se reproduktivni organi na ženskom gametofitu (oogoniji) i muškom gametofitu (anteridiji) razvijali tijekom toplijeg dijela godine.

REPRODUCTIVE CHARACTERISTICS OF THE ALGA *Dictyopteris polypodioides*

Lj. Šimunić[1], B. Antolić[2], M. Despalatović[2] and A. Žuljević[2]
[1]Šibenska 25, HR-21000 Split, Croatia, [2]Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (ljerkas@net.hr, antolic@izor.hr, zuljevic@izor.hr)

The brown alga *Dictyopteris polypodioides* is the only species from the genus *Dictyopteris* which lives in the Mediterranean Sea. It extends on the rocky bottom of the sea from the surface to depths of 15 m. Thallus of the alga is erect,

dichotomously branched, ribbon-like with a conspicuous, prominent midrib. During the research period of one year, the developement of tetrasporophyte and male and female gametophytes was observed in the Split area. By collecting samples every two weeks and through detailed examination we obtained results about reproductive characteristics of this species. Reproductive organs on tetrasporophyte (tetrasporangia) develop almost throughout the whole year while reproductive organs of female gametophytes (oogonia) and male gametophytes (antheridia) develop rarely, mainly through the warmer period of the year.

OP-46

Dictyota dichotoma – KOLIKO JE VARIJETETA U JADRANSKOM MORU?

A. Žuljević, B. Antolić i M. Despalatović
Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (zuljevic@izor.hr, antolic@izor.hr, mare@izor.hr)

Za smeđu morsku algu *Dictyota dichotoma* do danas su znanstveno opisana i prihvaćena tri varijeteta. Dva varijeteta naseljavaju Sredozemno i Jadransko more i to *D. dichotoma* var. *dichotoma* i *D. dichotoma* var. *intricata*. Detaljnije istraživanje morfologije njihovih talusa, dimenzija i oblika stanica, reproduktivnih organa te vegetacijskog i reproduktivnog godišnjeg ciklusa na primjercima iz okolice Splita, ukazala su na prisustvo još jedne, do sada neopisane svojte ove vrste. Istraživanja na širem području srednjeg i južnog Jadrana pokazala su kako je ova "nepoznata svojta" zapravo sasvim uobičajen i čest organizam koji se prije pogrešno vodio kao *D. dichotoma* var. *dichotoma.*

Dictyota dichotoma – HOW MANY VARIETIES ARE LIVING IN THE ADRIATIC SEA?

A. Žuljević, B. Antolić and M. Despalatović
Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (zuljevic@izor.hr, antolic@izor.hr, mare@izor.hr)

Three varieties of the brown seawater alga *Dictyota dichotoma* are scientifically confirmed today. Two varieties are living in the Mediterranean as well as in the Adriatic Sea: *D. dichotoma* var. *dichotoma* and *D. dichotoma* var. *intricata*. Detailed research of its thallus morphology, shape and dimension of the cells

and reproductive organs as well as vegetative and reproductive annual cycle of the specimens from the Split area was made. It showed presence of one additional, until now not yet described taxon of this species. Observations in the wider area of the middle and southern Adriatic Sea showed that this "unknown taxon" is indeed quite common organism which was previously noted incorrectly as *D. dichotoma* var. *dichotoma.*

OP-47

PRELIMINARNI PREGLED MAKROBENTOSA U OKOLICI NEREZINA (OTOK LOŠINJ, SJEVERNI JADRAN)

A. Jaklin
Centar za istraživanje mora, Institut "Ruđer Bošković", Paliaga 5, HR-52210 Rovinj, Hrvatska (jaklin@cim.irb.hr)

Tijekom prosinca 2003. godine obavljeno je jednokratno istraživanje pridnenih životnih zajednica duž triju transekata u uvali Artac (Nerezine, otok Lošinj). Za pregled makrobentosa upotrijebljena je standardna metoda izravnog opažanja *in situ* i uzorkovanja uz uporabu autonomne ronilačke opreme. Zabilježene su ukupno 23 vrste makroalga, jedna vrsta morskih cvjetnica i 84 životinjske vrste, te utvrđene četiri bentoske biocenoze. Hridinasto dno područja istraživanja zauzima biocenoza infralitoralnih alga, ali zbog dominacije scijafilnih elemenata već u najplićem dijelu možemo govoriti o njenom degradiranom aspektu. Smeđe alge roda *Cystoseira*, koje su temeljni element sredozemne zajednice infralitoralnih alga, u istraživanom akvatoriju ne tvore uobičajene guste sastoje već se radi o pojedinačnim primjercima ili tek malim i rijetkim nakupinama. Sedimentno dno, koje čini detritusni pijesak s tankim površinskim slojem mulja, naseljava cvjetnica *Cymodocea nodosa*. U pregledanom području očito je povećanje njene brojnosti i gustoće u smjeru juga, usprkos povećanju dubine. Obilje trpova (*Holothuria* spp.), koji su po načinu prehrane detritofagi i hrane se organskom tvari u površinskom filmu na dnu, vjerojatno je znak povećanog unosa organske tvari u ekosustav. Stanje zabilježeno ovim preliminarnim pregledom djelomično odgovara dostupnim podacima iz literature. Opća slika makrobentosa, kao i sastav životnih zajednica ukazuju na recentno pogoršanje uvjeta u okolišu. Naknadno je utvrđeno da se u sjevernom dijelu akvatorija nalazio direktan ispust netretiranih komunalnih otpadnih voda, što je dovelo do uočene degradacije makrobentosa u istraživanom području. Nedavnim uklanjanjem tog izvora onečišćenja uvjeti u okolišu su se počeli popravljati i zajednice pokazuju znakove oporavka.

A MACROBENTHOS PRELIMINARY SURVEY IN THE VICINITY OF NEREZINE (LOŠINJ ISLAND, NORTHERN ADRIATIC)

A. Jaklin
Center for Marine Research, Ruđer Bošković Institute, Paliaga 5, HR-52210 Rovinj, Croatia (jaklin@cim.irb.hr)

Benthic communities were once investigated along three bottom transects in Artac Bay (Nerezine, Lošinj Island) during December 2003. Macrobenthos research was performed by a standard method of direct observation *in situ* and sampling using SCUBA diving equipment. A total of 24 species of macroalgae, one marine phanerogam and 84 animal species were recorded, and four benthic biocoenoses were established. The hard bottom in the research area is occupied by biocoenosis of photophilic seaweeds. Because of the dominance of sciaphilic elements in the shallow water, the community couldn be considered degraded. Brown algae of the *Cystoseira* genus, a basic element of the Mediterranean biocoenosis of photophilic seaweeds, do not form ordinary dense associations in the research area but are present as solitary individuals or small scarce clumps. The sedimentary bottom consists of detritic sand with a thin surface muddy layer and is occupied by the phanerogam *Cymodocea nodosa*. An increase of the phanerogam abundance and density in the southward direction was noticed despite the increase of depth in the area surveyed. A high abundance of deposit feeding sea-cucumbers (*Holothuria* spp.) is probably an evidence of a higher input of organic matter in the ecosystem. According to this preliminary survey conditions and state of benthos are partially in concordance with the available literature data. The general picture of macrobenthos, as well as composition of benthic communities are pointing to a recent worsening of environmental conditions. It has been found out afterwards that a direct outlet of untreated waste waters was placed in the northern part of the area surveyed, which caused the noticed degradation of macrobenthos. The recent closure of this pollution source enabled improvement of environmental conditions and benthic communities start to show signs of recovery.

OP-48
STRUKTURA I DINAMIKA FAUNE MNOGOČETINAŠA SEDIMENTNOG DNA SJEVERNOG JADRANA

B. Mikac
Laboratorij za ekologiju i sistematiku, Centar za istraživanje mora, Institut Ruđer Bošković, G. Paliaga 5, HR-52210 Rovinj, Hrvatska (barbara.mikac@cim.irb.hr)

Mnogočetinaši (Polychaeta) predstavljaju najznačajniju i najbrojniju skupinu makrofaune u zajednicama pomičnih morskih dna. Za razumijevanje stanja

bentoskih zajednica otvorenog sjevernog Jadrana i promjena koje se u njima događaju, značajno je stoga upoznati strukturu i dinamiku faune mnogočetinaša. Fauna mnogočetinaša na tri pučinske postaje u sjevernom Jadranu istraživana je sezonski od ožujka 2004. do prosinca 2005. godine. Uzorci su uzimani Van Veenovim grabilom otvora površine 0,1 m^2 i prosijavani kroz sito promjera oka 2 mm. Utvrđeno je ukupno 155 vrsta mnogočetinaša iz 100 rodova i 36 porodica, što predstavlja 27,4% ukupne faune mnogočetinaša Jadranskog mora. Fauna mnogočetinaša na tri istraživane postaje po svojoj strukturi i sastavu pokazuje relativno veliku sličnost. 60 vrsta (39%) bilo je zajedničko za sve tri postaje. Najbrojnije vrste, zajedničke za sve tri postaje, *Notomastus latericeus*, *Owenia fusiformis, Myriochele oculata* i *Pectinaria auricoma,* karakteristične su vrste obalnih detritičkih i zamuljenih obalnih detritičkih dna. Pronađeni su predstavnici roda *Clymenella*, koji do sada nije zabilježen u Jadranskom moru. Kolebanje brojnosti i broja vrsta mnogočetinaša bilo je različito na tri postaje. Porast i smanjenje brojnosti nije uvijek pratio i porast ili smanjenje broja vrsta, što upućuje na povećanu dominantnost pojedinih vrsta u određenim periodima. U usporedbi sa faunom mnogočetinaša na pomičnim dnima u ostalim dijelovima sjevernog Jadrana, fauna mnogočetinaša istraživanog područja vrlo je bogata. Rezultati istraživanja upućuju na to da su u razdoblju od ožujka 2004. do prosinca 2005. godine zajednice mnogočetinaša na istraživanom području bile vrlo stabilne.

STRUCTURE AND DYNAMICS OF THE NORTHERN ADRIATIC SOFT BOTTOM POLYCHAETE ASSEMBLAGES

B. Mikac
Laboratory for Ecology and Systematics, Marine Research Centre, Ruđer Bošković Institute, G. Paliaga 5, HR-52210 Rovinj, Croatia (barbara.mikac@cim.irb.hr)

Polychaetes are the most important and most abundant group of animals in benthic soft-bottom communities. Thus, for understanding the structure of the Northern Adriatic benthic communities as well as the changes they are undergoing it is necessary to understand the structure and dynamics of Polychaete fauna. Polychaete assemblages were investigated seasonally on three offshore stations in the Northern Adriatic Sea, from March 2004. to December 2005. Samples were collected with 0,1 m^2 Van Veen grab and sieved through a 2 mm mesh. A total of 155 species, belonging to 36 families, were identified, which represents 27,4% of the known Adriatic Polychaete fauna. Structure of Polycaete assemblages on the whole investigated area was rather similar. 60 species (39%) were common for all three stations. The most

abundant species, mutual for three stations, *Notomastus latericeus*, *Owenia fusiformis*, *Myriochele oculata* and *Pectinaria auricoma*, are characteristic species of detritic and muddy detritic bottoms. Genus *Clymenella*, previously not reported in the Adriatic Sea, was found on all investigated area. Seasonal fluctuations of abundance and species richness were different on three stations. Increase and decrease of abundance was not closely followed by the growth and reduction of species richness. Compared with the other North Adriatic soft-bottom communities, Polychaete fauna on investigated area was very rich. Our results indicate relatively high stability of Polychaete assemblages in the period from March 2004. to December 2005.

OP-49

PREGLED PRIDNENIH ZAJEDNICA U UVALI GAŽENICA (TRAJEKTNI TERMINAL ZADAR, SREDNJI JADRAN)

V. Nerlović i A. Jaklin
Centar za istraživanje mora, Institut »Ruđer Bošković«, HR-52210 Rovinj, Hrvatska

Tijekom rujna 2003. obavljena je biocenološka analiza pridnenih životnih zajednica uvali Gaženica, a u svrhu biološke procjene studije utjecaja na okoliš izgradnje trajektne luke Zadar. Tehnikom autonomnog ronjenja i primjenom izravnog opažanja *in situ* pregledan je makrobentos uzduž tri transekta. Na istraživanom području je zabilježeno ukupno 15 vrsta makroalga, jedna morska cvjetnica i 69 makroživotinjskih vrsta. Mali broj zabilježenih vrsta može se objasniti slabom dinamika mora i većim donosom najsitnije frakcije sedimenta. Usprkos maloj dubini istraživanog područja najveći dio dna čini fini sediment koji podsjeća na terigeni mulj. Sporadične enklave čvrste podloge duž sva tri transekta (pojedinačno kamenje ili krupni otpad) naseljene su malobrojnim scijafilnim organizmima pretežno filtratorskog ili suspenziofagog tipa prehrane. Smanjeno prodiranje svjetla i stalan donos čestica u suspenziji objašnjavaju malu dubinu njihovog pojavljivanja. Prisutnost alge *Dasycladus vermicularis*, koja je indikatora zamuljivanja, potvrđuje pojačanu sedimentaciju. Naselja dagnje *Mytilus galloprovincialis* u mediolitoralnoj stepenici potvrđuju dotok slatke vode u površinskom sloju. Mjestimično gusta naselja smeđe vlasulje *Anemonia sulcata* ukazuju na povećan unos organske tvari u ekosustav. Ovu pretpostavku potvrđuje i nalaz zelene nitrofilne alge *Ulva lactuca*, koja se smatra indikatorom opterećenja akvatorija hranjivim solima. Ograničene i izolirane površine dna obrasle rijetkom svilinom *Cymodocea nodosa*, te izostanak karakterističnih elemenata zajednice upućuju na recentnu degradaciju livada ove morske cvjetnice. Ovaj pregled pridnenih zajednica

se može smatrati preliminarnom procjenom sadašnjeg nultog stanja budući da nema biocenoloških podataka za istraživano područje.

A SURVEY OF BENTHIC COMMUNITIES IN GAŽENICA BAY (ZADAR, MIDDLE ADRIATIC)

V. Nerlović and A. Jaklin
Center for Marine Research, Ruđer Bošković Institute, HR-52210 Rovinj, Croatia

A biocenological estimation of benthic communities was carried out in Gaženica bay, Zadar area, during September 2003. Macrobenthos was observed *in situ* along three bottom transects using SCUBA divinig technique and by direct observation method. A total of 15 macroalgae species, one marine phanerogam and 69 animal species was recorded. Quite a small number of recorded species could be explained through the weak sea water dinamic and increased input of the finest sediment fraction. Despite the shallownes of the area investigated the largest part of the bottom consists of fine sediment resembling to terignos ooze. Sporadic enclaves of hard bottom along all the three transects (individual stones or bigger litter) are colonized by a small number of sciaphilic organisms, mainly of filtrator or suspension-feeding type. Their occurence in the shallow water is probably the result of a reduced light penetration and a permanent input of organic particles in suspension. The presence of the green alga *Dasycladus vermicularis*, an indicator of mud deposition, confirms the stronger sedimentation. Settlements of the mussel *Mytilus galloprovincialis* in the mediolittoral step are an evidence of fresh water inflow in the surface layer of the area investigated. Dense settlements of the brown anemone *Anemonia sulcata* in some places indicate a higher input of organic matter in the ecosystem. This statement is supported by the presence of the green nitrophilic alga *Ulva lactuca*, which is considered as an indicator of a higher dominance of nutrients in the zone. Reduced and isolated bottom surfaces occupied by the phanerogam *Cymodocea nodosa*, as well as the absence of characteristic biocoenosis elements, suggest a recent degradation of this community. This survey of benthic communities should be considered as a preliminary assessment of the present initial state since there are no biocenological data for the area investigated.

OP-50

BROJNOST I EKOLOŠKE ZNAČAJKE FAUNE SPUŽAVA LIMSKOG KANALA (SJEVERNI JADRAN, HRVATSKA)

W. Zucht[1], M. Sidri[1], A. Jaklin[2], B. Hamer[2] i F. Brümmer[1]
[1]Biološki institut, Zavod za Zoologiju, Sveučilište u Stuttgartu, Pfaffenwaldring 57, 70569 Stuttgart, Njemačka, [2]Centar za istraživanje mora, Institut Ruđer Bošković, Rovinj, Croatia
(jaklin@cim.irb.hr; hamer@cim.irb.hr)

Fauna spužava okolice Rovinja istraživana je tijekom mnogobrojnih ronjenja autonomnom opremom. Od ukupno 151 vrste spužava zabilježenih u području obalnog mora Rovinja, Limski kanal je habitat s najraznovrsnijom faunom spužava sa 51 vrstom. Na malim dubinama u fauni spužava Limskog kanala dominiraju fotofilne vrste. Broj vrsta spužava najveći je u mirnom središnjem dijelu zaljeva, dok prema zapadnom ulazu i istočnom kraju opada. Ulaz u zaljev je pod utjecajem gibanja vodenih masa otvorenog mora sjevernog Jadrana, a kraj zaljeva karakterizira visoka sedimentacija i posljedično smanjenje pogodne podloge. Jedino usamljeno kamenje ili veće kolonije kamenog koralja *Cladocora caespitosa* osiguravaju podlogu za rast spužava u tom području. Zahvaljujući smjeru pružanja zaljeva istok – zapad, obale se razlikuju u izloženosti suncu. Posljedično, bogatstvo vrsta spužava smanjeno je na sjevernoj strani zaljeva, u usporedbi s njegovom južnom stranom. Tijekom istraživanja diverziteta spužava određena je i brojnost najčešćih vrsta u Limskom kanalu (*Aplysina aerophoba* i *Chondrilla nucula*), u odnosu na čimbenike okoliša. Obje vrste imaju sličan raspored i najveću brojnost dostižu na dubini od 6 do 10 metara na sjevernoj strani zaljeva. Na pojedinim mjestima *C. nucula* tvori poseban facies *Chondrilla-nucula*. Vremenska dinamika zajednice spužava u Limskom kanalu bila je proučavana tijekom dvogodišnjeg razdoblja. Sezonski utjecaj na morfološke promjene, rast i degeneracijske pojave bili su promatrani na stalnim kvadratima.

ABUNDANCE AND ECOLOGICAL STRUCTURE OF SPONGES IN THE LIMSKI KANAL (NORTHERN ADRIATIC, CROATIA)

W. Zucht[1], M. Sidri[1], A. Jaklin[2], B. Hamer[2] and F. Brümmer[1]
[1]Biological Institute, Department of Zoology, University of Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart, Germany, [2]Center for Marine Research, Ruđer Bošković Institute, Rovinj, Croatia (jaklin@cim.irb.hr; hamer@cim.irb.hr)

The sponge fauna of Rovinj's coastal waters was examined during numerous SCUBA dives. The Limski kanal is the habitat with the most diverse sponge fauna in the area hosting 51 out of the 151 sponge species reported for the area of Rovinj. Due to its shallow depths the sponge fauna of the Limski kanal

is dominated by photophilic species. Sponge-diversity is highest in the calm middle part of the Limski kanal and decreases towards the western opening and the eastern end. The opening is influenced by currents and wave actions of the open northern Adriatic Sea, whereas high sedimentation and, subsequently, the lesser availability of appropriate substrate lead to a lower diversity in the backside of the "channel". Only isolated rocky outcrops or bigger *Cladocora caespitosa* banks emerging from the mud provide appropriate substrate for a variety of sponge species in this area. The shore-lines of the "channel" differ in their exposure to the sun due to its West-East orientation. Subsequently sponge diversity is reduced on the northern side in comparison to the south. In addition to the diversity surveys, the abundances of the most common sponges in the Limski kanal (*Aplysina aerophoba* and *Chondrilla nucula*) in relation to ecological parameters were determined. Both species show a very similar distribution and reach a maximum abundance in depths between 6 and 10 meters on the northern side. At some locations *C. nucula* creates a special *Chondrilla-nucula* facies. The temporal dynamic of the sponge community in the Limski kanal was over a period of two years. Seasonality, morphological variations, growth and degeneration phenomena were observed within permanent sampling quadrats.

Posterska priopćenja
Posters

P-84
KONDICIONIRANJE MATIČNOG JATA I MRIJEST IVERKA *Platichthys flesus* (Linnaeus,1758)

N. Antolović[1], N. Glavić[1], D. Skaramuca[1], P. Tutman[2] i B. Skaramuca[1].
[1]Sveučilište u Dubrovniku, Institut za more i priobalje, Damjana Jude 12, HR-20000 Dubrovnik, Hrvatska, (nenad.antolovic@zg.htnet.hr), [2]Intitut za oceanografiju i ribarstvo, Šetalište I.Meštrovića 63, HR-21000 Split, Hrvatska

Iverak je rasprostranjen u istočnom Atlantiku, od Bijelog mora do sjevernih obala Mediterana, te uz obale Maroka. U Jadranu je prisutan u ušćima rijeka zalazeći duboko u njihov tok i jezera sve dok se osjeća utjecaj mora, te lagunama sjevernog Jadrana gdje je brojniji. Ukopava se u supstrat, hrani se mekušcima i rakovima. U gospodarskom ribolovu je značajan. U nekim zemljama Europe provode se opsežna eksperimentalna istraživanja o uvođenju ove vrste u komercijalni uzgoj. Matični stok (21 ženka i 7 mužjaka) za eksperimentalni mrijest prikupili smo u ušću rijeke Neretve i kondicionirali u laboratorijskim uvjetima Instituta za more i priobalje, laboratorija za ekologiju i uzgoj morskih organizama. Budući da se uvjeti u laboratoriju znatno razlikuju(salinitet oko 37‰)od onih u ambijentu ulova matičnog stoka (salinitet oko 5‰) te je bilo potrebito izvršavati prilagodbu na znatno veći salinitet u laboratoriju. Praćena je oogeneza, spermatogeneza, kao i pokretljivost spermija. Kad su jajašca bila promjera 0.870-0.978mm budući da nije zabilježen spontani mrijest, jajašca i spermiji su ručno istiskivani kod prethodno benzokainom uspavanih jedinki. Jajašca i spermiji različitih jedinki miješana su primjenom suhog miješanja. Oplođena jajašca su ostavljena u inkubator na temperaturi od 13-15°C gdje je praćen daljnji embrionalni razvoj.

CONDITION AND SPAWNING OF EUROPEAN FLOUNDER *Platichthys flesus* (Linnaeus,1758)

N. Antolović[1], N. Glavić[1], D. Skaramuca[1], P. Tutman[2] and B. Skaramuca[1].
[1]University of Dubrovnik, Institute of Marine and Coastal Research, D. Jude 12, HR-20000 Dubrovnik, Croatia(nenad.antolovic@zg.htnet.hr), [2]Institute of Oceanography and Fisheries Split, I. Meštrovića 63, HR-21000 Split, Croatia

European flounder is wide spread in east Atlantic, from White sea to north coast of Mediterrianian sea, and coast of Morocco. It is present in Adriatic on river estuaries, haunting the rivers where influence of sea is felt, and in lagoons of north Adriatic wher is numberd. It digs in, feeds with mollusks and crabs. In comercial fishery it is significant. In some European countries comprehensive expermental reaserch is conducted about introduction of european flounder in commercial culture. The broodstock (21 female and 7 male) for experimental spawn was colected in river Neretva estuary and acclimatized to laboratory conditions in Intitute of marine and costal reaserch, laboratory for ecology and mariculture. Since conditions in laboratory were much different (salinity 37‰) from those in Neretva estuary (salinity 5‰) we had to adapt the animals to much higher salinity. We monitored oogenesis and spermatogenesis, as well as sperm motility . When the egg diameter reached 0.870-0.978mm, fish were stripped since spontanius spawning didnt start. The fish were anesthetized for the stripping with the benzokaine. Eggs and sperm from different individuals were dry mixed. Fertilized eggs were placed in the incubator at temperature 13-15°C where embrional development was monitored.

P-85

OSNOVNA OBILJEŽJA NASELJA MORSKE CVJETNICE *Posidonia oceanica* (L.) Delile NA OTOKU VISU I DUGOM OTOKU

B. Berković, A. Obarčanin i T. Bakran-Petricioli
Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (buga.berkovic@gmail.com, andrea.obarcanin@gmail.com, tatjana.bakran-petricioli@zg.t-com.hr)

Naselja vrste *Posidonia oceanica* (L.) Delile su područja najveće biološke raznolikosti i predstavljaju klimaks vegetacije na pomičnoj podlozi u infralitoralu. Ona imaju visoku primarnu produkciju, prozračuju more i morsko dno te stabiliziraju sediment. Cilj ovog istraživanja bio je utvrditi osnovna obilježja naselja posidonije u uvalama Lojišće na Dugom otoku i Rukavac na otoku Visu. Uzorci posidonije sakupljeni su u rujnu i listopadu 2005. godine. Sakupljeno je 30 do 50 izdanaka s dijelom rizoma na četiri dubine: 5, 15, 20 i 32 m, te su prebrojani izdanci *in situ* u reprezentativnim kvadratima površine 40 x 40 cm. Zabilježene su gornja i donja granica rasprostiranja naselja po dubini, te je izmjeren intenzitet svjetlosti na 5, 15 i 34 m dubine. Na uzorcima posidonije napravljena je biometrija listova i lepidokronološka analiza te je procijenjena biomasa i primarna produkcija. Uzorci za procjenu primarne produkcije uzeti su u travnju i lipnju 2006. godine. Između dva istraživana

naselja posidonije uočene su razlike s obzirom na dubinu u: gustoći naselja, indeksu lisne površine, koeficijentu A, biomasi i procijenjenoj primarnoj produkciji. Primarna produkcija je uspoređena s istraživanim naseljima posidonije u Sredozemnom moru. Utvrđene razlike na različitim dubinama u naseljima mogu se objasniti smanjenim intenzitetom svjetlosti na većoj dubini što potvrđuju i rezultati mjerenja intenziteta svjetlosti. Ovo je prvo komparativno istraživanje navedenih obilježja naselja posidonije u srednjem i južnom Jadranu.

THE BASIC CHARACTERISTICS OF *Posidonia oceanica* (L.) Delile MEADOWS ON THE ISLANDS VIS AND DUGI OTOK

B. Berković, A. Obarčanin and T. Bakran-Petricioli
Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (buga.berkovic@gmail.com, andrea.obarcanin@gmail.com, tatjana.bakran-petricioli@zg.t-com.hr)

Meadows of *Posidonia oceanica* (L.) Delile are the areas of the greatest biodiversity and they represent a climax stage of vegetation on the sediment seabed in the infralittoral. Meadows of *Posidonia* have high primary production; they aerate water and seabed and stabilize the sediment. The aim of this research was to determine the main characteristics of *Posidonia* meadows in the coves Lojišće on Dugi otok and Rukavac on the island Vis. *Posidonia* samples were taken from the meadows in September and October 2005. Around 30 to 50 shoots (fascicles) with accompanying rhizome parts were taken at four depths: 5, 15, 20 and 32 m, and the number of shoots were counted in representative squares (40 x 40 cm) *in situ*. The upper and lower limits of the bathymetric extension of the meadows were measured. The light intensity was measured at 5, 15 and 34 m depth. Leaf biometry and lepidochronological analysis were done, and biomass and primary production were estimated. Samples for estimation of primary production were taken in April and June 2006. Differences between these two researched *Posidonia* beds were noted along the depth gradient in: shoot density, leaf area index, coefficient A, biomass and estimated annual primary production. The primary production was compared to researched *Posidonia* beds in the Mediterranean. Determined differences could be explained with lower light intensity at greater depths, which can be confirmed with the results of light intensity measurement. This is the first comparative research of the mentioned characteristics of the *Posidonia* beds in the Middle and Southern Adriatic.

P-86

KALANOIDNI KOPEPODI U KANALIMA SREDNJEG JADRANA

D. Bojanić
Institut za more i priobalje, Sveučilište u Dubrovniku, Kneza Damjana Jude 12, HR-20000 Dubrovnik, Hrvatska (dubravka.bojanic@unidu.hr)

Sastav populacija kalanoidnih kopepoda istraživan je na dvjema postajama Srednjeg Jadrana; CJ007 Splitska vrata (dubina 50 m) i CJ008 Pelegrin (75 m). Planktonski materijal je sakupljen tijekom devet krstarenja od svibnja 2002. do prosinca 2003. godine. Uzorci su uzimani mrežom tipa Nansen s mehanizmom za zatvaranje finoće tkanja 200 ìm, promjera otvora 57 cm i dužinom od 255 cm, okomitim potezima od dna do površine. Prikupljeni uzorci odmah su konzervirani neutraliziranim formaldehidom konačne koncetracije 2.5%. Obje istraživane postaje su obalne te ih karakteriziraju visoke vrijednosti kalanoidnih kopepoda ali smanjeni broj vrsta. Udio kopepodita u ukupnom broju kalanoida, osim u rujnu 2002. godine, veći je od 65%. Među odraslim jedinkama nađene su 34 vrste od kojih dominiraju tipične neritičke vrste *Paracalanus parvus*, *Ctenocalanus vanus*, *Temora stylifera* i *Clausocalanus jobei*. Cijeli vodeni stupac na istraživanim postajama je eufotička zona pa se većina vrsta hrani filtriranjem fitoplanktona. Visoke vrijednosti biomase fitoplanktona u proljetnom periodu slijedi velika brojnost kalanoida mjesec dana kasnije, dok niske vrijednosti biomase u ljetnim mjesecima rezultiraju minimalnim brojem kalanoida. Minimalna abundancija kalanoida 108.6 ind./m^3 zabilježena je u lipnju 2002. na postaji CJ007, a maksimalna 1333.1 ind./m^3 u travnju 2003. godine na istoj postaji.

CALANOID COPEPODS IN THE COASTAL MIDDLE ADRIATIC SEA

D. Bojanić
Institute for Marine and Coastal Research, University of Dubrovnik, Kneza Damjana Jude 12, HR-20000 Dubrovnik, Croatia (dubravka.bojanic@unidu.hr)

Population structure of calanoid copepods was investigated at two stations in the Middle Adriatic Sea: CJ007 Splitska vrata (depth 50 m) and CJ008 Pelegrin (75 m). Samples were collected during nine cruises from May 2002 till December 2003, using Nansen net (mesh size 200 ìm, mouth opening 57 cm, length 255 cm) in vertical haul from the bottom to the surface. Organisms were preserved in buffered formaldehyde. Both investigated stations are coastal with high abundance of calanoid copepods but inferiority of species.

Contribution of juvenile developmental stages of calanoids was pointed out. Their percentage in the total number of calanoids were more than 65%, except in September 2002. From total of 34 adult species, neritic calanoids *Paracalanus parvus, Ctenocalanus vanus, Temora stylifera* and *Clausocalanus jobei* were the most abundant. Entire water column is a euphotic zone where the majority of the species are phytoplankton grazers. The peak of phytoplankton biomass in spring is followed by high values of calanoid copepods a month later, while the lowest values in the summer results in minimum calanoid abundance. That minimum value (108.6 ind./m^3) was recorded in July 2002 on the station CJ007 and maximum abundance (1333.1 ind./m^3) in April 2003 on the same station.

P-87
RASPROSTRANJENOST DEKAPODNOG RAKA *Solenocera membranacea* U JADRANSKOM MORU

M. Despalatović, I. Grubelić i I. Cvitković
Laboratorij za bentos, Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (mare@izor.hr, grubelic@izor.hr, cvite@izor.hr)

Kozica *Solenocera membranacea* (Risso, 1816) (Decapoda, Solenoceridae) uobičajena je vrsta u noćnim lovinama pridnenom kočom. Osnovni ciljevi ovog istraživanja su bili ustanoviti njenu rasprostranjenost i abundanciju na području sjevernog i srednjeg Jadrana, abundanciju u pojedinim dubinskim pojasevima, na različitim tipovima sedimenta, te razliku u količinama ulova u pojedinim dobima dana. Podaci o ulovu vrste u Jadranu su sakupljeni za vrijeme ribarstveno-bioloških istraživanja kočarskih dna kontinentske podine tijekom ekspedicije Pipeta od 1985. do 1994. godine. Uzorkovanje je obavljeno na površini od približno 59000 km^2 na unaprijed planiranim stalnim postajama na različitim tipovima sedimenta, na dubinama od 10 do 430 m. Ovo istraživanje obrađuje 285 potega pridnenom kočom. Rezultati pokazuju da se *S. membranacea* najviše lovi noću. Zabilježena je na dubinama od 55 do 289 m. Najveća obilnost vrste je zabilježena u dubinskom pojasu od 55 do 100 m te na «reliktnom» pijesku i glinovitom «reliktnom» pijesku.

DISTRIBUTION OF DECAPOD SHRIMP *Solenocera membranacea* IN THE ADRIATIC SEA

M. Despalatović, I. Grubelić and I. Cvitković

Laboratory for Benthos, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (mare@izor.hr, grubelic@izor.hr, cvite@izor.hr)

In the Adriatic Sea, the penaeoid shrimp, *Solenocera membranacea* (Risso, 1816) (Decapoda, Solenoceridae) is common in night catches by bottom trawl. The main purposes of this research were to establish distribution and abundance of the species in the northern and central Adriatic Sea, its abundance in different depth strata, in various types of sediment, and also the differences in catch rates during different times of the day. Data on catch quantities in the Adriatic Sea were obtained in the framework of fishery-biological investigations of the trawling grounds on the Adriatic continental shelf, carried out by the Pipeta Expedition from 1985 to 1994. The expedition sampled approximately 59,000 km^2 at predetermined permanent stations over different sediment types at depths of 10 to 430 m. The present investigation analyses 285 bottom trawl hauls. The results show that *S. membranacea* was mainly caught at night. The shrimp were found in depths of 55 to 289 m. The highest abundance was observed in the 55 to 100 m depth layer, and in "relict" sand and clayey "relict" sand sediments.

P-88

VELIČINA REPNE PERAJE DOBRIH DUPINA (*Tursiops truncatus*) IZ JADRANSKOG MORA

A. Divokvić[1], H. Gomerčić[2], T. Gomerčić[3], M. Đuras Gomerčić[2], H. Lucić[2], D. Škrtić[2], S. Ćurković[2] i S. Vuković[2]
[1]Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska, [2]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet, Sveučilište u Zagrebu, HR-10000 Zagreb, Hrvatska (hrvoje.gomercic@vef.hr, martina.duras@vz.htnet.hr, hlucic@vef.hr, svukovic@vef.hr), [3]Zavod za biologiju, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr)

Bitna morfološka značajka za razlikovanje vrsta i populacija kitova (Cetacea) je oblik, veličina repne peraje i njen odnos prema ukupnoj duljini tijela. Glavna uloga repne peraje je pokretanje životinje te je vrlo zanimljiv odnos veličine repne peraje i cijelog tijela tijekom odrastanja životinje. U 67 dobrih dupina (*Tursiops truncatus*) iz Jadranskog mora izmjerene su tjelesna masa, ukupna duljina tijela, raspon i širina repne peraje, te su izračunate korelacije između mjera repne peraje i cijelog tijela. Raspon repne peraje u 16 fizički zrelih životinja iznosio je 68,66±5,41 cm (57,5 do 76,0 cm), dok je širina peraje iznosila 18,77±1,78 cm (16,0 do 22,0 cm). Značajna razlika ovih mjera

između spolova nije utvrđena. Raspon repne peraje iznosi prosječno 23,03% ukupne duljine tijela bez obzira na dob dupina, dok širina repne peraje iznosi prosječno 6,81% ukupne duljine tijela, a kod mlađih životinja je taj postotak veći. Poznavanjem raspona repne peraje moguće je odrediti ukupnu duljinu tijela koristeći jednadžbu: ukupna duljina tijela (cm) = 3,2 x raspon repne peraje (cm) + 60,3, uz faktor korelacije R^2=0,81. S obzirom da je raspon repne peraje u dobrih dupina iz Jadranskog mora manji u odnosu na podatke iz literature, ova jednadžba primjenljiva je samo za jedinke iz jadranske populacije.

SIZE OF TAIL FLUKES OF BOTTLENOSE DOLPHINS *(Tursiops truncatus)* FROM THE ADRIATIC SEA

A. Divokvić[1], H. Gomerčić[2], T. Gomerčić[3], M. Đuras Gomerčić[2], H. Lucić[2], D. Škrtić[2], S. Ćurković[2] and S. Vuković[2]
[1]Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia, [2]Department of Anatomy, Histology and Embryology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (hrvoje.gomercic@vef.hr, martina.duras@vz.htnet.hr, hlucic@vef.hr, svukovic@vef.hr), [3]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr)

The shape and size of the tail flukes and their relationship to the total body length is an important factor in determination of cetacean species. The main role of the tail flukes is the propulsion of the cetacean body and the relationship between tail flukes size and total body length during body growth is very interesting. Body mass, total body length, tail flukes span and width of 67 bottlenose dolphins (*Tursiops truncatus*) from the Adriatic Sea were measured and the correlations between tail flukes measurements and the total body length were estimated. The tail flukes span of 16 physically mature animals was 68.66±5.41 cm (57.5 to 76.0 cm) and the tail flukes width was 18.77±1.78 cm (16.0 to 22.0 cm). There is no signifficant sex difference of these two measurements. Tail flukes span is in average 23.03% of the total body length in all age classes. Tail flukes width is 6.81% of total body length but this ratio is higher in younger animals. The total body length can be estimated (correlation factor: R^2=0,81) based on tail flukes span according to the following formula: Total body length (cm) = 3.2 x tail flukes span (cm) + 60.3. This formula is appropriate only for bottlenose dolphins from the Adriatc Sea beacause, according to the literature, these animals have lesser tail flukes spans than bottlenose dolphins from other populations.

P-89

MODULAR SPECTRAL LUMINOMETER/FLUOROMETER FOR MEASUREMENTS OF PHYTOPLANKTON

L. Drinovec, M. Berden Zrimec and A. Zrimec
Institute of Physical Biology, Velika Loka 90, SI-1290 Grosuplje, Slovenia (luka.drinovec@guest.arnes.si, maja@ifb.si, alexis@ifb.si)

Coastal waters have high variability in turbidity and biomass, which makes conventional *in situ* optical measurements of phytoplankton a challenge. A modular portable luminometer/fluorometer with multispectral excitation and emission filters has been designed and tested for measurements of different parameters of phytoplankton. Delayed fluorescence (DF) of chlorophyll is measured after illuminating the sample with white or monocromatic light. DF intensity is correlated with living biomass and primary productivity as it is emitted only from photosynthetically active cells. DF decay curves give information on photosynthetic electron flow and various control mechanisms and external influences, affecting it. DF excitation spectra are used for monitoring phytoplankton biomass and composition. Prompt fluorescence (PF) of chlorophyll is a measure of chlorophyll concentration, and variable PF to stress. With PF spectroscopy it is possible to detect specific dissolved fluorophores, and with the addition of fluorogenic probes, specific compounds (e.g. reactive oxygen species). The system consists of different detachable modules for sample holding, sample excitation, and light detection. Static samples can be measured in standard cuvettes in a thermostated sample holder with 4 optical windows for sample illumination and measurement of emitted light. There is also a flow-through chamber equipped with a peristaltic pump and light trap for sample pre-excitation. For the illumination, LED's or LED modules and a halogen lamp in conjunction with a linear filter are used. For light detection, two cooled photon counting photomultipliers are available for simultaneous light detection with different filters. A silicon photodiode light detector and a commercial spectrophotometer can also be attached to the device.

P-90

USPOREDBA MORFOMETRIJSKIH ZNAČAJKI DOBROG DUPINA (*Tursiops truncatus*) IZ JADRANSKOGA MORA I DUPINA IZ RODA TURSIOPS IZ DRUGIH SVJETSKIH MORA

M. Đuras Gomerčić[1], T. Gomerčić[2], H. Gomerčić[1], H. Lucić[1], D. Škrtić[1], S. Ćurković[1] i S. Vuković[1]

[1]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (martina.duras@vz.htnet.hr, hrvoje.gomercic@vef.hr, hlucic@vef.hr, svukovic@vef.hr), [2]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr)

Dobri dupin (*Tursiops truncatus*) je široko rasprostranjena vrsta kitova (Cetacea) koja dolazi u svim morima svijeta osim u morima polarnih područja, a jedini je morski sisavac koji nastanjuje Jadransko more. Morfološke razlike između pojedinih svjetskih populacija su znatne i upućuju na biološke razlike između tih populacija koje zahtjevaju odgovarajući pristup u zaštiti i gospodarenju. Na temelju tjelesne mase i 175 vanjskih tjelesnih i osteometrijskih mjera utvrđene su sličnosti i razlike 23 fizički zrela dobra dupina iz Jadranskog mora u odnosu na dupine iz roda Tursiops iz ostalih svjetskih mora. Znatne morfometrijske razlike utvrđene su između dobrih dupina iz Jadranskog mora i pripadnika vrste *Tursiops aduncus* iz mora oko Kine i južne Afrike. *T. aduncus* je znatno manji, manje je tjelesne mase, ima kraću i užu lubanju, uži kljun te veći broj zubiju. U usporedbi s dobrim dupinima iz Sarasote i istočne Floride dobri dupini iz Jadranskog mora su znatno veći, no imaju manji broj zubiju. Znatno duže lubanje i veći broj zuba od dobrih dupina iz Jadranskog mora imaju dobri dupini iz mora oko Mauritanije, Sjevernog mora, priobalja istočnog Tihog oceana, oko južne Afrike i oko Velike Britanije. Uzimajući u obzir kondilobazalnu duljinu i širinu lubanje, te duljinu i širinu kljuna dobri dupin iz Jadranskog mora najsličniji je onome iz mora oko Kine, no ove jedinke imaju veći broj zuba. U daljnim istraživanjima dobrih dupina iz Jadranskog mora posebnu pozornost treba posvetiti i ostalim biološkim sličnostima između ovih populacija.

COMPARISON OF MORPHOMETRICAL CHARACTERISTICS OF THE BOTTLENOSE DOLPHIN (*Tursiops truncatus*) FROM THE ADRIATIC SEA WITH SPECIES OF THE GENUS TURSIOPS FROM OTHER SEAS

M. Đuras Gomerčić[1], T. Gomerčić[2], H. Gomerčić[1], H. Lucić[1], D. Škrtić[1], S. Ćurković[1] and S. Vuković[1]
[1]Department of Anatomy, Histology and Embryology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (martina.duras@vz.htnet.hr, hrvoje.gomercic@vef.hr, hlucic@vef.hr, svukovic@vef.hr), [2]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr)

The bottlenose dolphin is a widely spread cetacean species that inhabits all world seas except the seas of the circumpolar region. It is also the only marine mammal resident in the Adriatic Sea. There are significant morphological differences between bottlenose dolphin populations and they point to different protection and management approaches. Based on the body mass and 175 external and osteological measurements of 23 physically mature bottlenose dolphins from the Adriatic Sea the similarities and differences to species of the genus Tursiops from other seas were estimated. The bottlenose dolphin from the Adriatc Sea differs significantly from the species *Tursiops aduncus* from the seas around China and south Africa. *T. aduncus* is shorter, has a lesser body mass, the skull and rostrum are shorter and narrower but the teeth count is higher. Compared to the bottlenose dolphins from Sarasota and eastern Florida the bottlenose dolphins from the Adriatic Sea are larger, but they have a lesser teeth count. The skulls of bottlenose dolphins from Mauretania, North Sea, coastal region of the Eastern Pacific, south Africa and Great Britain are longer and these bottlenose dolphins have a higher teeth count then the bottlenose dolphins from the Adriatic Sea. Based on the condylobasal length, skull width, length and width of the rostrum, the bottlenose dolphin from the Adriatc Sea is most similar to the bottlenose dolphins from the seas around China, but these bottlenose dolphins have a higher teeth count. Further investigation on the bottlenose dolphins of the Adriatic Sea should also compare other biological aspects of these two populations.

P-91

BIOLOGIJA NEDORASLE OVČICE, *Lithognathus mormyrus* (LINAEUS, 1758) (TELEOSTEI, SPARIDAE) NA ISTOČNOJ OBALI JADRANSKOG MORA

J. Ferri, S. Matić- Skoko, M. Kraljević i J. Dulčić
Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska (sanja@izor.hr)

Biologija nedorasle ovčice, *Lithognathus mormyrus* je analizirana na osnovu uzoraka s područja Duće Glava, istočni Jadran. Ukupno 2133 nedoraslih ovčica, raspona ukupne dužine od 0,8 do 10,3 cm, je ulovljeno specijalno konstruiranom malom obalnom potegačom. Većina jedinki (99,53%) je pripadala 0^+ kohortu. Analiza dnevno-noćnih ulova *L. mormyrus* nije rezultirala posebnim zaključkom o pojavi vrste u pojedinom dijelu dana. Prve jedinke, starosti 1,5-2,0 mjeseci, zamjećene su krajem kolovoza. Novačenje se odvijalo 12 mjeseci od ulaska nedoraslih ovčica u ovo područje. Odnos između ukupne dužine i mase je ukazao na pozitivni alometrijski rast (b = 3.141). Indeks kondicije, kao posljedica dužinsko-masenog odnosa, je bio CF = 1.245.

Gompertz-ova jednadžba (c = 0.080 mm dan^{-1}; R^2 = 0.962) je najpogodnija za opis rasta nedorasle *L. mormyrus*. Gompertz-ov i von Bertalanffy-ev model, korišteni za analizu rasta *L. mormyrus*, dobro opisuju podatke u prvih pet mjeseci života, kada je ujedno zamjećen i najintenzivniji rast, dok nakon tog razdoblja, Gompertz-ov model precjenjuje rast u usporedbi sa stvarnim rastom dok von Bertalanffy-ev model potcjenjuje rast. Modeli korišteni za procjenu smrtnosti su rezultirali s različitim vrijednostima ukazujući još jednom na probleme takvih analiza kod nedoraslih riba.

BIOLOGY OF JUVENILE STRIPED SEABREAM, *Lithognathus mormyrus* (LINAEUS, 1758) (TELEOSTEI, SPARIDAE) IN THE EASTERN PART OF THE ADRIATIC SEA

J. Ferri, S. Matić- Skoko, M. Kraljević and J. Dulčić
Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia (sanja@izor.hr)

Biology of juvenile striped seabream, *Lithognathus mormyrus* from the Duće Glava, eastern Adriatic Sea, was analyzed. A total of 2133 juveniles, ranging in total length from 0.8 to 10.3 cm, were caught by small beach seine. Most individuals (99.53%) belonged to the 0^+ cohort. Analysis of *L. mormyrus* day-night catches didn't show any particular diel pattern. The first settlers, aged 1.5-2.0 months, were recorded at the end of August. Recruitment occurred 12 months after settlement in this area. Relationship between total length and weight indicates positive allometric growth (b = 3.141). The condition factor, as a consequence of length-weight relationship, was CF = 1.245. The Gompertz equation (c = 0.080 mm day^{-1}; R^2 = 0.962) seems to be the most appropriate for the description of young *L. mormyrus* growth. The Gompertz and von Bertalanffy models, used for juvenile *L. mormyrus*, fit its data very well in first five months when the most intensive growth were recorded, while after that period, Gompertz model overestimated growth in comparison with the real growth slope and the von Bertalanffy model underestimated growth. Models used for mortality estimations resulted with different values of natural mortaliy pointed once again the problems with such analysis at juvenile fishes.

P-92
GENETIČKA RAZNOLIKOST DOBROG DUPINA (*Tursiops truncatus*) IZ HRVATSKOG DIJELA JADRANSKOG MORA MJERENA ANALIZOM MIKROSATELITSKIH LOKUSA

A. Galov[1], G. Lauc[2], T. Gomerčić[3], I. Kocijan[1], M. Đuras-Gomerčić[4], I. Bašić[1] i H. Gomerčić[4]
[1]Zavod za animalnu fiziologiju, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb,Hrvatska (agomercic@yahoo.com,ivnatom@yahoo.com,ibasic1@yahoo.com),Croatia, [2]Zavod za biokemiju i molekularnu biologiju, Farmaceutsko-biokemijski fakultet, A. Kovačića 1, HR-10000 Zagreb (glauc@pharma.hr), [3]Zavod za biologiju, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr), [4]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet, Sveučilište u Zagrebu, HR-10000 Zagreb, Croatia (martina.duras@vz.tel.hr, hrvoje.gomercic@vef.hr)

Dobri dupin (*Turiops truncatus*) jedina je vrsta morskih sisavaca koja stalno nastanjuje hrvatski dio Jadranskog mora, a brojnost na tom području joj se procijenjuje na 220 do 250 jedinki. U Hrvatskoj je dobri dupin ugrožena i zakonom zaštićena vrsta. Premda je za zaštitu ugroženih vrsta od velikog značaja održanje genetičke varijacije unutar populacija, do sada nisu provedena nikakva istraživanja genetičke raznolikosti u populaciji dobrih dupina u Hrvatskoj. Genetička varijabilnost se smatra nužnim čimbenikom za mogućnost adaptacije i dugoročno preživljenje populacija. Mikrosateliti su genetički markeri velike varijabilnosti te se koriste za istraživanja genetičke raznolikosti. Mi smo analizirali mikrosatelitske lokuse u 30 jedinki koje su nađene mrtve u periodu od 1994 do 2003 godine. DNA smo izolirali iz tkiva lešina, te smo proveli multiple lančane reakcije polimerazom u kojima je amplificirano 12 polimorfnih mikrosatelitskih lokusa dinukleotidnih ponavljanja (EV1, EV14, EV37, EV94, TexVet3, TexVet5, TexVet7, D08, D14, D18, D22, D28). PCR proizvode smo analizirali na ABI PRISM 310 Genetic Analyzer korištenjem programa GeneScan i Genotyper. Analizu genetičke varijacije proveli smo korištenjem programa Genetix 4.05. Izmjeren je broj alela po lokusu od tri do 15, sa srednjom vrijednošću 7.17, dok je očekivana heterozigotnost iznosila od 0.34 do 0.89, sa srednjom vrijednošću od 0.69. Rezultati pokazuju relativno visoku genetičku raznolikost u populaciji dobrog dupina u Hrvatskoj.

GENETIC DIVERSITY OF BOTTLENOSE DOLPHIN (*Tursiops truncatus*) FROM CROATIAN PART OF THE ADRIATIC SEA REVEALED BY MICROSATELLITE ANALYSIS

A. Galov[1], G. Lauc[2], T. Gomerčić[3], I. Kocijan[1], M. Đuras-Gomerčić[4], I. Bašić[1] and H. Gomerčić[4]
[1]Department of Animal Physiology, Faculty of Science, University of

Zagreb, Rooseveltov trg 6, HR-10000 Zagreb (agomercic@yahoo.com, ivnatom@yahoo.com, ibasic1@yahoo.com), Croatia, [2]Department of Biochemistry and Molecular Biology, Faculty of Pharmacy and Biochemistry, University of Zagreb, A. Kovačića 1, HR-10000 Zagreb, Croatia (glauc@pharma.hr), [3]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, 10000 Zagreb, Croatia (tomislav.gomercic@vef.hr), [4]Department of Anatomy, Histology and Embriology, Faculty of Veterinary Medicine, University of Zagreb, 10000 Zagreb, Croatia (martina.duras@vz.tel.hr, hrvoje.gomercic@vef.hr)

The bottlenose dolphin (*Tursiops truncatus*) is the only resident marine mammal species in Croatian part of the Adriatic Sea, with number estimated at 220 to 250 individuals. It is endangered and legally protected species in Croatia. Although a general concern for the conservation of endangered species is the maintenance of genetic variation within populations, no research has been done on genetic variation of bottlenose dolphin in Croatia, up to now. Genetic variability is thought to be essential to the long-term persistence and adaptability of populations. Microsatellites are genetic markers that show a high level of variation and are usefull tools for examining genetic diversity. We analysed microsatellite loci in 30 individuals found dead from 1994 untill 2003. DNA was extracted from tissues of carcasses. Multiplex polymerase chain reactions were performed in which 12 polymorphic dinucleotide repeat cetacean microsatellite loci (EV1, EV14, EV37, EV94, TexVet3, TexVet5, TexVet7, D08, D14, D18, D22, D28) were amplified. PCR products were analysed on ABI PRISM 310 Genetic Analyzer using GeneScan and Genotyper softwares. Genetic variation analysis was performed using the Genetix 4.05 program. The mean allelic diversity per microsatellite locus was 7.17, ranging from three to 15 alleles and the mean expected heterozygosity was 0.69, ranging from 0.34 to 0.89. The results reveal relatively high genetic variability in population of bottlenose dolphins in Croatia.

P-93

MRIJEST SIPE (*Sepia officinalis*, Linnaeus, 1758) I IZVALJIVANJE JAJAŠACA U LABORATORIJSKIM UVJETIMA

N. Glavić[1], P. Tutman[2], N. Antolović[1], B. Skaramuca[1], D. Skaramuca[1] i V. Kožul[1]
[1]Sveučilište u Dubrovniku, Institut za more i priobalje, Kneza Damjana Jude 12, HR-20000 Dubrovnik, [2]Institut za oceanografiju i ribarstvo, Šetalište I. Meštrovića 63, HR-21000 Split, Hrvatska (galvic@mailcity.com)

U radu smo prikazali mrijest sipe (*Sepia officinalis*, Linnaeus, 1758) u laboratorijskim uvjetima, izvaljivanje jajašaca te osnovnu dinamiku izvaljivanja jednog pologa jajašaca. Dana 23.03. 2005 godine u laboratorijske bazene donešeno je 11 sipa, koje su ulovljene u pridnenu mrežu stajačicu (barakuda) na području ušća rijeke Neretve, na dubini od 6m (t=15,7°C, s=36,9 psu). Stavljene su u bazen s konstantnim protokom morske vode dimenzija 1,2x1,2x0,3 m, zapremine 0,45 m^3 (t=14,7°C, s=35,2 psu) sa plastičnom mrežicom za polaganje jajašaca. Sutra dan popodne sipe, barem tri ženke, su počele polagati jajašca. Ukupno je položeno 616 jajašaca, koja su razdvojena, te stavljena u plutajuće inkubatore, u kojima ih je struja zraka miješala. U inkubator A je stavljeno 174 jajašca, a u inkubator B=442 jajašca. Sipe su se počele izvaljivati 31.05. 2005 godine. Dnevno je bilježen broj izvaljenih sipa u svakom inkubatoru, a odmah po izvaljivanju mjerena im je težina. U inkubatoru A ukupno je kroz 28 dana izvaljeno 162 sipe, odnosno 93,1%, a u inkubatoru B 342 sipe, odnosno 77,3%. Mortalitet tek izvaljenih ličinki (na dan izvaljivanja) zabilježen je tek zadnja dva dana izvaljivanja, a bio je za inkubator A 36 jedinki, odnosno 22,2%, a u inkubatoru B 9 jedinki, odnosno 0,26%. Također, korelacija između vremena izvaljivanja i težine tek izvaljene sipice je pokazala određenu pozitivnu vrijednost.

SPAWNING OF CUTTLEFISH (*Sepia officinalis*, Linnaeus, 1758) AND EGG HATCHING IN THE LABORATORY.

N. Glavić[1], P. Tutman[2], N. Antolović[1], B. Skaramuca[1], D. Skaramuca[1] and V. Kožul[1]
[1]University of Dubrovnik, Institute for Marine and Coastal research, D. Jude 12, HR-20000 Dubrovnik, Croatia, [2]Institute of Oceanography and fisheries, Split, I. Meštrovića 63, HR-21000 Split, Croatia (galvic@mailcity.com)

Described in this paper are spawning in the laboratory, egg hatching as well as basic dynamics of hatching of one batch of eggs. On march 23. 2005. eleven cuttlefish were brought in the laboratory. They were caught in the river Neretva estuary in gillnet (barakuda), at a depth of 6m (t=15,7°C, s=36,9 psu). They were placed in plastic retangular pool 1,2x1,2x0,3m, containing 0,45m^3 of constant flow-through seawater (t=14,7°C, s=35,2 psu). In that pool a plastic mesh was placed to give the cuttlefish surface for laying eggs. During the afternoon of 24. 03. 2005. cuttlefish, at least three of the females, started laying eggs, and layed 616 eggs by the end of that day. The day after the eggs were separated and placed in floating incubators in which they were agitated by the stream of air. 174 eggs were placed in the incubator A, and 442 eggs in the incubator B. Young cuttlefish started hatching on 31. 05. 2005. The number

of newly hatched cuttlefish in each incubator was counted on a daily basis, and they were immediately weighted. In a period of 28 days 162 cuttlefish hatched in the incubator A, which makes 93,1%, and 342 cuttlefish in the incubator B, which makes 77,3%. The mortality in newly hatched cuttlefiah was not recorded untill the day 26 of hatching, and was for the incubator A 36 individuals (22,2%), and for the incubator B 9 individuals (0,26%). Also, correlation between the time of hatching and and the weight of newly hatched cuttlefiah showed certain positive trend.

P-94

POJAVA I STRADANJA GLAVATIH DUPINA (*Grampus griseus*) U POSLJEDNJIH 15 GODINA U HRVATSKOM DIJELU JADRANA

H. Gomerčić[1], M. Đuras Gomerčić[1], T. Gomerčić[2], H. Lucić[1], D. Škrtić[1], S. Ćurković[1], S. Vuković[1], Đ. Huber[2], V. Gomerčić[3] i J. Bubić Špoljar[4]
[1]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (hrvoje.gomercic@vef.hr, martina.duras@vz.htnet.hr, hlucic@vef.hr, svukovic@vef.hr), [2]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr, djuro.huber@vef.hr), [3]Krešimirov trg 3, HR-10000 Zagreb, Hrvatska, [4]Pliva - Istraživanje i razvoj d.o.o. PJ Biotehnologija, Filipovićev prilaz 29, HR-Zagreb, Hrvatska (jadranka.bubic@pliva.hr)

U posljednjih 15 godina pregledali smo 132 trupla različitih vrsta kitova (Cetacea), nađenih u hrvatskom dijelu Jadrana. Od toga broja, osam je trupala glavatih dupina (*Grampus griseus*), čiju smo približnu dob procijenili na osnovi rendgenskih snimaka okoštavanja kostiju prsne peraje. Gotovo sve su bili mužjaci dužine 286-318 cm i mase 185-305 kg. Dva fizički zrela mužjaka, nađena 20. VI. 2000, uginula su na obali vrlo plitke uvale Sabuše na otoku Molatu. Fizički zrela ženka, uginula zbog upale maternice, nađena je 21. XI. 2001. na Preluci pokraj Rijeke. Dana 31. XII. 2001. nađen je uz otočić Karantunić u blizini jugozapadnog kraja otoka Ugljana fizički zreli mužjak koji se utopio u ribarskoj mreži, a isti dan nađen je glavati dupin neutvrđenog spola, dobi i uzroka smrti na poluotoku Oštrica, južno od Šibenika. Ukupno tri fizički nezrela mužjaka nađena su: prvi 10. I. 2002. u uvali Saplunara na otoku Mljetu, uginuo zbog parazitarne upale želučane sluznice, te drugi 18. I. 2002. u Viškoj luci i treći 30. IV. 2002. u uvali Gršćica na južnoj obali Korčule, uginuli zbog zaplitanja u ribarsku mrežu i utapanja. Iz ovih nalaza trupala glavatih dupina zaključujemo da su u hrvatski dio Jadrana ušli najmanje jedna ženka i u dva navrata jata mužjaka. Sredinom 2000. godine veliki valovi su

preko vrlo plitkog spruda prebacili dva mužjaka u plitku uvalu srednjeg dijela hrvatskog Jadrana u kojoj su uginuli, a početkom 2002. godine pet mužjaka je stradalo u srednjem i južnom dijelu hrvatskog Jadranu pretežno zbog zaplitanja u ribarske mreže i posljedičnog utapanja.

ABUNDANCE AND MORTALITY OF RISSOS'S DOLPHINS (*Grampus griseus*) IN THE LAST 15 YEARS IN THE CROATIAN PART OF THE ADRIATIC SEA

H. Gomerčić[1], M. Đuras Gomerčić[1], T. Gomerčić[2], H. Lucić[1], D. Škrtić[1], S. Ćurković[1], S. Vuković[1], Đ. Huber[2], V. Gomerčić[3] and J. Bubić Špoljar[4]
[1]Department of Anatomy, Histology and Embryology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (hrvoje.gomercic@vef.hr, martina.duras@vz.htnet.hr, hlucic@vef.hr, svukovic@vef.hr), [2]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr, djuro.huber@vef.hr), [3]Krešimirov trg 3, HR-10000 Zagreb, Croatia, [4]Pliva - Istraživanje i razvoj d.o.o. PJ Biotehnologija, Filipovićev prilaz 29, HR-10000 Zagreb, Croatia (jadranka.bubic@pliva.hr)

In the last 15 years we examined 132 cetacean carcasses found in the Croatian part of the Adriatic Sea. Eight carcasses were Rissos's dolphins (*Grampus griseus*). Their age was estimated according to radiographs showing epiphyseal fusion of pectoral fin bones. Seven Rissos's dolphins were males 286-318 cm long with body mass of 185-305 kg. Two physical mature males were found on 20th of April 2000 on the coast of Sabuša, a shallow bay of the island Molat. A physical mature female died of uterus inflammation and was found on 21st of November 2001 in Preluka near Rijeka. On 31st of December 2001 a physical mature male entangled in a net was found near the island Katunarić near Ugljan. On the same day a Rissos's dolphin of unknown sex, age and cause of death was found on Oštrica near Šibenik. Three physical immature males were found at the beginning of 2002: first died of gastric parasitic invasion on 10th of January 2002 in bay Saplunara of Mljet, second on 18th of January 2002 in harbor of Vis and the third on 30th of April 2002 in bay Gršćica of Korčula, both of net entanglement. We conclude that at least one female and on two occasions, schools of males visited the Adriatc Sea in the last 15 years. In 2000 two males of these schools stranded in a shallow bay and in 2002 five males died mostly due to net entanglement.

P-95

POKUSNI UZGOJ RANIH RAZVOJNIH FAZA UŠATE (*Oblada melanura*, Linnaeus, 1758)

V. Kožul[1], N. Antolović[1], V. Onofri[1] i S. Tomšić[2]
[1]Institut za more i priobalje, D. Jude 12, HR-20000 Dubrovnik, [2]Sveučilište Dubrovnik, Ć. Carića 4, HR-20000 Dubrovnik, Hrvatska

Postličinke ušate (*Oblada melanura*) ulovljene su u južnom Jadranu oko Dubrovnika. Sakupljane su u plitkim uvalama početkom ljetnih mjeseci. Istraživan je rast i prilagodba ranih razvojnih stadija u kontroliranom uzgoju. Ulovljeno je 430 postličinaka starih izmedju 30 i 40 dana. Prosječna tjelesna masa na početku pokusa iznosila je 0.026±0.01 g, dok je standardna dužina bila 10,70±0.91 mm. Prosječna ukupna dužina bila je 12.88±0.87 mm. Ličinke su hranjene komercijalnom peletiranom hranom 5-6 puta dnevno. Prosječna temperatura mora u prva tri mjeseca uzgoja iznosila je 21.9 ºC dok je salinitet bio 37.6. Smrtnost je u istraživanom razdoblju iznosila 8%. Nakon tri mjeseca uzgoja tjelesna masa je prosječno bila 1.30±0.47 g. Standardna dužina bila je 37.36±4.02 mm, dok je prosječna ukupna dužina iznosila 44.24±4.42 mm. Ušate su pokazale dobru prilagodbu na uzgoj i lako prihvatile peletiranu hranu. Tijekom biometriskih mjerenja i anesteziranja uzoraka ribe smrtnost nije zabilježena.

EXPERIMENTAL REARING OF EARLY DEVELOPMENTAL STAGES OF SADDLE BREAM (*Oblada melanura*, Linnaeus, 1758)

V. Kožul[1], N. Antolović[1], V. Onofri[1] and S. Tomšić[2]
[1]Institute for Marine and Coastal Research, D. Jude 12, HR-20000 Dubrovnik, [2]University of Dubrovnik, Ć. Carića 4, HR-20000 Dubrovnik, Croatia

Postlarvae of saddled bream (*Oblada melanura*) were caught in the Southeastern Adriatic, in the vicinity of Dubrovnik. They were collected in shallow water at the beginning of summer. Growth and adaptability of early stages in captivity were investigated. The postlarvae (n= 430) were 30-40 days old. Average body weight at the start of the experiment was 0.026±0.01 g, average standardlength was 10,70±0.91 mm and total length was 12.88±0.87 mm. In the experiment, postlarvae were fed with commercial feed for early stages, 5-6 times during the day. Average temperature and salinity in this period were measured to be 21.9 ºC and 37.6 respectively. Mortality was 8%. After three months of rearing, average body weight was 1.30±0.47 g, average length was 37.36±4.02 mm and total length was 44.24±4.42 mm. Specimens demonstrated good adaptability

to captive environment and it responded well to pelleted feed. There was no mortality reported during biometrical measurements.

P-96

PORODICE LAMNIDAE, ALOPIIDAE I CARCHARHINIDAE (SQUALIFORMES) U RIBARSKOM ULOVU NA PODRUČJU SREDNJEG DIJELA JADRANSKOG MORA

P. Kružić[1] i I. Petrov-Rančić[2]
[1]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (pkruzic@zg.biol.pmf.hr), [2]Bana Josipa Jelačića 50, HR-22000 Šibenik

U razdoblju od 1997. do 2002. godine bilježen je ulov jedinki iz porodice Lamnidae, *Lamna nasus* (Bonnaterre, 1788) i *Isurus oxyrinchus* (Rafinesque, 1810), porodice Alopiidae, *Alopias vulpinus* (Bonnaterre, 1788) i porodice Carcharhinidae, *Carcharhinus plumbeus* (Nardo, 1827) i *Prionace glauca* (Linnaeus, 1785) na području srednjeg dijela Jadranskog mora. Sve ulovljene jedinke morfološki su obrađene, a upisani su i podaci poput mjesta, datuma, dubine i metode ulova. U istraživanju su osim vlastitih podataka korišteni i podaci dobiveni u suradnji s lokalnim ribarima. Za istraživane vrste napravljene su karte s ucrtanim mjestima ulova. Ukupno je ulovljeno 59 jedinki, od toga 1 jedinka vrste *Lamna nasus*, 11 jedinki vrste *Isurus oxyrinchus*, 12 jedinki vrste *Alopias vulpinus*, 4 jedinke vrste *Carcharhinus plumbeus* i 31 jedinka vrste *Prionace glauca*. Kako za istočni dio Jadranskog mora ne postoje sustavni podaci o ulovu morskih pasa, teško je odrediti stupanj ugroženosti za svaku od istraživanih vrsta.

FAMILIES LAMNIDAE, ALOPIIDAE AND CARCHARHINIDAE (SQUALIFORMES) IN FISHING CATCH IN THE CENTRAL PART OF THE ADRIATIC SEA

P. Kružić[1] and I. Petrov-Rančić[2]
[1]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (pkruzic@zg.biol.pmf.hr), [2]Bana Josipa Jelačića 50, HR-22000 Šibenik, Croatia

Specimens of family Lamnidae, *Lamna nasus* (Bonnaterre, 1788) and *Isurus oxyrinchus* (Rafinesque, 1810) Alopiidae, *Alopias vulpinus* (Bonnaterre, 1788) and Carcharhinidae, *Carcharhinus plumbeus* (Nardo, 1827) and *Prionace*

glauca (Linnaeus, 1785) were caught from 1997 to 2002 in the Croatian central part of the Adriatic Sea. All the specimens were morphologically analysed and the other data concerning place, date, depth and catch method were recorded as well. Besides personal observations, in this research data recorded by local fishermen were also taken in account. The map of Adriatic Sea with positions where the specimens were caught is given for all investigated species. A total of 59 specimens were caught, of which 1 belonged to *Lamna nasus*, 11 to *Isurus oxyrinchus*, 12 to *Alopias vulpinus*, 4 to *Carcharhinus plumbeus* and 31 to *Prionace glauca*. Since there have been no statistic data about shark fishery for the eastern Adriatic Sea, it is not possible to determine precise level of threat for each of this species in this area.

P-97

PRVI NALAZ TRI VRSTE GLAVOČA (PISCES: GOBIIDAE) U LEVANTU

M. Kovačić[1] i D. Golani[2]
[1]Prirodoslovni muzej Rijeka, Lorenzov prolaz 1, HR-51000 Rijeka, Hrvatska (Marcelo.Kovacic@public.srce.hr), [2]Department of Evolution, Systematics and Ecology, The Hebrew University of Jerusalem, 91904 Jerusalem, Izrael.

Vrste *Gobius couchi* Miller & El-Tawil, 1974, *Gobius fallax* Sarato, 1889, and *Odondebuenia balearica* (Pellegrin & Fage, 1907) do sada su bile poznate samo u sjevernom Mediteranu. Primjerci ove tri vrste nedavno su otkriveni u zbirci riba Sveučilišta u Jeruzalemu. Sakupljeni su na Cipru i predstavljaju prvi nalaz ovih vrsta u Levantu. Ovaj nalaz omogućio je opis morfologije primjeraka ove tri vrste iz Levanta. U radu je raspravljen problem određivanja vrste *Gobius fallax*. Do sada su za područje jugoistočnog Mediterana bile poznate 23 vrste glavoča. Svi nedavni nalazi u zbirci riba Sveučilišta u Jeruzalemu povećali su poznatu faunu glavoča jugoistočnog Mediterana za 17 %. Porast poznate biološke raznolikosti glavoča jugoistočnog Mediterana, uzrokovan sadašnjim nalazima, upućuje da je dosadašnji mali broj vrsta posljedica slabog intenziteta rada na glavočima, a ne stvarno slabe biološke raznolikosti ove svojte u južnom Mediteranu.

FIRST RECORDS OF THREE GOBIID SPECIES (PISCES: GOBIIDAE) IN THE LEVANT

M. Kovačić[1] and D. Golani[2]
[1]Natural Hystory Museum Rijeka, Lorenzov prolaz 1, HR-51000 Rijeka, Croatia (Marcelo.Kovacic@public.srce.hr), [2]Department of Evolution,

Systematics and Ecology, The Hebrew University of Jerusalem, 91904 Jerusalem, Israel.

Gobius couchi Miller & El-Tawil, 1974, *Gobius fallax* Sarato, 1889, and *Odondebuenia balearica* (Pellegrin & Fage, 1907) are gobiid species, each known to date in the Mediterranean from its northern parts. The specimens of these species from Cyprus, recently found in the Hebrew University of Jerusalem Fish Collection, represent the first records of these species in the Levant. The present findings provide data on the morphology of the Levantine specimens. Identification of *Gobius fallax* is discussed. Total of 23 gobiid species were recorded for this area previously. All recent findings in the Hebrew University of Jerusalem Fish Collection increased the known Levantine gobiid fauna by 17 %. The increase of known gobiid diversity of the Levant, due to the present records, strongly suggests that the low number of species in the Levant is the result of the intensity of work on gobies, and not the low biodiversity of Gobiidae in the southern Mediterranean.

P-98

SADRŽAJ ŽELUCA KRUPNOZUBOG DUPINA (Z*iphius cavirostris*) IZ JADRANSKOG MORA

I. Kovačić[1], T. Gomerčić[2], M. Đuras Gomerčić [3], H. Lucić[3] i H. Gomerčić[3]
[1]Vlaška 99a, HR-10000 Zagreb, Hrvatska (koiva@inet.hr), [2]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr), [3]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (martina.duras@vz.tel.hr, hrvoje.lucic@vef.hr, hrvoje.gomercic@vef.hr)

Malo je objavljenih podataka o biologiji krupnozubog dupina (Cetacea: Ziphiidae). Prehrana ove dubokomorske vrste u svijetu je poznata samo iz malog broja nasukanih jedinki, koje se rijetko nalaze u Jadranskom moru. U ovom istraživanju pregledali smo i analizirali sadržaj želuca tri jedinke nasukane u hrvatskom Jadranu u razdoblju između 1990. i 2005. godine. Ispitali smo hipotezu da su dubokomorski glavonošci dominantni u prehrani, te da je plijen u želucu ovih dupina ostatak hranjenja kroz duže razdoblje. Ostatci hrane su analizirani i determinirani do vrste korištenjem objavljenih ključeva, a biomasa plijena procijenjena je formulama regresije za svaku vrstu glavonožaca. Ostaci hrane pronađeni su u želucu jedne životinje i sadržavali samo čeljusti glavonožaca. Determinirano je sedam mezopelagičkih i batipelagičkih vrsta iz reda Teuthida s ukupno 94 jedinke. Procijenjena biomasa plijena je 11 kg, a vrste

Octopoteuthis sicula i *Chiroteuthis veranyi* dominiraju u prehrani brojnošću (68.5%) i biomasom (64.5%). Dvije vrste glavonožaca ne nalaze se u popisu faune Jadranskog mora, ali su rasprostranjene u Sredozemnom moru. Rezultati ukazuju da je dio glavonožaca ostatak hranjenja u Sredozemnom moru, ali da se dupin hranio i u Jadranskom moru. Vrste i veličina plijena upućuju da je krupnozubi dupin ronio i hvatao plijen u dubini od 400-1000m u oba područja.

STOMACH CONTENTS OF THE CUVIER'S BEAKED WHALE (*Ziphius cavirostris*) FROM THE ADRIATIC SEA

I. Kovačić[1], T. Gomerčić[2], M. Đuras Gomerčić[3], H. Lucić[3] and H. Gomerčić[3]
[1]Vlaška 99a, HR-10 000 Zagreb, Croatia (koiva@inet.hr), [2]Department of biology, The Veterinary Faculty, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr), [3]Department of anatomy, histology and embryology, The Veterinary Faculty, Heinzelova 55, HR-10000 Zagreb, Croatia (martina.duras@vz.tel.hr, hrvoje.lucic@vef.hr, hrvoje.gomercic@vef.hr)

Little information exists on the biology of the Cuvier's beaked whale (Cetacea: Ziphiidae). Moreover, the data on the diet is scarce and available only from stranded specimens, which are rarely found in the Adriatic Sea. In this study we examined stomach contents of three individuals stranded in the Croatian Adriatic in the period between 1990 and 2005. We suggested that firstly, stomach contents would be dominated by deep-sea cephalopods and secondly, the food remains would be from several feedings. Hard food remains were analysed and ascribed to species using published guides, and prey biomass and was estimated using regression equations. Food remains were found in one animal, and consisted solely of cephalopod beaks. The total number of cephalopods found was 94, and they belonged to 7 mesopelagic and bathypelagic species of the order Teuthida. Estimated prey biomass was 11 kg, and *Octopoteuthis sicula* and *Chiroteuthis veranyi* dominated both in terms of number (68.5%) and weight (64.5%). Two of the prey species are not listed in the Adriatic cephalopod fauna, but are widely distributed across the Mediterranean Sea. The results imply that the whale had some food remains from feeding in the Mediterranean, but was also foraging in the Adriatic Sea. The prey species and their size suggest that the whale was diving 400-1000 m deep to forage in both areas.

P-99

VARIJABILNOST ŽARNICA U LOVKAMA POLIPA KAMENIH KORALJA *Cladocora caespitosa* (Linnaeus, 1767) i *Balanophyllia europaea*

(Risso, 1826) U JADRANSKOM MORU

P. Kružić, I. Radić i A. Požar-Domac
Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (pkruzic@zg.biol.pmf.hr)

Žarnice, proizvodi unutarstaničnog lučenja kod koljena Cnidaria (Žarnjaci), imaju različitu ulogu kod raznih skupina žarnjaka, ali se rijetko koriste kao taksonomska osobina. Tradicionalno, skelet je glavno taksonomsko obilježje kamenih koralja u njihovoj sistematici, dok se podaci iz mekog tkiva polipa potpuno zanemaruje. Upotreba obilježba mekog tkiva (na primjer, anatomija polipa, veličina žarnica) je ustaljena u proučavanju ostalih redova iz podrazreda Hexacorallia. Proučavane su žarnice iz lovki polipa dvaju vrsta kamenih koralja s 5 postaja u Jadranskom moru - *Cladocora caespitosa* (Linnaeus, 1767) i *Balanophyllia europaea* (Risso, 1826). Sa živih jedinki izolirane su i izmjerene najmanje 50 neispražnjenih žarnica koje su svrstane u slijedeće kategorije: spirocist, bazitrih2, bazitrih3, holotrih2, mikrobazični p-mastigofor. Ukupno je izmjereno oko 2500 žarnica. Podaci su obrađeni opisnim statističkim metodama (srednja vrijednost, standardna devijacija, maksimum i minimum pomoću Box-Whiskers dijagrama), Bray-Curtis analizom i analizom Model II ANOVA. Većina žarnica ovih dviju jedinki pokazuju male razlike u prosječnim veličinama. Ukupno gledajući, veći prosjek u veličini žarnica zabilježen je kod vrste B. europaea. Dobiveni podaci pokazuju kvalitativne i kvantitativne razlike između ovih dviju vrsta. Ovo istraživanje pokazuje kako karakteristike žarnica mogu biti koristan taksonomski kriterij za razlikovanje vrsta kamenih koralja.

CNIDAE VARIABILITY IN THE POLYP TENTACLES OF THE SCLERACTINIAN CORALS *Cladocora caespitosa* (Linnaeus, 1767) AND *Balanophyllia europaea* (Risso, 1826) IN THE ADRIATIC SEA

P. Kružić, I. Radić and A. Požar-Domac
Department of Zoology, Division of Biology,, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (pkruzic@zg.biol.pmf.hr)

Cnidae, products of intracellular secretion diagnostic of the phylum Cnidaria, have acquired various degrees of importance in cnidarian groups, but were rarely used as taxonomic characters. Traditionally, skeleton structure has been the main source of taxonomic characters for scleractinian systematics,

whereas information from soft tissues has been comparatively neglected. The use of soft tissue characters (e.g. polyp anatomy, cnidae size) is routine in the study of other soft haxacoralian orders. The cnidae composition from the polyp tentacles of two species - *Cladocora caespitosa* (Linnaeus, 1767) and *Balanophyllia europaea* (Risso, 1826) have been studied from 5 stations in the Adriatic Sea. Living specimens of each species were used; the length of at least 50 unfired capsules from the tentacles were measured and taken from the following categories: spirocyst, basitrich2, basitrich3, holotrich2 and microbasic p-mastigophore. A total of 2.500 measurements were done. The data were analyzed with descriptive statistics (mean, standard deviation, median, maximum and minimum by Box-Whiskers plot), Bray-Curtis index and Model II ANOVA. Most of the cnidae common to both species showed slight differences in average and size range. As a general rule, the average and size range reached higher values in *B. europaea*, than in *C. caespitosa*. The data obtained have show consistent qualitative and quantitative differences between the two species. This study shows that the cnidae characters can be useful taxonomic criteria for distinguishing scleractinian species.

P-100

PRODUKCIJA KARBONATA KOD KORALJA *Cladocora caespitosa* (Linnaeus, 1767) U JADRANSKOM MORU

P. Kružić, I. Radić i A. Požar-Domac
Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (pkruzic@zg.biol.pmf.hr)

Cladocora caespitosa (Linnaeus, 1767) je česti kolonijalni kameni koralj u Jadranskom moru. Živi u simbiozi sa mnogobrojnim endosimbiontskim, fotosintetskim zooksantelama iz roda *Symbiodinium*. Koralj gradi velike nepravilne mase koje se mogu spojiti u grebene široke nekoliko stotine metara. Ove vrlo zanimljive tvorevine su jedinstvene u Sredozemnom moru, te ih možemo usporediti s koraljnim grebenima tropskih mora. Laboratorijska i *in situ* mjerenja volumena, težine skeleta, ukupne površine i broja čaški po koloniji koralja, zajedno s prosječnim godišnjim rastom čaški koralja, omogućuje određivanje biomase kolonije, gustoće skeleta i sekundarnu organsku (polip) i anorgansku ($CaCO_3$) produkciju s 15 postaja s kolonijama ili grebenima koralja *C. caespitosa* na dubinama od 6 do 36 metara. Prosječna biomasa kolonija varira između 0,43 i 1,27 kg suhe tvari/m^2, što prati gustoća skeleta s vrijednostima od 1,08 do 1,53 g $CaCO_3$/cm^3. Godišnja sekundarna organska produkcija varira od 279,9 do 603,7 g suhe tvari/m^2, a anorganska

(mineralna) produkcija od 0,03 do 2,73 kg $CaCO_3/m^2$. S potencijalnom produkcijom $CaCO_3$ do 14,3 kg/m^2godišnje, vrsta *C. caespitosa* se može smatrati jednom od glavnih vrsta koje doprinose taloženju karbonatnih naslaga u Sredozemnom moru. Ovi rezultati ukazuju na povećanu produkciju kalcij-karbonata u istraživanim kolonijama posljednjih desetljeća, što bi mogao biti pokazatelj globalnih klimatskih promjena. Drugi cilj ovog istraživanja je povećati interes za istraživanje bioloških tvorbi u Sredozemnom moru u svrhu zaštite područja na kojima se one nalaze, a kojima u mnogim slučajevima prijeti opasnost od štetne ljudske aktivnosti.

CARBONATE PRODUCTION OF THE CORAL *Cladocora caespitosa* (Linnaeus, 1767) IN THE ADRIATIC SEA

P. Kružić, I. Radić and A. Požar-Domac
Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (pkruzic@zg.biol.pmf.hr)

The *Cladocora caespitosa* (Linnaeus, 1767) is a common colonial scleractinian coral in the Mediterranean Sea. It occurs naturally with numerous endosymbiotic and photosynthetic zooxanthellae from genus *Symbiodinium*. Coral branches build big irregular masses which may fuse into banks several hundred meters wide. These are extremely interesting formations since they are unique in the Mediterranean for their true reef-coral origin and their relation with true coral banks of tropical seas. Laboratory and *in situ* measurements of volume, skeleton weight, surface and number of corallites per colony, together with mean annual growth rates, allowed for the estimation of colony biomass, skeletal density and secondary organic (polyp) and inorganic ($CaCO_3$) production from 15 stations with *C. caespitosa* colonies or beds from 6 to 36 m depth. The mean colony biomass varied between 0.43 and 1.27 kg dw/m^2, corresponding to a skeletal density between 1.08 to 1.53 g $CaCO_3/cm^3$. Organic secondary production was 279.9 - 603.7 g dw of polyps $/m^2y$, while inorganic (mineral) production was 0.03 - 2.73 kg $CaCO_3/m^2y$. With the potential net production of calcium carbonate up to 14.3 kg/m^2year, coral *C. caespitosa* is one of the major constructional marine organisms in the Mediterranean Sea. These results seem to indicate that its net production of calcium carbonate is in the same range of most tropical hermatypic corals and proves that the coral skeletons are the witnesses of sea temperature variations in global climatic change. The another aim of this study is to raise a greater interest for Mediterranean bioconstructions, in an effort to preserve and manage many interesting and sometimes beautiful sites which, in many cases, are strongly menaced by human activities and require urgent protection.

P-101

MEKUŠCI U ISHRANI GLAVATE ŽELVE (*Caretta caretta*) U ISTOČNOM JADRANU

B. Lazar[1,2], R. Gračan[1], D. Zavodnik[3], A. Jaklin[3], J. Katić[4], M. Buršić[4] i N. Tvrtković[1]
[1]Zoološki odjel, Hrvatski Prirodoslovni Muzej, Demetrova 1, HR-10000 Zagreb, Hrvatska (Bojan.Lazar@hpm.hr, romanagracan@yahoo.com, Nikola.Tvrtkovic@hpm.hr), [2]"*Plavi svijet*" Institut za istraživanje i zaštitu mora, Kaštel 24, HR-51551 Veli Lošinj, Hrvatska, [3]Centar za istraživanje mora, Institut "Ruđer Bošković", G. Paliaga 5, HR-52210 Rovinj, Hrvatska (dzavodnik@cim.irb.hr, jaklin@cim.irb.hr), [4]Studenti, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (jenakatic@yahoo.com, moira_149@yahoo.com)

Analizirali smo ishranu 28 glavatih želvi koje su pronađene mrtve nasukane ili slučajno ulovljene u ribarske mreže u Hrvatskoj i Sloveniji između 2001. i 2004. godine, sa zakrivljenim dužinama karapaksa između 25.0 i 51.3 cm (srednja vrijednost: 35.3 cm, SD: 5.3). Iz sadržaja probavila izolirali smo mekušce te ih konzervirali u 4% neutraliziranom formalinu. Uzorke smo nakon toga taksonomski obradili do najniže moguće svojte, sušili na 95°C tijekom 24h i izvagali suhe mase (s.m.). Mekušci (puževi, školjkaši, glavonošci i koponošci) su predstavljali najzastupljeniji plijen u ishrani želvi (41.2% ukupne suhe mase), sa zabilježenih 79 svojti. Većina determiniranih vrsta pripada puževima (42 vrste) i školjkašima (34), čineći 40.2% ukupne suhe mase mekušaca, dok na glavonošce (*Eledone moschata*, *Sepia* sp.) i koponošce (*Dentalium dentalis*) zajedno otpada samo 1.0% suhe mase. Rezultati ukazuju na značaj većih vrsta puževa (npr. *Gibbula magus, Natica stercusmuscarum, Bolinus brandaris*) u ishrani glavatih želvi u Jadranu, dok su manje vrste (npr. *Turritella communis, Bittium reticulatum*) vjerojatno usput pojedene pri potrazi za drugim vrstama plijena na pomičnim morskim dnima. Većina manjih kućica puževa i školjkaša bile su sub-fosilne, što upućuje na dodatnu ekološku ulogu glavatih želvi kao bioturbatora u ekosistemu Jadranskoga mora.

MOLLUSCS IN THE DIET OF THE LOGGERHEAD SEA TURTLE (*Caretta caretta*) IN THE EASTERN ADRIATIC SEA

B. Lazar[1,2], R. Gračan[1], D. Zavodnik[3], A. Jaklin[3], J. Katić[4], M. Buršić[4] and N. Tvrtković[1]
[1]Department of Zoology, Croatian Natural History Museum, Demetrova 1,

HR-10000 Zagreb, Croatia (Bojan.Lazar@hpm.hr, romanagracan@yahoo.com, Nikola.Tvrtkovic@hpm.hr), [2]*Blue World* Institute of Marine Research and Conservation, Kaštel 24, HR-51551 Veli Lošinj, Croatia, [3]Center for Marine Research, Ruđer Bošković Institute, G. Paliaga 5, HR-52210 Rovinj, Croatia, (dzavodnik@cim.irb.hr, jaklin@cim.irb.hr), [4]Students, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (jenakatic@yahoo.com, moira_149@yahoo.com)

We analyzed diet of 28 loggerhead sea turtles, found dead stranded or incidentally captured by fisheries in Croatia and Slovenia, in 2001-2004. Curved carapace length of loggerheads ranged from 25.0 to 51.3 cm (mean: 35.3 cm, SD: 5.3). Molluscs were isolated from digestive tract contents and preserved in 4% buffered formaldehyde. Molluscan items were later identified to the lowest taxon possible, dried at 95ºC for 24 hours, and dry weighted (d.w.). Molluscs (Gastropoda, Bivalvia, Cephalopoda and Scaphopoda) were the highest ranked prey in the diet of loggerheads (41.2% of total dry weight), with 79 taxa recorded. Most identified species belonged to gastropods (42 species) and bivalves (34), representing 40.2% of total molluscs d.w., whilst cephalopods (Eledone moschata, Sepia sp.) and scaphopods (Dentalium dentalis) together accounted for only 1.0% d.w. Our results suggest that larger gastropods (e.g. Gibbula magus, Natica stercusmuscarum, Bolinus brandaris) belong to main prey items in the diet of Adriatic loggerheads, whereas smaller species (e.g. Turritella communis, Bittium reticulatum) can be considered as incidentally taken while searching for other prey on deposit bottom. Most of these small gastropod and bivalvian shells were sub-fossil, which indicate additional ecological role of loggerheads as bioturbators in Adriatic ecosystem.

P-102
DOBNE I SPOLNE RAZLIKE U MINERALNOJ GUSTOĆI NADLAKTIČNE KOSTI I PODLAKTIČNIH KOSTIJU DOBROG DUPINA (*Tursiops truncatus*) IZ JADRANSKOG MORA

H. Lucić[1], S. Vuković[1], H. Gomerčić[1], M. Đuras-Gomerčić[2], T. Gomerčić[1], S. Ćurković[1] i D. Škrtić[1]
[1]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (hlucic@vef.hr, svukovic@vef.hr, hrvoje.gomercic@vef.hr, martina.duras@vz.htnet.hr), [2]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr),

Istraživanje je provedeno radi utvrđivanja dobnih i spolnih razlika u

parametrima mineralne gustoće nadlaktične i podlaktičnih kostiju dobrog dupina (*Tursiops truncatus*). Obavljeno je na koštanim preparatima prsne peraje 56 dobrih dupina od čega su 26 mužjaka i 30 ženki. Mjerenje sadržaja minerala (BMC) i mineralne gustoće (BMD) odabranih područja kosti obavljeno je metodom apsorpcije dvostrukih rendgenskih zraka pomoću standardnog humanog osteodenzitometra. Dobiveni podaci su statistički obrađeni s ciljem povezivanja parametara mineralne gustoće kosti s vrijednostima dužine tijela i dobi životinje koja je određena metodom brojanja slojeva zubnog dentina (GLG metoda). Utvrđeno je da se sadržaj minerala u kosti kao i mineralna gustoća kosti mijenja ovisno o dužini tijela i dobi životinje. Rastom životinje kao i porastom njene dobi povećavaju se vrijednosti parametara mineralne gustoće kosti slično kao kod ljudi. Dob kao biološki parametar utječe na metabolizam koštanog tkiva dupina u smislu povećanog odlaganja minerala u kosti tijekom porasta dobi životinje. Jednako tako povećanjem dužine tijela dupina povećava se mineralna gustoća kosti što se nastavlja i nakon završetka rasta životinje. Sličan trend utvrđen je u životinja oba spola, ali su prosječne vrijednosti parametara mineralne gustoće kosti u ženki niže nego u mužjaka dobrog dupina. Spomenute razlike među spolovima nisu statistički značajne obzirom da su ženke dobrog dupina manje i laganije od mužjaka te imaju manju prosječnu dužinu tijela od mužjaka istraženih dobrih dupina.

AGE AND GENDER RELATED DIFFERENCES OF THE BONE MINERAL DENSITY OF THE HUMERUS AND ANTEBRACHIAL BONES OF THE BOTTLENOSED DOLPHIN (TURSIOPS TRUNCATUS) FROM THE ADRIATIC SEA

H. Lucić[1], S. Vuković[1], H. Gomerčić[1], M. Đuras-Gomerčić[2], T. Gomerčić[1], S. Ćurković[1] and D. Škrtić[1]
[1]Department of Anatomy, Histology and Embryology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (hlucic@vef.hr, svukovic@vef.hr, hrvoje.gomercic@vef.hr, martina.duras@vz.htnet.hr), [2]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr),

This research was aimed to determinate age and gender related differences of the bone mineral density in the humerus and antebrachial bones of bottlenose dolphin (*Tursiops truncatus*). Osteological preparations of the flippers of the 69 dolphins were used. Sample was consisted of 56 flippers of the bottlenose dolphins, of which there were 26 males and 30 females. Bone mineral content (BMC) and bone mineral density (BMD) were measured by method of dual

energy X-ray absorptiometry with the standard human osteodensitometer. Data were statistically analysed with aim to establish correlation of bone mineral density, total body length and age of animals. Age of animals was estimated by counting of dentinal layers of the teeth (GLG method). Bone mineral content and bone mineral density vary depends of the total body length and age of animals. Bone mineral density values increase with increase of total body length and age of animal, same as in human. Increase of age, as an biological parameter, have some influence on metabolism of bone tissue within the meaning of progressive bone mineral deposition. Increase of bone mineral density is associated with increase of the total body length but increase of the bone mineral density is continue after the completion of animal growth. In the meaning of that, similar trends are presented in both genders, but mean values of bone mineral density are lower in females then in the males. That gender related differences are not statistical significant because females are smaller than males anyway, and females has a less mean of the body length than males of investigated bottlenose dolphins.

P-103

KARNIVORNI ZOOZOOPLANKTON SJEVERNOG JADRANA (LIPANJ 1999-SRPANJ 2002)

D. Lučić i J. Njire
Institut za more i priobalje, Sveučilište u Dubrovniku, Damjana Jude 12, HR-20000 Dubrovnik, Hrvatska, (lucic@labdu.izor.hr)

Sezonske i prostorne promjene gustoće populacija hidromeduza, sifonofora i hetognata su istraživane na tri stalne postaje u otvorim vodama sjevernog Jadrana. Rezultati su uspoređeni sa sezonskim varijacijama brojnosti njihovog potencijalnog plijena: protisti, naupliji, kopepoditi, mali adultni kopepodi. Najviše vrijednosti meduza utvrđene su u ljetnom i jesenskom razdoblju 2000 godine: 179 jed.m^{-3} u rujnu (*Clytia* spp. 98% brojnosti) i 162 jed.m^{-3} u prosincu (*Solmaris* spp. 99% brojnosti). Najveće gustoće sifonofora nađene su ljeti: 153 nektofora u srpnju 2000. godine i 291 nektofora početkom lipnja 2001. godine. *Muggiaea atlantica* je bila izrazito dominantna vrsta. Visoke vrijednosti hetognata (> 180 jed.m^{-3}) nađene su u svim sezonama. Maksimum od 255 jed.m^{-3} zabilježen je u studenom 2002. godine. Juvenilni hetognati su dominirale u svim uzorcima. Multivarijantnom MDS metodom na temelju Bray-Curtisovog koeficijenta sličnosti dobivena je jasna sveza između gustoća populacija sifonofora i hetognata, te cilijata i kopepodskih nauplijia. Nasuprot, utvrđena je njihova potpuna odvojenost od sezonskih varijacija brojnosti kopepodita i adultnih kopepoda. Ovi rezultati podržavaju

hipotezu da su visoke vrijednosti karnivornog zooplanktona u sjevernom Jadranu mogu povezati s specifičnim lancem ishrane koji uključuje flagelate - mali zooplankton - karnivorni zozooplankton. Pretpostavljamo da su velike sezonske i godišnje varijacije vrijednosti metagentskih meduza u sjevernom Jadranu razlog zbog kojeg nije dobivena jasna povezanost s gustoćama populacija njihovog potencijalnog plijena.

CARNIVORROUS ZOOPLANKTON IN THE NORTHERN ADRIATIC SEA (JUNE 1999-JULY 2002)

D. Lučić and J. Njire
Institute for Marine and Coastal Research, University of Dubrovnik, Damjana Jude 12, HR-20000 Dubrovnik, Croatia (lucic@labdu.izor.hr)

Temporal and spatial abundance of hydromedusae, siphonophores, and chaetognaths was studied monthly at three fixed station in the open northern Adriatic Sea. Data were compared with the densities of potential prey, namely ciliates, nauplii, copepodites, small adult copepods. Higher levels of medusae were found in spring and fall 2000: 179 ind.m^{-3} in September (*Clytia* spp. accounted 98%) and 162 ind.m^{-3} (*Solmaris* spp. accounted 99%), respectively. Highest siphonophores abundance was in spring, with 153 nectophores m^{-3} in July of 2000 and 291 nectophores in the beginning of June 2001. *Muggiaea atlantica* was the most numerous species. Chaetognaths were present at > 180 ind.m^{-3} in all seasons, and their maximum of 255 ind.m^{-3} was in November 2002. Juvenile chaetognaths specimens dominated in all samples. Multidimensional Scaling Method (MDS, Bray-Curtis similarity) analysis identified there relationships between seasonal abundance of carnivorous zooplankton and their potential pray. Siphonophores and chaetognaths closely correlated with ciliates and nauplii, while copepodites and adult copepods were distinctly separate from them. High levels of carnivorous zooplankton in northern Adriatic thus appear to depend on food chain that links small flagellates to small zooplankton to carnivorous zooplankton. The cycle of metagenesis determined seasonal variations in hydromedusae populations of the Northern Adriatic; this accounts for the low correlation of hydromedusae with abundance of their potential prey.

P-104
KOLIČINA UKUPNOG HLAPLJIVOG BAZNOG DUŠIKA (TVB-N) I TRIMETILAMIN-DUŠIKA (TMA-N) U SRDELAMA I HARINGAMA KORIŠTENIM KAO HRANA ZA TOV TUNA

J. Maršić-Lučić[1], M.Tudor[1] i V. Šćekić[1]
[1]Laboratorij za akvakulturu, Institut za Oceanografiju i Ribarstvo, Šetalište I. Meštrovića 63, HR-21000 Split, Hrvatska (jmarsic@izor.hr, tudor@izor.hr, vida@st-t.com.hr)

Uzgoj plavoperajne tune (*Thunnus thynnus*) u Sredozemlju, pa tako i u Hrvatskoj je zadnjih desetak godina u porastu. Za ishranu tune u kaveznom uzgoju upotrebljava se mala plava riba i to većinom srdela (*Sardina pilchardus*) i haringa (*Clupea harengus*). Ove dvije vrste se uglavnom uvoze iz zemalja Sjeverne Europe, te se u smrznutom stanju dopremaju na tunogojilišta. Kvaliteta mesa tuna iz uzgoja ovisi o kvaliteti i svježini ribe kojom se hrani. Hrana loše kvalitete uzrokuje zdravstvene probleme kao što je kočenje imunosupresije, povećana infekcija parazitima i stres što sve može uzrokovati smanjen rast i razvoj tune, a u nekim slučajevima i mortalitet. Zbog nedostatka radova iz područja kontrole kvalitete ribe koja se koristi za ishranu tune i rješavanja zdravstvenih problema koji se javljaju, proučavane su promijene količine ukupnog hlapljivog baznog dušika (TVB-N) i trimetilamin-dušika (TMA-N) kod srdele (*S. pilchardus*) i haringe (*C. harengus*) nakon godine dana pohranjivanja u smrznutom stanju. Analize su provedene u ovisnosti o masi tijela srdele i haringe. Istraživanje je pokazalo da između količine TVB-N i stupnja kvarenja ne postoji povezanost, jer su vrijednosti TVB-N za obje vrste riba u granicama tolerancije (25-35mg/100g). Količine TMA-N su veće od preporučenih granica tolerancije (10-15 mg/100g). Funkcionalni odnos između TVB-N i TMA-N u srdelama kao i haringama nije linearan. Na osnovu rezultata analiza može se zaključiti da je srdela i haringa kao hrana nakon godine dana zamrzavanja nepogodna za tov tune.

QUANTITIES OF TOTAL VOLATILE BASES NITROGEN (TVB-N) AND TRIMETHYLAMINE NITROGEN (TMA-N) IN SARDINES AND HERRINGS UTILIZED AS FOOD FOR TUNA FATTENING

J. Maršić-Lučić, M.Tudor and V. Šćekić
[1]Laboratory of aquaculture, Institute of Oceanography and Fisheries, Šetalište I. Meštrovića 63, HR-21000 Split, Croatia (jmarsic@izor.hr, tudor@izor.hr, vida@st-t.com.hr)

Farming of bluefin tuna (*Thunnus thynnus*) in Mediterranean countries as well as in Croatia has increased during the last ten years. For the feeding of tuna in farming production, small blue fish, sardine (*Sardina pilchardus*) and herring (*Clupea harengus*) are used. These two species of food are imported from Northern Europe, and are landed to farming companies in frozen condition

until usage. The quality of farmed tuna fish depends on quality and freshness in the fish flesh because feeding with low quality fish can cause a serious health problems:fall of the health defending system, the infection with parasites and stress which results with decrease of growth within the farming population and mortality. Because the lack of publications on the theme of freshness levels and health problems the quantities of total volatile bases nitrogen (TVB-N) and trimethylamine nitrogen (TMA-N) in sardines and herrings after one year of frozen storage were studied. Analyses were done depending on sardine and herring body mass. The study detected no relation between quantities of TVB-N and spoilage level, it indicates that TVB-N quantities for both species after one year of storage are within the limit of acceptability (25-35mg/100g). The quantities of TMA-N are greater than those registered as the limit of acceptability (10-15 mg/100g) for these species. Functional relations between TVB-N and TMA-N is not linear. These results makes the freshness of the analysed fish for the tuna fattening unsuitable.

P-105

RAZNOLIKOST KONTROLNE REGIJE MITOHONDRIJSKE DNA PLAVOBIJELOG DUPINA (*Stenella coeruleoalba*) IZ HRVATSKOG DIJELA JADRANSKOG MORA – PRELIMINARNO ISTRAŽIVANJE

N. Nikolić[1], A. Galov[1], T. Gomerčić[2], M. Đuras-Gomerčić[3], I. Kocijan[1], I. Bašić[1] i H. Gomerčić[3]
[1]Zavod za animalnu fiziologiju, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (zmegac_nela@yahoo.com, agomercic@yahoo.com, ivnatom@yahoo.com, ibasic1@yahoo.com), [2]Zavod za biologiju, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (tomislav.gomercic@vef.hr), [3]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (martina.duras@vz.tel.hr, hrvoje.gomercic@vef.hr)

Plavobijeli dupin (*Stenella coeruleoalba*) je kozmopolitska vrsta koja živi u tropskim morima i morima umjerenih područja. Iako nije stalni stanovnik Jadranskog mora, od 1991. godine se populacije tog dupina primjećuju i u Jadranu. U deset mrtvih plavobijelih dupina pronađenih od lipnja 1999. do srpnja 2002. godine u hrvatskom dijelu Jadranskog mora istražili smo kontrolnu regiju mitohondrijske DNA. Ova regija u većine životinja pokazuje mnogo veću varijabilnost od ostatka mitohondrijskog genoma pa je stoga vrlo koristan genetski biljeg u filogenetskim istraživanjima srodnih vrsta ili populacija. Ukupnu genomsku DNA smo izolirali iz tkiva, a fragment duljine

1000 baznih parova koji sadrži kontrolnu regiju umnožili smo lančanom reakcijom polimeraze korištenjem univerzalnih početnica. Pročišćeni produkt smo sekvencirali, tako da smo dobili fragmente na 5' kraju kontrolne regije mtDNA dugačke 400 bp koje smo potom analizirali u programu za sravnjenje sekvenci BioEdit. Uspješno smo sekvencirali kontrolne regije osam jedinki, a analizom smo utvrdili da se radi o četiri haplotipa. Naime, najčešći haplotip ima pet jedinki, kod dviju jedinki je razlika samo u jednoj, različitoj bazi, dok se četvrti haplotip razlikuje u deset baznih parova od najčešćeg haplotipa. Dosada nisu objavljena istraživanja genetičke raznolikosti kontrolne regije plavobijelog dupina premda se radi o najbrojnijoj pelagičnoj vrsti dupina u Sredozemnom moru.

DIVERSITY OF MITOCHONDRIAL DNA CONTROL REGION OF STRIPED DOLPHIN (*Stenella coeruleoalba*) FROM THE CROATIAN PART OF THE ADRIATIC SEA – A PRELIMINARY RESEARCH

N. Nikolić[1], A. Galov[1], T. Gomerčić[2], M. Đuras-Gomerčić[3], I. Kocijan[1], I. Bašić[1] and H. Gomerčić[3]
[1]Department of Animal Physiology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (zmegac_nela@yahoo.com, agomercic@yahoo.com, ivnatom@yahoo.com, ibasic1@yahoo.com), [2]Department of Biology, Veterinary Faculty, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr), [3]Department of Anatomy, Histology and Embryology, Veterinary Faculty, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (martina.duras@vz.tel.hr, hrvoje.gomercic@vef.hr)

The striped dolphin (*Stenella coeruleoalba*) is cosmopolitan cetacean found in tropical and temperate waters. Although isn't resident to Adriatic Sea, populations of striped dolphin have been found in Adriatic Sea since 1991. Mitochondrial DNA control region of ten striped dolphins found dead from June 1999 till July 2002 in the Croatian part of the Adriatic Sea was investigated. The analysis of animal mitochondrial DNA control region represents the most commonly used means for revealing phylogenetic relationships among closely related species and among populations of the same species. Total genomic DNA was isolated from tissues of dead dolphins. A 1000 base pair fragment of the mitochondrial DNA control region was amplified via the polymerase chain reaction using universal primers. Purified PCR-product was sequenced. The resulting sequences, 400 base pair fragments of the 5' end of the mitochondrial DNA control region, were analysed using BioEdit Sequence Alignment Editor. Control regions of eight dolphins were successfully sequenced and analysis

revealed four haplotypes. Five dolphins have the most frequent haplotype, two dolphins have haplotypes that differ by one different base pair and fourth haplotype differs by ten base pairs from the common haplotype. Up to this time, no research on genetic diversity of control region of striped dolphin has been published although it is the most common pelagic cetacean throughout the Mediterranean.

P-106
MRIJEŠĆENJE STRAŽNJEŠKRŽNJAKA (GASTROPODA, OPISTHOBRANCHIA) POD UZGAJALIŠTIMA TUNA NA JADRANU

D. Petricioli[1] i T. Bakran-Petricioli[2]
[1]D.I.I.V. d.o.o., HR-23281 Sali, Hrvatska (dpetricioli@oikon.hr), [2]Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (tatjana.bakran-petricioli@zg.t-com.hr)

Monitoring uzgajališta tuna propisan je Rješenjima Ministarstva za zaštitu okoliša, prostorno uređenje i graditeljstvo RH, a u obvezama izrađivača monitoringa propisani su i pregledi podmorja autonomnim ronjenjem. U sklopu monitoringa koji autori provode od 1996. godine na ukupno 6 uzgajališta tuna (od ukupno 14 postavljenih, od kojih je 8 sada aktivnih) obavljano je i ronjenje. U deset godina promatranja živog svijeta pod uzgajalištima obavljeno je oko sedamdeset urona u svim sezonama. Utvrđeno je organsko opterećenje sedimenta pod aktivnim uzgajalištima što je potvrđeno kemijskim analizama sedimenta. Pri ronjenju opažani su raznoliki makrobentoski organizmi te je pri tome uočeno da se ponekad na sedimentnom dnu pokraj uzgajališta tuna nalaze brojne jedinke nekoliko vrsta stražnješkržnjaka u mrijestu. Primijećene su četiri vrste stražnješkržnjaka: Aplysia depilans Gmelin, Pleurobranchus testudinarius Cantraine, Pleurobranchaea meckelii (Blainville) i Cratena peregrina Gmelin, od njih tri vrste: A. depilans, P. meckeili i C. peregrina u parenju, te nakupine jaja tri vrste: A. depilans, P. testudinarius i C. peregrina. Na temelju ovakvog ponašanja utvrđenih vrsta stražnješkržnjaka može se pretpostaviti da im povećana količina organske tvari u sedimentu ili povećana količina sitnih organizama koji se tom organskom tvari hrane, odgovara te ih potiče na zadržavanje, gregarizam i mrijest. Također, promatranje mriješćenja ovih inače rijetko zamjetnih organizama, doprinosi upoznavanju njihove ekologije. Uz originalne fotografije puževa u mrijestu pod uzgajalištima, na posteru će biti prikazani podaci o njihovoj brojnosti i vremenu mrijesta.

SPAWNING OF OPISTHOBRANCHIATE GASTROPODS UNDER THE TUNA FARMS IN THE ADRIATIC SEA

D. Petricioli[1] and T. Bakran-Petricioli[2]
[1]D.I.I.V. d.o.o., HR-23281 Sali, Croatia (dpetricioli@oikon.hr), [2]Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (tatjana.bakran-petricioli@zg.t-com.hr)

Monitoring of the tuna farms is prescribed by the Ministry of Environmental Protection, Physical Planning and Construction of the Republic of Croatia. One of the essential parts to be monitored is an underwater SCUBA survey below the cages with fish. Authors have been monitoring 6 tuna farms (among 14 existed, only 8 active today) since 1996, including SCUBA diving surveys. More than 70 diving was performed in 10 years of monitoring in all seasons of the year. The organic enrichment of sediment due to the sedimentation of part of tuna faeces was noticed and confirmed by chemical analysis. Various macrobenthic organisms were seen at the sediment bottom under the cages. At the occasions numerous adult opisthobranchiate gastropods were present. Four species were noticed: Aplysia depilans Gmelin, Pleurobranchus testudinarius Cantraine, Pleurobranchaea meckelii (Blainville) and Cratena peregrina Gmelin. Three species: A. depilans, P. meckelii and C. peregrina were seen copulating and aggregates of eggs of three species: A. depilans, P. testudinarius and C. peregrina were noted. It can be hypothesized that "enriched" sediment attracts the opisthobranchiate gastropods and stimulate them for aggregation, copulation and spawning. Also, direct observations of these gastropods, usually rarely seen during spawning and egg laying, can add to the knowledge about their ecology. Besides original underwater photos, the data about animal abundance and time of the spawning will be presented on the poster.

P-107

SPUŽVE U ŽIVOTNIM ZAJEDNICAMA UNUTAR MORSKE ŠPILJE "Y", UVALA BRBINJŠĆICA, DUGI OTOK

M. Radolović[1], H. Čižmek[1], D. Petricioli[2] i T. Bakran-Petricioli[1]
[1]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (mirko_radolovic@net.hr, hcizmek@yahoo.com, tatjana.bakran-petricioli@zg.t-com.hr), [2]D.I.I.V. d.o.o., HR-23281 Sali, Hrvatska (dpetricioli@oikon.hr)

Zbog geomorfoloških karakteristika istočne obale Jadrana i holocenske

transgresije mora, u Hrvatskoj su brojne morske jame, špilje, polušpilje i prolazi. Značajna skupina organizama koja naseljava morske špilje su spužve. U razdoblju od 2000. do 2005. godine istraživana je morska špilja "Y" na jugozapadnoj strani Dugog otoka, kraj uvale Brbinjšćica, Dugi otok. Uzorci spužvi sakupljani su tijekom višekratnih speleo-ronjenja pomoću autonomnih ronilačkih aparata. Špilja je najvećim dijelom pod morskom površinom, dno ulaznog dijela nalazi se na 12 m, a svod na 6 m dubine. Duga je oko 90 m i relativno uska, prosječno oko 3 m. Trideset metara od ulaza glavni kanal se račva na dva kraka, dulji, koji se pruža u smjeru SI i kraći, koji završava malom dvoranom sa zračnim džepom. Dno špilje se lagano uzdiže pa su dubine u unutrašnjosti male. Intenzitet svjetlosti unutar špilje mjeren je na sedam točaka istovremeno tijekom tri dana, dok je temperatura mjerena na šest točaka tijekom godinu dana. Na temelju mikroskopskih preparata skeletnih struktura utvrđeno je ukupno 55 vrsta spužvi, a zabilježene su i ostale vrste koje tu obitavaju. U prednjem dijelu špilje, u zajednici polutamnih špilja, utvrđena je najveća biomasa organizama kao i raznolikost vrsta. Srednji i krajnji dio špilje se značajno razlikuju od prednjeg, kako po broju i sastavu vrsta tako i po abiotičkim čimbenicima.

SPONGES IN LIVING COMMUNITIES INSIDE THE MARINE CAVE "Y", BRBINJŠĆICA COVE, DUGI OTOK

M. Radolović[1], H. Čižmek[1], D. Petricioli[2] and T. Bakran-Petricioli[1]
[1]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (mirko_radolovic@net.hr, hcizmek@yahoo.com, tatjana.bakran-petricioli@zg.t-com.hr), [2]D.I.I.V. d.o.o., HR-23281 Sali, Croatia (dpetricioli@oikon.hr)

Due to the geomorphologic characteristics of the Eastern Adriatic coast and the Holocene sea transgression submarine pits, caves, half-caves and passages are numerous in Croatia. Sponges are important inhabitants of marine caves. During period from 2000 to 2005 marine cave "Y" on the SW side of Dugi otok, near Brbinjšćica cove was researched. Sponge samples were collected during a number of speleo-diving with the autonomous diving apparatus. The cave is located mostly below sea surface, bottom of the entrance part is on 12 m and ceiling of it on 6 m of depth. It is approximately 90 m long and relatively narrow, around 3 m. Thirty meters from the entrance the main channel bifurcates: the long arm extends in the NE direction and the short one ends with a small chamber with an air pocket. The bottom of the cave is gradually rising from the entrance inwards so depths inside are small. Light intensity in the cave was measured simultaneously on the seven spots during three days,

while the temperature was measured on the six spots during one year. On the basis of microscopic slides of skeletal structures 55 sponge species were determined. Also, the other organisms that inhabit the cave were recorded. In the entrance part, in the community of semi-dark caves, the highest biomass of organisms, as well as the highest species diversity, were detected. The middle and the end part of the cave significantly differ from the entrance part not only in number and composition of species but in abiotic factors as well.

P-108

KARAKTERIZACIJA VRSTE *Mytilus galloprovincialis* (Lamarck, 1819) GENETIČKIM MARKERIMA U MALOSTONSKOM ZALJEVU I UŠĆU NERETVE

D. Skaramuca[1], N. Antolović[1], N. Glavić[1], J. Bolotin[1], P. Tutman[2], I. Brautović[1] i B. Skaramuca[1]
Sveučilište u Dubrovniku, Institut za more i poriobalje, Laboratorij za ekologiju i uzgoj morskih organizama, Damajana Jude 12, HR-20000 Dubrovnik, Hrvatska (daria.skaramuca@zg.htnet.hr), [2]Institut za Oceanografiju i Ribarstvo, I. Meštrovića 63, HR-21000 Split, Hrvatska (daria.skaramuca@zg.htnet.hr)

Stonska mušula (Mytilus Galloprovincialis) stoljećima se eksploatira i konzumira kao vrlo cijenjen proizvod mora, a od polovice 20. stoljeća masovno se i uzgaja. Postojala je sumnja u izvornost te vrste na uzgajalištima u Malostonskom zaljevu i duž ostalih dijelova istočnog Jadrana. Tijekom 2005. i 2006. godine (u okviru opsežnog Projekta Mytilus kompleksa u cijelom Mediteranu i dijelovima istočne obale Atlantika) proveli smo uzorkovanja duž istočne obale Jadrana od zaljeva Boka Kotorske do Limskog kanala. Donosimo rezultate dijela tih istraživanja koji se odnose na Malostonski zaljev. Morfološki je nemoguće razlikovati vrste unutar Mytilus kompleksa zbog njihove izuzetne sličnosti i direktnog utjecaja okoline na oblik školjke. Međutim, razlike u određenoj «varijabilnoj regiji» sekvence u nerepetitivnoj domeni foot proteina 1 u skladu je s taksonomskom pozicijom ovih vrsta. Dužina fragmenata nerepetitivne regije umnoženih pomoću početnica Me 15 i 16 (Inoue, 1995) je uniformna za svaku pojedinu vrstu, a različita je među vrstama, te omogućava da ove početnice koristimo kao dijagnostički marker za određivanje i potvrdu vrste. Uzorkovali smo 95 jedinki sa 6 lokacija, od kojih su dvije bile uzgojne. Po DNA ekstrakciji, te PCR amplifikaciji, elektroforeza je pokazala da sve jedinke imaju jednu uniformnu vrpcu na istoj poziciji koja je karakteristična vrsti Mytilus galloprovincialis (Lamarck, 1818), koja je po svojoj prirodi invazivna vrsta (Geller et al. 1993), te se vjerojatno uspjela očuvati zbog te svoje odlike.

CHARACTERIZATION OF SPECIES *Mytillus galloprovincialis* (Lamarck, 1819) WITH GENETIC MARKERS IN THE MALI STON BAY AND NERETVA ESTUARY

D. Skaramuca[1], N. Antolović[1], N. Glavić[1], J. Bolotin[1], P. Tutman[2], I. Brautović[1] and B. Skaramuca[1]
[1]University of Dubrovnik, Institute of marine and coastal research, D. Jude 12, HR-20000 Dubrovnik, Croatia, [2]Institute of Oceanography and Fisheries Split, I. Meštrovića 63, HR-21000 Split, Croatia (daria.skaramuca@zg.htnet.hr)

Mali Ston mussel, (*Mytillus galloprovincialis*) has been cultured and consumed for centuries as one of the most esteemed sea products, and in the last half of 20th century it has become object of mass culture. There has been some doubts about the origins of this species in the Mali Ston culture facilities, as well as in other parts of eastern Adriatic coast. During the years 2005 and 2006 (as a part of comprehensive project of *Mytilus* complex in Mediterranean region and in parts of eastern Atlantic) we conducted series of samplings along eastern Adriatic coast, from Boka Kotorska bay to the Limski channel. The results of these investigations reffering to the Mali Ston bay and estuary of the river Neretva are presented in this paper. The species within *Mytilus* complex are virtually impossible to differentiate morphologicaly because of their high similarity and due to direct impact of the environment on the shell shape. However, some differences in certain «variable region» of a sequence in the nonrepetitive domain of the foot protein 1 are in correlation with the taxonomic rank of these species. The length of nonrepetitive region fragments amplified with Me 15 and Me 16 primers (Inoue, 1995) is specific to each species, and differs from species to species , enabling the usage of these primers as diagnostic markers for determination and confirmation of the species. We sampled 95 individuals from 6 locations, of which 2 locations were reared ones. After DNA extraction and PCR amplification, electrophoresis revealed one single and uniform band for all of investigated individuals on the position characteristic for *Myilus galloprovincialis* (Lamarck, 1819), the species invasive by its nature (Geller et al. 1993) and that trait may be the reason for maintaining its purity.

P-109

RASPROSTRANJENOST IMPOSEKSA KOD VRSTE *Hexaplex trunculus* U KAŠTELANSKOM ZALJEVU

N. Stagličić[1], M. Prime[2], K. Madirazza[1], D. Brajčić[1], Ž. Erak[1], M. Zoko[1], D. Blažević[1], K. Jelić[1], Z. Popović[1] i M. Peharda[3]

[1]Centar za studije mora, Sveučilište u Splitu, Livanjska 5/III, HR-21000 Split, Hrvatska (kmadirazza@yahoo.com), [2]University of Wales - Bangor, School of Marine Sciences, Menai Bridge, Anglesey, LL59 5AB, UK, [3]Institut za oceanografiju i ribarstvo, Šet. I. Meštrovića 63, HR-21000 Split, Hrvatska

Imposeks, pseudohermafroditizam karakteriziran pojavom muških spolnih obilježja u ženki prednjoškržnih puževa, upotrebljava se kao bionidikator zagađenja tributiltinom (TBT) koji je osnovni sastojak protuobraštajnih boja. Za procjenu pojave i intenziteta imposeksa korištene su vrijednosti indeksa stupnja vas deferensa (VDSI) i dužine penisa u ženke (FPL) dobivene analizom primjeraka *H. trunculus* prikupljenih sa 6 postaja u Kaštelanskom zaljevu: Bene (N=20), Marina Kaštela (N=19) i Kaštel Stari (N=18) u studenom i prosincu 2004., te Lora (N=14), Lučica (N=20) i Resnik (N=20) u travnju 2006. godine. Na svim istraživanim postajama analizom 111 ženki (visina kućice=67,5±7,4 mm) utvrđena je potpuna zahvaćenost imposeksom. Štoviše, većina zahvaćenih ženki bila je u uznapredovalom stadiju imposeksa (VDSI=4,5±0,7; raspon vrijednosti=2-5). Penisi su bili dobro razvijeni kod ženki (max=20 mm) sa srednjim vrijednostima od 6,7 do 12,6 mm. Utvrđene su statistički značajne razlike u VDSI (H=30,82, p<0,001) i FPL (F=5,49, p<0,001) između postaja. Rezultati istraživanja potvrđuju široku rasprostranjenost imposeksa i mogu se koristiti kao referentne vrijednosti za daljnje praćenje.

IMPOSEX INCIDENCE IN *Hexaplex trunculus* FROM THE KAŠTELA BAY

N. Stagličić[1], M. Prime[2], K. Madirazza[1], D. Brajčić[1], Ž. Erak[1], M. Zoko[1], D. Blažević[1], K. Jelić[1], Z. Popović[1] and M. Peharda[3]
[1]Centre for Marine Studies, University of Split, Livanjska 5/III, Split, Croatia (kmadirazza@yahoo.com), [2]University of Wales - Bangor, School of Marine Sciences, Menai Bridge, Anglesey, LL59 5AB, UK, [3]Institute of Oceanography and Fisheries, Šet. I. Meštrovića 63, HR-21000 Split, Croatia

Imposex, a pseudo-hermaphroditic condition characterized by the imposition of male genitalia on female prosobranch gastropods, is used as a bioindicator of pollution by tributyltin (TBT) based antifoulants. The incidence and the intensity of imposex, evaluated from the vas deferens sequence index (VDSI) and the female penis length (FPL), were investigated in *Hexaplex trunculus* populations from six locations in Kaštela Bay: Bene (N=20), Marina Kaštela (N=19) and Kaštel Stari (N=18) in November and December, 2004 followed by Lora (N=14), Lučica (N=20) and Resnik (N=20) in April, 2006. Analysis of 111 females (height=67.5±7.4 mm) revealed the absolute prevalence of the

imposex in all the investigated locations. Furthermore, most of the females were affected at the advanced imposex stages (VDSI=4.5±0.7, range=2-5). Female penis homologues were found to be well developed (max=20 mm) with mean values ranging from 6.7-12.6 mm. Significant differences were detected regarding both the VDSI ($H=30.82$, $p<0.001$) and the FPL ($F=5.49$, $p<0.001$) between the locations. The results presented in the study confirm the widespread incidence of imposex and can provide reference values for future monitoring programs.

P-110

DISTRIBUCIJA VELIČINA I REPRODUKCIJSKI CIKLUS HRIDINSKOG JEŽINCA (*Paracentrotus lividus*) IZ UVALE BISATRINA

S. Tomšić, I. Dupčić i B. Glamuzina
Sveučilište u Dubrovniku, Ćira Carića 4, HR-20000 Dubrovnik, Hrvatska

Istraživana je distribuciju veličina i reprodukcijski ciklus hridinskog ježinca *Paracentrotus lividus* na području istočne obale Jadranskog mora, u uvali Bistrina. Populacija je uzorkovana jednom mjesečno na dubinama u od 0 do 3 m od površine. Distribucija veličina promjera kučice ukazuje da se populacije kreće u rasponu od 10 do 65 mm, a glavnina populacija je u klasi 30-45 mm. Godišnja distribucija gonadosomatskog indeksa ukazuje na maksimalne vrijednosti u travnju. Histološka analiza gonada pokazala je periodičnu interakciju somatskih stanica (NP) i zametnih stanica (spolnih stanica). Omjer nutritivnih fagocita prema spolnim stanicama (u različitim stadijima razvoja) se mjenjao tijekom sazrijevanja gonada.

SIZE DISTRIBUTION AND REPRODUCTION OF SEA URCHIN (*Paracentrotus lividus*) IN BISTRINA LAGOON

S. Tomšić, I. Dupčić and B. Glamuzina
Dubrovnik University, Ćira Carića 4, HR-20000 Dubrovnik, Croatia

The paper presents size distribution and reproduction of sea urchin species *Paracentrotus lividus* in the eastern Adriatic Sea coast of Croatia and in particular, the Bistrina lagoon. The population was sampled on monthly basis and from depths ranging between 0 to 3 m from the surface. Size distribution of the test diameter of the individuals showed that the population size ranges between 10 and 65 mm in the area with the main population in the class 30-45 mm. The gonad somatic index annual distribution showed that the peak

of reproduction occurs in April. Histological analysis of the gonads was also performed and it showed gradual interaction among somatic cells (nutritive phagocytes) and germ cells (male and female gametes). The relationship between nutritive phagocytes and germ cells (in quality and quantity) was gradually changing during reproductive cycle.

P-111

ZNAČENJE UVALA DONJI MOLUNAT I PRAPRATNA NA DNEVNO - NOĆNU RAZNOLIKOST RIBLJIH NASELJA

P. Tutman[1], N. Glavić[2], V. Kožul[2], N. Antolović[2], D. Skaramuca[2] i B. Skaramuca[2]
[1]Institut za oceanografiju i ribarstvo Split, Šetalište I. Meštrovića 63, HR-21000 Split, Hrvatska (tutman@izor.hr), [2]Institut za more i priobalje, Sveučilište u Dubrovniku, Kneza Damjana Jude 12, HR-20000 Dubrovnik, Hrvatska

U razdoblju od travnja 2003. do ožujka 2004. u plitkim dijelovima uvala Donji Molunat i Prapratna na području južnog Jadrana, istraživana je dnevno – noćna i sezonska kolebljivost sastava, ukupne brojnosti i biomase ribljih naselja. Tijekom 24-satnog razdoblja u četverosatnim razmacima, uzorci su sakupljani priobalnom mrežom potegačom 25 metara duljine i visine 500 cm na središnjem dijelu s centralnom vrećom. Promjer oka je 8 mm na vanjskim krilima i 4 mm na središnjem dijelu mreže. U uvali Donji Molunat ulovljeno je ukupno 12 429 jedinki, pripadnika 30 porodica i 67 vrsta, ukupne biomase 19 674,46 g, a u uvali Prapratna 51 802 jedinke iz 24 porodice i 58 vrsta, ukupne biomase 55 983,27 g. Prevladavajuće vrste uvale Donji Molunat Boops boops (48,85%), Coris julis (7,65%), Pagellus bogaraveo (6,64%), Sardina pilchardus (5,72%), kao i uvale Prapratna Boops boops (57,21%), Atherina boyeri (19,70%), Sardina pilchardus (19,70%) i Sarpa salpa (6,60%) brojnošću i biomasom su prevladavale u različito doba dana ili noći. Na razini zajednica, brojem jedinki i biomasom u uvali Donji Molunat je prevladavala dnevna, dok je u uvali Prapratna prevladavala noćna sastavnica. Zabilježena je sezonska kolebljivost u brojnosti i biomasi ulova s najvišim vrijednostima početkom ljeta (svibanj i lipanj) i najnižim zimi (prosinac). Najveće strukturalne promjene odvijaju se tijekom novačenja i prelaska sa zimskog na proljetno-ljetno razdoblje. Prevladavanje stadija mlađi u ukupnom ulovu ukazuje na ulogu istraživane uvale kao važnih hranilišta i rastilišta. Svojim ihtiofaunističkim osobitostima uvale predstavljaju zasebne cjeline sličnog sastava vrsta, ali s drugačijom brojnošću i dnevno-noćnom raspodjelom.

IMPORTANCE OF DONJI MOLUNAT AND PRAPRATNA BAY ON DIEL DIVERSITY OF FISH ASSEMBLAGE

P. Tutman[1], N. Glavić[2], V. Kožul[2], N. Antolović[2], D. Skaramuca[2] and B. Skaramuca[2]
[1]Institute for Oceanography and Fisheries Split, Šetalište I. Meštrovića 63, HR-21000 Split, Croatia (tutman@izor.hr), [2]Institute for Marine and Coastal Research, University of Dubrovnik, Kneza Damjana Jude 12, HR-20000 Dubrovnik, Croatia

Diel and seasonal variation in structure and biomass in catch with small beach seine are reported for a juvenile dominated fish population at shallow-water part of Donji Molunat and Prapratna Bay, southeastern Adriatic from April 2003 to March 2004. Samples were collected during 24-hours in 4h intervals with modified beach seine 25 m long, and 500 cm high in central part with the central sac. Mesh size was 8 mm on outer vings and 4 mm in central part of the net. A total of 12 429 fishes representing 30 families and 67 species, biomass 19 674, 46 g were caught in the Donji Molunat Bay, while 51 802 fishes from 24 families and 58 species, biomass 55 983,27 g were caught in Prapratna Bay. The dominant species of Donji Molunat, *Boops boops* (48,85%), *Coris julis* (7,65%), *Pagellus bogaraveo* (6,64%), *Sardina pilchardus* (5,72%) and Prapratna Bay, *Boops boops* (57,21%), *Atherina boyeri* (19,70%), *Sardina pilchardus* (19,70%) and *Sarpa salpa* (6,60%) were caught in consistently higher numbers and biomass in different time of diel period. At the assemblage level, generally more individuals and biomass in Donji Molunat were caught during daytime, whereas in Prapratna Bay dominated nighttime assemblage structure in both terms. There was seasonal variation in the abundance and biomass of individuals, with catches peaking in early summer (May and June), and the lowest in winter (December). The major disruptions occur when the assemblage undergoes restructuring through periods of recruitment and as the assemblage switches from an overwintering to a spring/summer structure. The dominance of juveniles in the catches indicate that these bay serve as nursery and feeding ground for several commercially important species. Investigated bays represent separate unities with similar species assemblage, but different number of individuals and biomass structure over diel distribution.

P-112

DOPRINOS POZNAVANJU EKOLOGIJE SPUŽVE *Suberites domuncula* (OLIVI, 1792) U SJEVERNOM JADRANU

A. Jaklin i B. Hamer

Centar za istraživanje mora, Institut "Ruđer Bošković", Paliaga 5, HR-52210 Rovinj, Hrvatska (jaklin@cim.irb.hr, hamer@cim.irb.hr)

Spužve su kroz stoljeća pod značajnim utjecajem čovjekovih aktivnosti kao što su trgovina, javni akvariji i znanstveni rad. Na populacije spužava također negativno utječu pridneni ribolov i onečišćenje. Radi slabog poznavanja opsega ovih čimbenika, glavni cilj ovog rada bila je procjena veličine populacije spužve *Suberites domuncula* u blizini Rovinja (sjeverni Jadran, Hrvatska). Tijekom 17-mjesečnog razdoblja u razdoblju, od lipnja 2004. do rujna 2005. godine, zabilježeno je ukupno 768 primjeraka. Po prvi put određena je brojnost spužve kao jedna jedinka na približno 3m^2, te promjene gustoće populacije tijekom razdoblja istraživanja od 39 do 96 jedinki na 150m^2. Tijekom istraživanja zabilježili smo spužve različitih boja: crvena, plava, žuta, smeđa i bijela, kao i različite kombinacije tih boja. Brojnošću izrazito odskaču crveno-narančasti primjerci sa 85,12 ± 4,40% učestalosti. Uspoređujući veličinu jedinki izmjerenih *in situ*, na dubini >30m s veličinom izmjerenom naknadno u akvariju, ustanovili smo smanjenje volumena tkiva spužvi od 40 do 70%. Ovo smanjenje, koje uključuje i nestanak vidljivog oskuluma, vjerojatno je očiti izraz stresa, te može predstavljati opći indikator stresa. Očigledno je da ta pojava može imati dalekosežne posljedice na držanje i preživljavanje jedinki *S. domuncula* u akvariju.

CONTRIBUTION TO ECOLOGY OF SPONGE *Suberites domuncula* (OLIVI, 1792) IN THE NORTHERN ADRIATIC

A. Jaklin and B. Hamer
Center for Marine Research, Ruđer Bošković Institute, Paliaga 5, HR-52210 Rovinj, Croatia (jaklin@cim.irb.hr, hamer@cim.irb.hr)

Through centuries sponges have been widely affected by human activities like commercial trade, usage for show aquaria and in scientific work. Sponge populations are also greatly impacted by bottom fishing and by pollution. Due to the limited knowledge about the extent of these factors the main objective of this study was to estimate the abundance and possible population dynamics of the sponge *Suberites domuncula* near Rovinj (Northern Adriatic, Croatia). During a 17-month period, 768 specimens in total have been recorded from June 2004 to September 2005. We determined for the first time abundance of *S. domuncula* as one individual per approximately 3 m^2 with annual fluctuations of population density of 34 to 96 specimens per 150 m^2. During the research period we observed sponges of different colours: red, blue, yellow, brown, and white as well as combinations thereof with differing patterns. There is a

great prevalence of the red-orange colour variety of 85.12 ± 4.40%. Tissue volume of *Suberites* specimens as measured *in situ* at a depth of >30 m as well as measured after they had been placed in aquaria, showed a permanent reduction of 40 to 70%. This reduction which included the disappearance of a visible *osculum* may be an explicit expression of stress, and as such could function as a stress indicator in general. It is obvious that it can have far-reaching consequences on the maintenance and life of *S. domuncula* specimens in aquaria.

P-113

UTJECAJ SASTAVA MIKROFITOPLANKTONA NA NASTAJANJE TEP-a

T. Radić, R. Kraus i D. Fuks
Centar za istraživanje mora, Institut „Ruđer Bošković“, G. Paliage 5, HR-52210 Rovinj (radic@cim.irb.hr, kraus@cim.irb.hr, fuks@cim.irb.hr)

Fitoplankton izlučuje različite polimere u okolni medij, kako u uobičajenim, tako i u stresnim uvjetima, a najveći udio u njima čine polisaharidi. Agregiranjem kiselih polisaharidnih polimera mogu nastati prozirne egzopolimerne čestice (TEP, engl. Transparent Exopolymer Particles) mikrometarskih dimenzija, koje su iznimno važne u procesima agregacije u morskoj vodi. Brojnim pokusima je dokazano da je fitoplankton najvažniji izvor izlučenih polisaharida potrebnih za nastajanje TEP-a, međutim rijetka su opsežna istraživanja povezanosti TEP-a i fitoplanktona u stvarnim ekosustavima, gotovo bez pokušaja tumačenja uloge sastava vrsta u nastajanju ovih čestica. S obzirom da je u sjevernom Jadranu utvrđena statistički značajna korelacija TEP-a s biomasom fitoplanktona, napravljena je i analiza povezanosti koncentracije TEP-a sa sastavom mikrofitoplanktona tijekom petogodišnjeg razdoblja na profilu Rovinj-delta rijeke Po. Cilj je bio utvrditi da li su određene vrste zaslužnije za nastajanje TEP-a od drugih, s obzirom da nemaju sve vrste istu sposobnost izlučivanja TEP prekusora. Prikazani su rezultati za deset najčešće cvjetajućih vrsta, među kojima se sljedeće u većini slučajeva mogu povezati s najvišim koncentracijama TEP-a: *Skeletonema costatum, Chaetoceros* sp. i *Pseudonitzschia delicatissima.* Iako niti jedna vrsta nije pri svakom svom cvjetanju uzrokovala intenzivno nastajanje TEP-a, kod vrste *Skeletonema costatum* je to bilo češće nego kod drugih. Zanimljivo je da su stanice *Chaetoceros* sp. uglavnom bile solitarne, što može ukazivati na različit fiziološki potencijal pojedinačnih i lančastih stanica ovog roda za izlučivanje tvari iz koje nastaje TEP. Također, od analiziranih vrsta najmanju povezanost s nastajanjem TEP-a su pokazale *Cylindrotheca closterium*, *Asterionellopsis glacialis*, *Pseudonitzschia seriata* i *Nitzschia longissima* f. *tenuirostris*.

INFLUENCE OF MICROPHYTOPLANKTON COMPOSITION ON TEP FORMATION

T. Radić, R. Kraus and D. Fuks
Center for Marine Research, „Ruđer Bošković“ Institute, G. Paliage 5, HR-52210 Rovinj (radic@cim.irb.hr, kraus@cim.irb.hr, fuks@cim.irb.hr)

Phytoplankton excretes diverse polymers into the surrounding medium, both in typical and stressed conditions, with polysaccharides as the largest fraction. By aggregation of acidic polysaccharidic polymers micrometer Transparent Exopolymer Particles (TEP) may be formed, which are exceptionally important in aggregation processes in seawater. Numerous experiments have shown that phytoplankton is the most important source of excreted polymers required for TEP formation although comprehensive studies of the relationship between TEP and phytoplankton in real ecosystems are rare, without almost any attempt at interpreting the role of species composition in TEP formation. Considering statistically significant correlations between TEP and phytoplankton biomass found in the northern Adriatic, additional analysis of the interaction of microphytoplankton composition and TEP along the Rovinj-Po river delta profile during a five-year period was carried out. The aim was to establish whether there exist species which are more important for TEP formation than others, due to differing capabilities of excreting TEP precursors. Results for the ten most often blooming species are shown, of which *Skeletonema costatum, Chaetoceros* sp. and *Pseudonitzschia delicatissima* are usually most related to high TEP concentrations. While none of these species causes intensive TEP formation during each bloom, *Skeletonema costatum* however induces TEP formation more often than other species. It is interesting that *Chaetoceros* sp. cells were mainly solitary, indicating the different physiological potential of solitary and chain cells of this genus for excreting organic matter suitable for TEP formation. Furthermore, among analysed species, *Cylindrotheca closterium*, *Asterionellopsis glacialis*, *Pseudonitzschia seriata* and *Nitzschia longissima* f. *tenuirostris* were those least correlated with TEP formation.

P-114
RASPODJELA DAPI- ŽUTIH ČESTICA (DYP) SJEVERNOG JADRANA

T. Šilović, D. Fuks i T. Radić
Centar za istraživanje mora, Institut „Ruđer Bošković“, G. Paliage 5. HR-52210 Rovinj (tina.silovic@cim.irb.hr, radic@cim.irb.hr, fuks@cim.irb.hr)

Glavni izvor organske tvari u pelagičkom sistemu je fitoplankton. Tijekom

procesa transformacije energije i organskog ugljika unutar hranidbene mreže značajna količina čestica se otpušta kao otopljena organska tvar ili se tranformira u neživu tvar. DYP su organske, enzimski razgradive čestice građene uglavnom od fitoplanktonskog detritusa i otopljenog organskog ugljika i smatraju se znatno razgrađenom organskom tvari, što je vjerovatno razlogom njihove velike brojnosti. Cilj ovog rada je bio prosuditi njihovu vremensku i prostornu raspodjelu u području sjevernog Jadrana, budući da nema ranijih studija. Istraživanje je provedeno tijekom prosinca 1996 do srpnja 1997 na 6 postaja. Uzorci DYPa obojani su DAPI-ijem na polikarbonatnim filtrima, te brojani upotrebom epifluorescentnog mikroskopa.DYP su grupirani u tri klase različite veličine (<2µm-piko,2-20 µm-nano,>20 µm-mikro). Ova studija je pokazala da je totalna brojnost DYP čestica varirala od 0,3-70,4x10^7 L^{-1}, s najvećim udjelom u klasi mikro veličine čestica. Statistička analiza pokazala je značajnu razliku između istočnih i zapadnih postaja s manjom brojnošću čestica na istočnim postajama. Između sjevernih i južnih postaja nije bilo statistički značajnih razlika. Sezonska raspodjela pokazala je veće brojnosti tijekom zimkog nego ljetnog perioda (max. prosinac 1996 i siječanj 1997, min. srpanj 1997), dok se iz vertikalne raspodjele vidi veća brojnost u dubljim slojevima. Ovo istraživanje pokazuje velike brojnosti DAPI-žutih čestica u sjevernom Jadranu i njihovu važnost u ukupnoj partikularnoj tvari i potrebu za njihovim daljnjim proučavanjem.

DISTRIBUTION OF DAPI-YELLOW PARTICLES (DYP) IN THE NORTHERN ADRIATIC

T. Šilović, D. Fuks and T. Radić
Center for Marine Research, „Ruđer Bošković“, G.Paliage 5. HR-52210 Rovinj (tina.silovic@cim.irb.hr, radic@cim.irb.hr, fuks@cim.irb.hr)

The primary source of organic matter (POM) in pelagic ecosystem is phytoplankton. During the transfer processes of energy and organic carbon within the food web considerable amount of these organic matter is released as dissolved form or transformed into dead matter. DYP are organic, enzyme-degradable matter made mostly of phytoplankton-derived detritus and dissolved organic carbon and are considered as very degraded stage of detrital particulate matter, which is probably the reason why they are so abundant. The scope of this study was to estimate their seasonal and spatial distribution in the area of the northern Adriatic, specially because there are no earlier studies on that problem. A study was conducted from December 1996 to June 1997 within 6 stations. Samples for DYP were stained with DAPI collected on polycarbonate black filters and counted using epifluorescence microscope.

DYP where grouped into three different size classes (<2µm-pico,2-20 µm-nano,>20 µm-micro).This study showed that total abundance of DYP varied between 0,3-70,4x10^7 L^{-1} with the largest proportion in the size class from 2-20 µm.Statistical analysis showed significant difference between eastern and western stations whith lower abundances on eastern ones. Between southern and nortern stations there were no significant differences. Seasonal distribution showed higher abundance during winter than summer period (max. December 1996 and January 1997, min. July 1997) while vertical distibution reveal that they were more abundant in deaper layers.This study reveals high abundances of DYP in the northern Adriatic and their importance in total particulate organic matter and necessity of their further research.

P-115

STRUKTURA I DINAMIKA FAUNE BODLJIKAŠA (ECHINODERMATA) POMIČNOG DNA SJEVERNOG JADRANA

T. Vojvoda[1], A. Travizi[2] i A. Požar-Domac[3]
[1]Trg J. Rakovca 19, HR-52440 Poreč, Hrvatska, [2]Centar za istraživanje mora Insitiuta Ruđer Bošković, G. Paliaga 5, HR-52210 Rovinj, Hrvatska, [3]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska

Kvalitativni i kvantitativni sastav faune bodljikaša proučavan je tijekom 2003. godine u otvorenim vodama sjevernog Jadrana na postajama SJ 005, SJ 007 i SJ 107. Uzorci sedimenta za analizu bodljikaša prikupljani su sezonski u veljači, svibnju, kolovozu i listopadu Van-Veenovim grabilom zahvatne površine 0,1 m^2. Analizama su bili obuhvaćeni glavni populacijski (gustoća, dominantnost, stalnost, prostorna i vremenska raspodjela) i cenološki parametri (kvalitativni sastav, brojnost, bogatstvo vrsta, ravnomjernost raspodjele vrsta, diverzitet i stupanj faunističke sličnosti). Rezultati su obrađeni univarijatnim, multivarijatnim i grafičko-distribucijskim metodama. Pronađeno je ukupno 10 porodica, 12 rodova i 17 vrsta bodljikaša. Na svim su postajama prevladavale zmijače, a najbrojnija vrsta na svim postajama je bila *Amphiura filiformis*. Postaje su se odlikovale sličnom kombinacijom abiotičkih uvjeta i pripadale su istoj zajednici *Schizaster chiajei*. Tijekom istraživanja na njima su utvrđene sličnosti u pogledu prostorne i vremenske dinamike faune bodljikaša. Utvrđene su i značajne razlike u odnosu na rezultate prethodnih istraživanja iz postanoksičnog razdoblja (1989-1991). Rezultati ukazuju na stabilnost faune bodljikaša istraživanog područja i prevladavanje povoljnih ekoloških uvjeta.

STRUCTURE AND DYNAMICS OF THE NORTHERN ADRIATIC SEA SOFT-BOTTOM ECHINODERMS FAUNA (ECHINODERMATA)

T. Vojvoda[1], A. Travizi[2] and A. Požar-Domac[3]
[1]Trg J. Rakovca 19, HR-52440 Poreč, Croatia, [2]CIM Rovinj, G. Paliaga 5, HR-52210 Rovinj, Croatia, [3]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia

Qualitative and quantitative composition of echinoderms was studied during 2003 in the northern Adriatic offshore area at stations SJ 005, SJ 007 and SJ 107. Sediment samples for echinoderms analysis were collected seasonaly in February, May, August and October by a Van Veen grab (surface area 0,1 m^2). Examinations involved the main population (density, dominance, frequency, spatial and temporal distribution) and coenological parameters (composition, abundance, species richness, eveness, diversity and similarity).The results were subjected to univariate, multivariate and distibutional analyses. In total, 10 families, 12 genera and 17 species were found. At all stations ophiurids dominated and the most abundant species was *Amphiura filiformis*. Stations compared were characterised by similar environmental features and belonged to the same community *Schizaster chiajei*. A very close pattern was found out related to the spatial and temporal dynamics of echinoderms fauna. Notable differences were found in comparison to the results of previous investigation that concerned postanoxic period (1989-1991). The results pointed out the stability of echinoderms fauna and the prevalence of favourable environmental conditions.

P-116

PROMJENA ABUNDANCIJE I SASTAVA PLANKTONSKIH ZAJEDNICA U EKSPERIMENTALNIM UVJETIMA UZGOJA LIČINKI KAMENICA (*Ostrea edulis*)

E. Marčelja[1], V. Onofri[2], N. Jasprica[2], D. Lučić[2] i J. Njire[2]
[1]Sveučilište u Dubrovniku, Ćira Carića 4, HR-20000 Dubrovnik, Hrvatska (marcelja@spray.se), [2]Institut za more i priobalje, Sveučilište u Dubrovniku, Damjana Jude 12, HR-20000 Dubrovnik, Hrvatska (onofri@labdu.izor.hr, jasprica@labdu.izor.hr, lucic@labdu.izor.hr, njire@labdu.izor.hr)

Cilj rada je pokazati kako promjena ekoloških uvjeta utječe na abundanciju i sastav planktonskih populacija pri uzgoju ličinki kamenica u zatvorenim sustavima. Brzina rasta i preživljavanje ličinki su promatrane u mezokozmosima

tijekom 17 dana. U prvom mezokozmosu se nalazila samo morska voda, a u drugi i treći je dodana jednaka količina ličinki kamenica. U trećem mezokozmosu je dodavana konzervirana fitoplanktonska hrana (Instant Algae). Promjene osnovnih hidrografskih parametara, koncentacije klorofila *a* i feopigmenata, abundancije i sastava fitoplanktona i mikrozooplanktona promatrane su u mezokosmosima i u okolnom moru. Nisu utvrđene statistički značajne razlike u abiotskim parametrima, koncentracijama klorofila *a* i feopigmenata, kao ni u abundanciji fitoplanktona između svih mezokosmosa i okolnog mora. Relativno visoka abundancija mikrofitoplanktona se nije mijenjala tijekom trajanja pokusa. Nasuprot tome, abundancije nelorikatnih cilijata značajno su smanjene u drugom mezokosmosu. Iz navedenih rezultata može se zaključiti da su ličinke kamenica konzumirale cilijate, te da oni predstavljaju važnu komponentu u njihovoj ishrani. Pri kraju eksperimenta u trećem je mezokozmosu, u vrijeme kada se razvijene ličinke kamenica radi prihvata spuštaju pri dno, došlo do znatnog povećanja abundancije cilijata. Razlog tome može biti smanjena predacija cilijata u gornjem sloju morskog stupca. Dodatak fitoplanktonske hrane u treći mezokozmos pogodovao je razvoju nauplija kopepoda.

CHANGES IN ABUNDANCE AND COMPOSITION OF PLANKTON COMMUNITIES IN EXPERIMENTAL CONDITIONS OF REARING OYSTER LARVAE (*Ostrea edulis*)

E. Marčelja[1], V. Onofri[2] , N. Jasprica[2], D. Lučić[2] and J. Njire[2]
[1]University of Dubrovnik, Ćira Carića 4, HR-20000 Dubrovnik, Croatia (marcelja@spray.se), [2]Institute of Marine and Coastal Research, University of Dubrovnik Damjana Jude 12, HR- 20000 Dubrovnik, Croatia (onofri@labdu.izor.hr, jasprica@labdu.izor.hr, lucic@labdu.izor.hr, njire@labdu.izor.hr)

The objective of this work was to show how changes in ecological conditions affect the abundance and composition of plankton communities during rearing of oyster larvae in closed systems. Growth rates and survival of larvae were monitored in mesocosms during 17 days. The first mesocosm contained only sea water, while oyster larvae in equal quantities were added to the second and third mesocosm. In the third mesocosm, conserved phytoplankton (Instant Algae) was added during the experiment. Changes in basic hydrographical parameters, chlorophyll *a* and phaeopigment concentrations, abundance and composition of phytoplankton and microzooplankton communities were monitored in the mesocosms and the ambient sea. There were no statistically significant differences in the abiotic parameters, chlorophyll *a* and phaeopigment concentrations and abundance of phytoplankton between

the mesocosms and in the ambient sea. The relatively high abundance of microphytoplankton did not change during the experiment. In contrast, the abundance of non-loricate ciliates showed a significant decrease in the second mesocosm. From these results it can be concluded that oyster larvae consume ciliates and that they constitute an important component in the diet of larvae. In the end of the experiment, when developed oyster larvae sink towards the bottom for attachment, in the third mesocosm a considerable increase in ciliate abundance was noted. The reason might be a reduced predation on ciliates in the upper part of the water coumn. The addition of phytoplankton in the third mesocosm favoured the development of copepod nauplii.

KONGRESNI DAN POSVEĆEN 115. OBLJETNICI CENTRA ZA ISTRAŽIVANJE MORA INSTITUTA "RUĐER BOŠKOVIĆ"
CONGRESS DAY DEDICATED TO THE 115th ANNIVERSARY OF THE CENTER FOR MARINE RESEARCH, RUĐER BOŠKOVIĆ INSTITUTE

IL-13
TRADITIONAL AND MODERN BIOMEDICAL PROSPECTING: SUSTAINABLE EXPLOITATION OF BIODIVERSITY (SPONGES AND INVERTEBRATES) IN THE ADRIATIC SEA AT ROVINJ (CROATIA)

W.E.G. Müller and I.M. Müller
Institut für Physiologische Chemie, Abteilung Angewandte Molekularbiologie, Universität, Duesbergweg 6, D-55099 Mainz; Germany and Center for Marine Research, "Ruder Boskovic" Institute, HR-52210 Rovinj; Croatia

Nature, especially in the marine environment, provides the most effective drugs used in human therapy. Among the metazoans especially the sessile filter feeders with the marine sponges (phylum Porifera) in the first place produce the most potent and most highly selective bioactive secondary metabolites. These animals (or their associated symbiotic microorganisms) synthesize secondary metabolites whose activity and selectivity was shaped during their long evolutionary history (evochemistry). The exploitation of these resources became possible with the progress in molecular biology and cell biology. The German Center of Excellence "*BIOTEC*marin" is following this rationale. However, already in the past these animals had been successfully and intensively used to isolate bioactive compounds and biomaterials for human benefit. Pharmaceuticals from marine animals, primarily from sponges have been applied from ancient times (Hippocrat, Aristotle and later Plinius). It will be reported that extracts/components from sponges can be used for

the treatment of distinct diseases. For a systematic and applied-oriented exploitation, the success in the development of effective compounds depends largely on the quality of the institutional infrastructure of marine stations and more so on the biodiversity existing around it. These prerequisites are exceptionally given for the Center for Marine Research in Rovinj (Croatia). In this Institution, founded in 1891, major discoveries had been made in the past to exploit secondary metabolites/biomaterials from sponges for human benefit in therapy and to obtain biomaterials for human wellbeing.

IL-14

25 GODINA GENOTOKSIKOLOŠKIH ISTRAŽIVANJA U CENTRU ZA ISTRAŽIVANJE MORA

N. Bihari
Institut «Ruđer Bošković», Centar za istraživanje mora, Laboratorij za morsku molekularnu toksikologiju, G. Paliaga 5, HR-52210 Rovinj, Hrvatska

U proteklih 25 godina u svjetskim znanstvenim istraživanjima pa tako I u Centru za istraživanje mora postignut je značajan napredak u istraživanjima procjene učinka fizikalnih i kemijskih genotoksina na morske organizme, posebno beskralješnjake. Ovaj pregled (a) sažima najvažnija ostvarenja u ovom zanimljivom području istraživanja (b) uspoređuje ih sa saznanjima iz genotoksikoloških studija sisavaca, gdje je to moguće (c) iznosi rezultate znanstvenika Laboratorija za morsku molekularnu toksikologiju objavljenih u 20-ak znanstvenih radova (d)), raspravlja uporabu određivanja oštećenja DNA za utvrđivanje prisutnosti i učinka genotoksina u moru te (d) iznosi hipoteze i smjernice za daljnja istraživanja u ovom uzbudljivom području istraživanja.

25 YEARS OF GENOTOXICOLOGICAL STUDIES IN CENTER FOR MARINE RESEARCH

N. Bihari
Institute «Ruđer Bošković», Center for Marine Research, Laboratory for Marine Molecular Toxicology, G. Paliaga 5, HR-52210 Rovinj, Croatia

Substantial progress, including investigations in Center for Marine Research, has been made in the last 25 years to evaluate the impact of physical and chemical genotoxins in marine organisms, especially invertebrates. This overview (a) summarizes the major high lights in this stimulating area of research (b) compares developments in this field with the development in

mammalian genotoxicological studies, where appropriate, (c) presents results of 20 different articles of the members of Laboratory of Marine Molecular Toxicology (d) discusses the use of DNA damage as a signal of presence and effects of genotoxins in the marine environment and (e) hypothesizes on future direction of research in this exciting field.

IL-15

UZ 115. GODIŠNJICU ISTRAŽIVANJA MORA U ROVINJU: PROCES EUTROFIKACIJE I POJAVA CVJETANJA MORA U SJEVERNOM JADRANU

D. Degobbis, R. Precali i T. Đakovac
Institut"Ruđer Bošković", Centar za istraživanje mora, G. Paliaga 5, HR-52210 Rovinj, Hrvatska

Već su početkom dvadesetih godina istraživači rovinjske znanstvene institucije započeli dugoročna mjerenja nekih osnovnih parametara (salinitet, temperatura, kisik, prozirnost), te su obavljene prve studije sastava mikrofitoplanktonske zajednice i sezonskog ciklusa hranjivih soli. Vremenom (osim većim dijelom četrdesetih godina) mjerenja su bila upotpunjena drugim parametrima, posebno od kraja šezdesetih godina (hranjive soli, klorofil *a*, fotosintetska aktivnost, suspendirane tvari, brojanje nano i mikrofitoplanktona) te od 1990. (mikrobna petlja) i 1998. (profili masnih kiselina, prozirne egzopolimerne čestice-TEP). Ova su mjerenja temelj jedne od sadašnjih znanstvenih problematika u Centru za istraživanje mora (CIM). Na temelju ovih nizova podataka, kao i komplementarnim *in situ* i laboratorijskim pokusima, istraživani su osnovni mehanizmi sezonskih i dugoročnih promjena u ekosustavu sjevernog Jadrana. Ova su saznanja bila korisna da se barem na polukvantitativnoj razini određuje relativna važnost pojedinih procesa koji utječu na stupanj i trend eutrofikacije sjevernog Jadrana. Zaključeno je da od druge polovice osamdesetih godina klimatske i meteorološke promjene, koje znatno utječu na raslojavanje vodenog stupca i na sustav strujanja, poprimile su važniju ulogu u odnosu na vanjski dotok hranjivih soli (prvenstveno rijekom Po) nego u ranijem razdoblju. Osim toga, znanstvenici CIM-a intenzivno proučavaju pojavu cvjetanja mora (prekomjerna proizvodnja ogromnih sluzavih nakupina) od 1988. godine, od kada je postala sve učestalija u sjevernom Jadranu (1988, 1989, 1991, 1997, 2001-2004). Ovu su pojavu također proučavali, osim talijanskih i slovenskih, znanstvenici iz više Europskih zemalja, Kanade i SAD-a, ali još uvijek ostaju nedovoljno razjašnjeni mehanizmi njeno „okidanje" i planktonske vrste koje bi bile najvažnije za proizvodnju sluzave matrice. Glavni doprinosi znanstvenika CIM-a su: 1) pokazalo se da procesi proizvodnje i recikliranja organske tvari

unutar sluzavih agregata (proučavanih na temelju određivanja profila masnih kiselina, sastava fitoplanktona, grupa bakterija i drugih parametara), određuju njihovo „samoodržavanje“ dužeg vremena u vodenom stupcu; 2) argumentirana hipoteza da je „okidač“ pojave fizičke prirode (posebna struktura raslojavanja vodenog stupca u uvjetima izražene poluzatvorene cirkulacije); 3) hipoteza da uvjeti na fizikalnim frontovima (vertikalnim i horizontalnim) pogoduju razmnožavanje nekih vrsta koji proizvode velike količine sluzi; 4) hipoteza da su dugoročne promjene u ekosustavu bitan čimbenik za učestalost pojave.

115th ANNIVERSARY OF MARINE RESEARCH IN ROVINJ: EUTROPHICATION AND THE MUCILAGE PHENOMENON IN THE NORTHERN ADRIATIC

D. Degobbis, R. Precali and T. Djakovac
“Ruđer Bošković” Institute, Center for Marine Research, G. Paliaga 5, HR-52210 Rovinj, Croatia

Long-term measurements of basic oceanographic parameters (salinity, temperature, oxygen and transparency), performed by scientists of the Rovinj research institution, started already in the early 1920-ies, including studies of mycrophytoplankton composition and seasonal nutrient cycles. Afterwards, these measurements were enlarged with other parameters, especially at the end of 1960-ies (nutrients, chlorophyll *a*, photosynthetic activity, suspended matter and nano- and microphytoplankton abundances), further in 1990 (microbial loop) and in 1998 (fatty acid composition and transparent exopolymer particles-TEP). These measurements represent the basic for one of the actual scientific activities in the Center of Marine Research (CMR). The main mechanisms of seasonal and long-term changes in the northern Adriatic ecosystem have been studied referring to these data series, as well as to complementary *in situ* and laboratory experiments. The achieved knowledge was useful to explain the relative importance of particular processes (at least on semi-quantitative level) that determine the degree and trend of eutrofication in the northern Adriatic. It was concluded that since the mid 1985-ies climatic and meteorological changes, that greatly influenced the water column stratification and the circulation pattern, have achieved a major relative importance than external nutrient contribution (mainly by the Po River). Moreover, since 1988 CMR scientists were intensively engaged in researches of the mucilage phenomenon (formation of very large organic aggregates and gelatinous surface layers), which events have progressively increase in frequency in the northern Adriatic (1988, 1989, 1991, 1997, 2001-2004). This phenomenon has also been investigated by scientists from Italy, Slovenia and other European countries, Canada and USA, but the trigger

mechanisms and planktonic species responsible for production of mucous matrix still remains unexplained. The main contributions of CMR scientists were: 1) the study of production and recycling of organic matter within the mucilaginous aggregates (fatty acid and phytoplankton compositions, bacterial groups and other parameters) explained processes of their "self-sustaining" for longer time in the water column, 2) an hypothesis was supported that claims that trigger mechanism of mucilage events is of physical nature (particular structure of water column stratification in conditions of enhanced semienclosed circulation), 3) an hypothesis was elaborated assuming that conditions on physical fronts (vertical and horizontal) can favour phytoplankton species that produce much higher quantities of mucous exudates than other species, 4) finally it was shown that long-term changes in the ecosystem may greatly influence the mucilage event frequency.

IL-16
UZ 115. GODIŠNJICU MORSKE ISTRAŽIVAČKE POSTAJE U ROVINJU: SUVREMENA ISTRAŽIVANJA BENTOSA

A. Travizi
Institut Ruđer Bošković, Centar za istraživanje mora Rovinj, G. Paliaga 5, HR-52210 Rovinj, Hrvatska

Preko 90% životinjskih vrsta te gotovo sve vrste makrofita koje obitavaju u morima i oceanima žive u neposrednom ili bliskom kontaktu s morskim dnom i sačinjavaju bentos. Zahvaljujući iznimnom bogatstvu vrsta bentos predstavlja glavni izvor bioraznolikosti u morskim ekosustavima. Istraživanje bentosa u Centru za istraživanje mora Rovinj (CIM, uključujući institucije koje su mu prethodile) ima dugu tradiciju koja seže u tridesete godine prošlog stoljeća i vezana je za početke istraživanja bentoskih zajednica uz istočnu obalu Jadrana. Laboratorij za ekologiju i sistematiku je nastavio tradiciju klasičnih biocenoloških istraživanja i unaprijedio ih uvođenjem novih problematika, metoda i pristupa. Misija LES-a je usmjerena ka razumijevanju strukture, funkcije i bioraznolikosti bentoskih zajednica u odnosu na promjene svojstvene morskom ekosustavu (sezonska dinamika i/ili gradijent abiotičkih čimbenika) kao i promjene uzrokovane antropogenim djelovanjem. Tekuća istraživanja uglavnom su vezana uz prostornu i/ili vremensku varijabilnost bentoskih zajednica u odnosu na postojeće gradijente i promjene koje se dešavaju u morskom ekosustavu. Temeljna istraživanja pokrivaju florističku (makrofitobentos) i faunističku (makrofauna, meiofauna) komponentu bentoskih zajednica i provode se kroz biocenološke studije izabranih staništa (osjetljiva, ugrožena i zaštićena područja), te ekološke studije viših

taksonomskih kategorija (alge, oblići, puževi, školjkaši, mnogočetinaši, bodljikaši) i izabranih vrsta. Primjenjena istraživanja su usmjerena na praćenje utjecaja kriznih situacija na bentoske zajednice uključujući prirodne i antropogeno uzrokovane pojave napr. eutrofikaciju, prekomjerni cvat fitoplanktona, pojavu mukoznih agregata, pomanjkanje kisika, pojavu i širenje invazivnih vrsta, negativni utjecaj marikulture i sl. Dodatne aktivnosti LES-a uključuju prikupljanje, sistematizaciju, pohranu, obradu i analizu povjesnih podataka tj. stvaranje temeljne dokumentacijske baze za procjenu globalnih promjena u ekosustavu sjevernog Jadrana, kao i za potrebe cenzusa života u moru, odnosno, za istraživanje bioraznolikosti. Jedan od važnih zadataka je održavanje dopunjavanje i revizija studijske zbirke beskralježnjaka CMRR koja obuhvaća oko 3000 primjeraka, prvenstveno predstavnike oblića, mekušaca, mnogočetinaša, mahovnjaka i riba.

THE 115th ANNIVERSARY OF THE MARINE RESEARCH STATION AT ROVINJ: RECENT BENTHIC RESEARCH

A. Travizi
Ruđer Bošković Institute, Center for Marine Research Rovinj, G. Paliaga 5, HR-52210 Rovinj, Croatia

Over 90% of the animal species found in the oceans and nearly all marine macrophytes live in close association with the sea-floor and form the benthos. Tremendous variety of benthic organisms represents the main repository of marine biodiversity. Benthic investigations in the Center for Marine Research Rovinj (CMRR, including several predecessors) have the long history that extends back to 1930's, i.e. the first surveys of benthic communities at the eastern coast of the Adriatic Sea. The Laboratory for Ecology and Systematics (LES) have proceeded traditional benthic research and enhance it by implementation of novel topics, methods and approach. The mission of LES is to understand the structure, function and biodiversity patterns of benthic communities relative to both, changes and processes immanent to marine environment (gradient and/or seasonal dynamics of environmental factors) and changes induced by anthropogenic impact. Ongoing investigations mainly focus on spatial and/or temporal variability of benthic communities, including its relation to environmental gradients, as well as to changes occurring in the marine ecosystem. Basic investigations cover floristic (macrophytobenthos) and faunistic (meiofauna, macrofauna) component of benthic communities, and they are conducted through biological and ecological studies of the selected habitats (sensitive, endangered and protected), higher taxa (Algae, Nematoda, Gastropoda, Bivalvia, Polychaeta, Echinodermata) and selected

species. Applied research is focused on monitoring of environmental impacts on benthic communities including both natural and anthropogenic stressors, e.g. eutrophycation, excessive phytoplankton blooms, appearance of mucilaginous aggregates, oxygen deficiency, appearance and spreading of invasive species, mariculture farming etc. Additional activities of LES involve gathering, systematisation, storing, processing and analysing historical data relevant for documenting and assessment of global changes in the northern Adriatic ecosystem, as well as for census of marine life and biodiversity studies. One of important scopes is maintenance, completion and revision of the CMRR marine invertebrate's collection that contains about 3000 specimens, mostly representatives of Nematoda, Mollusca, Polychaeta, Crustacea, Bryozoa, and Pisces.

IL-17
PRIRODNI I ANTROPOGENI UTJECAJI NA PROCESE I EKOLOŠKE ODNOSE U JADRANSKOM MORU (PRIJEDLOG PROGRAMA ISTRAŽIVANJA U CENTRU ZA ISTRAŽIVANJE MORA U NAREDNIH 5 GODINA)

R. Batel
Institut "Ruđer Bošković", Centar za istraživanje mora, G. Paliaga 5, HR-52210 Rovinj, Hrvatska (batel@cim.irb.hr)

Jadran je poluzatvoreni bazen pod snažnim utjecajem kontinentalnog okruženja, što uvjetuje opće promjene ekosustava: ubrzano kruženje organske tvari ovisno o hidrometeorološkim i oceanografskim uvjetima, poremećaje i dugoročne promjene životnih zajednica sedimenata, morskoga dna i vodenog stupca te biološke raznolikosti, posebno u područjima gdje je antropogeni utjecaj najveći. Tome u prilog govore dosadašnje spoznaje o neuobičajenim pojavama (npr. cvjetanju mora), pomoru organizama prilikom sve češćih anoksija, prekomjernom razmnožavanju nekih planktonskih vrsta (npr. meduze), progresivnom naseljavanju alohtonih organizama (alge, ribe i dr.) i promjenama fizioloških, biokemijskih i genetskih svojstava ekološki i gospodarski važnih vrsta pod utjecajem prirodnih i antropogenih stresora. Ciljevi programa su: (1) objašnjavanje sezonskih mehanizama hidrodinamike i termodinamike te procesa dugoročnih promjena u biotopu, planktonu i bentosu (2) proučavanje interakcije biocenoza otvorenih i obalnih sustava kao mehanizma opstojnosti i stabilnosti dinamičke ekološke ravnoteže, (3) proučavanje proizvodnje i razgradnje organske tvari unutar osnovnih karika hranidbenog lanca, (4) istraživanje strukture i fiziologije mikrobnih zajednica, njihov utjecaj na tokove organske tvari ovisno o hidrodinamičkim promjenama,

(5) utvrđivanje sastava, strukture i poremećaja biološke raznolikosti duž prostornog gradijenta specifičnog tipa promjena, (6) utvrđivanje promjena u fiziološkim i biokemijskim svojstvima odabranih morskih organizama, uključujući procese biomineralizacije te (7) proučavanje mehanizama djelovanja toksičnih i genotoksičnih onečišćivača na stanične i molekularne procese. Dugoročni cilj programa je dati znanstveni doprinos prihvatljivom gospodarenju prostorom i bogatstvima Jadranskog mora u svrhu održivog razvitka Jadranskog prostora. Rezultati istraživanja značajno će doprinijeti poznavanju osnovnih značajki ali i ukupnog stanja Jadranskog mora. Utvrditi će se smjer dugoročnih promjena, posebno procesa stvaranja i kruženja organske tvari i promjena biološke raznolikosti. Spoznati će se mehanizmi odgovora organizama na podražaje okoliša prirodnog ili antropogenog porijekla. Važnost predloženih interdisciplinarnih istraživanja ogledati će se i u prepoznatljivom doprinosu svjetskoj znanosti o moru.

NATURAL AND ANTHROPOGENIC IMPACTS ON THE ADRIATIC SEA ECOSYSTEM (PROGRAM PROPOSED BY CENTER FOR MARINE RESEARCH TO BE PERFORMED WITHIN NEXT 5 YEARS)

R. Batel
"Ruđer Bošković" Institute, Center for Marine Research, G. Paliaga 5, HR-52210 Rovinj, Croatia (batel@cim.irb.hr)

The Adriatic sea is a semienclosed basin under a significant influence of the continental environment, conditioning changes in the ecosystem: accelerated circulation of the organic matter depending on hydrometeorological and oceanographic conditions; disturbances and long-term changes of living communities (sediment, bottom and water column); and biological diversity especially in areas with the highest anthropogenic influence. This is supported by the gathered knowledge about unusual events (i.e. mucilage events), organisms' mortality during more often events of anoxia, excessive reproduction of some planktonic species (i.e. jelly fish), progressive inhabitation of alochthonic organisms (algae, fish etc.) and changes of physiological, biochemical and genetic properties of ecologically and economically important species under the influence of natural and anthropogenic stressing factors. Aims of the program are: (1) to estimate the relative importance of the climatic and anthropogenic influence on the dynamic balance in the ecosystem of the northern Adriatic, especially on variations in the sea circulation system and freshwater inputs, furthermore on physiological changes in the microbial communities and biodiversity of phytoplankton, zooplankton and benthic communities (2) to determine changes of physiological and biochemical characteristics of

selected marine organisms, including processes of biomineralisation, and research of the effect mechanisms of the toxic and genotoxic pollutants on cellular and molecular processes of ecologically and economically significant species. Long-term goal of the program is to achieve scientific contribution to acceptable management of the environment and resources of the Adriatic Sea. Results will significantly contribute to the comprehension of the basic features and general conditions of the Adriatic Sea. Direction of long-term changes will be established, particularly in production and cycling of organic matter and biodiversity. Response mechanisms of the organisms to natural or anthropogenic environmental stimuli will be conceived. Relevance of proposed interdisciplinary research will be reflected in recognizable contribution to the world marine science.

TOKSIKOLOGIJA, EKOTOKSIKOLOGIJA I BIOMONITORING

TOXICOLOGIA ET OECOTOXICOLOGIA

TOXICOLOGY, ECOTOXICOLOGY AND BIOMONITORING

Uvodna tematska predavanja
Introductory Lectures

IL-18
EKOTOKSIKOLOŠKI POKAZATELJI ONEČIŠĆENJA U KLENU (*Leuciscus cephalus* L.) – ISTRAŽIVANJA U OKVIRU EU FP6 PROJEKTA "SARIB"

S. Krča, R. Žaja, V. Čalić i T. Smital
Instutut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (krca@irb.hr)

Glavni cilj EU FP6 projekta *SARIB* (Sa*va* Ri*ver* B*asin: Use, Management and Protection of Resources*) je utvrđivanje razine onečišćenja rijeke Save. Uz korištenje suvremenih analitičko-kemijskih metoda za određivanje prisustva organskih zagađivala i teških metala, u vodi, sedimentu i tkivu riba mjeren je i odgovor niza ekotoksikoloških biomarkera. Aktivnost 7-etoksirezorufin deetilaze (EROD), bioaktivacijski potencijal i metaboliti policikličkih aromatskih amina mjereni su u jetri, odnosno žuči klena *Leuciscus cephalus*, vrste rasprostranjene i često korištene u monitorinzima zagađenja europskih rijeka. Klenovi su izlovljavani na pet postaja: Otok Samoborski (referentna postaja), Sava Jarun (uzvodno od glavnih ispusta grada Zagreba), te Oborovo, Lukavec Posavski i Jasenovac (opterećeni komunalnim i industrijskim otpadnim vodama Zagreba i Siska). U jetri klenova izlovljenih u rujnu 2005. g.zabilježena je značajna indukcija aktivnosti EROD: 3.2 puta na postaji Sava Jarun , 3.9 puta na Oborovu, 4.8 puta na Lukavcu Posavskom, te 7.2 puta na postaji Jasenovac u odnosu na kontrolnu nezagađenu postaju Otok Samoborski. Najviša vrijednost (20.7 pmol/min/mg_{PROT}) dobivena na postaji Jasenovac predstavlja ~50% maksimalne EROD aktivnosti koja je izmjerena u riba laboratorijski tretiranih modelnim EROD inducerom â-naftoflavonom (25 mg/kg). Količina CYP1A proteina mjerena ELISA metodom pokazala je identičan trend kao i EROD aktivnost. Značajno povećan bioaktivacijski potencijal jetre klena izmjeren je na svim lokacijama u odnosu na Otok Samoborski. Metaboliti policikličkih aromatskih ugljikovodika u žuči nisu pratili obrazac EROD aktivnosti i bioaktivacijskog potencijala. U izlaganju ćemo dati i usporedbu s vrijednostima istih biomarkera izmjerenih u drugim europskim rijekama i/ili monitoring programima.

EKOTOXICOLOGICAL INDICATORS OF POLLUTION IN THE EUROPEAN CHUB (*Leuciscus cephalus* L.) – RESEARCH WITHIN THE

EU FP6 "SARIB" PROJECT

S. Krča, R.Žaja, V.Čalić and T. Smital
Ruđer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (krca@irb.hr)

The main goal of the FP6 *SARIB* project (Sa*va* R*iver* B*asin: Use, Management and Protection of Resources*) is to evaluate the extent of pollution of the Sava river (Croatia). Besides the advanced analytical-chemical methods for PAHs, PCBs and heavy metal presence in the water, sediment and tissues of a common cyprinid freshwater fish European chub (*Leuciscus cephalus*), various ecotoxicological biomarkers (EROD activity, bioactivation potential, PAH bile metabolites) have been measured. The sampling survey involved 5 stations: Otok Samoborski (reference site), Sava Jarun (upstream from the main Zagreb city outlet), and Oborovo, Lukavec Posavski and Jasenovac (inputs of domestic and industrial effluents from the Zagreb and the Sisak city area). Significant induction of EROD activity was observed in chub caught in September 2005. In comparison to the Otok Samoborski the EROD activity was higher 3.2 fold at Sava Jarun location, 3.9 fold at Oborovo, 4.8 fold at Lukavec Posavski and 7.2 fold at Jasenovac. The highest value (20.7 pmol/min/mg_{PROT}) obtained for Jasenovac was ~50% of maximal EROD activity measured in fish laboratory treated with model EROD inducer â-naphtoflavone (25 mg/kg). The same trend as for EROD activity was observed for the amount of CYP1A protein. Significantly higher bioactivation potential was measured at all locations in comparison to control site. PAH bile metabolites did not folow the pattern observed for the EROD activities and bioactivation potential. In addition, the results described will be compared with data available for the same set of biomarkers measured in other European rivers and/or monitoring programs.

IL-19
UČINAK KOLEBANJA ČIMBENIKA OKOLIŠA NA BIOLOŠKE POKAZATELJE STRESA U DAGNJI *M. galloprovincialis*

B. Hamer[1], J. Pavičić[2], D. Ivanković[2], L. Perić[1], D. Pavičić-Hamer[1] i Ž. Jakšić[1]
[1]Centar za istraživanje mora, Institut Ruđer Bošković, G. Paliaga 5, HR-52210 Rovinj, Croatia (hamer@cim.irb.hr, lorena.peric@cim.irb.hr, pavicic@cim.irb.hr, jaksic@cim.irb.hr), [2]Zavod za istraživanje mora i okoliša, Institut Ruđer Bošković, Bijenička cesta 54, HR-10000 Zagreb, Croatia (pavicic@irb.hr, ivankovic@irb.hr)

U radu je istraživana progresivna prilagodba dagnji M. galloprovincialis na različite salinitete morske vode tijekom visokih temperatura mora, te njen učinak na biokemijske markere i biotestove pokazatelje prirodnog stresa i antropogenog onečišćenja okoliša. Za potrebe laboratorijske prilagodbe i eksperimenata tijekom ljeta (temperatura mora 27°C, salinitet 37.5 psu) korištene su dagnje iz uzgajališta Marimirna (Limski kanal, sjeverni Jadran, Hrvatska). Dagnje su aklimatizirane postepeno 14 dana na finalni salinitet 37.0, 28.5, 18.5 i 11 psu, što iznosi približno 100, 75, 50 i 30% morske vode. Na početku i na kraju prilagodbe određen je integritet DNA, sadržaj stresnih proteina i metalotioneina u škrgama, te su dagnje podvrgnute testu preživljavanja na zraku. Test preživljavanja dagnji na zraku kao fiziološki indeks zdravlja i vitalnosti organizma pokazao je signifikantan negativni učinak (LT50) aklimatizacije u odnosu na kontrole (Limski kanal i 100% MV), osim kod dagnji aklimatiziranih na 50% MV. Niži integritet DNA određen Fast Micromethod-om također je potvrdio učinak aklimatizacije i pratećeg fiziološkog stresa. Utvrđene su značajne razlike sadržaja stresnih proteina u dagnjama izloženih 50 i 30% morskoj vodi (HSP70 viši, HSP72 niži) u odnosu na kontrolu. Sadržaj metalotioneina u škrgama dagnji prvo pada (75 i 50% MV) pa značajno raste (30% MV). Rezultati ukazuju da promjene saliniteta u morskom okolišu mogu biti značajan čimbenik zdravlja i vitalnosti morskih organizama, te utjecati na biološke pokazatelje onečišćenja i stresa. Ova istraživanja proširuju razumijevanje učinka čimbenika iz okoliša na specifičnost primijenjenih biomarkera i biotestova, pružajući uvid u procese i stresni odgovor morskih organizama.

EFFECT OF ENVIRONMENTAL CONDITIONS VARIATION ON BIOLOGICAL STRESS INDICATORS IN MUSSEL *M. galloprovincialis*

B. Hamer[1], J. Pavičić[2], D. Ivanković[2], L. Perić[1], D. Pavičić-Hamer[1] and Ž. Jakšić[1]
[1]Center for Marine Research, Ruđer Bošković Institute, G. Paliaga 5, HR-52210 Rovinj, Croatia (hamer@cim.irb.hr, lorena.peric@cim.irb.hr, pavicic@cim.irb.hr, jaksic@cim.irb.hr), [2]Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička cesta 54, HR-10000 Zagreb, Croatia (pavicic@irb.hr, ivankovic@irb.hr)

In the present work we investigated under experimental conditions progressive acclimation of mussel M. galloprovincialis to different lower salinity during high seawater (SW) temperature and its effect on several biochemical markers and biotests. Mussel M. galloprovinicialis were purchased from Limski kanal (Northern Adriatic, Croatia) in summer (SW temperature 27°C, salinity 37.5

psu). DNA integrity, induction of stress proteins and metallothioneins were measured and mussels were tested (survival in air) at the beginning and at the end of acclimation. Mussels were finally acclimated during 14 days to 37.0, 28.5, 18.5 and 11 psu, what correspond approximately 100, 75, 50 and 30% of SW. Survival in air (SOS) as a physiological index of mussel health and vitality had significantly lower LT50 values, and seems to be negatively affected by acclimation in comparison to control (100% SW and Limski kanal), except mussels acclimated to 50% SW. Lower DNA integrity determined by Fast Micromethod proved impact of salinity acclimatization and corresponding physiological stress on DNA level as well. Significant differences of stress-70 proteins contents in mussels' gills of control groups and mussels exposed finally to 50 and 30% SW were established (HSP70 increase and HSP72 decrease). Contents of metallothionens in gills first reduced (75 and 50% SW) and then significantly increased (30% SW). Results indicated that SW salinity variation in marine environment can affect all investigated parameters. This investigation expands our understanding of multifactorial effects of the physical environment on the specificity of investigated biomarkers and biotests, providing insight into the stress response processes of mussel how it might be disrupted by environmental stresses and pollution.

Kratka usmena priopćenja
Oral Presentations

OP-51
DELAYED FLUORESCENCE MEASUREMENTS IN TOXICOLOGY AND PHYSIOLOGY OF ALGAE AND PLANTS

M. Berden Zrimec[1], L. Drinovec[1], T. Tišler[2], M. Monti[3], A. Beran[3], I. Molinari[4] and A. Zrimec[1]
[1]Institute of Physical Biology, Velika Loka 90, SI-1290 Grosuplje, Slovenia (maja@ifb.si, luka.drinovec@guest.arnes.si, alexis@ifb.si), [2]National Institute of Chemistry, Hajdrihova 19, SI-1000 Ljubljana, Slovenia (tatjana.tisler@ki.si), [3]Istituto Nazionale di Oceanografia e Geofisica Sperimentale, Dept. BIO, Via A. Piccard 54, I-34010, Trieste, Italy (mmonti@inogs.it, aberan@inogs.it), [4]Department of Biology, University of Trieste, Via Valerio 32, I-34127 Trieste, Italy (jajarhcp@msn.com)

Delayed fluorescence (DF) measurement is a very perspective method for monitoring toxic influences on growth and physiological status of photosynthetic organisms. DF is a long-lived light emission after a short light flash. DF can be used as a measure of living algal biomass, and DF intensity reflects photosynthetic activity. DF decay kinetics can be used to indicate organisms' physiological state. DF action spectra are a useful tool for determination of phytoplankton composition, especially during algal blooms. DF measurement is nondestructive, simple and fast and allows monitoring of photosynthesis or cell growth. The measuring system enables detection of very weak signals, allowing measurements of samples with very low cell counts. In contrast to many other techniques, sample manipulation is not required, which diminishes errors due to various treatments. DF showed similar or higher sensitivity to tested toxicants compared to the usual endpoints in *Scenedesmus subspicatus*, *Dunaliella tertiolecta*, *Skeletonema costatum* and *Lemna minor* growth inhibition tests. Influence of toxicants on DF was measured after a few minutes to several hours, enabling introduction of DF based short-term tests. DF is emitted only from living cells and can therefore be used for phytoplankton cell lysis detection. It was used to monitor growth of different strains of the marine dinoflagellate *Prorocentrum minimum*, showing differences and similarities among them. DF showed also specific responses in *P. minimum* grown at various salinities, illumination and temperature. Influence of nutrient deprivation on *P. minimum* and *Dunaliella tertiolecta* was monitored, showing specific changes in DF kinetics and intensity.

OP-52

UČINAK TALIJ-ACETATA NA VODENU LEĆU *Lemna minor* L.

P. Cvjetko[1], M. Babić[2], D. Papeš i M. Pavlica[1]
[1]Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (pcvjetko@zg.biol.pmf.hr, mpavlica@zg.biol.pmf.hr), [2]Botanički zavod, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (mbabic@zg.biol.pmf.hr)

Postoji vrlo malo podataka o toksičnosti talija. Ioni talija (Tl^+) ugrožavaju vodene ekosustave zbog svoje sličnosti s ionima kalija (K^+) što omogućuje njihovu brzu akumulaciju u hranidbenim lancima. Mi smo istražili učinak talij-acetata na vodenu leću *Lemna minor* L.. U tu svrhu biljke su izlagane različitim koncentracijama talij-acetata u laboratorijskim uvjetima. Za procjenu toksičnosti korišten je standardizirani test inhibicije rasta. Po prvi puta primijenjen je komet-test na vodenoj leći u svrhu procjene genotoksičnog učinka talij-acetata. Komet-testom moguće je detektirati nisku razinu oštećenja DNA, u relativno malom broju stanica po uzorku, pri čemu se stanice ne moraju nužno dijeliti. Prednosti vodene leće kao modelne biljke u toksikološkim istraživanjima su njezin brzi rast, vegetativno razmnožavanje, veličina i osjetljivost na različite onečišćivače. Kako bismo dokazali je li *L. minor* pogodan test-organizam za istraživanja genotoksičnog učinka te optimizirali alkalnu verziju komet-testa, korišten je etil metansulfonat (EMS) i to u koncentracijama (1-10 mM) za koje je poznato da induciraju lomove DNA u biljaka. Oštećenje molekule DNA bilo je proporcionalno korištenim koncentracijama EMS-a i talij-acetata. Vrijeme denaturacije molekule DNA u komet-testu je bio kritičan parametar kojim se u kontrolnim uzorcima osigurala minimalna, a istovremeno u tretiranim uzorcima maksimalna pokretljivost molekule DNA. Pri višim koncentracijama EMS-a i talij-acetata uočeni su inhibicija rasta vodene leće te povećan broj nekrotičnih i klorotičnih biljaka.

EVALUATION OF THALLIUM-ACETATE TOXICITY USING AQUATIC PLANT *Lemna minor* L.

P. Cvjetko[1], M. Babić[2], D. Papeš and M. Pavlica[1]
[1]Department of Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia (pcvjetko@zg.biol.pmf.hr, mpavlica@zg.biol.pmf.hr), [2]Department of Botany, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (mbabic@zg.biol.pmf.hr)

There are few data available on thallium toxicity in plants. Thallous (Tl^+) ions are a threat to aquatic ecosystems due to their similarity to potassium (K^+) ions, which enables their rapid accumulation in food chains. We evaluated thallium-acetate toxicity using *Lemna minor* plants during time- and concentration-dependent exposures in laboratory conditions. The thallium toxicity assessment was based on the *L. minor* growth inhibition as the most standardized biotest, with the Comet assay applied for assessing DNA damage for the first time. Comet assay enables detection of low levels of DNA damage for a small number of cells per sample with no need for cell division. *L. minor* is an aquatic macrophyte regularly used for toxicological studies due to fast growth rate, vegetative reproduction, small size and sensitivity to numerous pollutants. To prove its susceptibility to genotoxicity assessment and to optimize the alkaline version of Comet assay we used ethyl methanesulfonate (EMS) as a positive control for DNA fragmentation at concentrations (1-10 mM) known for adverse effects on higher plants. The dose-response experiment resulted in the DNA damage being correlated to the EMS and thallium-acetate concentration. It is concluded that DNA-unwinding time is a critical parameter of the Comet assay in order to obtain a minimum DNA migration in the control plants and a maximum sensitivity in the treated samples. The strongest growth inhibition of *Lemna* plants was at higher concentrations of EMS and thallium acetate, where an increase of necrotic and chlorotic plants was observed.

OP-53

PROCJENA RAZINE PRIMARNIH OŠTEĆENJA DNA U LEUKOCITIMA PERIFERNE KRVI ISPITANIKA OPĆE POPULACIJE HRVATSKE PRIMJENOM KOMET-TESTA

N. Kopjar, D. Želježić S. Ramić i V. Garaj-Vrhovac
Institut za medicinska istraživanja i medicinu rada, Ksaverska cesta 2, HR-10000 Zagreb, Hrvatska (nkopjar@imi.hr, dzeljezi@imi.hr, sramic@imi.hr, vgaraj@imi.hr)

Poznavanje normalnih razina oštećenja DNA u ispitanika opće populacije nužan je preduvjet za tumačenje podataka dobivenih biomonitoringom profesionalno ili akcidentalno izloženih populacija. Ovo istraživanje predstavlja prvu opsežniju studiju koja je obuhvatila ispitanike opće populacije Hrvatske s ciljem procjene utvrđivanja kontrolnih vrijednosti oštećenja DNA i njihove uvjetovanosti vanjskim i unutarnjim čimbenicima. Stupanj varijabilnosti oštećenja DNA istražen je primjenom alkalne inačice komet-testa u leukocitima periferne krvi 170 zdravih davatelja krvi oba spola, nasumično izabranih iz opće populacije i različitih regija Hrvatske. Pomoću računalnog programa za

analizu slike u svakom je uzorku krvi izmjereno 100 kometa, a kao glavni pokazatelj oštećenja korištena je dužina repa kometa. Utvrđeno je da se vrijednosti dužine repa kometa u leukocitima periferne krvi opće populacije RH kreću u rasponu 12,10 ± 1,49 μm do 15,91 ± 2,24 μm (prosjek 14,25 ± 0,80 μm; medijan 14,31 μm). Uočene su značajne individualne razlike koja ukazuju na različitu osjetljivost i stabilnost genoma. Dokazano je da porastu razine primarnih oštećenja DNA u najvećoj mjeri doprinose navika pušenja te izloženost dijagnostičkim pretragama (osobito X-zrakama). Spol i starosna dob ispitanika nisu značajno utjecali na izmjerene vrijednosti primarnog oštećenja DNA. Premda su u ispitanika koji su uzorkovanju krvi pristupili u jesen i zimi utvrđene nešto više vrijednosti dužine repa kometa, pretpostavljamo da su iste uvjetovane dijagnostičkom izloženosti zračenju i navikom pušenja, a ne zračenjem iz okoliša. Rezultati ovog istraživanja ukazuju na potrebu usporednog praćenja ispitanika opće populacije, a predstavljaju osnovu za studije biomonitoringa populacija profesionalno i ambijentalno izloženih mutagenima planirane u budućnosti.

EVALUATION OF DNA DAMAGE IN WHITE BLOOD CELLS OF HEALTHY HUMAN VOLUNTEERS USING THE ALKALINE COMET ASSAY

N. Kopjar, D. Želježić S. Ramić and V. Garaj-Vrhovac
Institute for Medical Research and Occupational Health, Ksaverska cesta 2, HR-10000 Zagreb, Croatia (nkopjar@imi.hr, dzeljezi@imi.hr, sramic@imi.hr, vgaraj@imi.hr)

Understanding of the normal levels of DNA damage in the general population is essential for the proper interpretation of data obtained by monitoring of populations occupationally or accidentally exposed to known or potentially genotoxic agents. Present study was undertaken to investigate how the variability in baseline damage in white blood cells from healthy human donors is associated with external and internal factors. Altogether 170 healthy donors, randomly selected from the general population of the Republic of Croatia, participated in the study. Using the alkaline comet assay and a computer-based image analysis system in each blood sample 100 comets were evaluated. As a measure of DNA damage in this study tail length was used. Individual values of DNA migration in white blood cells were in the range 12.10 ± 1.49 to 15.91 ± 2.24 μm (average value 14.25 ± 0.80 μm; the median 14.31 μm). The results confirmed inter-individual differences, indicating different genome sensitivity. As revealed by present analysis, smoking habit mostly influenced the background levels of DNA damage. Gender and age did not significantly contribute to the pattern

of DNA migration in white blood cells. Although the highest levels of primary DNA damage were recorded in blood samples collected in autumn, we presume that they were mostly affected by smoking status and diagnostic exposure, rather than the irradiation from environmental sources. The data obtained point to the significance of regular biomonitoring of unexposed populations and can serve as control values in forthcoming biomonitoring studies.

OP-54

ODREĐIVANJE ESTROGENOSTI UZORAKA PRIOBALNE VODE JADRANSKOG MORA I VODE IZ PROČIŠĆIVAČA MIJEŠANIH OTPADNIH VODA UPOTREBOM YES ("YEAST ESTROGEN SCREEN") BIOTESTA

B. Pivčević, T. Maltar i T. Smital
Laboratorij za molekularnu ekotoksikologiju, Zavod za istraživanje mora i okoliša, Institut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska (pivcevic@irb.hr)

U devedesetima je primijećeno da je zbog porasta količine vitelogenina i feminizacije reproduktivnih organa u divljim populacijama mužjaka ribe došlo do narušavanja endokrinog sustava. Ovo je uzrokovalo povećanu zabrinutost da hormonski aktivne tvari (tzv. endokrini modulatori) mogu uzrokovati štetne endokrine učinke na vodene organizme. Kemijske analize otpadnih voda iz uređaja za pročišćivanje pokazale su prisustvo raznih estrogeno aktivnih tvari kao što su prirodni i sintetički estrogeni, fitoestrogeni i industrijske kemikalije "ksenoestrogeni" (alkilfenoli i njihovi metaboliti, pesticidi, UV-filteri). U ovoj studiji koristili smo tzv. "Yeast estrogen screen" (YES) biotest kojim smo po prvi puta u Hrvatskoj odredili ksenoestrogeni potencijal okolišnih uzoraka. Ovaj test koristi rekombinirani soj kvasca *Saccharomyces cerevisiae* transfeciran s hER (humani estrogeni receptor) kojim se mjeri agonizam i antagonizam vezanja na ER. Za svaki uzorak estrogena aktivnost se odredila usporedbom doza odgovor krivulje uzorka s doza odgovor krivuljom 17â-estradiolom (E2) kao pozitivne kontrole. Konačno estrogeni potencijal uzoraka izražen je u ekvivalentima E2 (EEQ). Rezultati su pokazali da najviša izmjerena koncentracija EEQ u otpadnim vodama ne prelazi 0.25 ng/L (1 pM E2) što je u odnosu na slične studije u Europi izuzetno nisko. U drugoj studiji YES biotestom se mjerio ksenoestrogeni učinak uzoraka obalne vode skupljene sezonski na 24 mjesta duž Jadranske obale. Rezultati su pokazali da postoji sezonska varijacija u koncentraciji ksenoestrogena, pa je tako u ožujku izmjereno prosječno 5.3 ng/L EEQ, u lipnju 46.2 ng/L EEQ, u kolovozu 40.7 ng/L EEQ, dok je najviših 80.7 ng/L EEQ izmjereno u listopadu.

ESTROGENICITY OF WATER SAMPLES FROM ADRIATIC COAST AND FROM MUNICIPAL SEWAGE TREATMENT PLANTS IN CROATIA USING YEAST ESTROGEN SCREEN BIOASSAY

B. Pivčević, T. Maltar and T. Smital
Laboratory for molecular ecotoxicology, Department for marine and environmental research, Ruđer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (pivcevic@irb.hr)

In the nineties the endocrine disruption was observed in wild populations of male fish, by measuring vitellogenin induction and feminization of reproductive organs. This generated growing concern that hormonally active agents (i.e. endocrine disruptors) may cause harmful endocrine effects in aquatic organisms. Chemical analysis has revealed the presence of various substances that possess estrogenic activity, like natural and synthetic estrogens, phytoestrogens and industrial chemicals «xenoestrogens» (alkylphenols and their metabolites, pesticides, UV-filters) in effluents of sewage treatment plants (STP). In this survey we used Yeast estrogen screen (YES) bioassay to determine for the first time xenoestrogen potential of environmental samples from Croatia. This assay uses recombinant yeast *Saccharomyces cerevisiae* transfected with hER (human estrogen receptor) to measure agonists and antagonists of binding on ER. Estrogenic activity for each sample was determined by comparing dose response curves of samples with reference dose response curve of 17â-estradiol (E2). Estrogenic potential of samples were finally expressed in E2 equivalents (EEQ). Results showed that maximal determined concentration of EEQ in STP effluents did not exceed 0.25 ng/L (1 pM E2) what is very low when compared with other similar surveys of waste water samples in Europe. In the second study xenoestrogen potential of coastal water samples collected seasonally from 24 locations along the Adriatic coast was determined using YES bioassay. Results revealed seasonal variation in EEQ concentrations of xenoestrogens with average concentration of 5.3 ng/L EEQ in March, 46.2 ng/L EEQ in June and 40.7 ng/L of EEQ in August, and the highest 80.7 ng/L of EEQ determined in October.

OP-55

KONCENTRACIJA METALOTIONEINA I METALA (Zn, Cu, Cd) U CITOSOLU JETRE KLENA (*Leuciscus cephalus* L.) IZ RIJEKE SAVE

M. Podrug, Z. Dragun, M. Erk i B. Raspor
Laboratorij za biološke učinke metala, Zavod za istraživanje mora i okoliša, Institut "Ruđer Bošković", Bijenička c. 54, HR-10002 Zagreb, Hrvatska (mpodrug@irb.hr, zdragun@irb.hr, erk@irb.hr, raspor@irb.hr)

Na postajama rijeke Save od Otoka Samoborskog do Jasenovca (rujan, 2005.) određeni su biometrijski parametri (dužina, masa klena i masa jetre kao glavnog detoksifikacijskog organa), starost i spol klena (*Leuciscus cephalus* L.), odabranog kao bioindikatorskog organizma. Također, u citosolu jetre provedena su ispitivanja razine metala (Zn, Cu, Cd) i metalotioneina (MT) kao biomarkera izloženosti metalima. Ustanovljena je visoka pozitivna korelacija biometrijskih parametara ($p<0,01$). U citosolskoj frakciji izoliranoj centrifugiranjem homogenata tkiva na 50000xg, određena je koncentracija metala (atomska apsorpcijska spektrometrija) i MT (diferencijalna pulsna voltametrija). Usporedbom koncentracija metala u citosolu jetre klena na odabranim postajama uočeno je da su uzvodno od Zagreba povećane razine Zn i Cu, dok se razine Cd povećavaju nizvodno od Zagreba, s najvišim vrijednostima na postaji Jasenovac. Koncentracije MT ne razlikuju se značajno među postajama, ali su više vrijednosti zabilježene na Jasenovcu gdje je povećana i razina Cd. Statistička analiza rezultata za svaku postaju ukazuje na pozitivnu korelaciju MT i esencijalnih metala (Zn, Cu). Samo u jedinkama s postaje Oborovo ustanovljena je statistički značajna korelacija svih promatranih parametara (MT, esencijalnih metala Zn i Cu i biometrije). Za pravilnu interpretaciju razine MT i izloženosti klena metalima, neophodno je sustavno praćenje i prikupljanje većeg broja podataka radi definiranja osnovne razine tog biomarkera.

METALLOTHIONEIN AND METAL (Cu, Zn, Cd) CONCENTRATIONS IN LIVER CYTOSOL OF CHUB (*Leuciscus cephalus* L.) FROM SAVA RIVER

M. Podrug, Z. Dragun, M. Erk and B. Raspor
Laboratory of biological effects of metals, Division for Marine and Environmental Research, Ruđer Bošković Institute, P.O.Box 180, HR-1002 Zagreb, Croatia (mpodrug@irb.hr, zdragun@irb.hr, erk@irb.hr, raspor@irb.hr)

Biometric parameters (length, mass of chub and liver as main detoxification organ), age and sex were determined in chub (*Leuciscus cephalus* L.), selected as bioindicator organism in Sava river, from Otok Samoborski to Jasenovac (September, 2005). Also, metal (Zn, Cu, Cd) and metallothionein (MT) levels as biomarker of metal exposure were measured in cytosolic fraction of liver. Biometric parameters have positive and significant correlation ($p<0.01$). In the cytosolic fraction of liver, prepared by centrifugation of tissue homogenate at 50000xg, metals (atomic absorption spectrometry) and MT (differential pulse voltammetry) were measured. Comparison of metal levels in liver cytosol from selected locations indicated to higher values of Zn and Cu upstream of

Zagreb, while Cd levels increased downstream of Zagreb, with the highest value at Jasenovac. MT levels at different locations were comparable, except at Jasenovac where the highest values were also recorded with higher Cd. Statistical analysis of results at each sampling site indicate to the correlations between MT and essential metals (Zn, Cu). Statistically significant correlations between all parameters (MT, essential metals Zn and Cu and biometry) were detected on Oborovo location. More data need to be collected for correct interpretation of MT levels and chub exposure to metals, in order to define constitutive level of that biomarker.

Posterska priopćenja
Posters

P-117
INTERAKCIJE ATOKSINOGENIH SOJEVA PLIJESNI I AFLATOKSINOGENOG SOJA *Aspergillus flavus* NNRL 3251

Z. Cvetnić i S. Pepeljnjak
Zavod za mikrobiologiju, Farmaceutsko-biokemijski fakultet , Sveučilišta u Zagrebu, Schrottova 39, HR-10000 Zagreb, Hrvatska (zcvetnic@pharma.hr)

Aflatoksini (AF) su toksični, kancerogeni i mutageni metaboliti plijesni *Aspergillus flavusi, A. parasiticus* i drugih vrsta rodova *Aspergillus* i *Penicillium*. Prirodni su kontaminanti mnogih žitarica i drugih usjeva kako na polju za vrijeme vegetacije tako i u skladištima. Tvorba mikotoksina tijekom skladištenja može se spriječiti različitim fizičkim i kemijskim postupcima koji suzbijaju rast plijesni. Jedna od mogućnosti je strategija biokontrole, koja uključuje primjenu sojeva koji ne proizvode mikotoksine (atoksinogeni sojevi). Ti atoksinogeni sojevi kompetitivno isključuju proizvođače mikotoksina koji kontaminiraju poljoprivredne kulture. Cilj našeg rada bio je procjeniti in *vitro* biotske interakcije između 25 atoksinogenih sojeva različitih vrsta plijesni (*Alternaria* spp., *Cladosporium* spp., *Mucor* spp., *A flavus*, *A. niger*) i standardnog soja *A. flavus* NRRL 3251, producenta aflatoksina B_1. Tvorba AFB_1 provedena je postupkom biosinteze u 50 mL tekuće hranjive podloge sa kvašćevim ekstraktom (YES-bujon). Podloge su simultano inokulirane sa 1 mL suspenzije konidija (10^6/mL) ispitivanih kultura a zatim inkubirane na 25°C tijekom 10 dana uz svakodnevno potresanje. Ekstrakcije AFB_1 iz biomase izvršene su kloroformom (50 mL) i koncentrirane uparavanjem do suha. Suhi ekstrakti otopljeni su u 0.2 mL kloroforma i pripremljeni za identifikaciju i kvantifikaciju toksina TLC metodom uz odgovarajući standard AFB_1 (2 µg/mL). Inkubacija mješanih kultura atoksinogenih sojeva vrsta *Alternaria*, *Cladosporium*, *Mucor* i *Aspergillus* i producenta AFB1 rezultirala je smanjenjem tvorbe ovog mikotoksina za 50 do 100%, u odnosu na kontrolu (16 µg/mL). Rezultati ukazuju na potencijalnu vrijednost upotrebe atoksinogenih sojeva raznih vrsta plijesni koji smanjuju ili potpuno inhibiraju tvorbu AFB_1 u interakciji sa toksinogenim sojevima.

INTERACTION OF ATOXIGENIC MOULD STRAINS WITH AFLATOXIN-PRODUCER *Aspergillus flavus* NRRL 3251

Z. Cvetnić and S. Pepeljnjak
Department of Microbiology, Faculty of Pharmacy and Biochemistry, University of Zagreb, Schrottova 39, HR-10000 Zagreb, Croatia (zcvetnic@pharma.hr)

Aflatoxins (AFs) are high toxic, carcinogenic and mutagenic metabolites produced by *Aspergillus flavus*, *A. parasiticus* and other *Aspergillus* as well as *Penicillium* species. The occurrence of aflatoxins as natural contaminants of major agricultural commodities and other foodstuff is a significant problem. Mycotoxin production during storage can be stopped by reducing mould growth using various physical and chemical agents. One strategy for reducing mycotoxin contamination in grains is biocontrol, which involves application of non-mycotoxin-producing strains (atoxigenic-strains) that competitively exclude mycotoxin producers in agricultural environments. The main objective of this study was to evaluate biotic interaction between 25 atoxigenic mould strains (*Alternaria* spp., *Cladosporium* spp., *Mucor* spp., *A. flavus* and *A. niger*), and AFB_1 producer strain *A. flavus* NRRL 3251 (). One mililiter suspension of conidia (10^6/mL) of each atoxigenic strain and *A. flavus* NRRL 3251 were cultured in 50 mL of Yeast Extract Saccharose broth. Flasks were incubated at 25°C for 10 days with daily shaking. After AFB_1 was extracted with chloroform (50 mL) samples were evaporated to dryness. Dry extracts were redissolved in 0.2 mL of chloroform and applied adjacent to AFB_1 standard (2 µg/mL) on TLC plates. Results of these interactive biosyntheses showed that aflatoxin production was decreased for 50 to100% of control (16 µg/mL), indicating antagonistic interactions of atoxigenic strains of *Alternaria*, *Cladosporium*, *Mucor*, and *Aspergillus* species towards AFB_1 producer *A. flavus*. According to these findings, some atoxigenic moulds could be used in biocontrol of aflatoxin producers by suppression of their growth and/or reduction of mycotoxin production.

P-118

USE OF ERYTHROPOIETIN AND ITS EFFECTS ON BLOOD LACTATE IN HAEMODIALYSIS PATIENTS

M. Ilieva[1] and B. Gosic-Markovska[2]
[1]Clinical Biochemistry, General Hospital, Svetozara Markovica 116, Leskovac, 16000, Serbia/Montenegro (medimak@mt.net.mk), [2]Faculty of Natural Scieces and Mathemathics, University "Sts, Cyril and Methodius", Skopje, F.Y.R.M.

Patients with end-stage renal disease receiving chronic haemodialysis treatment are often severely limited in their physical capacity. The availability

of recombinant human erythropoietin (rHuEPO) raise peripheral red cell count offers the possibility of improving oxygen delivery to the tissues and increasing aerobic energy supply. Increased concentration of lactate in the blood is thus an indicator of anaerobic metabolism. The effect of correcting anaemia were evaluated in 40 haemodialysis patients before starting treatment with rHuEPO (Hb concentration 76,1±2,86g/L) and in 20 haemodialysis patients after correction of the anaemia (Hb concentration 97,4±3,18g/L, p<0,001). Applied dose was 3x20IU/kg body weight per week (Recormon®). 40 healthy subject constituted the control group. No significant changes in blood lactate concentration pre- and post-rHuEPO therapy did not differ (from 1,58±0,29 to 1,51±0,026mmol/L, p-n.s), but the blood lactate concentration in the haemodialysis patients was significantly higher than that in the control subjects (1,33±0,013mmol/L, p<0,05). The increase of the haemoglobin content under the rHuEPO-therapy leads to a marked reduction of the tissue hypoxia and increased pO_2 for 22,11% (p<0,001). Therfore rHuEPO treatment results both in better oxygen transport capacity and reduced intra erythrocyte oxygen affinity, which is followed by improved oxygen delivery to tissues per unit of haemoglobin. The increase of the hemoglobin content leads to a marked reduction of the tissue hypoxia and consequently of anaerobic energy production.

P-119

POGODNOST RIBE *Gambusia affinis* ZA MONITORING ZAGAĐENJA KOPNENIH VODA PESTICIDIMA

N. Landeka[1], B. Hamer[2], Ž. Jakšić[2] i R. Batel[2]
[1]Zavod za javno zdravstvo Istarske županije, Nazorova 23, HR-52100 Pula, Hrvatska (ddd@zzjziz.hr), [2]Centar za istraživanje mora, Institut Ruđer Bošković, G. Paliaga 5, HR-52210 Rovinj, Hrvatska (hamer@cim.irb.hr, jaksic@cim.irb.hr, batel@cim.irb.hr)

U ekotoksikološkim istraživanjima praćenja onečišćenja okoliša, učinka zagađenja na organizme i procjenu rizika izloženosti sve češće rabimo metode molekularne biologije, odnosno biomarkere i biotestove. Pesticidi djeluju na više razina biološke organizacije, ali sva kemijska zagađivala moraju početno djelovati tako što mijenjaju strukturu i/ili funkcionalna svojstva esencijalnih molekula. Stoga osjetljive i specifične biokemijske metode mogu služiti kao rani upozoravajući pokazatelji negativnog učinka na biološke sustave. Kozmopolitska riba *Gambusia affinis,* Baird i Girardi 1853. je alohtona vrsta u lokvama na području južne Istre. Modelni ksenobiotik, pesticid lindan (gama-HCH) se koristi kao insekticid u javnom zdravstvu, veterini (stočarstvo), te

zbog njegove postojanosti u okolišu predstavlja opasnost zbog zagađenja površinskih voda. Biomarkeri izloženosti i učinka zagađenja ispitani su eksperimentalno određivanjem LC50, izlaganjem organizama subletalnim koncentracijama ksenobiotika, te u prirodi na pet lokacija gdje ova riba obitava. U ovom smo radu pratili promjenu u indukciji sustava oksidaza miješanih funkcija (OMF) ovisnih o citokromu P450, mjerenjem aktivnosti etoksiresorufin-O-deetilaze (EROD) kao biomarkera izloženosti, te promjenu cjelovitosti DNA kao biomarkera učinka (Fast Micromethod). Usporedbom eksperimentalnih rezultata i rezultata biomarkera u riba iz okoliša, te analizom organoklorovih pesticida u vodi i sedimentu lokava, utvrđena je povezanost indukcije detoksikacijskih enzima, smanjenog integriteta DNA i povećanja koncentracije lindana. Rezultati ukazuju da je vrsta *G. affinis*, kao i navedeni biomarkeri, pogodna za praćenje opterećenosti okoliša pesticidima zbog svojih bioloških i ekoloških svojstava, te doznog odgovora istraživanih biomarkera.

USE OF THE FISH *Gambusia affinis* FOR MONITORING OF FRESH WATERS PESTICIDE CONTAMINATION

N. Landeka[1], B. Hamer[2], Ž. Jakšić[2] and R. Batel[2]
[1]Istra County Institute of Public Health, Nazorova 23, HR-52100 Pula, Croatia (ddd@zzjziz.hr), [2]Center for Marine Research, Ruđer Bošković Institute, G. Paliaga 5, HR-52210 Rovinj, Croatia (hamer@cim.irb.hr, jaksic@cim.irb.hr, batel@cim.irb.hr)

Molecular biology methods, applied as biomarkers and biotests, are increasingly used in ecotoxicology for the monitoring of pollution, effect and environmental risk assessment. While pesticides affect biological systems on several levels, all contaminants act by changing the structure and/or functional properties of essential cellular molecules. Therefore sensitive and specific biochemical methods can be used as early warning indicators in helping avoid negative impacts on ecosystems. The cosmopolitan fish Gambusia affinis Baird and Girardi 1853 is an alohtone species in south Istrian ponds. The model xenobiotic Lindan (gama-HCH) is used as an insecticide in both public health and veterinary science. Because of its persistence in the environment it represents a threat for surface fresh waters. Biomarkers of exposure, and the effects of contamination, were examined experimentally by determination of LC50 for the xenobiotic Lindan, by exposing the organisms to sub-lethal doses in their natural environment at five locations where this species lives. In this work we have applied the induction of hepatic cytochrome P450-dependent mixed function oxygenase (MFO), measured as the activity of ethoxyresorfin-O-deethylase (EROD), as a biomarker of exposure with

changes in DNA integrity, measured by the Fast Micromethod, as a biomarker of effect. Comparison of experimental results (Lindan exposure and field) with pesticides determined in pond water and sediments showed a positive correlation between the induction of detoxification enzymes, lower DNA integrity and increased Lindan concentrations. Results indicated that the fish G. affinis, as well as the examined biomarkers, are suitable for monitoring of fresh water pesticide contamination, due to both their biological – ecological characteristics and the biomarkers dose-response.

P-120

EKOTOKSIKOLOŠKA KARAKTERIZACIJA OTPADNIH VODA EROD BIOTESTOM (PLHC-1 STANIČNA LINIJA) I TESTOM TOKSIČNOSTI NA ALGAMA (*Pseudokirchneriella subcapitata*)

J. Lončar[1], R. Žaja[1], M. Ahel[2] i T. Smital[1]
[1]Laboratorij za molekularnu ekotoksikologiju, [2]Laboratorij za biogeokemiju organskih spojeva, Zavod za istraživanje mora i okoliša, Institut "Ruđer Bošković", Bijenička c. 54, HR-10000 Zagreb, Hrvatska

Tijekom posljednjeg desetljeća biotestovi uz korištenje *in vitro* toksikoloških modela često se koriste u karakterizaciji i evaluaciji toksičnosti pojedinačnih kemikalija i složenih okolišnih uzoraka. U ovom istraživanju dva biotesta, EROD biotest na hepatoma PLHC-1 staničnoj liniji riblje jetre, te test kronične toksičnosti na algama (jednostanična zelena alga *Pseudokirchneriella subcapitata*), korišteni su u testiranju kemijski složenih uzoraka otpadnih voda sakupljnih u 2005. god. na 16 lokacija u Hrvatskoj i Bosni i Hercegovini. Primarni i sekundarni efluenti, te influenti otpadnih voda ekstrahirani su, a metanolski eluati su dalje koncentrirani za biotestove. Rezultati EROD biotesta pokazali su značajne razlike u koncentraciji CYP1A inducera među uzorcima otpadnih voda. Najviše vrijednosti toksičnih ekvivalenata (FEL-TEQ) bile su na razini ng/L (do 1.52 ng/L TCDD ekvivalenata). Jasna razlika među uzorcima opažena je i s obzirom na opći toksični potencijal uzoraka određivan testom toksičnosti na algama. Štoviše, ovi rezultati ukazuju da je obrada primarnih otpadih voda u brojnim slučajevima uspješna u uklanjanju tvari koje uzrokuju primarni toksični odgovor. Međutim, u nekoliko slučajeva izmjerena koncentracija CYP1A inducera bila je čak i veća u sekundarnom efluentu, ukazujući da postupak obrade primarne otpadne vode vjerojatno nije adekvatan za uklanjanje specifičnih organskih zagađivala koja mogu biti određena EROD biotestom. Ovo istraživanje ukazuje na značajan potencijal i upotrebljivost ovih biotestova za ekotoksikološku karakterizaciju složenih okolišnih uzoraka.

ECOTOXICOLOGICAL CHARCTERISATION OF WASTEWATER SAMPLES USING EROD BIOASSAY (PLHC-1 CELL LINE) AND ALGAL TOXICITY ASSAY (*Pseudokirchneriella subcapitata*)

J. Lončar[1], R. Žaja[1], M. Ahel[2] and T. Smital[1]
[1]Laboratory for Molecular Ecotoxicology, [2]Laboratory for Organic Biogeochemistry, Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia

In the last decade bioassays using *in vitro* toxicological models have been widely used for screening and ranking toxicity of chemicals and complex environmental samples. In this study two bioassays, the EROD bioassay using fish liver PLHC-1 hepatoma cell line and algal toxicity assay with green unicellular algae *Pseudokirchneriella subcapitata*, respectively, have been used for testing of complex wastewater samples collected in 2005 at 16 sites in Croatia and Bosnia and Herzegovina. Primary and secondary effluents as well as raw water samples were extracted and methanol elutes were further concentrated for bioassay analyses. The EROD bioassay results revealed significant differences in concentration of CYP1A inducers among wastewater samples from different sites. The highest determined toxic equivalents (FEL-TEQ) values were in lower ng/L range (up to 1.52 ng/L of TCDD equivalents). Clear discrimination among the samples was obtained in respect to overall chronic toxicity response as measured using algal toxicity assay. Furthermore, these results revealed that subsequent treatment of primary effluents was efficient in removing many substances that cause primary toxic response. However, in several cases the determined concentrations of CYP1A inducers were even higher in secondary effluents, preliminary suggesting that the used wastewater treatment procedures are most probably not adequate for removal of specific organic pollutants that can be determined using EROD bioassay. This study illustrates the versatility and high potential of used bioassays for the High Throughput Screening and ecotoxicological characterization of complex environmental wastewater samples.

P-121

BIOELEKTROMAGNETSKI PRISTUP PROCJENI BIOLOŠKIH UČINAKA FREKVENCIJA MOBILNE TELEFONIJE

I. Pavičić i I. Trošić
Institut za medicinska istraživanja i medicinu rada, Ksaverska c. 2, HR-10000 Zagreb, Hrvatska (ivan.pavicic@imi.hr)

Namjera ovog istraživanja bila je stvoriti elektromagnetsko polje (EM) frekvencije mobilne telefonije kakvo je prisutno u općem okolišu. Jednoličnost i biološki učinci stvorenog EM polja bili su ispitani u gigahercnoj transverzalnoj elektromagnetskoj komori (GTEM-komora) korištenjem kulture V79 stanica. Za stvaranje EM polja frekvencije mobilne telefonije korištena je GTEM-komora i izvor signala Hewlett Packard HP 5675A. Jakost električnog polja i njegova jednoličnost mjerena je s mjeračem električnog polja i odgovarajućom sondom (ETS-Lindgren Holaday, USA). U svrhu istraživanja biološke učinkovitosti polja, stanični uzorci su bili izlagani 1, 2 i 3 sata kontinuiranim valovima frekvencije 935 MHz u GTEM-komori. Stanice su bile održavane u vlažnoj atmosferi s 5% CO_2 i 37°C. Stanična vijabilnost određena je metodom tripanskog modrila. Sposobnost stvaranja kolonija određena je brojem kolonija sedmog dana nakon zračenja uzoraka. Raspon jakosti električnog polja u GTEM-komori bio je od 9.0 V/m kod septuma do 7.2 V/m pri bazi komore. Vijabilnost i sposobnost stvaranja kolonija ozračenih stanica nije se statistički razlikovala od kontrolnih uzoraka. Mjerenja jakosti polja pokazala su jednoličan raspored u komori s prihvatljivim odstupanjem od 1.8 V/m. U primijenjenim *in vitro* pokusnim uvjetima, jednolično EM polje frekvencije mobilne telefonije (935 MHz) nije pokazalo štetan biološki učinak.

BIOELECTROMAGNETICS APPROACH IN THE ASSESSMENT OF MOBILE PHONE FREQUENCY BIOEFFECTS

I. Pavičić and I. Trošić
Institute for Medical Research and Occupational Health, Ksaverska c. 2, HR-10000 Zagreb, Croatia (ivan.pavicic@imi.hr)

This study was designed to create a mobile phone frequency field within the electromagnetic spectrum (EM) of frequencies occurring in the general environment. Uniformity and biological effects of the created EM field have been tested in a gigahertz transversal electromagnetic mode cell (GTEM-cell) using V79 cell culture. The GTEM-cell, equipped by a Hewlett Packard HP 5675A signal generator, was used to create mobile phone frequency field. Electric field strength and uniformity were measured by electric field meter and corresponding field probe (ETS-Lindgren Holaday, USA). To test electric field biological potency, cell samples were exposed to continuous waves of 935 MHz frequency in the GTEM-cell for 1, 2 and 3 hours. The cells were cultivated in a humid air with 5% CO_2 at 37°C. Cell viability was assessed using the Trypan blue exclusion test. Colony-forming ability was determined by colony-counts 7 days after exposure. The electric field strength in the GTEM-cell ranged from 9.0 V/m by septum to 7.2 V/m at the base section. The

viability and colony-forming ability of the irradiated cells did not significantly differ from control samples. The measurements of the field strength showed that field distribution inside the GTEM-cell was uniform, with an acceptable variation of 1.8 V/m. The uniform mobile phone frequency field of 935 MHz in applied *in vitro* experimental conditions did not reveal harmful biological effects.

P-122

BIOCHEMICAL MARKERS OF CADMIUM INDUCED OXIDATIVE STRESS IN DUCKWEED (*Lemna minor* L.)

J. Razinger[1] , M. Dermastia[2], J.D. Koce[2] and A. Zrimec[1]
[1]Institute of Physical Biology, Velika Loka 90, SI-1290 Grosuplje, Slovenia, [2] University of Ljubljana, Biotechnical Faculty, Department of Biology, Večna pot 111, SI-1000 Ljubljana, Slovenia (jaka@ifb.si)

We estimated the potential use of duckweed (*Lemna minor* L.) as an indicator of environmental metal contamination and a biomarker of oxidative stress. Oxidative stress was evaluated during different exposure times and concentrations of the metal salt $CdCl_2$ using two antioxidant parameters: the activity of antioxidant enzymes (glutathione reductase – GR, catalase – CAT, guaiacol peroxidase – GPOD) and the ratio between oxidized – GSSG and reduced glutathione – GSH. We observed that the enzymes exhibit different sensitivity to Cd exposure and that the changes in their activities are concentration-dependent. We also discovered that exposure of *L. minor* to various concentrations of Cd results in a decrease of total glutathione (GSx) pool and that *L. minor* accumulates Cd in relatively high concentrations. As the accumulation rate of Cd was higher at lower Cd concentrations in the test medium, we propose that *L. minor* exhibits some traits commonly found in accumulator species. We conclude that the changes of GSx concentration and G-POD activity could be used as biochemical biomarkers of Cd pollution and that *L. minor* could be used in various phytoremediation schemes dealing with heavy-metal polluted waters.

P-123

DUGOTRAJNA POSTOJANOST ALKILACIJSKOG OŠTEĆENJA DNA U HEMOCITIMA ŠKOLJKAŠA *Unio pictorum*

A. Štambuk[1], M. Pavlica[2] i G.I.V. Klobučar[1]
[1]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet,

Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (astambuk@biol.pmf.hr, gklobuca@zg.biol.pmf.hr), [2]Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu,, HR-10000 Zagreb, Hrvatska (mpavlica@biol.pmf.hr)

Određivanje oštećenja molekule DNA od velikog je značaja u mjerenju toksičnog djelovanja onečišćenja na vodeni okoliš. U tu svrhu vrlo često se koriste školjkaši jer su sedentarni organizmi koji filtracijom akumuliraju toksične tvari prisutne u vodi. Procjena trajnosti takvog oštećenja varira ovisno o vrsti i učinkovitosti mehanizma za popravak DNA te trajnosti same stanice. a vrlo je bitna za određivanje negativnog učinka onečišćenja. Stoga smo jedinke školjkaša *U. pictorum* (slikarska lisanka) izložili djelovanju monofunkcionalnog alkilirajućeg agensa, etil metanosulfonata (EMS) (0, 10, 50, 100 mg/l) u trajanju od 24 sata i pratili postojanost oštećenja DNA u njihovim hemocitima tijekom 72 dana oporavka u čistoj, dekloriranoj vodi. Oštećenja DNA mjerena su komet-testom i mikronukleus-testom. Inducirano oštećenje DNA detektirano je komet-testom i nakon 72 dana oporavka, što upućuje na dugotrajnu postojanost alkilacijskog oštećenja DNA u hemocitima slikarske lisanke. Oštećenje DNA mjereno komet-testom bilo je proporcionalno koncentracijama EMS-a tijekom cijelog razdoblja oporavka. Dvije najviše koncentracije EMS-a pokazale su sličan uzorak promjena količine oštećenja DNA kroz vrijeme (% DNA u repu) kod kojeg je nakon značajnog pada prvog dana oporavka, količina DNA lezija rasla do 7. dana, nakon čega je slijedio popravak/razrijeđenje oštećenja tijekom slijedećih 65 dana koji ni tada nije dosegnuo kontrolne vrijednosti. Najviša učestalost hemocita s mikronukleusima izmjerena je 3. dana oporavka. Broj hemocita s mikronukleusima smanjuje se sedmog dana, dok su 19. dana oporavka izmjerene vrijednosti bile vrlo blizu kontrolnih. Raspravit će se izmjerena dugotrajnost oštećenja DNA u hemocitima vrste *U. pictorum* i procesi uključeni u stvaranje DNA oštećenja detektiranih komet-testom i mikronukleus-testom nakon izlaganja alkilirajućim agensima.

LONG-TERM PERSISTENCE OF THE ALKYLATION DNA DAMAGE IN HAEMOCYTES OF FRESHWATER MUSSEL *Unio pictorum*

A. Štambuk[1], M. Pavlica[2] and G.I.V. Klobučar[1]
[1]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Zagreb, Croatia (astambuk@biol.pmf.hr, gklobuca@zg.biol.pmf.hr), [2]Department of Molecular Biology, Division of Biology, Faculty of Science, University of Zagreb, Zagreb, Croatia (mpavlica@biol.pmf.hr)

One of the endpoints of a major importance in assessing pollution related toxicity is genotoxicity. Being sedentary organisms that feed by filtration, bivalve species are often used for monitoring pollution impact on aquatic biota. In order to get an insight into a time course and persistence of alkylation DNA damage in haemocytes of painter's mussel *Unio pictorum*, we have exposed them for 24 hours to a gradient concentration of a monofunctional alkylating agent, ethyl methanesulfonate (EMS) (0, 10, 50, 100 mg/l). Time course of DNA damage was assessed immediately upon exposure and over the recovery period of up to 72 days, using comet and micronucleus assays. Induced DNA damage in mussels was detectable by the comet assay even after 72 days of recovery in dechlorinated water, suggesting a long persistence of alkylation DNA damage in mussel's haemocytes. Moreover, percentage of tail DNA showed dose-response relationship in DNA damage throughout the whole recovery period. Similar pattern of time course of DNA damage (% tail DNA) was observed for mussels exposed to the two highest concentrations. After a substantial decline on the first recovery day, amount of DNA lesions detected by the comet assay was increasing till the seventh day of recovery, followed by the subsequent repair and/or dilution of DNA damage over the next 65 days, but still not reaching the control values. Incidence of micronucleated haemocytes was the highest on the third day of recovery period, it decreased substantially on the seventh day and returned almost to the control levels nineteen days after the exposure. Measured long-term persistence of DNA damage in haemocytes of *U. pictorum* and mechanisms involved in generation of DNA lesions detected by comet and micronucleus assays upon exposure to alkylating agents are discussed.

P-124
ODREĐIVANJE DETOKSIFIKACIJSKOG I BIOAKTIVACIJSKOG POTENCIJALA RAZLIČITIH ŽIVOTNIH STADIJA BRANCINA (*Dicentrarchus labrax* L.)

L. Traven[1,2], S. Krča[3], R. Žaja[3], J. Lončar[3], V. Mićović[1,2] i T. Smital[3]
[1]Katedra za zdravstvenu ekologiju, Medicinski fakultet, Sveučilište u Rijeci, Braće Branchetta 20a, HR-51000 Rijeka, Hrvatska (Luka.Traven@medri.hr), [2]Nastavni zavod za javno zdravstvo Primorsko-goranske županije, Krešimirova 52a, HR-51000 Rijeka, Hrvatska, [3]Laboratorij za molekularnu ekotoksikologiju, Zavod za istraživanje mora i okoliša, Institut Ruđer Bošković, Bijenička 54, HR-10002 Zagreb, Hrvatska

U ovom radu prikazan je utjecaj različitih životnih stadija brancina (*Dicentrarchus labrax* L.) na odgovor niza ekotoksikoloških biomarkera. U

S9 frakciji homogenata jetre brancina određivana je aktivnost etoksirezorufin O-deetilaze (EROD), aktivnost glutation S-transferaze (GST), ekspresija CYP1A proteina (ELISA) i bioaktivacijski potencijal (Ames test). Krajnji cilj ovog istraživanja jest odrediti optimalni životni stadij brancina za upotrebu u programima praćenja kakvoće morskog okoliša upotrebom tehnike kaveznog izlaganja. Ribe tri različite težinske klase/starosti (50-100, 150-200 i 300-400 g) dobivene iz uzgajališta u limskom kanalu (Marimirna d.d.) jednokratno su i.p tretirane različitim dozama (0.1-50 mg/kg) modelnog CYP1A inducera β-naftoflavona (BNF). Rezultati dobiveni nakon 4 dana izlaganja ukazuju da EROD aktivnost i proteinska ekspresija CYP1A rastu s povećanjem doze u svim razvojnim stadijima dok GST aktivnost ne pokazuje porast u ovisnosti o porastu doze. Također, rezultati pokazuju da juvenilne ribe imaju značajno veći raspon indukcije, i nižu bazalnu EROD-aktivnost u odnosu na odrasle jedinke. Na temelju ovih rezultata preliminarno zaključujemo da je juvenilna kategorija brancina (manje od 100 g) optimalna za korištenje u programima biološkog praćenja kakvoće morskog okoliša tehnikom kaveznog izlaganja. Ova hipoteza bit će polazište za testiranje u stvarnim uvjetima kaveznog izlaganja u slijedećoj fazi istraživanja.

DETERMINATION OF DETOXIFICATION AND BIOACTIVATION POTENTIAL IN DIFFERENT LIFE STAGES OF SEA BASS (*Dicentrarchus labrax* L.)

L. Traven[1,2], S. Krča[3], R. Žaja[3], J. Lončar[3], V. Mićović[1,2] and T. Smital[3]
[1]Department of Environmental Medicine, Medical faculty, University of Rijeka, Braće Branchetta 20a, HR-51000 Rijeka, Croatia (LukaTraven@medri.hr), [2]Teaching Institute of Public Health of the Primorsko - goranska County, Krešimirova 52a, HR-51000 Rijeka, Croatia, [3]Laboratory for Molecular Ecotoxicology, Division for Marine and Environmental Research, Ruđer Bošković Institute, Bijenička 54, HR-10002 Zagreb, Croatia

In the present study we have analyzed the relation of different life stages to the response of a series of ecotoxicological biomarkers measured in the S9 fraction of the liver of the marine fish species sea bass (*Dicentrarchus labrax* L.): ethoxyresorufin O-deethylase activity (EROD), glutathione S-transferase (GST) activity, CYP1A protein expression (ELISA) and liver bioactivation potential (Ames test). The overall goal of the study was to determine the optimal life stage of sea bass for biomonitoring practices using the cage exposure approach. Fish of three different weight classes/life stages (weighing 50-100, 150-200 and 300-400 g, respectively) were collected from a local fish farm (Marimirna, d.d., Lim; Croatia) and subsequently treated

with a single i.p. injection of the model CYP1A inducer β-naphtoflavone (BNF) at different doses (0.1-50 mg/kg). Our results showed that after 4 days of exposure EROD activities and CYP1A protein expression responded in a dose dependent manner in all life-stage classes, whereas GST activity did not. Different life stages showed different responses to BNF treatment with juvenile fish exhibiting the strongest EROD induction (fold increase over control) and the lowest basal EROD activity. Since juvenile fish show a much more pronounced inducibility compared to mature fish it can be tentatively stated that this class should be preferably used in biomonitoring practices involving cage exposure. This hypothesis will be further tested in real cage exposure conditions in the next stage of the study.

P-125

ALKALNI KOMET TEST KAO BIOMARKER OŠTEĆENJA DNA U RADNIKA ZAPOSLENIH U INDUSTRIJI CIGARETA

M. Đurinec i V. Garaj-Vrhovac
Jedinica za mutagenezu, Institut za medicinska istraživanja i medicinu rada, Ksaverska cesta 2, HR-10000 Zagreb, Hrvatska (djurinec@imi.hr, vgaraj@imi.hr)

Cilj istraživanja bio je pronaći moguće genotoksične učinke u osoba profesionalno izloženih duhanskoj prašini i stronciju 90. Svi radnici su nosili osobne dozimetre. Izložena grupa se sastojala od 8 ženskih i 12 muških osoba prosječne životne dobi dob 46.4 godine (22-54 godine). Prosječna godina staža je bila 26.7 godina (3 do 38 godina). Kontrolna grupa se sastojala od 17 ženskih i 13 muških osoba iz opće populacije Republike Hrvatske prosječne životne dobi 39.8 godine (21-61). Procjena primarnog oštećenja molekule DNA urokovano duhanskom prašinom i stroncijem 90 mjerena je komet testom u alkalnim uvjetima na limfocitima periferne krvi osoba zaposlenih u duhanskoj industriji. Rezultati komet testa prikazani su mjerenjem srednjih vrijednosti dužine repa u mikrometrima. Rezultati pokazuju da su srednje vrijednosti dužine repa u osoba izložene skupine između 12.19±0.14μm i 15.85±0.20μm. U kontrolnoj grupi, srednje vrijednosti dužine repa su bile od 12.19±0.06μm do 15.08±0.15μm. Unutar profesionalno izložene populacije, nije bilo statistički značajnih inter-individualnih razlika u oštećenju DNA ($p<0.05$). Pušenje, spol i dob nisu u korelaciji sa rezultatima oštećenja molekule DNA. Prosječna efektivna doza za osobe izložene skupine je bila manja od 50μSv. Rezultati pokazuju da se alkalni komet test može koristiti kao osjetljivi biološki indikator u procjeni mogućeg rizika u osoba zaposlenih u duhanskoj industriji.

THE ALKALINE COMET ASSAY AS BIOMARKER OF DNA DAMAGE IN WORKERS IN CIGARETTE MANUFACTORY

M. Đurinec and V. Garaj-Vrhovac
Unit for Mutagenesis, Institute for Medical Research and Occupational Health, Ksaverska cesta 2, HR-10000 Zagreb, Croatia (djurinec@imi.hr, vgaraj@imi.hr)

The aim of this study was to find possible genotoxic effects of occupational exposure to tobacco dust and additional exposure to a source of strontium 90. During their work they all wore individual dosimeters (film badges). Exposed group consists of 8 females and 12 male subjects aged 22 to 54 (mean age 46.4). Their main duration of occupationaly exposure was 26.7 (range 3 to 38). Control group was choosen from general Croatian population and it consists of 17 female and 13 male subjects aged 21 to 61 (mean age 39.8). The assessment of primary DNA damage in peripheral blood leukocytes was performed using the alkaline comet assay. Tail length was measured as main comet parameter. The results showed that the comet tail length measured in exposed workers were in the range of mean values between 12.19±0.14μm and 15.85±0.20μm. In the control group, the tail length means ranged from 12.19±0.06μm to 15.08±0.15μm. Within the exposed population, there were no significant inter-individual differences in DNA damage ($p<0.05$). Cigarette smoking age and sex were not potent confounding factors in the control and exposed subjects. The observed non-significant data suggest that tobacco dust and strontium 90 does not significantly contribute to the DNA damage. The average effective dose receiveid one month before blood sampling was lower than 50 μSv. The alkaline comet assay stresses the importance of biological indicators in providing information on the actual risk of tobacco dust and strontium 90 exposed individuals. According to our results comet assay as sensitive biomarker can be used as additional complement to physical dosimetry in assesment of occupationally exposure to tobacco dust and Strontium 90.

KONZERVACIJSKA BIOLOGIJA, ZAŠTITA PRIRODE I OKOLIŠA I ZAKONODAVSTVO

BIOLOGIA CONSERVATIONIS, PROTECTIO NATURAE ET LEGISLATIO

CONSERVATION BIOLOGY, CONSERVATION OF NATURE, ENVIRONMENTAL PROTECTION AND LEGISLATION

Uvodna tematska predavanja
Introductory Lectures

IL-20
NACIONALNA EKOLOŠKA MREŽA – NOVI MEHANIZAM ZAŠTITE PRIRODE

J. Radović i R.Topić
Državni zavod za zaštitu prirode, Savska cesta 41/23, HR-10000 Zagreb, Hrvatska (jasminka.radovic@dzzp.hr, ramona.topic@dzzp.hr)

Nacionalna ekološka mreža (NEM) propisana Zakonom o zaštiti prirode (2005.) predstavlja novi mehanizam zaštite prirode usmjeren na očuvanje ugroženih vrsta i stanišnih tipova. U Državnom zavodu za zaštitu prirode izrađen je prijedlog NEM kao stručna podloga za Uredbu Vlade RH o NEM. U prijedlog su uključena područja važna za očuvanje vrsta i stanišnih tipova koji su ugroženi na nacionalnoj i međunarodnoj razini, uključujući i potencijalna područja EU ekološke mreže NATURA 2000. Republika Hrvatska je obvezna predložiti Europskoj komisiji svoj doprinos ovoj ekološkoj mreži do dana pristupa EU. U prijedlogu NEM za svako područje navode se osnovni podaci te ciljevi i opće mjere očuvanja. Za izradu konačnog prijedloga NATURA 2000 potrebno je prikupiti dodatne podatke o rasprostranjenosti i brojnosti pojedinih vrsta i stanišnih tipova zaštićenih Direktivom o pticama i Direktivom o staništima koji se upisuju u bazu podataka NATURA 2000. Ta područja propisat će Vlada RH Uredbom o međunarodnim ekološki važnim područjima, predvidivo do konca 2008.godine. Proglašavanjem NEM počet će se primjenjivati ocjena prihvatljivosti planiranih zahvata za prirodu i to za svaki planirani zahvat koji sam ili u kombinaciji s drugim zahvatima može imati značajan utjecaj na područje NEM na ciljeve njegova očuvanja. Pojedina područja NEM mogu biti zaštićena u nekoj od kategorija prema Zakonu o zaštiti prirode ili će se štititi kroz ugrađivanje nužnih mjera upravljanja u djelatnosti korištenja prirodnih dobara. U izlaganju će biti opisana metodologija izrade NEM, stanje podataka te potrebni daljnji koraci u cilju izrade konačnog prijedloga NATURA 2000.

NATIONAL ECOLOGICAL NETWORK – NEW MECHANISM OF NATURE PROTECTION

J. Radović and R.Topić
State Institute for Nature Protection, Savska cesta 41/23, HR-10000 Zagreb, Croatia (jasminka.radovic@dzzp.hr, ramona.topic@dzzp.hr)

National ecological network (NEN), according to the Nature Protection Act (2005) represents a new mechanism of nature protection aimed at conservation of threatened species and habitat types. State Institute for Nature Protection developed a NEN proposal as a background study for NEN Government Regulation. This proposal comprises sites important for conservation of species and habitat types threatened on national and international level, including potential sites of EU ecological network NATURA 2000. Republic of Croatia has an obligation to deliver a proposal of its contribution to this ecological network by the day of accession to the EU. NEN proposal includes basic biological data as well as conservation measures and objectives for each site. For the preparation of final NATURA 2000 proposal it is necessary to gather additional data on abundance and distribution of particular species and habitat types protected by Habitats and Birds Directive, which is then entered into the standard database. NATURA 2000 sites will be enacted by Government Regulation on internationally important areas, which is envisaged for the end of 2008. NEN enactment will enable the implementation of nature impact assessment for each planned intervention that is likely to have a significant effect, either individually or in combination with other plans or projects, on conservation objectives of the site. Particular NEN sites can be designated in one of the categories under the Nature Protection Act, or will be protected through incorporation of needed conservation management measures into the activities of natural resources utilization. Presentation will describe the methodology of NEN development, state of the data and further necessary steps towards the drafting of final NATURA 2000 proposal.

Kratka usmena priopćenja
Oral Presentations

OP-56
ISTRAŽIVANJE ŠUMA HRASTA CRNIKE (*Quercus ilex* L.) I MOGUĆNOST PRIRODNE OBNOVE U ISTRI

T. Dubravac, S. Dekanić i B. Vrbek
Odjel za ekologiju i uzgajanje šuma, Šumarski institut, Jastrebarsko, Trnjanska 35, HR-10000 Zagreb, Hrvatska (tomod@sumins.hr)

Hrast crnika (*Quercus ilex* L.) predstavlja temeljnu klimatogenu vrstu drveća na Mediteranu, a većina tih šuma nalazi se u niskom uzgojnom obliku (panjačama). Panjače (izdanačke šume) hrasta crnike nastale su namjernim ili nenamjernim procesima degradacije sastojina visokog uzgojnog oblika. Zajedničko im je obilježje izostanak bilo kakvih uzgojnih radova u mladosti i tijekom njihova razvoja. Kako su prepuštene spontanom razvoju, formirao se čitav spektar, od onih najkvalitetnijih, suvislo obraslih, dobro sklopljenih s relativno visokom drvnom masom pa do nekvalitetnih, razbijenog sklopa, s kržljavim i kvalitetno lošim stablima male drvne mase. Istraživanja su obavljena u Eumediteranskoj vegetacijskoj zoni vazdazelenih šuma, na području Šumarije "Pula", "Poreč", "Cres-Lošinj" (7 pokusnih ploha) te na plohi u NP "Brijuni". Plohe imaju sve značajke šume crnike i crnog jasena (*Orno-Quercetum ilicis* H-ić/1956/1958). Praćeni su temeljni elementi strukture sastojine, zastrtosti tla te pojavnost i brojno stanje mladog naraštaja. Istraživanja pokazuju kako je brojno stanje mladog naraštaja hrasta crnike iz sjemena, kao temeljnog uvjeta za razvoj i opstanak tih sastojina, na svim plohama izrazito dobro, osim na plohi u NP "Brijuni". Međutim, zadovoljavajuća prirodna obnova upitna je zbog prevelikog broja stabala po ha, uskih krošanja te prevelike zastrtosti tla od preko 85%. Tijekom prirodne obnove ovih sastojina, nailazimo na određene probleme od kojih se po svojoj važnosti izdvajaju agresivnost crnike i lovora iz panja, konkurencija grmlja, neadekvatni i nepravovremeni uzgojni zahvati te prevelika prisutnost divljači. Autohtone sastojine hrasta crnike stabilni su ekosustavi koji se relativno lako odupiru negativnim biotičkim i abiotičkim činiteljima te stoga zaslužuju intenzivnija istraživanja.

INVESTIGATION OF EVERGREEN OAK FORESTS (*Quercus ilex* L.) AND POSSIBILITY OF NATURAL REFORESTATION IN ISTRIA

T. Dubravac, S. Dekanić and B. Vrbek

Department for Ecology and Silviculture, Forest Research Institute, Jastrebarsko, Trnjanska 35, HR-10000 Zagreb, Croatia (tomod@sumins.hr)

Evergreen oak (*Quercus ilex* L.) represents the basic climatogenic tree species in the Mediterranean and the majority of these forests exist in a low silvicultural form (coppice forests). Coppice forests (sprout forests) of Evergreen oak developed by intentional or unintentional processes of stand degradation from the high silvicultural form. A common characteristic of coppice forests is the absence of any silvicultural interventions during early growth and during their development. As they were left to spontaneous development, a whole spectrum was formed from those of highest quality, coherently stocked, with a well-developed canopy, and with a relatively high volume of wood, up to those of poor quality with broken canopy, and with undeveloped and poor quality trees with low volume of wood. Investigations were carried out in the Eu-Mediterranean vegetation zone of evergreen forests, in the area of Forest Offices of Pula, Poreč, Cres-Lošinj (7 experimental plots), and on the plot in the Brijuni National Park. The plots have all the characteristics of Evergreen oak and Flowering ash (*Orno-Quercetum ilicis* H-ić/1956/1958). Basic stand structure elements, crown cover over soil and the occurrence and numbers of the young growth, are monitored. Investigations show that the numbers of the Evergreen oak young growth from seed, as the basic condition for development and existence of the stands, are exceptionally satisfactory on all plots except the plot in the Brijuni National Park. However, satisfactory natural reforestation is in question due to the excessive number of trees per ha, narrow crowns, excessive crown cover over soil of over 85%. During natural reforestation of these stands, certain problems become evident, of which according to their importance are the aggression of Evergreen oak and laurel from the stump, competition of shrubs, inadequate and untimely silvicultural interventions and excessive presence of game. Autochthonous stands of Evergreen oak are stable ecosystems, which resist negative biotic and abiotic factors relatively easily and which therefore deserve more intensive research.

OP-57
USPOREDBA BILJNE RAZNOLIKOSTI PRAŠUMA I GOSPODARENIH BUKOVO-JELOVIH ŠUMA NA KRŠU HRVATSKE

S.D. Jelaska[1] i O. Antonić[2]
[1]OIKON d.o.o. – Institut za primijenjenu ekologiju, Prekratova 20, HR-10020 Zagreb, Hrvatska (sjelaska@oikon.hr), [2]Institut "Ruđer Bošković", Bijenička cesta 54, HR-10002 Zagreb, Hrvatska

Prašumama smatramo sve one sastojine u kojima je izostao direktan čovjekov utjecaj odnosno gospodarenje. Takve sastojine najčešće doživljavamo kao oaze prirodnosti i sačuvane biološke raznolikosti. S druge strane, podaci nekih istraživanja pokazuju da gospodarene sastojine imaju veću biljnu raznolikost sagledanu kroz broj biljnih vrsta, što bi moglo implicirati manji značaj prašuma u očuvanju prirode. Naša istraživanja provedena u dinarskim bukovo-jelovim šumama (*Omphalodo-Fagetum*), u kojima se nalazi većina prašumskih kompleksa u Hrvatskoj, obuhvatila su detaljnije analize biljne raznolikosti od broja vrsta. Rezultati analize florističkog sastava i stanišnih uvjeta (ekoloških i sastojinskih) pokazali su da floristička raznolikost u prvom redu ovisi o ekološkim uvjetima (nadmorska visina i klimatski parametri), a tek potom o strukturnim (otvorenost sklopa krošnji i broj stabala) koji su posljedica gospodarenja. Na razini asocijacije, u gospodarenim sastojinama zabilježen je prosječno veći broj biljnih vrsta i vrijednost Shannon-Wiener indeksa raznolikosti, dok na razini subasocijacija nije uočen jedinstven trend u usporedbi prašumskih s gospodarenim sastojinama. Indeks jednolikosti veći je u gospodarenim sastojinama na obje sintaksonske razine. S obzirom na udio flornih elemenata, zabilježen je veći udio euroazijatskih u gospodarenim šumama, te cirkum-holarktičkih i europskih u prašumama. Ustanovljeni značaj svjetla na floristički sastav, te veća heterogenost sklopa krošnji (time i prostorna varijabilnost raspoloživog svjetla) u prašumskim sastojinama, ukazuje na potrebu dodatnog istraživanja s ciljem određivanja minimalne površine i prostornog rasporeda uzorkovanja (s obzirom na različite razvojne stadije prašume i očekivane florističke razlike između njih).

COMPARISON OF PHYTODIVERSITY IN VIRGIN AND LOGGED SILVER FIR – BEECH FORESTS ON CROATIAN KARST

S.D. Jelaska[1] and O. Antonić[2]
[1]OIKON Ltd. – Institute for Applied Ecology, Prekratova 20, HR-10020 Zagreb, Croatia (sjelaska@oikon.hr), [2]Ruđer Bošković Institute, Bijenička 54, HR-10002 Zagreb, Croatia

By virgin forests we consider forest stands without direct human influence, especially logging. Usually we think of them as bastions of naturalness and preserved biodiversity. However, some researchers have noticed higher phytodiversity measured with number of present species, in logged forests implying indirectly decreased importance of virgin forests in nature preservation and conservation. Our research took place in Dinaric silver fir – beech forests (*Omphalodo-Fagetum*) that contain majority of virgin forests in Croatia, using more detailed analysis and comparisons than the sole number

of species. Analyses of floristic composition and habitat conditions (ecological and stand structures) has shown that floristic diversity depends primarily on ecological conditions (elevation and climatic parameters), while structural ones (canopy openness and number of trees) as a consequence of logging being of lesser importance. Mean number of plant species and Shannon-Wiener index of diversity were higher in logged forests at community level, while at sub-association level unique trend was not found. Evenness was higher in logged forests, both at community and sub-association level. Virgin forests had higher proportion of plants belonging to Circum-Holarctic and European floristic elements, while logged forests had higher proportion of Euro-Asiatic elements. Established impact of light on floristic assemblage, together with higher heterogeneity of canopy gaps (i.e. available light on the ground) in the virgin forests implies need for additional research with aim of establishing size of minimum unit surveyed, as well as its spatial distribution (having in mind different development phases and expected differences in floristic assemblage between them).

OP-58
ZAŠTIĆENA PRIRODNA VRIJEDNOST - MEĐIMURSKI KONJ

D. Kiš-Novak
Visoka učiteljska škola u Čakovcu, Dr. Ante Starčevića 55, HR-42000 Čakovec, Hrvatska (darinka.kis-novak@vus-ck.hr)

Zaštićene prirodne vrijednosti čine zaštićena područja, zaštićene svojte (strogo zaštićena i zaštićena divlja i zavičajna udomaćena svojta), zaštićeni minerali i fosili. Istovremeno, biološka raznolikost predstavlja sveukupnost svih živih organizama koji su dijelovi ekoloških sustava i ekoloških kompleksa, a uključuje raznolikost unutar vrsta, između vrsta te raznolikost između ekoloških sustava. Očuvanje međimurskoga konja kao prirodne baštine predstavlja primjer nasljeđa za buduće generacije, predstavlja nacionalni prostorni identitet, zavičajni identitet, prirodnu, nacionalnu, tradicijsku, etnografsku i kulturnu vrijednost, a simbol je i težačkog načina života međimurskoga čovjeka. Prema Zakonu o zaštiti prirode (NN, 162/03, čl. 87.) što je novina u odnosu na prethodni Zakon o zaštiti prirode (*NN, 30/94*), ugrožene zavičajne udomaćene svojte predstavljaju zaštićene prirodne vrijednosti. Zadnjih nekoliko godina grupa entuzijasta iz Čakovca intenzivno se bavi animacijom i javnim promocijama ideje o očuvanju autohtone zavičajne pasmine uzgojene u Međimurju. Međimurski konj kao čista pasmina pojavio se u drugoj polovici 19. stoljeća, a poznat je i pod imenom prvi hrvatski hladnokrvni konj. Međimurskom konju prijeti iščeznuće.

Godine 2004. registrirano je manje od 30 jedinki (prema kriteriju FAO-a za utvrđivanje ugroženosti pasmina) i ima status ugrožene pasmine. Rezultati anonimne ankete provedene među studentima prve godine predškolskog i učiteljskog studija u Visokoj učiteljskoj školi u Čakovcu potvrđuju potrebu širenja edukacije o međimurskom konju. Osim naše savjesti, i održivo korištenje ekoloških sustava, Konvencija o biološkoj raznolikosti i Zakon o zaštiti prirode pozivaju nas na zaštitu, promicanje i poticanje istraživanja koja doprinose očuvanju i održivom korištenju biološke raznolikosti u skladu sa tradicijom i kulturom domaćega stanovništva .

PROTECTED NATURAL VALUE – MUR INSULAN HORSE

D. Kiš-Novak
Teacher Training College, Dr. Ante Starčevića 55, HR-42000 Čakovec, Croatia (darinka.kis-novak@vus-ck.hr)

Protected natural values consist of protected areas, protected breeds (strictly protected and protected wild and local domesticated breed), protected minerals and fossils. At the same time, biological diversity presents wholeness of live organisms that are parts of the ecological systems and ecological complexes. It includes diversity within species, between species and diversity of ecological systems. The preservation of the Mur Insulan Horse as a natural heritage is an example of heritage for future generations. It presents national spatial identity, local identity, natural, national, traditional, ethnographical and cultural value, and it is a symbol of the labourer's way of life of the man from the County of Međimurje. According to the Nature Protection Bill (Official Gazette No.162/03, A*rticle 87*) and this presents a novelty in relation to the previous Nature Protection Bill (Official Gazette No.*30/94*), endangered local area domesticated breeds present protected natural values. During the last couple of years a group of enthusiasts from Čakovec has been intensively dealing with animation and public promotions of the idea of the protection of the indigenous, local area breed that was bred in the county of Međimurje. Mur Insulan Horse as a pure breed appeared in the second half of the 19th century. It is also known under the name of First Croatian Cold-blooded Horse. Mur Insulan Horse is in danger of disappearance. In the year of 2004 there were less than 30 individuals (according to FAO criterion for determing that a breed is endangered) and has the status of an endangered species. The results of an anonymous survey that was conducted among the first year students of the Nursery School Teacher Programme and of the Primary School Teacher Programme at the Teacher Training College at Čakovec confirm the need for wider education about the Mur Insulan Horse.

Not only our conscience, but also sustainable use of ecological systems and the Convention about Biological Diversity call us to protect, promote and to stimulate research which contributes to the protection and to sustainable use of biological diversity which is in line with tradition and culture of the domestic population.

OP-59

CRNA RIJEKA (N.P. PLITVIČKA JEZERA) KAO UZGOJNI VODOTOK AUTOHTONE POTOČNE PASTRVE (*Salmo trutta*)

S. Leiner[1] i B. Pevalek–Kozlina[2]
[1]Hrvatski prirodoslovni muzej, Demetrova 1, HR-10000 Zagreb, Hrvatska (srecko.leiner@hpm.hr), [2]Botanički Zavod, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (bpevalek@pmf.hr)

Trogodišnja istraživanja ihtiocenoza akvatorija Nacionalnog parka Plitvička jezera dokazala su promjene u sastavu ihtio-populacija. Autohtona potočna pastrva gotovo je u potpunosti potisnuta iz jezerskih ekosustava, a u vodotocima dijeli staništa s egzotičnom dužičastom pastrvom (*Oncorhynchus mykiss*). Rezultati ihtioloških i ekološka istraživanja Crne Rijeke, Bijele Rijeke i Matice, pokazali su Crnu Rijeku kao prihvatljivi vodotok za uzgoj autohtone potočne pastrve. Na taj bi način Crna Rijeka postala izvor autohtonog genotipa za sukcesivno poribljavanje akvatorija. Sadašnje stanje ovog vodotoka je nezadovoljavajuće iz dva ključna razloga: rast populacija autohtone potočne pastrve ograničena je prisutnošću alohtone dužičaste pastrve, a ukupna procjena broja jedinki ovisna je o samo 12% korisne vodene površine. Teritorijalno ponašanje, karakteristično za odrasle jedinke ovisi trenutačno o svega 0,065 ha dubljih staništa ili 3% vodene površine. Iz tog razloga ne začuđuje da sadašnja staništa omogućuju jedinki potočne pastrve zauzimanje 34,5 površinskih metara vodotoka, a dužičastoj 18,5 m^2. Povećanje korisnih površina za pastrve (skrovišta, bazenska staništa i dr.) zahtijeva studiozne zahvate na mikrolokacijama u koritu i obalnim točkama. Restauracija i unapređenje vodenih staništa, uz odstranjenje alohtone pastrve, povećala bi sadašnju populaciju za 3 do 8 puta. U tom su smislu napravljene preporuke za organizaciju Crne Rijeke kao prvog uzgojnog vodotoka na području Republike Hrvatske.

THE CRNA RIJEKA (PLITVICE LAKES NATIONAL PARK) AS REARING STREAM OF NATIVE BROWN TROUT (*Salmo trutta*)

S. Leiner[1] and B. Pevalek–Kozlina[2]
[1]Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia (srecko.leiner@hpm.hr), [2]Department of Botany, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (bpevalek@pmf.hr)

Three years of research of Plitvice Lakes freshwater habitats proved the changes of fish population assemblages. Native brown trout is disappearing from the lake ecosystems, while streams are shared with exotic rainbow trout (*Oncorhynchus mykiss*). Results of ichthyological and ecological research of Crna Rijeka, Bijela Rijeka and Matica streams suggest Crna Rijeka as acceptable stream for rearing native brown trout. This way, the stream would become native gene pool source to gradually populate freshwater habitats. Present condition of the Crna Rijeka stream is not satisfactory for two main reasons. First, increase of native brown trout population is suppressed by the presence of rainbow trout population. Second, present fish populations utilize only 12 percent of total water surface. Presently, characteristic territorial behavior of adult trouts depend on 0.065 ha (3.0 %) of favorable habitats. This is the main reason why individual brown trout can occupy 34.5 m^2 and rainbow trout 18.5 m^2 of the stream water surface. Increase of favorable habitat areas (cover, pool-rifle ratio etc.) demand instream habitat restoration. Improvement and restoration along with rainbow trout removal would increase 3 to 8 times the Crna Rijeka brown trout population. Through this objective, recommendations were made to organize the Crna Rijeka as brown trout rearing stream, the first in Croatia.

OP-60
FILM – ŠPILJSKA FAUNA NP KRKA

M. Lukić
Hrvatsko biospeleološko društvo (HBSD), Demetrova 1, HR-10000 Zagreb, Hrvatska (marko_lukic@inet.hr)

Tijekom 2005. godine članovi Hrvatskog biospeleološkog društva u suradnji s NP Krka vršili su sustavna biospeleološka istraživanja na širem području NP Krka. Tijek istraživanja, prostor i speleothemi speleoloških objekata te pronađena fauna video je dokumentirana Mini DV kamerom model Sony DCR-HC1000E. Podvodne kadrove snimio je Anđelko Novosel Mini DV kamerom modela Sony VX1000 sa Amphibico podvodnim kućištem. Na temelju snimljenog materijala izrađen je film pod naslovom “Špiljska fauna NP Krka” koji prvi prikazuje iznimno raznoliku podzemnu faunu Hrvatske.

Ukratko je prikazana raznolikost kopnene i vodene špiljske faune i njene prilagodbe na pojedine tipove staništa. Po prvi put video dokumentirane su neke troglobiontne životinje i njihova aktivnost *in situ*. Prikazano je parenje podzemnih jednakonožnih rakova roda *Alpioniscus,* hranjenje podzemnih rakušaca roda *Niphargus* te jedinstvene kolonije mnogočetinaša *Marifugia cavatica* na sigama. Snimljena je i ostala podzemna funa iz skupina: Polychaeta (*Marifugia cavatica*), Isopoda, Amphipoda, Decapoda, Aranea, Opiliones, Pseudoscorpiones, Coleoptera, Orthoptera, Diplopoda, Chilopoda, Collembola, Gastropoda, Amphibia (*Proteus anguinus*), Pisces i Chiroptera. Video snimanje špiljske faune izrazito je bitan segment popularizacije podzemne faune jer na jedinstven način približuje javnosti zanimljive špiljske životinje u njihovom prirodnom okruženju.

FILM – CAVE FAUNA OF THE NATIONAL PARK KRKA, CROATIA

M. Lukić
Croatian Biospeleological Society, Demetrova 1, HR-10000 Zagreb, Croatia, (marko_lukic@inet.hr)

Members of the Croatian Biospeleological Society in cooperation with National park Krka carried out sustained biospeleological research in wider area of National park Krka during 2005. Field work, speleothemes and discovered fauna has been taped using Sony MiniDV camcorder DCR-HC1000. Speleodiver Anđelko Novosel with Sony MiniDV camcorder VX1000 with Amphibico underwater housing taped underwater shoots. 11th minute movie “Cave fauna of the National park Krka” shows high biodiversity of terrestrial and aquatic cave animals and their adaptations to subterranean habitats. Some of the cave animals have been taped in their natural environment for the first time. The movie reveals copulating of terrestrial isopods genus *Alpioniscus*, feeding of amphipods genus *Niphargus*, unique colony of polycheats *Marifugia cavatica* on underwater stalactites and many more interesting scenes. Others groups like Isopoda Amphipoda, Decapoda, Aranea, Opiliones, Pseudoscorpiones, Coleoptera, Orthoptera, Diplopoda, Chilopoda, Collembola, Gastropoda, Amphibia (*Proteus anguinus*), Pisces and Chiroptera are presented too. Filming cave fauna is very important segment of the popularization of cave fauna because it shows, in unique way, interesting cave animals in their natural environment to the public.

OP-61
INTERPRETACIJA U URBANIM ZAŠTIĆENIM PODRUČJIMA

S. Malić-Limari[1] i B. Janev Hutinec[2]
[1]Javna ustanova Park prirode "Medvednica", Bliznec bb, HR-10000 Zagreb, Hrvatska (park.prirode.medvednica@zg.t-com.hr), [2]Javna ustanova "Maksimir", Maksimirski perivoj bb, HR-10000 Zagreb, Hrvatska (strucnivoditelj@park-maksimir.hr)

Po prvi puta u povijesti više ljudi živi u urbanim no u ruralnim i polururalnim područjima. Na njihove stavove prema zaštiti prirode može se značajno utjecati čineći ih svjesnim biljnih i životinjskih vrsta te ekosustava koje mogu pronaći u svom neposrednom okolišu. Za znatan broj ljudi osobni kontakt s biološkom raznolikošću zbiva se jedino u urbanim područjima. Zaštićena područja u neposrednoj blizini urbanih zajednica su mjesta gdje je neophodno osigurati kontakt posjetitelja s prirodom i "korištenje" njezinih dobrobiti. Većina urbane zajednice Hrvatske gravitira prema Parku prirode "Medvednica" i parku Maksimir, kao i velik broj turista koji posjete kontinentalni dio Hrvatske, prvenstveno Zagreb. Ta dva zaštićena područja značajna su u sustavu zaštite prirode Hrvatske zbog istaknute funkcije koju imaju u komuniciranju s javnošću zbog velikog broja posjetitelja, usprkos činjenici da u broju vrsta ne konkuriraju ostalim zaštićenim područjima. Primjerice, procjena je da tijekom razdoblja «navale» posjetitelja svako od tih dva područja ima između 5000 i 10000 posjetitelja. Komunikacija s posjetiteljima se u ta dva zaštićena područja odvija putem edukacije, interpretacije, kampanja, događanja… Zbog mogućnosti utjecaja na velik broj posjetitelja raznih ciljanih skupina, uključujući i osobe s posebnim potrebama, edukativna, interpretativna i turistička funkcija je značajna u ta dva područja. U ovom radu dani su primjeri i rezultati nekih interpretativnih programa.

INTERPRETATION IN URBAN PROTECTED AREAS

S. Malić-Limari[1] and B. Janev Hutinec[2]
[1]Public institution Nature park "Medvednica", Bliznec bb, HR-10000 Zagreb, Croatia (park.prirode.medvednica@zg.t-com.hr), [2]Public Institution "Maksimir", Maksimirski perivoj bb, HR-10000 Zagreb, Croatia (strucnivoditelj@park-maksimir.hr)

For the first time in history more people live in urban areas than in the countryside. Their attitudes towards biodiversity in general may be significantly affected by making them aware of the wild species and ecosystems found in their immediate environment. For an increasing number of people personal contacts with biodiversity takes place only in urban areas. Protected areas near urban communities are places where it is necessary to provide increased

opportunities for citizens to contact nature and «use» its benefits. The majority of urban population of Croatia gravitates towards Nature Park Medvednica and Park Maksimir, as well as large number of tourist which visit continental part of Croatia, mainly Zagreb. These two PA's are important for nature protection in Croatia due to pronounced function of communication with public because of a large number of visitors, regardless of the fact that in number of species they don't compete with other protected areas. For example, assessment is that during "rush periods" each of these two PA's daily have between 5000 and 10 000 visitors. Communication with visitors in these two Parks stands for education, interpretation, campaigns, events…Because of the possibility of influencing large number of visitors in different target groups, including persons with special needs, educative, interpretative and touristic functions itself, in these two protected areas, have been imposed as very significant. In this work are given examples and results of some interpretative programs.

OP-62
ŠPILJA VJETRENICA – NAJBOGATIJI PODZEMNI EKOSUSTAV NA SVIJETU

R. Ozimec[1] and I. Lučić[1,2],
[1]Hrvatsko biospeleološko društvo (HBSD), Demetrova 1, HR-10000 Zagreb, Hrvatska (roman.ozimec@zg.t-com.hr), [2]Speleološka udruga Vjetrenica-Popovo polje, 88370 Ravno, Bosna i Hercegovina (ivo@vjetrenica.com)

Špilja Vjetrenica u Popovom polju predstavlja složeni špiljski sustav dužine 6230 m i najveća je u Bosni i Hercegovini. Kroz nju protječe više vodenih tokova koji formiraju veće vodene akumulacije. Od 1950. godine zaštićena je kao geomorfološki spomenik prirode, a od 1964. godine uređena za turističke posjete. Vjetrenicu 77. godine prvi spominje rimski pisac Plinije stariji u djelu Historia naturalis. Intenzivna istraživanja špilje provode tijekom 20. stoljeća K. Absolon, M. Radovanović, M. Malez, B. Sket i drugi. Od 2000. godine opsežna međunarodna istraživanja organizira Speleološka udruga Vjetrenica-Popovo polje iz Ravnoga, u kojima sudjeluju speleolozi iz Speleološkog odsjeka Planinarskog Društva Sveučilišta Velebit iz Zagreba te biospeleolozi iz Hrvatskog biospeleološkog društva. Špilja je detaljno istražena i topografski snimljena, te se provode zahtjevna ekološka i biospeleološka istraživanja. Za potrebe trajnog monitoringa 2005. godine su na devet unutarnjih i jednu vanjsku lokaciju postavljene sonde za izmjere temperature zraka i vode, relativne vlage zraka, smjera i brzine strujanja zraka te tlaka zraka/vode. U Vjetrenici su utvrđene 183 faunističke svojte, a s 87 špiljskih svojti, 45 troglobionata i 42 stigobionta, špilja je najbogatija u svijetu. Vjetrenica je

tipsko nalazište za čak 34 svojte, od kojih je deset vrsta do sada nađeno samo u Vjetrenici, uključujući tri monotipska roda: Zavalia vjetrenicae (Gastropoda), Troglomysis vjetrenicensis (Crustacea, Decapoda) i Nauticiella stygivaga (Coleoptera, Leptodirini). Predstavljen je popis faune s ekološkim statusom, endemizmom i stupnjem ugroženosti, kao i osnovni ekološki parametri objekta. Potrebna je zaštita cijelog sljevnog područja uz održivo turističko gospodarenje objektom.

THE VJETRENICA CAVE – RICHEST SUBTERANEAN ECOSYSTEM IN WORD

R. Ozimec[1] and I. Lučić[1,2]
[1]Croatian Biospeleological Society (CBS), Demetrova 1, HR-10000 Zagreb, Croatia (roman.ozimec@zg.t-com.hr), [2]Speleological Society Vjetrenica-Popovo polje, 88370 Ravno, Bosnia and Hercegovina (ivo@vjetrenica.com)

Vjetrenica Cave in Popovo polje is a complex underground system 6230 m long, biggest in Bosnia & Herzegovina. In the Cave several water flows formed bigger water accumulations. It is legally protected as Geomorphological Nature Monument since 1950 and since 1964 is arranged for tourists. First time Vjetrenica is mentioned by Pliny the Elder in his work Historia naturalis in 77 AD. Intensive researches of Vjetrenica start in 20 century by work of K. Absolon, M. Radovanović, M. Malez, B. Sket and other. Since 2000, extensive international research are organised by Speleological Society Vjetrenica-Popovo polje from Ravno, with participation of Speleological section of University Mountaineering Club Velebit from Zagreb and Croatian Biospeleological Society. The Cave is researched and topographically surveyed and complexly ecologically and biospeleologicaly surveyed. In 2005, on nine locations inside Cave and one outside, stations for permanent monitoring are located. They measure air and water temperature, same as air humidity, direction and speed of air flow and air/water pressure. In Vjetrenica, 183 faunistic taxa are detected, 87 of them cave-dwelling, 45 troglobitic and 42 stygobitic, what make Cave richest in the word. Vjetrenica is typical location for 34 taxa, 10 of them found only here, included three monotypic genus: Zavalia vjetrenicae (Gastropoda), Troglomysis vjetrenicensis (Crustacea, Decapoda) and Nauticiella stygivaga (Coleoptera, Leptodirini). Fauna list is given along with ecological status, endemism and endangerment level for all species. Described are basic cave ecological parameters. Protection of the whole drainage area along with sustainable management of the cave is necessary.

OP-63

USPIJEVANJE PROVENIJENCIJA DUGLAZIJE (*Pseudostsuga menziesii* (MIRB.) FRANCO) U SREDIŠNJOJ HRVATSKOJ

S. Perić, J. Medak i I. Pilaš
Šumarski institut Jastrebarsko, Cvjetno naselje 41, HR-10450 Jastrebarsko (sanjap@sumins.hr)

Zelena duglazija pripada među najproduktivnije i gospodarski najinteresantnije vrste šumskog drveća u SAD. Zbog široke ekološke valencije i adaptabilnosti ta vrsta je unesena u prvoj polovici 19. stoljeća i u Europu. Europski šumari posvetili su veliku pozornost proučavanju njenih brojnih provenijencija jer je poznavanje uspijevanja pojedinih provenijencija presudno kod unosa šumske vrste na područja van njezina prirodnog areala. U Hrvatskoj je porastao interes za zelenom duglazijom pokretanjem akcije pošumljavanja slobodnih šumskih i vanšumskih površina 60-tih godina prošlog stoljeća. Pokusi različitih provenijencija zelene duglazije osnovani su na vanšumskim površinama s ciljem istraživanja uspijevanja pojedinih provenijencija u različitim stanišnim uvjetima Republike Hrvatske te pronalaženja adekvatnih provenijencijama (brz rast i prirast, dobra kvaliteta, otpornost na štetnike i dr.) za naše područje. U ovom radu prikazat ćemo rezultate uspijevanja 12 i 14 provenijencija zelene duglazije starosti 37 godina u terenskim pokusima Paulinovac i Slatki potok (središnja Hrvatska). Domaća provenijencija Buzet (S) je bolja od prosjeka svih provenijencija. Od izvornih sjevernoameričkih provenijencija najbolje su one iz obalnog područja savezne države Washington s nižih nadmorskih visina.

GROWTH OF DOUGLAS FIR PROVENANCES (*Pseudostsuga menziesii* (MIRB.) FRANCO) IN CENTRAL CROATIA

S. Perić, J. Medak and I. Pilaš
Forest Research Institute Jastrebarsko, Cvjetno naselje 41, HR-10450 Jastrebarsko (sanjap@sumins.hr)

Douglas fir is one of the most productive and in economic terms the most interesting species of forest trees in the USA. Due to its wide ecological valence and adaptability, this species was introduced in Europe in the first half of the 19th century. European foresters very attentively studied its numerous provenances being aware of the fact that knowledge of the growth of an individual species is crucial when introducing it in areas out of its natural distribution. In Croatia the afforestation drive in the 60s of the last century gave

rise to an ever increasing interst in douglas fir.Trials of various provenances of douglas fir are established in non-forest areas in order to examine the growth of individual provenances in various stand conditions of the Republic of Croatia as well as to find adequate provenances for our region (fast growth and increment, good quality, resistance to diseases etc.). In this paper we are going to report on growth results of 12 and 14 provenances of 37 year old douglas fir in field trials Paulinovac and Slatki potok (Central Croatia). Local provenance Buzet (S) is better than the average of all the provenances. Among the original North American provenances those belonging to the coastal area of the Federal State of Washington from lower heights above sea-level are considered to be the best.

OP-64

ZAŠTITA VUKA UZ PRIHVAĆANJE SVIH INTERESNIH SKUPINA: IZRADA PLANA UPRAVLJANJA VUKOM U HRATSKOJ

A. Štrbenac[1], Đ. Huber[2], J. Kusak[2], A. Bath[3], A. Majić – Skrbinšek[3], J. Jeremić[1] i S. Desnica[1]
[1]Državni zavod za zaštitu prirode, Savska cesta 41/XXIII, p.p. 50, HR-10144 Zagreb, Hrvatska (ana.strbenac@dzzp.hr, jasna.jeremic@dzzp.hr, sonja.desnica@dzzp.hr), [2]Veterinarski fakultet Sveučilišta u Zagrebu, Zavod za biologiju, Heinzelova 55, HR-10000 Zagreb, Hrvatska (huber@vef.hr, kusak@vef.hr), [3]Memorial University of Newfoundland, Department of Geography, St. John's, Newfoundland, Canada, A1B 3X9 (abath@mun.ca,almajic@gmail.com)

Kako pronaći ravnotežu između ekonomskih, ekoloških, socioloških interesa da bi se osiguralo dugoročno očuvanje vuka uz što skladniji suživot s čovjekom? Kao rezultat zabrinjavajućeg stanja populacije vuka u Hrvatskoj, vuk je strogo zaštićen 1995. godine. Ipak, ova odluka nije riješila probleme koji ugrožavaju opstanak vuka. Činjenica da vuk dijeli svoj plijen s čovjekom izazvala je neslaganje lovaca i stočara s novim statusom vuka. Ovom mišljenju priklonili su se i mediji, koji su često prikazivali vuka kao opasnu zvijer te tako pridonosili negativnom stavu javnost prema ovoj životinjskoj vrsti. Unatoč zaštiti, vuka se i dalje nezakonito odstrjeljivalo bez raspolaganja točnim informacijama o ovim slučajevima, jer ih nitko nije želio prijaviti. U cilju rješavanja ovakve situacije, započelo se s pristupom ljudske dimenzije u planiranju upravljanja vukom. Sredstva su osigurana iz LIFE programa Europske komisije, čime je omogućeno održavanje niza radionica na kojima su sudjelovali predstavnici svih interesnih skupina (od lovaca do "zelenih" nevladinih udruga). Istovremeno su se provodile brojne aktivnosti vezane

uz smanjivanje šteta na domaćim životinjama, podizanje javne svijesti i unaprjeđenje znanja o vuku. Plan upravljanja vukom je izrađen kao rezultat napora različitih interesnih skupina, koje su bile spremne poslušati različita mišljenja i zajedničkim radom predložiti moguća rješenja za očuvanje vuka. Ovaj dokument je i službeno usvojen, a uključuje niz mjera za smanjenje postojećih problema, na način koji svi predstavnici interesnih skupina smatraju prihvatljivim.

CONSERVATION OF WOLF THROUGH ACCEPTANCE BY ALL INTEREST GROUPS: DEVELOPMENT OF THE CROATIAN WOLF MANAGEMENT PLAN

A. Štrbenac[1], Đ. Huber[2], J. Kusak[2], A. Bath[3], A. Majić – Skrbinšek[3], J. Jeremić[1] and S. Desnica[1]
[1]State Institute for Nature Protection, Savska cesta 41/XXIII, p.p. 50, HR-10144 Zagreb, Croatia (ana.strbenac@dzzp.hr, jasna.jeremic@dzzp.hr, sonja.desnica@dzzp.hr), [2]Veterinary faculty, University of Zagreb, Biology Department, Heinzelova 55, HR-10000 Zagreb, Croatia (huber@vef.hr, kusak@vef.hr), [3]Memorial University of Newfoundland, Department of Geography, St. John's, Newfoundland, Canada, A1B 3X9 (abath@mun.ca,almajic@gmail.com)

How to find a balance between economical, ecological and sociological interests to ensure a long-term conservation of wolf with as harmonious as possible coexistence with humans? As the result of the alarming status of wolf population in Croatia, the wolf was strictly protected in 1995. However, this decision did not solve the issues that threatened wolf's existence. The fact that wolf shares domestic and wildlife prey with human provoked hunters and livestock breeders to express their dissatisfaction with the new status of the wolf. Media accompanied this opinion and often presented the wolf as a dangerous beast thus reinforcing negative attitudes of the public. Illegal killings of wolves occurred, without accurate data about them, since no one would willingly report such acts. In order to solve this situation, a human dimension approach to the wolf management planning was introduced. The funds were ensured from the European Commission's LIFE Programme, enabling the organization of series of workshops with representatives of all interest groups (from hunters to «green» NGOs). At the same time, a number of activities were implemented to reduce damages to livestock, to raise public awareness and improve knowledge of wolf. The Wolf Management Plan was developed as the result of efforts of many different interest groups, who were willing to listen to different viewpoints and work together to propose possible solutions. The Plan

that includes a set of measures for the reduction of existing conflicts in a way that all interest groups would find acceptable was also officially adopted.

OP-65
FENOTIPSKE OSOBINE HRASTA LUŽNJAKA IZ SJEMENSKIH SASTOJINA HRVATSKE

M. Gradečki-Poštenjak[1] i K. Poštenjak[2]
[1]Šumarski institut, Jastrebarsko, Odjel za opl. i šumsko sjemenarstvo, Cvjetno naselje 41, HR-10450 Jastrebarsko, Hrvatska (marijag@sumins.hr), [2]Veleučilište u Karlovcu, Odjel lovstva i zaštite prirode, Ivana Meštorvića 10, HR-47000 Karlovac, Hrvatska

Tijekom minulih 150 godina površina lužnjakovih šuma u Panonskom području Hrvatske je smanjena za gotovo 80%. Time je značajno umanjen i lužnjakov genetski potencijal. U prošlom stoljeću u lužnjakovim šumama je uočljivo kontinuirano sušenje stabala (ali i čitavih sastojina – Kalje) i izostanak prirodne obnove. Značaj i uloga prirodne obnove lužnjakovih šuma su ogromni i nemjerljivi, kako kroz prirodnu selekciju tako isto i za biodiverzitet. Ispomoć prirodnoj obnovi očituje se u potražnji sve većih količina žira iz sjemenskih sastojina (pola stoljetni indeks iznosi 1100!). Poznata je činjenica da se prirodu teško oponaša. Iz tog je razloga, kroz pola stoljetnu pozitivnu masovnu selekciju izbora i bonitiranja u sjemenskim sastojinama lužnjaka, bar djelomično otklonjen dio mnogih nedostataka „umjetne obnove“. Meliorativnim proredama iz sjemenskih sastojina su odstranjivani fenotipski negativna stabla lužnjaka čime je značajno poboljšana (do 90%) fenotipska struktura lužnjakovih sastojina, a indirektno je utjecano i na poboljšanje (3-5%) njegova genotipa u potomstvu. Sušenje nizinskog brijesta i njegov nestanak iz lužnjakovih šuma u prošlom stoljeću ostavili su trajne negativne posljedice na ekosustav ovih šuma, na njihov biodiverzitet kao i na fenotip lužnjaka. Nekoliko zadnjih zrelih primjeraka nizinskog brijesta u Spačvanskom bazenu sugestivno ukazuju na njegovu ulogu u šumi lužnjaka i njegov utjecaj na kakvoću fenotipa lužnjakovih stabala. Poremećeni ekosustav, narušeni i osiromašeni biodiverzitet lužnjakove šume te njegov lošiji fenotip prepoznatljive su posljedice čovjekova djelovanja osobito zadnje stoljeće.

PHENOTYPICAL CHARACTERISTICS OF PEDUNCLED OAK FROM CROATIAN SEED STANDS

M. Gradečki-Poštenjak[1] and K. Poštenjak[2]
[1] Forest Research Institute, Jastrebarsko, Department of Breeding and

Forest Seed Husbandry, Cvjetno naselje 41, HR-10450 Jastrebarsko, Croatia (marijag@sumins.hr), [2]Polytechnic of Karlovac, Department of Wildlife Management, Ivana Meštrovića 10, HR-47000 Karlovac, Croatia

During the past 150 years an area of Peduncled oak forests in the Pannonian region of Croatia has decreased by almost 80%. Consequently the genetic potential of Peduncled oak has been considerably reduced. In the last century continuous dieback of trees (and complete stands - Kalje) has been noticed in Peduncled oak forests, including absence of natural reforestation. The importance and role of natural reforestation of Peduncled oak forests are enormous and immeasurable, both through natural selection and also for biodiversity. Help for natural reforestation is reflected in the demand for an increasing amount of acorn from seed stands (half-century index amounts to 1100). It is a well known fact that nature is difficult to imitate. For this reason positive mass selection of choice and determination of site classes of Peduncled oak stands, which has been practised for 50 years, has at least partially eliminated some of the many drawbacks of "artificial reforestation". By means of land improvement thinnings from seed stands phenotypical negative Peduncled oak trees were removed which resulted in significant improvement (up to 90%) of phenotypical structure of Peduncled oak stands, and indirectly influenced the improvement (3-5%) of its genotype in progenies. Dieback of lowland Elm and its disappearance from Peduncled oak forests in the last century left permanent negative consequences on the ecosystem of these forests, their biodiversity and on the Peduncled oak phenotype. Several of the latest ripe samples of lowland Elm in the Spačva Basin indicate its role in the Peduncled oak forest and its effect on the quality of the phenotype of Peduncled oak trees. The disturbed ecosystem, disrupted and poor biodiversity of Peduncled oak forests, and its poorer phenotype are recognisable consequences of man's activity, particularly over the past century.

OP-66

PEST VULNERABILITY MATRIX (PVM): A GRAPHIC MODEL FOR ASSESSING THE INTERACTION BETWEEN TREE SPECIES DIVERSITY AND URBAN FOREST SUSCEPTIBILITY TO INSECTS AND DISEASES

I. Laćan and J.R. McBride
University of California, Berkeley, Department of Environmental Science, Policy and Management, 137 Mulford Hall #3114, Berkeley, CA 94720-3114, USA. (ilacan@nature.berkeley.edu, jrm@nature.berkeley.edu)

Low diversity of trees in urban areas, caused by the over-reliance on a few tree species, predisposes the urban forests to mortality due to outbreaks of insects and tree diseases. And although information is available on susceptibility of individual tree species to insects and diseases, it is difficult to determine from such data the overall vulnerability of an urban forest to locally important pests, or to assess the effects of changing tree species composition, or introducing new pests. This project presents a means for rapid graphic display of the interaction between tree species diversity and the susceptibility of the urban forest to insects and diseases. Our model combines tree species data (e.g. an urban tree inventory) and local pest data – using programmed pest-host information – into a matrix (table) showing the susceptibility of the tree population to insects and diseases. The model enables the urban forester to quickly identify (1) the most important pests (widest host range) and (2) the most vulnerable tree species (those susceptible to the greatest number of pests). The model facilitates overall assessment of the cumulative vulnerability of the urban forest by calculating the percentage of trees affected by each insect/disease. The model also allows weighting the tree species data by population size, so that the most numerous tree species are highlighted, and enables evaluation of the effect of future plantings (i.e. adding new tree species) and exotic pests on the cumulative vulnerability of the urban forest.

Posterska priopćenja
Posters

P-126
VIĐENJA SREDOZEMNE MEDVJEDICE (*Monachus monachus*) U HRVATSKOM DIJELU JADRANA S POSEBNIM OSVRTOM NA POPULACIJU PUČINSKIH OTOKA

J. Antolović, M. Antolović, N. Antolović, B. Furlan, Lj. Adamić – Antolović, R. Antolović i I. Čok
Grupa sredozemna medvjedica, Udruga za istraživanje i zaštitu prirode, Krešimirov trg 15, HR-10000 Zagreb, Hrvatska (jasna.antolovic@zg.t-com.hr)

Sredozemna medvjedica (*Monachus monachus*, Hermann 1779) pripada redu perajara (*Pinnipedia)*, porodici tuljana (*Phocidae)*, rodu morskih medvjedica (*Monachus)*. Danas još živi u manjim skupinama po Mediteranu i Atlantiku uz obalu Mauritanije i Maroka. Ukupna populacija broji oko 350 jedinki, i to u manjim izoliranim i ugroženim skupinama, o čijoj se biologiji još uvijek nedovoljno zna. Nekada je u Jadranu obitavala populacija od 64 jedinke, a danas je taj broj drastično smanjen. Cilj šestogodišnjeg (2000. – 2005.) istraživanja je prikupljanje podataka o viđenjima sredozemne medvjedice u hrvatskom dijelu Jadrana, obilazak špilja/staništa, te dobiti uvid u stavove interesnih skupina, radi poticanja suradnje. Postupak pri provođenju je anketa, edukacija/razgovor sa ribarima i ostalim stanovnicima srednjeg i južnog Jadrana. Prikupljeni podaci iz anketnog listića i informativne razglednice (o viđenjima jedinke), te analiza istih omogučava spoznaju zajedničkih stavova prema zaštiti vrste, temeljem kojih možemo upoznati ponašanje jedinke prilikom susreta, te vrijeme zadržavanja/promatranja. Rezultati - Šestogodišnjim sustavnim istraživanjima staništa (51 špilja) pučinskih otoka Jadrana, te njihovim snimanjem, utvrđeno je da medvjedica boravi u njima. Sredozemna medvjedica je prisutna u Jadranskom moru.. Dojave viđenja su bile na području cijelog hrvatskog dijela Jadrana (107 viđenja). Analizom dojava, najčešće je viđena u proljetnim i ljetnim mjesecima, dok u jesenskim i zimskim rjeđe. Veličina i boja viđenih jedinki je različita. Zaključak - Edukativnim metodama/predavanja, djeljenje anketnih listića o viđenjima sredozemne medvjedice, uspjelo se zainteresirati javnost da svoja opažanja vrste javlja. Istovremena viđenja na različitim područjima ukazuju da u Jadranu obitava manja populacija sredozemne medvjedice u dvije kolonije 6-8 jedinki. Materijalni dokazi su fotografije jedinki snimljenim na različitim područjima hrvatskog dijela Jadrana. Zakonske odredbe nisu učinkovite, a veća sigurnost za opstanak vrste je u uspostavljanju posebno zaštićenih područja pučinskih otoka Jadrana.

SIGHTINGS OF THE MONK SEAL ((*Monachus monachus*) IN THE CROATIAN PART OF THE ADRIATIC WITH A SPECIAL REFERENCE TO THE POPULATION OF OPEN-SEA ISLANDS

J. Antolović, M. Antolović, N. Antolović, B. Furlan, Lj. Adamić – Antolović, R. Antolović and I. Čok
The Mediterranean Monk Seal Group, The Association for the research and protection of nature, Krešimirov trg 15, HR-10000 Zagreb,Croatia (jasna.antolovic@zg.t-com.hr)

The monk seal (*Monachus monachus*, Hermann 1779) belongs to the order (*Pinnipedia)*, family (*Phocidae)*, genus (*Monachus)*. It has still been living in groups around the Mediterranean and the Atlantic along the coast of Mauritania and Morocco. The total population is about 350 individuals in smaller isolated and endangered groups, whose biology is still not very well-known. In the Adriatic the population of 64 individuals used to live, but today this number has significantly decreased. The aim of a six-year (2000 – 2005) research is to collect data about the sightings of the monk seal in the Croatian part of the Adriatic, visit caves/habitats and get the insight into the attitude of interest groups, in order to encourage cooperation. The procedure that was used was a survey, education/conversation with fishermen and other inhabitants of the Central and South Adriatic. Collected data from a questionnaire and informative postcard (about the sightings of an individual) and their analyses enable the idea of mutual attitudes towards the protection of the species, based on which we can learn about the behaviour of an individual during an encounter and during its stay/observation. Results – Based on a six-year systematic research of the habitat (51 caves) of open sea islands of the Adriatic, and their shooting, it has been established that a seal lives in them. The monk seal has been present in the Adriatic sea. Reports on sightings were in the area of the whole Croatian part of the Adriatic (107 sightings). By the analyses of reports, it has been mostly seen in spring and summer months and rarely in autumn and winter months. The size and colour of observed individuals was different. Conclusion – by educational methods/lectures, distributing questionnaires on sightings of the monk seal, the public has become interested in reporting their sightings. Simultaneous sightings on several areas indicate that a smaller population of the monk seal lives in the Adriatic in two colonies of about 6-8 individuals. Material evidence are photographs of individuals recorded on various areas of the Croatian part of the Adriatic. Legal regulations are inefficient and a greater possibility for the survival of the species lies in establishing specially protected areas of the open sea islands of the Adriatic.

P-127

PROJEKTI KRAJOBRAZNOG UREĐENJA AUTOCESTA U FUNKCIJI ZAŠTITE BIOLOŠKE I KRAJOBRAZNE RAZNOLIKOSTI

B. Banjad Ostojić i M. Stojan
Zavod za ekološki inženjering, Institut građevinarstva Hrvatske, J. Rakuše 1, HR-10000 Zagreb, Hrvatska (blazenka.banjad@igh.hr, mara.stojan@igh.hr)

Kod planiranja i izrade projekata krajobraznog uređenja velikih infrastrukturnih zahvata kao što su autoceste potrebno je posebno voditi računa o zaštiti sveukupne biološke i krajobrazne raznolikosti. U sustavu uređenja krajobraza u sklopu planiranja, projektiranja i izgradnje autocesta potrebno je osigurati kontinuirani slijed provedbe zaključaka postupka procjene utjecaja na okoliš, odnosno optimalnog uklapanja trase u krajobraz, počevši od idejnog rješenja krajobraznog uređenja u sklopu stručne podloge za ishođenje lokacijske dozvole, pa sve do izvedbenog projekta krajobraznog uređenja. Metodski pristup u kontekstu krajobraznog uređenja infrasturkture autocesta je dvojak: primarno u funkciji zaštite krajobraza, ali i uz uvjet podržavanja njegovog identiteta, odnosno planiranje i projektiranje kroz definiranje oblikovno – estetskih kriterija. Zaštita u užem koridoru autoceste najčešće je sanacijskog karaktera (biološka sanacija krune usjeka, rastrošenih pokosa, pokosa nasipa, portala tunela, devastiranih kontaktnih zona cestovnih objekata, odlagališta materijala i manipulativnih površina) uz krajobrazno uređenje prolaza za životinje, sustava za zaštitu od buke, cestovnih siguronosnih sustava i sustava navođenja, čvorišta i pratećih uslužnih objekata. Intervencije u širem koridoru autoceste koje se odnose na definiranje i oblikovanje karakterističnih krajobraznih uzoraka, migracijskih koridora, kompenzacijskih staništa, mjera zaštite osjetljivih i zaštićenih biljnih i životinjskih vrsta i staništa, tla, kulturno-povijesnih vrijednosti i dr., za sada ostaju najčešće zbog višestruke problematike na planersko-idejnoj razini. Problematici rješavanja krajobraznog uređenja i oblikovanja prostora uz autoceste treba pristupiti na način da predloženi projekti budu rezultat multidisciplinarnog promišljanja stručnih područja zaštite okoliša kako se ne bi narušili dragocjeni krajobrazni resursi prostora Republike Hrvatske i ujedno dobila rješenja očuvanja prostora i optimalnog uklapanja autocesta u prostor.

HIGHWAY LANDSCAPE PLANNING PROJECTS IN FUNCTION OF BIOLOGICAL AND LANDSCAPE DIVERSITY PROTECTION

B. Banjad Ostojić and M. Stojan
Zavod za ekološki inženjering, Institut građevinarstva Hrvatske, J. Rakuše 1, HR-10000 Zagreb, Croatia (blazenka.banjad@igh.hr, mara.stojan@igh.hr)

In the process of planning and making landscape planning projects for considerable infrastructure interventions, such as highways, it is necessary to pay attention to the protection of the overall biological and landscape diversity. In the system of landscape planning, together with planning, project making and highway construction, it is necessary to ensure the continual implementation of the evaluation process conclusions about the influence on the environment. That means that attention must be paid to the fitting of the route to the landscape, starting with the concept design of the landscape planning which includes professional basis for the location permit, and ending with the design for construction of landscape planning. Landscape protection is implemented by defining and evaluation of the state of all units of landscape diversity. Methodic approach in the context of landscape planning of highway infrastructure is two-sided: primarily it is in the function of landscape protection, but only under condition that it supports its identity, which means planning and project making by defining formative-aesthetic criteria. Protection of the narrow highway corridor is mostly improvement – (biological improvement of crown cuttings, slopes, slope banks, tunnel portals, and devastated contact zones of road objects, material repositories and manipulative areas). It is also landscape planning of passes for animals, noise protection systems, road safety systems and guiding systems, highway junctions, supporting service facilities and objects. Interventions in the wide highway corridor (defining and forming of characteristic landscape samples, migration corridors, compensation habitat, measures of protection of delicate and protected plants and animal spices and their habitats, soil, cultural and historical values etc.) are, for many reasons still only in the concept design phase for now. Approach to the landscape planning and forming of the highway area must be made so that the suggested projects are the result of multidisciplinary consideration in all fields of environment protection in order not to harness valuable landscape resources of the Republic of Croatia and at the same time to find solutions for environment preservation and optimal fitting of the highway into the location.

P-128

DJELOVANJE TRIFLURALINA NA KLIJANCE BOSILJKA (*Ocimum basilicum* L.)

K. Batelja[1], N. Ljubešić[2], T. Prebeg[2] i S. Goreta [1]
[1]Institut za jadranske kulture i melioraciju krša, Put Duilova 11, HR-21000 Split, Hrvatska (kristina@krs.hr, smilja@krs.hr), [2]Institut «Ruđer Bošković», Bijenička c. 54, HR-10000 Zagreb, Hrvatska (ljubesic@irb.hr, prebeg@irb.hr)

Toksično djelovanje sredstava za zaštitu bilja nije usmjereno samo na ciljane organizme, nego se ono odražava i na uzgajane kulture, životinje i čovjeka. Trifluralin se standardno koristi kao predsjetveni herbicid u komercijalnoj proizvodnji bosiljka. Cilj ovog rada bio je istražiti djelovanje herbicida trifluralina na klijance bosiljka te utvrditi razlike u osjetljivosti s obzirom na primijenjene koncetracije od 0,0147, 0,147, 1,47 i 14,7 mg a.t. (aktivne tvari) po jedinici površine. Analize klijavosti sjemena i preživljenja klijanaca, mjerenja mase svježe tvari klijanca, te morfološke analize hipokotila, korijena i kotiledona provedene su 11, 14, 18, 20, i 22 dana nakon sjetve, dok su spektrofotometrijske analize plastidnih pigmenata učinjene 10 i 24 dan nakon sjetve. Za svjetlosno- i elektronsko-mikroskopska istraživanja materijal je priređen prema standardnom protokolu, a morfometrijske analize napravljene su pomoću programskog sustava Issa 3.1Vamstek. Utvrđeno je da se s porastom koncentracije trifluralina klijavost, preživljenje i masa svježe tvari klijanaca značajno smanjuju, a korijen, hipokotil i kotiledoni postaju kraći. Elektronsko-mikroskopska istraživanja pokazala su da kloroplasti kotiledona klijanaca posijanih u tretiran supstrat gube karakteristični lećasti oblik te postaju okruglastiji. Istodobno, tilakoidne membrane postaju valovite, a struktura tilakoidnog sistema se reducira. Spektrofotometrijske analize pokazale su da dolazi do povećanja koncentracije klorofila *a*, klorofila *b* te ukupnih karotenoida kod primjenjene veće koncentracije trifluralina.

EFFECTS OF TRIFLURALIN ON SPROUTS OF SWEET BASIL (*Ocimum basilicum* L.)

K. Batelja[1], N. Ljubešić[2], T. Prebeg[2] and S. Goreta[1]
[1]Institute for Adriatic Crops and Karst Reclamation – Split, Put Duilova 11, HR-21000 Split, Croatia (kristina@krs.hr, smilja@krs.hr), [2]Rudjer Bošković Institute, Bijenička c. 54, HR-10000 Zagreb, Croatia (ljubesic@irb.hr, prebeg@irb.hr)

The toxic influence of pesticides affects not only the target organisms, but also cultivated plants, animals and humans. Trifluralin is commonly used pre-sowing herbicide in Sweet Basil commercial production. The aim of this research was to determine influence of Trifluralin on Sweet Basil sprouts regarding to the concentrations used. The Trifluralin was applied at concentrations 0.0147, 0.147, 1.47, and 14.7 mg of active ingredient per area. Analysis of germination and surviving of sprouts, fresh weight measurements of sprouts, and morphologic analysis of cotyledons, root and hypocotyls were conducted at 11, 14, 18 and 20 days after sowing (DAS) while spectrophotometric analysis of plastid pigments was done at 10 and 24

(DAS). For light and electron microscopy the material was prepared using standard methods, morphometrical analysis was conducted with program Issa 3.1 Vamstek. Ultrastructural changes on chloroplasts were observed by electron microscopy. Germination, survival and fresh weight of sprouts were significantly reduced as concentration of was increased, and the same trend was found for root, hypokotil and cotyledons length. Electron microscopy analysis showed that form of chloroplasts from lentil was changed to more round following Trifluralin application. Thylakoide membranes were wrinkled and thylakoid system structure was reduced, as well. Increased concentration of chlorophyll *a*, chlorophyll *b* and carotenoids was measured at 10 and 24 DAS as rate of Trifulrain was raised.

P-129

STATUS UGROŽENOSTI I ZAŠTITE POZNATIH VRSTA FLORE I FAUNE U NACIONALNOM PARKU PLITVIČKA JEZERA

A. Belančić i I. Špoljarić
Znanstveno-stručni centar "Ivo Pevalek", Nacionalni park Plitvička jezera, HR-53231 Plitvička jezera, Hrvatska (anita.belancic@np-plitvicka-jezera.hr, ivanka.spoljaric@np-plitvicka-jezera.hr)

Pregledom rezultata postojećih inventarizacijskih popisa izdvojili smo svojte koje imaju značajnije statuse ugroženosti ili zaštite i to prema: a) Crvenom popisu ugroženih vrsta Hrvatske, b) Dodatcima Direktiva Natura-e 2000 za Hrvatsku i c) Pravilnika o proglašavanju strogo zaštićenih i zaštićenih svojti RH (NN 7/06). U analizu su uključene slijedeće skupine (ukupan br. svojti): vaskularna flora (1.267), sisavci (60), ptice (162), gmazovi (14), vodozemci (12), slatkovodne ribe (8) i danji leptiri (70). U različitim kategorijama ugroženosti, na Crvenom popisu nalazi se: 121 svojta vaskularne flore, 10 leptira, 40 ptica, 1 vodozemac, 2 svojte gmazova, 2 svojte riba, i 25 svojte sisavaca. Ukupno je trinaest je kritično ugroženih vrsta. Određeni broj svojti nalazi se na dodacima Natura-e 2000 (HD Ann.I, BD Ann. I i II): vaskularna flora (8), leptiri (1), ptica (24), vodozemci (1), gmazovi (1) i sisavci (13). Kao vrste posebno vrijedne pažnje izdvojili smo vrste koje se nalaze na sve tri navedene liste i to u najvišim kategorijama ugroženosti: *Ligularia sibirica* (L.) Cass., *Asio flammeus* (Pont.), *Cypripedium calceolus* L., *Circus pygargus* (L.), *Miniopterus schreibersi* (Kuhl, 1817), *Myotis capaccinii* Bonaparte, 1837 i dr. Rezultati ovog rada namijenjeni su definiranju mjera zaštite u upravljanju Parkom.

DEGREE OF THREAT AND CONSERVATION STATUS OF KNOWN FLORA AND FAUNA SPECIES IN PLITVIČKA JEZERA NATIONAL PARK

A. Belančić and I. Špoljarić
Scientific-expert center "Ivo Pevalek", National park Plitvička jezera, HR-53231 Plitvička jezera, Croatia (anita.belancic@np-plitvicka-jezera.hr, ivanka.spoljaric@np-plitvicka-jezera.hr)

By reviewing available inventory lists, we sort out the taxa with significant degree of threat or conservation status, according to: a) Red List of Threatened Plants and Animals of Croatia, b) Natura 2000 Directive Annexes for Croatia and c) Rules on Proclaiming Strictly Protected and Protected taxa of Republic of Croatia. Analysis is conducted on following groups (total nr.of taxa): vascular plants (1.267), mammals (60), birds (162), reptiles (14), amphibians (12), freshwater fish (8) and butterflies (70). Under various threat categories in Red List are: 121 species of vascular plants, 10 species of butterflies, 40 species of birds, 1 species of amphibians, 3 species of reptiles, 2 taxa of freshwater fish and 25 species of mammals. There is total of 13 critically endangered (CR) species. Number of species is also on Natura 2000 Annexes (HD Ann. I, BD Ann. I i II): vascular plants (8), butterflies (1), birds (24), amphibians (2), reptiles (1), and mammals (13). As species of specific significance we extracted those recorded on all three analyzed lists and with higher degree of threat: *Ligularia sibirica* (L.) Cass., *Asio flammeus* (Pont.), *Cypripedium calceolus* L., *Circus pygargus* (L.), *Miniopterus schreibersi* (Kuhl, 1817), *Myotis capaccinii* Bonaparte, 1837 etc. Results of this paper are to be used as basis for conducting conservation measures in Park management.

P-130

MORFOLOŠKA OBILJEŽJA, BIOGEOGRAFIJA I UGROŽENOST OGULINSKE ŠPILJSKE SPUŽVICE *Eunapius subterraneus* SKET I VELIKONJA 1985 (DEMOSPONGIA, SPONGILLIDAE)

H. Bilandžija[1], J. Bedek[1,2], B. Jalžić[1,2], M. Kerovec[1,3] i S. Gottstein Matočec[3]
[1]Hrvatsko biospeleološko društvo, Demetrova 1,HR-10000 Zagreb, Hrvatska (helena_bilandzija@yahoo.com), [2]Hrvatski prirodoslovni muzej, Demetrova 1, HR-10000 Zagreb, Hrvatska (jana.bedek@inet.hr, branko.jalzic@hpm.hr), łZoologijski zavod, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (sgottst@biol.pmf.hr, mkerovec@biol.pmf.hr)

Jedina do sada zabilježena stigobiontska vrsta koljena Porifera je *Eunapius subterraneus* s dvije podvrste *E. subterraneus subterraneus* Sket i Velikonja, 1986 *i E. subterraneus mollisparspanis* Sket i Velikonja, 1986. Od opisa podvrsta, kada su bila poznata tri nalazišta, broj nalaza se povećao te je vrsta zabilježena na šest novih lokaliteta. Prva istraživanja nakon opisa vrste 1985. godine provedena su u sklopu projekta "Conservation of *Eunapius subterraneus*, the only underground freshwater sponge in the world", kako bi se analizirala morfološka obilježja i odredila taksonomska pripadnost populacija s novih lokaliteta te razina ugroženosti populacija i staništa. Terenskim istraživanjima sakupljeni su uzorci sa šest lokaliteta, a jedinke su morfometrijski obrađene. Podvrsta *E. subterraneus subterraneus* utvrđena je na tri nova lokaliteta, a podvrsti *E. subterraneus mollisparspanis* je samo potvrđeno nalazište s tipskog lokaliteta. Na dva lokaliteta, Špiljski sustav Đula-Medvedica i Špilja u kamenolomu Tounj, koji se nalaze na Popisu 10 najugroženijih krških fenomena u Hrvatskoj spužve nisu zabilježene. Vrsta *E. subterraneus* se nalazi na Crvenom popisu ugroženih biljaka i životinja Hrvatske. Osim toga, ogulinsko područje, kojim se obuhvaća njen areal, je 2003. godine Karst Waters Institute (Washington, SAD) proglasio jednim od 10 najugroženijih krških ekosustava na svijetu, što govori o nužnosti poduzimanja hitnih mjera zaštite ovog jedinstvenog faunističkog fenomena.

MORPHOLOGICAL CHARACTERISTICS, BIOGEOGRAPHY AND ENDANGERMENT OF OGULIN CAVE SPONGE *Eunapius subterraneus* SKET & VELIKONJA 1985 (SPONGILLIDAE, DEMOSPONGIA)

H. Bilandžija[1], J. Bedek[1,2], B. Jalžić[1,2], M. Kerovec[1,3] and S. Gottstein Matočec[3]
[1]Croatian biospeleological society, Demetrova 1,HR-10000 Zagreb, Croatia (helena_bilandzija@yahoo.com), [2]Croatian Natural History Museum,, Demetrova 1, HR-10000 Zagreb, Croatia (jana.bedek@inet.hr, branko.jalzic@hpm.hr), [3]Faculty of Science, University of Zagreb, Rooseveltov square 6, HR-10000 Zagreb, Croatia (sgottst@biol.pmf.hr, mkerovec@biol.pmf.hr)

The only stygobiotic sponge, known up to date, is *Eunapius subterraneus* including two subspecies *E. subterraneus subterraneus* Sket & Velikonja 1986 and *E. subterraneus mollisparspanis* Sket & Velikonja 1986. Since the first description of the species, when only three localities were known, the species was found in six additional localities. This research has been part of the project "Conservation of *Eunapius subterraneus*, the only underground freshwater sponge in the world", and it has been conducted in order to analyse

morphological features and identify newly recorded populations, as well as to examine the current state of habitat quality and population-threatening changes. Samples were collected from six localities and specimens were examined morphometrically. The subspecies *E. subterraneus subterraneus* was recorded in three new localities. Subspecies *E. subterraneus mollisparspanis* was only found at the type locality. In two localities, Cave system Đula Medvedica and Cave in stone-pit Tounj, which are registered in the List of 10 most endangered karst phenomena in Croatia populations were not found. *Eunapius subterraneus* is listed in the Red list of threatened plants and animals of Croatia, and, in addition, Ogulin as a part of distribution area is registered in 2003 as one of 10 most endangered karst ecosystems in the world by Karst waters institute (Washington, USA). These two facts indicate the need for urgent protection measures to save this unique element of Croatian fauna.

P-131
ZAŠTIĆENE PRIRODNE VRIJEDNOSTI NA PODRUČJU GRADA DUBROVNIKA – ZAŠTITA I UPRAVLJANJE

M. Crnčević[1], P. Tutman[2], D. Bojanić[3], N. Glavić[3] i N. Sudarević[1]
[1]Grad Dubrovnik, Pred Dvorom 1, HR-20000 Dubrovnik, Hrvatska (mcrncevic@dubrovnik.hr), [2]Institut za oceanografiju i ribarstvo, HR-21000 Split, Hrvatska (tutman@izor.hr), [3]Institut za more i priobalje, Sveučilište u Dubrovniku, Damjana Jude 12, HR-20000 Dubrovnik, Hrvatska (niksa.glavic@unidu.hr, dubravka.bojanic@unidu.hr)

Postupak proglašavanja, zaštite i upravljanja zaštićenim dijelovima prirode je složen, a provodi se na lokalnoj, regionalnoj i državnoj razini. Sukladno Zakonu o zaštiti prirode određene su različite kategorije zaštite, a pojedina područja štite se na temelju prostorno-planske dokumentacije. Ciljevi zaštite, kao i način upravljanja pojedinim zaštićenim područjima su različiti, ovisno o stupnju zaštite. Do 2006. na području Dubrovnika proglašeno je 12 zaštićenih prirodnih vrijednosti – zaštićenih područja na ukupnoj površini od oko 50% ukupne površine grada Dubrovnika (zajedno sa zaštićenom površinom akvatorija). Sukladno zakonu postoje različite kategorije zaštićenih područja: posebni rezervat šumske vegetacije (otok Lokrum), spomenik prirode – geomorfološki (Gromačka i Močiljska špilja), značajni krajobraz (Rijeka dubrovačka), park šuma (Velika i Mala Petka, Trsteno - Brsečine, Osmoliš, Gornje čelo i Donje čelo na otoku Koločepu) spomenik parkovne arhitekture (Arboretum Trsteno), spomenik parkovne arhitekture (pojedinačno stablo – dvije platane, Trsteno). Sukladno prostorno-planskoj dokumentaciji određene su mjere zaštite pojedinih krajobraznih i prirodnih vrijednosti. Danas su zaštićena područja

posebno izložena devastaciji uslijed povećanog pritiska na okoliš. Pojedina područja značajno su devastirana tijekom Domovinskog rata, požarima i neplanskom izgradnjom. Tijekom zadnjih godina započeto je nekoliko projekata uređenja, sanacije i protupožarne zaštite, program rekultivacije opožarenih površina i znanstveno istraživački program valorizacije pojedinih zaštićenih prirodnih vrijednosti. Posebno su značajna znanstvena istraživanja u svrhu održivog razvitka, očuvanja bioraznolikosti i staništa ugroženih vrsta na području zakonom zaštićenih prirodnih vrijednosti. Za kvalitetnu zaštitu i upravljanje prirodnim vrijednostima potrebna je suradnja različitih institucija, a temelj je osnivanje javnih ustanova s odgovarajućim stručnim kadrom.

SPECIALLY PROTECTED AREAS IN THE CITY OF DUBROVNIK – PROTECTION AND MANAGEMENT

M. Crnčević[1], P. Tutman[2], D. Bojanić[3], N. Glavić[3] and N. Sudarević[1]
[1]City of Dubrovnik, Pred Dvorom 1, HR-20000 Dubrovnik, Croatia (mcrncevic@dubrovnik.hr), [2]Institute of Oceanography and Fisheries, HR-21000 Split, Croatia (tutman@izor.hr), [3]Institute for Marine and Coastal Research, University of Dubrovnik, Damjana Jude 12, HR-20000 Dubrovnik, Croatia (niksa.glavic@unidu.hr, dubravka.bojanic@unidu.hr)

Proceedings of declaration, protection and management of protected areas is very complex, performing on local, regional and national levels. Different regimes of nature protected areas are defined according to Law on Nature Protection. Some areas are protected according to physical planning documents. The aims of protection and management of protected areas are different, depending on protection level. Up to 2006, 12 areas that make approximately 50% of City of Dubrovnik area (including marine surface area) were proclaimed as protected ones. According to Law, in the City of Dubrovnik there are different categories of nature protected areas: special reserve (Lokrum), natural monument (Gromačka and Močiljska cave), protected landscape (Rijeka dubrovačka), park forest (Velika i Mala Petka, Trsteno - Brsečine, Osmoliš, Gornje čelo and Donje čelo – island of Koločep), horticultural monument (Arboretum Trsteno), horticultural monument (two individual trees-*Platanus orientalis).* According to physical plans protection measures of some natural values and landscape are proposed. Nowadays, nature protected areas are considerably exposed to devastation due to increased pressure on the environment. Consequences of the Independence War, fires and urban development without any plan have significantly destroyed some areas. During last years there have been started a few projects: fire protection, cultivation and forest development and scientific research - valorisation of some

nature protected areas. Sustainable development, preservation of biodiversity and habitats of endangered species in natural protected areas require scientific approach. For appropriate protection and management of natural resources, collaboration of different institution is required. Special public institutions and professionals must manage protected areas.

P-132

ODREĐIVANJE DOBI EUROAZIJSKIH RISOVA (*Lynx lynx*) U HRVATSKOJ PREMA SLOJEVIMA ZUBNOG CEMENTA SJEKUTIĆA

T. Gomerčić[1], J. Barišić[2], M. Vuđan[2], S. Ćurković[3], G. Gužvica[4], M. Đuras Gomerčić[3], D. Pavlović[1], A. Frković[5] i Đ. Huber[1]
[1]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska ([1]tomislav.gomercic@vef.hr, dpavlovic@vef.hr, djuro.huber@vef.hr), [2]Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska, [3]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (martina.duras@vz.htnet.hr), [4]Oikon d.o.o., Institut za primijenjenu ekologiju, Vlade Prekrata 20, HR-10000 Zagreb, Hrvatska (gguzvica@oikon.hr) i [5]Kvarnerska 43, HR-51000 Rijeka, Hrvatska

Jedna od važnijih značajki za pravilno upravljanje zaštićenim životinjskim vrstama je dobna struktura unutar populacije. Da bi odredili dobnu strukturu euroazijskog risa (*Lynx lynx*) korištena je modificirana metoda određivanja starosti jedinki na temelju slojeva zubnog cementa sjekutića. Korišteno je 55 risjih lubanja sakupljenih s područja Hrvatske, iz kojih je izvađen sjekutić, a u jednom slučaju pretkutnjak. Korijeni sjekutića odgovarajuće su histološki obrađeni, a preparati su obojani modificiranom metodom po Hariss-u. Svi sjekutići su pregledani i na temelju tamnih linija u zubnom cementu je utvrđena dob životinja. Najveća utvrđena dob mužjaka je 15 godina, dok je kod ženke 9 godina. Prosječna dob uzorka populacije risova u Hrvatskoj je 5,4 godina. To bi značilo da je populacija risova u Hrvatskoj relativno stara i za opstanak nepovoljna, što može biti i posljedica procjene dobi na trofejnim lubanjama koje u pravilu potječu od starijih životinja. Na lubanji starijoj od jednog stoljeća također je bilo moguće odrediti dob na korijenu četvrtog pretkutnjaka.

AGE DETERMINATION IN EUROASIAN LYNXES (*Lynx lynx*) IN CROATIA BY COUNTS OF INCREMENTAL LINES IN INCISOR TEETH CEMENTUM

T. Gomerčić[1], J. Barišić[2], M. Vuđan[2], S. Ćurković[3], G. Gužvica[4], M. Đuras Gomerčić[3], D. Pavlović[1], A. Frković[5] and Đ. Huber[1]
[1]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (tomislav.gomercic@vef.hr, dpavlovic@vef.hr, djuro.huber@vef.hr), [2]Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia, [3]Department of Anatomy, Histology and Embriology, Faculty of Veterinary Medicine, University of Zagreb (martina.duras@vz.htnet.hr), Heinzelova 55, HR-10000 Zagreb, Croatia, [4]Oikon d.o.o., Institute for Applied Ecology, Vlade Prekrata 20, HR-10000 ZAGREB, Croatia (gguzvica@oikon.hr), [5]Kvarnerska 43, HR-51000 Rijeka, Croatia

The age of individuals in a population is essential in the management of endangered species. The age of Euroasian lynxes (*Lynx lynx*) has been determined by counts of dark stained incremental lines in incisor root cementum. One premolar and 54 incisors have been removed from lynx skulls collected in Croatia. The roots were cut of, histologicaly treated and stained by modified Harris' method. The age has been determined by counting dark lines in tooth cementum for all incisors. The oldest male was 15 years old and oldest female was 9 years old. Average age of examined specimens of Croatian lynx population was 5.4 years. According to that estimation, Croatian lynx population is relatively old and unfavourable for survival. That could be a result of age determination on the trophy skulls that usually come from older animals. A skull older than one century, that presented one of the specimens, was also successfully age determined on fourth premolar root.

P-133

DESET GODINA TRŽIŠNOG UZGOJA BILJAKA OPLEMENJENIH GENETIČKIM INŽENJERSTVOM

S. Jelenić
Hrvatska udruga genetičkih inženjera, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (hugi@zg.biol.pmf.hr, www.hugi.hr)

Godina 2005. obilježava desetgodišnjicu tržišnog uzgoja poljoprivrednih kultura oplemenjenih genetičkim inženjerstvom (GM kultura). Površine zasijane GM kulturama povećane su 50 puta tijekom proteklog desetljeća, od 1,7 milijuna hektara u 1996. na 90 milijuna hektara u 2005. godini. Godine 2005. takve kulture uzgajalo je 8,5 milijuna farmera u 21 državi (SAD, Argentina, Brazil, Kanada, Kina, Paragvaj, Indija, JAR, Urugvaj, Australija, Meksiko, Rumunjska, Filipini, Španjolska, Kolumbija, Iran, Honduras,

Portugal, Njemačka, Francuska i Češka). Najznačajnija GM kultura u 2005. godini bila je soja, koja se uzgajala na 54,4 milijuna hektara, što obuhvaća 60% ukupnih svjetskih površina zasijanih sojom. GM soja uzgaja se u SAD-u, Argentini, Brazilu, Paragvaju, Kanadi, Urugvaju, Rumunjskoj, JAR-u i Meksiku. Druga najraširenija kultura bio je kukuruz, uzgajan na ukupno 21 milijuna hektara u SAD-u, Argentini, Kanadi, JAR-u, Filipinima, Španjolskoj, Urugvaju, Hondurasu, Portugalu, Njemačkoj, Francuskoj i Češkoj. Sljedeće najznačajnije kulture bile su pamuk (uzgajan na 9,8 miljuna hektara; što je gotovo 1/3 ukupne svjetske proizvodnje) i uljana repica (4,7 milijuna hektara ili 18% ukupne proizvodnje). Odgovornim upravljanjem procesima odobravanja i uzgoja GM kultura, temeljenim na znanstvenim spoznajama, izbjegnuti su apokaliptični scenariji proricani od protivnika te tehnologije. Uzimajući u obzir prednosti uzgoja GM kultura te globalna nastojanja u razvijenim i nerazvijenim državama, može se pretpostaviti da će se površine zasijane GM kulturama nastaviti širiti i narednih godina.

TEN YEARS OF COMMERCIAL GROWTH OF GENETICALLY ENGINEERED CROPS

S. Jelenić
Croatian Association of Genetic Engineers, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (hugi@zg.biol.pmf.hr, www.hugi.hr)

The year 2005 marks the first decade of the commercialisation of genetically modified (GM) crops. The global area of GM crops increased more than 50 fold during the ten-year period, from 1.7 million hectares in 1996 to 90 million hectares in 2005. In 2005 GM crops were commercially grown by approximately 8.5 million farmers in 21 countries (USA, Argentina, Brazil, Canada, China, Paraguay, India, South Africa, Uruguay, Australia, Mexico, Romania, Philippines, Spain, Colombia, Iran, Honduras, Portugal, Germany, France and Czech Republic). The principal GM crop in 2005 was soybean occupying 54.4 million has or 60% of global soybean area. It was grown commercially in the USA, Argentina, Brazil, Paraguay, Canada, Uruguay, Romania, South Africa, and Mexico. The second most dominant crop was maize grown at 21 million has in the USA, Argentina, Canada, South Africa, the Philippines, Spain, Uruguay, Honduras, Portugal, Germany, France, and the Czech Republic. The other most important GM crop was cotton, grown at 9.8 million has (almost 1/3 of global cotton area), followed by canola at 4.7 million has or 18% of global area. Various catastrophic outcomes predicted by the opponents of the biotechnology were avoided in the first decade through responsible management of GM crops. Taking all these global developments

in both industrial and developing countries into account, the outlook for the next decade points to continued growth in the global hectarage of GM crops.

P-134

KARTIRANJE PROLJETNOG DRIJEMOVCA (*Leucojum vernum* L) , OBIČNE KOCKAVICE (*Fritillaria meleagris* L.) I KEBRAČA (*Myricaria germanica* (L.) DESV.

Ž. Lukša[1], M. Rašan[2] i T. Bartolić[3]
[1]Gimnazija, V.Nazora 34, HR-40000 Čakovec, Hrvatska, (zaklin.luksa@ck.t-com.hr), [2]Srednja škola, Prelog, Hrvatska, (miso.rasan@ck.htnet.hr), [3]PBF, Sveučilište u Zagrebu, studentica

Nedostatne informacije o nekim vrstama na području Međimurja, čak i u Crvenoj knjizi, ponukale su nas na ovo istraživanje. Za to smo izabrali tri vrste koje u Crvenoj knjizi nisu navedene u Međimurju, a iz naših dosadašnjih obilazaka terena znamo da su tu zastupljene. To su proljetni drijemovac (*Leucojum vernum L.),* obična kockavica (*Fritillaria meleagris L.)* i kebrač (*Myricaria germanica (L.) Desv).* Istraživanje je provedeno od 1999. do 2005. godine. Anketiranjem učenika Gimnazije u Čakovcu prikupili smo podatke o mogućim lokacijama navedenih vrsta. Nakon obilaska terena utvrdili smo na kojim lokalitetima te vrste stvarno postoje i izvršili kartiranje lokaliteta GPS-om. Na nekim lokacijama označili smo ispitne površine i određivali brojnost, pokrovnost i socijalnost po metodi Braun- Blanquet. Zabilježili smo lokacije proljetnog drijemovca koji je u Crvenoj knjizi iz 1994. godine označen kao osjetljiva vrsta (VU) dok 2005. više nije naveden. Njegova brojnost smanjuje se unutar istraživanog razdoblja. Kartirano je i nekoliko lokacija obične kockavice koja je 1994. godine u Crvenoj knjizi navedena kao ugrožena vrsta (E), a 2005. kao kritično ugrožena vrsta (CR). Kartirali smo i dvije lokacije kebrača koji je također od ugrožene vrste (E) 1994. godine promijenio status u kritično ugroženu vrstu (CR) 2005. Na jednom od kartiranih staništa zabilježen je rast brojnosti kebrača no najčešći uzrok nestajanja ove vrste, kao i kod obične kockavice, je uništavanje staništa ljudskom djelatnošću.

CHARTING OF THE *Leucojum vernum* L., THE *Fritillaria meleagris* L. AND THE *Myricaria germanica* (L.) DESV.

Ž. Lukša[1], M. Rašan[2] and T. Bartolić[3]
[1]Gymnasium, V. Nazora 34, HR-40000 Čakovec, Croatia (zaklin.luksa@ck.t-com.hr), [2] High School, HR-42320 Prelog, Croatia, miso.rasan@ck.htnet.

hr, [3]Faculty of Food Technology and Biotechnology, University of Zagreb, student

The lack of information about the great number of vegetable species in Međimurje (the region in the north-west of Croatia) inspired us for this research. Among the species which can be found in the Red book and haven't been mentioned in the region of Međimurje , we have chosen the spring snow-flake (*Leucojum vernum L.),* guinea hen-flower (*Fritillaria meleagris L.)* and *Myricaria germanica (L.) Desv.* The research lasted from 1999 until 2005. By means of questionnaire among the students of our school, we have collected the facts about the locations and then we charted the locations of the mentioned species by GPS, estimated their number, coverage and sociability using the Braun- Blanquet method. We have charted seven locations of the spring snow-flake (*Leucojum vernum L.)* , which has been mentioned in the Red book from 1994 as a vulnerable species (VU). In the Red book from 2005 it isn't mentioned. Its number has been obviously decreased on some locations during the research period. We also searched seven guinea hen-flower locations. In 1994 it was categorized as the endangered species (E), and in 2005 it was critically endangered (CR). In our research the number of the guinea hen- flower has declined on the most locations comparing with the number from the very first year. All locations are near the river Mura and the spring Trnava. Two locations of *Myricaria germanica (L.) Desv.* which was an endangered species in 1994 (E) and in 2005 a critically endangered species (CR) have been charted. The main cause of their disappearance is that human activity is destroying their locations. Our data about its number on the remained locations do not prove this since on one location we measured the increase in its number.

P-135

ZAŠTITA KLOŠTARSKIH PIJESAKA

A. Partl i V. Posavec Vukelić
Državni zavod za zaštitu prirode, Savska cesta 41/XXIII, 10 000 Zagreb, Hrvatska (anamarija.partl@dzzp.hr, vida.posavec@dzzp.hr)

Kloštarski pijesci su posljednji ostaci nekad prostranih panonskih pijesaka. Pijesci sa prirodnom pješčarskom vegetacijom ubrajaju se među najugroženije tipove staništa na nacionalnoj, ali i europskoj razini, te se kao prioritetna staništa nalaze na Dodatku I Direktive o staništima. Zbog toga je ovo područje jezgra preliminarne Nacionalne ekološke mreže te će zbog svoje međunarodne važnosti biti dio hrvatskog prijedloga za europsku ekološku mrežu NATURA

2000. Biološku vrijednost Kloštarskih pijesaka čini rijetka i endemična biljna zajednica *Corynephoro-Festucetum vaginatae* Soklić 1943. U literaturi je na ovom lokalitetu zabilježeno deset kritično ugroženih biljnih vrsta, ali se za neke pretpostavlja da su danas potpuno nestale sa ovoga područja. Mikološka istraživanja su pokazala da je ovaj lokalitet od iznimne važnosti za očuvanje bioraznolikosti gljiva Hrvatske. Zabilježeno je pet kritično ugroženih i dvije ugrožene vrste gljiva. Neke od tih vrsta gljiva u Hrvatskoj pronađene su jedino na ovom području. Ovo, sa stanovišta zaštite prirode izrazito vrijedno područje, u Hrvatskoj je pred nestajanjem. Komercijalno iskapanje pijeska na ovom lokalitetu konstantno smanjuje njegovu površinu napredujući sa sjevera. Povrh toga, događa se i povremeno neovlašteno iskapanje pijeska za privatne potrebe na još sačuvanom dijelu staništa. U blizini najočuvanijeg dijela staništa nalazi se i odlagalište otpada. Prirodna vegetacijska sukcesija također prijeti nestajanju psamofitskih vrsta. Područje je predloženo je za zakonsku zaštitu u kategoriji posebnog rezrvata. Nužnima smatramo hitnu primjenu aktivnih mjera zaštite - ciljana biološka i socioekonomska istraživanja, edukaciju lokalnog stanovništva te izradu i provođenje akcijskog plana očuvanja ovoga područja.

PROTECTION OF KLOŠTAR SANDS

A. Partl and V. Posavec Vukelić
State Institute for Nature Protection, Savska cesta 41/XXIII, HR-10000 Zagreb, Croatia (anamarija.partl@dzzp.hr, vida.posavec@dzzp.hr)

Kloštar sands are last remains of once widely spread Pannonic sands. Sands with natural psamophytic vegetation are amongst the most threatened habitat types on national and European level and are thus listed as priority habitat type on Annex I of the Habitats Directive. Therefore, this site is designated as a core area of preliminary National Ecological Network and will, due to its international importance, be a part of the Croatian proposal for European ecological network NATURA 2000. Biological value of Kloštar sands lies in rare and endemic plant community *Corynephoro – Festucetum vaginatae* Soklić 1943. In literature ten critically endangered plant species have been recorded for this area, most of which are assumed to be extinct from this site today. Mycological research has shown great importance of Kloštar sands for conservation of mycological diversity of Croatia. Five critically endangered and two endangered fungi species have been recorded here and for some of them this is only known locality in Croatia. This, from the nature conservation aspect, extremely important area is near its extinction in Croatia. Commercial sand excavation at this locality constantly decreases its surface. Additional

problem presents occasional unauthorized sand extraction on still preserved part of the habitat. Furthermore, in the vicinity of the most valuable part of the habitat local landfill is situated. Natural vegetation succession also represents a threat to psamophytic species. Area is proposed for legal protection in the category of special reserve. Urgent implementation of active conservation measures is necessary – targeted biological research, education of local community and development and implementation of management plan.

P-136
DOBNA I SPOLNA STRUKTURA VUKOVA U HRVATSKOJ

D. Pavlović[1], T. Gomerčić[1], G. Gužvica[2], Đ. Huber[1] i J. Kusak[1] i S. Ćurković[3]
[1]Zavod za biologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (dpavlovic@vef.hr, tomislav.gomercic@vef.hr, huber@vef.hr, kusak@vef.hr), [2]Oikon d.o.o., Institut za primijenjenu ekologiju, Vlade Prekrata 20, HR-10000 Zagreb, Hrvatska (gguzvica@oikon.hr), [3]Zavod za anatomiju, histologiju i embriologiju, Veterinarski fakultet Sveučilišta u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska

Podaci o smrtnosti sivih vukova (*Canis lupus*), dobiveni putem sustavnog prikupljanja lešina te zbrinjavanjem njihovih kostura, preduvjet su za istraživanje biologije ove vrste, od kojih su saznanja o dobnoj i spolnoj strukturi osnova populacijskih istraživanja. Metode kojima smo odredili dob vukova u ovom radu primjenjive su i na vrijednim muzejskim zbirkama lubanja, jer ne narušavaju njhov vanjski izgled. Istražene lubanje (N=34) potjecale su od vukova stradalih na području Hrvatske u razdoblju 1996-2004. godine i čuvanih u zbirci kostiju Zavoda za Biologiju Veterinarskog fakulteta u Zagrebu. Dob 22 vuka određena je prema broju cementnih linija u korijenu zuba izbrojanih na histološkom preparatu obojanon modificiranom metodom po Harrisu. Dob ostalih 12 vukova je određena prema morfološkom izgledu i stupnju sraštenja kostiju lubanje. Utvrđena dob vukova izražena je u godinama i mjesecima. Raspon dobi kretao se od 3 mjeseca do 8 godina i 9 mjeseci, a prosječna dob iznosila je 21.9 mjeseci ili blizu 2 godine. Prilikom obrade podataka vukovi su razvrstani u devet dobnih kategorija. Najviše vukova pripadalo je dobnoj kategoriji 0-1 godina (44.1%) i dobnoj kategoriji 1-2 godina (26.5%). Ukupno 70.5% (N=24) pregledanih lubanja je pripadalo vukovima u dobi do dvije godine života. Spol vukova određen je pregledom lešina prikupljenih životinja. Dvanaest lubanja pripadalo je mužjacima, 15 ženkama, a sedam vučjih lubanja bio je nepoznatog spola Najviše mužjaka (N=7) pripadalo je dobnoj kategoriji 0-1 godina, dok dobnoj kategoriji 1-2 godina pripada bilo najviše ženki (N=5).

AGE AND SEX STRUCTURE OF WOLVES IN CROATIA

D. Pavlović[1], T. Gomerčić[1], G. Gužvica[2], Đ. Huber[1], J. Kusak[1] and S. Ćurković[3]
[1]Department of biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, HR-10000 Zagreb, Croatia (dpavlovic@vef.hr, tomislav.gomercic@vef.hr, huber@vef.hr, kusak@vef.hr), [2]Oikon d.o.o., Institute for Applied Ecology, Vlade Prekrata 20, HR-10000 Zagreb, Croatia (gguzvica@oikon.hr), [3]Department of Anatomy, Histology and Embriology, Heinzelova 55, HR-10000 Zagreb, Croatia

Data on gray wolf (*Canis lupus*) mortality, collected by systematic gathering of dead wolf bodies and preserving their skeletons, are one of the key ways of studding their biology, especially the age and sex population structure. Methods used for age determination could be used on museum specimens as they do not ruin the skull structure. The examined skulls (N=34) originated from wolves that died due to various reasons in the period 1996-2004 and are deposited in the collection of the Biology Department of the Veterinary Faculty in Zagreb. Age of 22 wolves has been determined by counting the cementum lines around the tooth root on histological slides stained by modified Harris method. The age of the remaining 12 wolves was decided by examination of the skull morphology including the stage of bone fusion. The determined ages were expressed in years and months. The range was from 3 months to 8 years and 9 months, and the mean was 21.9 months or nearly 2 years. We distributed the wolves in 9 age categories. Most fell in the first two categories: from 0-12 months (44.1%), and from 13 to 24 months (26.5%), making a total of 70.5% (N=24) in the first two years of life. The sex was determined during the pathological examination of the bodies. Twelve skulls belonged to males, 15 to females, and 7 were of unknown sex. Most males (N=7) were in the age category of 0-1 year, while most dead females were in the age of 1-2 years (N=5).

P-137

POLAZIŠTA ZA UPRAVLJANJE POSEBNIM REZERVATOM PANTAN

G. Piasevoli
Javna ustanova za upravljanje zaštićenim prirodnim vrijednostima na području Splitsko-dalmatinske županije, Prilaz braće Kaliterna 10, HR-21000 Split, Hrvatska (gvido.piasevoli@dalmatian-nature.hr)

Posebni rezervat Pantan je priobalna boćata močvara, pored grada Trogira.

Cilj je osmisliti plan upravljanja rezervatom, kako bi se održala sadašnja razina bioraznolikosti, i eventualno povećala, te uskladiti zaštitu s ljudskim aktivnostima. Temeljem višegodišnjeg monitoringa i uočavanja specifičnosti Pantana, te primjenom općih načela upravljanja zaštićenim područjima, kao rezultat su se iskristalizirala slijedeća polazišta: smanjiti kretanje ljudi u nekim dijelovima rezervata i u nekim razdobljima podjelom rezervata na zone i djelomičnim ograđivanjem nekih zona; precizirati dopuštene ljudske aktivnosti, te mjesto i način njihova provođenja; izraditi studiju dinamike morskog i riječnog nanosa, koji je ključan za održavanje lagune i sprudova; razmotriti mogućnosti obnove dijelova degradirane bivše močvarne površine; proširiti zaštitu na dio priobalnog mora; razmotriti mogućnosti ciljanih specifičnih mjera za poticanje gniježđenja pojedinih u Hrvatskoj ugroženih ptičjih vrsta, kojima ekološki uvjeti Pantana načelno odgovaraju; nakon početka provođenja ovako osmišljenog upravljanja, organizirati monitoring ciljanih životinjskih i biljnih vrsta. Efekti ovako osmišljenog upravljanja Pantanom moći će se vidjeti nakon dvije-tri godine od početka provođenja većeg dijela predloženih smjernica, a najveća promjena očekuje se kod ornitofaune.

STARTING POINTS FOR THE PANTAN SPECIAL RESERVE MANAGEMENT

G. Piasevoli
Public Institution for the Protected Natural Values Management in the County of Split and Dalmatia, Prilaz braće Kaliterna 10, HR-21000 Split, Croatia (gvido.piasevoli@dalmatian-nature.hr)

Pantan special reserve is a coastal brackish marsh, near the town of Trogir. The aim is to give meaning to the management plan for the reserve, in order to maintain the present level of biodiversity, and to raise it eventually, and to harmonize nature conservation with human activities. On the basis of multi-year monitoring and noting the specific qualities of Pantan, and implementation of general principles of protected areas management, following starting points were crystallized: to reduce human presence in some parts of the reserve and in some periods by the partition of the reserve to zones and by partial fencing of some zones; to specify allowed human activities and places and ways of their execution; to make a study of the dynamics of sea and river sediment; to consider the possibilities of restoration of some parts of degradated former marshy land; to widen the protected area to the part of coastal marine area; to consider the possibilities of the aimed specific measures for the stimulating of nesting of some bird species, which are endangered in Croatia, and ecological conditions of Pantan are adequate for them; to organise monitoring of the

aimed animal and plant species, after the beginning of the implementation of such management. The effects of such management of Pantan will be visible after two or three years from the beginning of implementation of the majority of these measures, and the biggest change is expected in avifauna.

P-138

PILOT PROJEKT ZAŠTITE I UPRAVLJANJA POSEBNIM BOTANIČKIM REZERVATOM "CRET DUBRAVICA"

J. Stritih[1], Ana Štrbenac[2], V. Posavec Vukelić[2], M. Gluhaković[2] i V. Hršak[3]
[1]Oikos, Svetovanje za razvoj d.o.o., Jarška 30, 1230 Domžale, Slovenija (jernej.stritih@oikos.si), [2]Državni zavod za zaštitu prirode, Savska cesta 41/XXIII, p.p 50, HR-10144 Zagreb, Hrvatska (ana.strbenac@dzzp.hr, vida.posavec@dzzp.hr, maja.gluhakovic@dzzp.hr), [3]Prirodoslovno-matematički fakultet Sveučilišta u Zagrebu, Zavod za botaniku, Marulićev trg 20/II, HR-10000 Zagreb, Hrvatska (vhrsak@lipa.botanic.hr)

Cretovi spadaju među najrjeđa i najugroženija staništa u Hrvatskoj, a također se nalaze i na Dodatku I Direktive o staništima EU. Malih su površina, ali izuzetno važni u botaničkom, faunističkom i mikološkom smislu.
Cret Dubravica nalazi se u šumi nedaleko od naselja Dubravica, kraj Zaprešića. Zaštićen je 1966. godine kao botanički rezervat. Od vremena zaštite rezervata do prije par godina rezervatom se nije upravljalo te je on doživio znatne promjene uz gubitak osnovnih obilježja na većem dijelu površine. Čak 65% površine je obraslo šumom johe (*Alnus glutinosa*) i krkavine (*Frangula alnus*). Recentna istraživanja pokazuju da je vrijednost creta izuzetna i na području faune člankonožaca kao i gljiva. Područje je po svojim značajkama i vrijednostima predloženo u popis NATURA 2000 područja u Hrvatskoj. U okviru CARDS projekta Institucionalno jačanje Državnog zavoda za zaštitu prirode, predviđeno je pilot projektom razviti mehanizme učinkovite zaštite ovog lokaliteta. Kako do sada ovim zaštićenim područjem upravljanje nije bilo temeljeno na planu upravljanja, aktivnostima u okviru ovog projekta želi se razviti aktivan, osmišljen, dionički, znanstveno utemeljen i opće prihvaćen način zaštite, upravljanja i korištenja malih NATURA 2000 područja uz uključenje svih relevantnih sudionika i korištenje svih postupaka prikupljanja podataka, praćenja, održavanja i interpretacije zaštićenog područja. Mala površina lokaliteta, uz suradnju s lokalnom zajednicom koja je već iskazala interes za sudjelovanje na ovom projektu, omogućava efektivno upravljanje i s ograničenim financijskim sredstvima. Početni zahvati na upravljanju rezervatom pokazuju dobre rezultate u smislu revitalizacije ovog staništa.

PILOT PROJECT FOR CONSERVATION AND MANAGMENT OF THE SPECIAL BOTANIC RESERVE "BOG DUBRAVICA"

J. Stritih[1], Ana Štrbenac[2], V. Posavec Vukelić[2], M. Gluhaković[2] and V. Hršak[3]
[1]Oikos, , Development Consulting ltd., Jarška 30, 1230 Domžale, Slovenia (jernej.stritih@oikos.si), [2]State Institute for Nature Protection, Savska cesta 41/XXIII, p.p. 50, HR-10144 Zagreb, Croatia (ana.strbenac@dzzp.hr, vida.posavec@dzzp.hr, maja.gluhakovic@dzzp.hr), [3]Faculty of Science, University of Zagreb, Department of Botany, Marulićev trg 20/II, HR-10000 Zagreb, Croatia (vhrsak@lipa.botanic.hr)

Bogs are some of the most rare and threatened habitats in Croatia. They are also listed in teh Annex I of the EU Habitats Directive. They cover small surfaces but they are of high importance in terms of flora, fauna and fungi.
Bog Dubravica is located in a forest close to the village Dubravica, near Zaprešić. In 1966 it was designated a special botanic reserve. From its designation until a few years ago the site was not managed which resulted in significant change of on most of its surface. More than 65% of the surface turned to forest of alder (*Alnus glutinosa*) and lossy buckthorn (*Frangula alnus*). Recent research shows that the bog is of exceptional importance also for arthropod fauna and fungi. The site has accordingly been proposed for inclusion on the Natura 2000 list for Croatia. In the framework of the CARDS project Institutional Strengthening of the State Institute for Nature Protection a pilot project is planned to develop and demostrate mechanisms of effective conservation of this site. The project aims to develop an active and widely supported mode of conservation and use of small Natura 2000 sites based on objectives, stakeholder cooperation and scientific knowledge, involving all relevant stakeholders and applying the porocedures of invenorying, monitoring, maintenance and interpretation. Small size of the site combined with the willingness of the local community for active participation provides an opportunity for effective management with limited resources. Initial activities have already given positive results for revitalisation of the bog.

P-139
ZDRAVLJE PTICA, LJUDI I OKOLIŠA

K. Vlahović[1], E. Prukner Radovčić[2], M. Pavlak[1] i G. Gregurić Gračner[1]
[1]Zavod za biologiju, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska, (vlahovic@vef.hr; mpavlak@vef.hr, gordana.greguric.gracner@vef.hr), [2]Zavod za bolesti peradi s klinikom, Veterinarski fakultet, Sveučilište u Zagrebu, Heinzelova 55, HR-10000 Zagreb, Hrvatska (estela.prukner.radovcic@vef.hr)

U ovom preglednom radu razmatrana je mogućnost prijenosa i širenja nekih mikroorganizama s populacijama migratornih vrsta ptica. Migracija populacija nekih vrsta ptica biološki je fenomen, ali i jedan od glavnih epizootioloških činbenika širenja uzročnika bolesti, kao unutar jedne vrste, tako i između različitih vrsta ptica, gospodarski iskoristivih životinja i ljudi. Ptice se uključuju u širenje mikroorganizama putem tri mehanizma u kojima se pojavljuju kao: a) biološki nosioci uzročnika, ako se uzročnici umnažaju u njihovom organizmu; b) mehanički prenosioci, ako uzročnika nose na sebi (npr. spore gljivica) ili u sebi (pasaža kroz probavni sustav i c) nosioci zaraženih hematofagnih ektoparazita. Mnoge vrste mikroorganizama i to primarno virusi kao uzročnici više vrsta encefalitisa virusne etiologije (npr. *Eastern i Western equine encephalomyelitis,* West Nile, *St. Louis encephalitis* , *Japanese encephalitis virus*, i dr.), bakterije *Chlamydophila psittaci, Anaplasma phagocytophilum, Campylobacter jejuni, Salmonella enterica, Mycobacterium avium*, gljivice *Candida* spp., zajedničke su populacijama divljih ptica i toplokrvnim kralješnjacima, uključujući i ljude. Za veterinarsku medicinu veliko značenje imaju one zaraze ptica koje se brzo šire i nose velike gospodarske štete s posljedicama vrlo opasnim po zdravlje ljudi. Svrha ovoga prikaza je razmotriti mogućnosti prijenosa, ali i mjere ograničavanja razine ugroženosti populacija ptica, smanjenjem utjecaja patogenih mikroorganizama tamo gdje postoji razvidno da oni izravno utječu na zdravlje populacije ptica i ljudi. Razmatrat će se i različiti biotički i abiotički čimbenici iz okoliša koji djeluju na preživljavanje patogenih uzročnika u nekom ekosustavu i pogoduju uspješnosti širenja bolesti i zaražavanja ptica, gospodarski iskoristivih životinja i ljudi.

HEALTH OF BIRDS, HUMANS AND ENVIRONMENT

K. Vlahović[1], E. Prukner Radovčić[2], M. Pavlak[1] and G. Gregurić Gračner[1]
[1]Department of Biology, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, RH-10000 Zagreb, Croatia (vlahovic@vef.hr; mpavlak@vef.hr, gordana.greguric.gracner@vef.hr), Department of Avian Diseases, Faculty of Veterinary Medicine, University of Zagreb, Heinzelova 55, RH-10000 Zagreb, Croatia (estela.prukner.radovcic@vef.hr)

This paper considers the transmission and dissemination possibilities of some microorganisms spreading by migratory birds. Birds′ migration, representes a biological phenomena. They are also one of the main epizootiological factor for pathogenic microorganisms which spread within one species as well as among different species of birds, economically usable animals and among humans. Birds spread microorganism by three mechanisms they are involved in: a)

as biological carriers of an agent (agent reproducts in birds′ organism); b) as mechanical carriers of an agent (the agent is located on the surface of the birds′ body (e.g. spores of fungies) or in the birds′ body (e.g. the agent passes trough the digestive tract); c) as carrier of infected hematophagus ectoparasites. A lot of species of microorganisms, primarly viruses as agents of encephalitises caused by viruses (e.g. *Eastern i Western equine encephalomyelitis*, *West Nile, St. Louis encephalitis, Japanese encephalitis virus, etc.),* bacterias *Chlamydophila psittaci, Anaplasma phagocytophilum, Campylobacter jejuni, Salmonella enterica, Mycobacterium avium*, fungies *Candida* spp, are common for wild birds′ migratory population and for homeotermic vertebrates including humans. The main area of interest for veterinary medicine are the birds′ infectious diseases which spread very fast causing great economic damages which have conseqences on the health of human beings. In addition to that, the aim of this paper is to consider transmission possibilities, as well as presentation of measures for reducing the levels of the influence of pathogenic microorganisms which endanger bird popultions. This is very important in areas where they obviously have a great influence on the health of birds and humans. The paper will also consider different biotic and abiotic factors from enviroment which affect the survival of pathogenic agents in some ecosystem and which are important for infectious diseases spreading within birds′ population, economically usable animals and humans.

P-140

TLA CRNIKINIH ŠUMA ISTRE I KVARNERA

B. Vrbek, I. Pilaš i T. Dubravac
Šumarski institut, Jastrebarsko Odjel za ekologiju i uzgajanje šuma, Trnjanska 35, HR-10000 Zagreb, Hrvatska (borisv@sumins.hr)

Među mnogobrojnim tipovima tala koja se javljaju u Hrvatskoj, težište je ovdje na tlima pod šumom crnike. Pod prirodnom vegetacijom hrasta crnike i crnog jasena (Orno-Quercetum ilicis H-ić/1956/1958) stvorio se humusno akumulativni horizont prosječne debljine 2 do 5 cm sivo crne do tamno sive boje. Aoh (ohrični) horizont izmješan je često s Ofh horizontom poluraspadnutog listinca. Najčešća tla na kojima raste šuma crnike su crvenica – terra rossa , tipična, plitka i lesivirana, smeđe tlo na vapnecima i dolomitima-kalokokambisol, plitko i srednje duboko. Na dubljim matičnim supstratima mogu se također pojaviti smeđa lesivirana i lesivirana tla. Na području Istre i Kvarnera prema pedološkim istraživanjima najzastupljenija tla su crvenice (70%), smeđe tlo na vapnencu (20%) i lesivirana tla (10%). Na temelju analiza uzoraka tla iz pedoloških profila ustanovljeno je kako su

tla po reakciji (pH u M-KCl) slabo kisela do neutralna u A horizontu (srednja vrijednost pH u M-KCl iznosi 6,45 u raspon 6,9-7,3) dok su u B horizontu tla kisela (srednja vrijednost pH 5,45 u raspon od 5,2-7,4). Promjena kiselosti je dalje s dubinom profila tla. Po sadržaju hranjiva su slabo opskrbljena fiziološki aktivnim fosforom a dobro s kalijem. Dosta su humozna a odnos C:N je dobar. Po mehaničkome sastavu u A horizontu pripadaju u lake gline a u dubljim horizontima u glinaste ilovaće i u većini slučajeva teške gline. Šuma crnike vrlo je bitna za očuvanje tala na kršu i stvaranje pravog humusnog horizonta koji u drugim uvjetima i pod drugom vegetacijom ima lošije osobine što se tiče, hranjiva, debljine i količine humusa.

SOILS OF EVERGREEN OAK FORESTS IN ISTRIA AND KVARNER

B. Vrbek, I. Pilaš and T. Dubravac
Institute of Forestry Jastrebarsko, Department of Ecology and Forest Menagment, Trnjanska 35, HR-10000 Zagreb, Croatia (borisv@sumins.hr)

Among the many types of soil in Croatia, the soils under forests of Evergreen oak were the subject of this study. A humus accumulative horizon average thickness 2-5 cm, of grey-black to dark-grey, formed under the natural vegetation of Evergreen oak and Flowering ash (Orno-Quercetum ilicis H-ić/1956/1958). Aoh-horizon is often mixed with Ofh horizon of semi-decayed leaf litter. The soils on which Evergreen oak forests most frequently grow are: terra rossa, typical, shallow and luvic; calcicambisol, shallow and medium deep. On the deeper parental materials, cambic-luvic and luvic soils may also occur. According to pedological investigations, the most frequently found soils in the region of Istria and Kvarner are: terra rossa (70%), calcicambisol (20%) and luvic soil (10%). On the basis of analyses of soil samples from pedological profiles, it has been determined that according to reaction (pH in M-HCl), the soils are slightly acid to neutral in the A horizon (mean value pH in M-KCl amounted to 6.45, range 6.9-7.3), while in the B horizon soils were dystric (mean value pH 5.45 range 5.2-7.4). The change in acidity is in accordance with the depth of the soil profile. With regard to the content of nutrients, they are poorly supplied with physiologically active phosphorus, and well supplied with potassium. They are rather humous and the relation C: N is good. Regarding the mechanical structure A horizon contains light clays, and in deeper horizons clayey loam, and in the majority of cases heavy clays. The Evergreen forest is essential for the preservation of soils on the Karst area of the Mediterranean and formation of a true humus horizon, which in other conditions and under some other vegetation has poorer characteristics regarding nutrients, thickness and amount of humus.

P-141

ECOREMEDIATION AS A NEW PERSPECTIVE OF ENVIRONMENTAL PROTECTION AND RESTORATION

D. Vrhovšek and D. Istenič
LIMNOS d.o.o., Company for Applied Ecology, Požarnice 41, SI-1351 Brezovica pri Ljubljani, Slovenia (dani@limnos.si, darja@limnos.si)

The aim of our work is to implement a holistic approach to environment protection and restoration, and management of protected natural areas. The approach should consider and integrate the whole ecosystem instead of each constituent separately. Ecoremediation (ERM) comprises methods of protection and restoration of the environment by means of natural processes existing in ecosystems and is the most suitable holistic approach. ERM technologies combine natural, co-natural and artificial ecosystems. These complex ecosystems have a strong buffering, purification and biodiversity capacity to prevent toxic and bacteriological pollution and high retention capacity to prevent flooding and draught. ERM can be used as an efficient tool in sustainable and integrated water resources management, preservation and restoration of ecosystems and habitats to protect plants and animals. We implemented ERM in many places in Slovenia, Croatia and Italy; a lot of systems are planed for the future. The most frequent is ERM in the form of constructed wetlands for treatment of municipal wastewaters from small settlements, farms and industry, for remedy of seasonal pollution impacts (tourism) and conditioning of drinking water. We use ERM also for revitalization (biological restoration) of degraded watercourses, lakes and amelioration ditches. From our experience we can conclude that ERM is a successful and sustainable method of environmental protection, from economic and ecologic point of view. For numerous today's problems ERM is the only way how to protect environment. Due to complexity of the of ecosystems' characteristics, ERM offers a development of many new approaches to environment protection and restoration.

P-142

ANALIZA UGROŽENOSTI BILJAKA IZ PORODICE ORCHIDACEAE U POŽEŠKOJ KOTLINI I OKOLNOM GORJU

D. Zima[1], M. Đurkić[2] i M. Tomašević[3]
[1]Veleučilište u Požegi, Pape Ivana Pavla II 6, HR-34000 Požega, Hrvatska (dzima@vup.hr), [2]Poljoprivredni fakultet, Trg Sv. Trojstva 3, HR-31000 Osijek, Hrvatska (mdurkic@pfos.hr), [3]Mirko Tomašević, Vladimira Maceka 9, HR-34000 Požega, Hrvatska

Na području Požeške kotline i okolnoga gorja do sada je zabilježeno 1588 biljnih svojti vaskularne flore. U okviru porodice *Orchidaceae* utvrđeno je 35 svojti koje su raspoređene unutar 13 rodova. Među njima najbrojniji rodovi su: *Orchis, Ophrys* i *Dactylorhiza.* Najčešća staništa na kojima se nalaze svojte orhideja u Požeškoj kotlini i okolnom gorju su suhi pašnjaci, rubovi šuma i šikara, te svjetle šume. Terenskim istraživanjima tijekom 2004. i 2005. godine i usporedbom utvrđenih svojti s Crvenom knjigom vaskularne flore Hrvatske može se zaključiti da se u nekoj od kategorija ugroženosti nalaze 23 svojte (65,71%). Glavni razlozi njihove ugroženosti su neizravne posljedice, gubitak staništa i promjene u agroekosustavu. Od zabilježenih svojti samo 6 se nalazi pod zakonskom zaštitom. Dobiveni podaci o ugroženosti biljaka iz porodice *Orchidaceae* na području istraživanja sugeriraju nastavak daljnih istraživanja kako bi se pravodobno poduzele potrebne mjere njihove zaštite.

ANALYSIS OF THREATENED PLANTS FROM ORCHIDACEAE FAMILY OF THE POŽEGA VALLEY AND SURROUNDING MOUNTAINS

D. Zima[1], M. Đurkić[2] and M.Tomašević[3]
[1]Polytechnics of Požega, Pape Ivana Pavla II 6, HR-34000 Požega, Croatia (dzima@vup.hr), [2]Faculty of Agriculture, Trg Sv. Trojstva 3, HR-31000 Osijek, Croatia (mdurkic@pfos.hr), [3]Vladimira Mačeka 9, HR-34000 Požega, Croatia

In the area of the Požega Valley and surrounding mountains 1588 vascular plant taxa have been recorded so far. 35 plant taxa of *Orchidaceae* family are members of 13 genera. The most abundant are *Orchis, Ophrys,* and *Dactylorhiza.* Habitats that are most frequently occupied by orchid plant taxa in Požega valley and surrounding mountains are dry grasslands, forest and underbush edges, and bright forests. The results of field trials conducted in 2004 and 2005 were compared with reference to the Red Book of Vascular Flora of Croatia, inidicating that 23 plant taxa (65.71%) are threathened in some way. The main reasons for their status are indirect causes, loss of habitat and changes in the agro-ecosystem. Only 6 out of all recorded plant taxa are legally protected. The obtained records on the endangerment of *Orchidaceae* family in the investigated area call for further research, so that necessary plant protection measures could be implemented in a timely manner.

P-143
RIJETKA I UGROŽENA VLAŽNA STANIŠTA PLAŠČANSKE DOLINE

I. Zupan[1], K. Fabrio[1], V. Posavec-Vukelić[1], I. Žeger[1], R. Topić[1], J. Radović[1] i A. Alegro[2]
[1]Državni zavod za zaštitu prirode, Savska 41/23, PP 50, HR-10144 Zagreb, Hrvatska (irina.zupan@dzzp.hr, karla.fabrio@dzzp.hr, vida.posavec@dzzp.hr, irina.zeger@dzzp.hr, ramona.topic@dzzp.hr, jasminka.radovic@dzzp.hr), [2]Botanički zavod, Biološki odsjek PMF-a, Sveučilište u Zagrebu, Marulićev trg 20/II, HR-10000 Zagreb, Hrvatska (antun@botanic.hr)

Plaščanska dolina poznata je po rijetkim i vrijednim tipovima vlažnih staništa. Sustavna floristička, faunistička i mikološka istraživanja ovog područja nikada nisu provedena, no oskudni i uglavnom stari literaturni podaci o bioraznolikosti ovih staništa pokazuju njihovu visoku vrijednost sa stanovišta zaštite prirode. Na ovom su području zabilježene 4 zajednice bazofilnih cretova: cretovi crnkaste šiljevine (NKS kod C.1.1.1.1.), dinarski bazofilni cretovi suhoperke (NKS kod C.1.1.1.2.), bazofilni cretovi beskoljenke i hostovog šaša (NKS kod C.1.1.1.4.) i cretovi cretnog šaša (NKS kod C.1.1.1.5.). U literaturi je na ovom području zabilježeno 18 biljnih vrsta kojima prijeti izumiranje: 3 kritično ugrožene, 10 ugroženih i 5 osjetljivih. Većinu ovih vrsta zabilježili smo i pri našim terenskim obilascima. Još uvijek se mogu naći karakteristične vrste većine navedenih staništa, no u čitavom području vidljiva je snažna sukcesija i nestanak cretnih staništa. Vlažne livade jedan su od najugroženijih, a cretovi kritično ugroženi tip staništa u Hrvatskoj. Svi bazofilni cretovi ugroženi su i na europskoj razini, te se nalaze na Dodatku I. Direktive o staništima. Upravo je zbog toga područje Plaščanske doline dio jezgre preliminarne Nacionalne ekološke mreže, te će biti dio hrvatskog prijedloga za europsku ekološku mrežu Natura 2000. Ovo područje predloženo je za zakonsku zaštitu. Nužnima smatramo hitnu primjenu aktivnih mjera zaštite - ciljana biološka istraživanja, edukaciju lokalnog stanovništva te izradu i provođenje akcijskog plana očuvanja vlažnih staništa Plaščanske doline.

RARE AND THREATENED WET HABITATS OF THE PLAŠKI VALLEY

I. Zupan[1], K. Fabrio[1], V. Posavec-Vukelić[1], I. Žeger[1], R. Topić[1], J. Radović[1] and A. Alegro[2]
[1]State Institute for Nature Protection, Savska cesta 41/XXIII, HR-10000 Zagreb, Croatia (irina.zupan@dzzp.hr, karla.fabrio@dzzp.hr, vida.posavec@dzzp.hr, irina.zeger@dzzp.hr, ramona.topic@dzzp.hr, jasminka.radovic@dzzp.hr), [2]Department of Botany, Division of Biology, Faculty of Science, University in Zagreb, Marulićev trg 20/II, HR-10000 Zagreb, Hrvatska (antun@botanic.hr)

The Plaški valley is known for its rare and valuable types of wet habitats. Although there has been no systematic floristic, faunal or mycological research of this area, the poor and mostly old literal data on biodiversity of these habitats show their high value in terms of nature protection. At this site four communities of alkaline fens have been determined: As. *Orchidi-Schoenetum nigricantis*; NHC code C.1.1.1.1., As. *Eriophoro-Caricetum paniceae*; NHC code C.1.1.1.2., As. *Molinio caeruleae-Caricetum hostianae*; NHC code C.1.1.1.4. and As. *Caricetum davallianae*; NHC code C.1.1.1.5. 18 plant species threatened by extinction have been recorded in literature for this area: 3 critically endangered, 10 endangered and 5 vulnerable. The majority of these species was confirmed during our fieldwork. Although we have observed strong succession and loss of moor habitats, characteristic species of the most of habitats mentioned can still be found. Wet grasslands are among the most threatened, while moors are critically endangered types of habitat in Croatia. As all alkaline fens are threatened at the European level they are all listed in Annex I. of the Habitats Directive. Therefore, the Plaški valley is a part of the core area of the preliminary National Ecological Network and will become a part of the Croatian proposal for the European ecological network NATURA 2000. This site is proposed for legal protection. Active protection measures need to be taken, such as targeted biological research and local community education. An action plan for conservation of wet habitats of the Plaški valley should be developed and implemented.

P- 144

MEĐUNARODNA ŠKOLA KONZERVACIJSKE BIOLOGIJE: OBRAZOVANJEM DO OČUVANJA BIORAZNOLIKOSTI

B. Lazar[1,2,3], V. Besendorfer[1,4], B. Hamer[1,5], D. Holcer[1,2,3], S. S. Heppell[6] i S. A. Heppell[6]

[1]Hrvatsko biološko društvo, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska; [2]Zoološki odjel, Hrvatski prirodoslovni muzej, Demetrova 1, HR-10000 Zagreb, Hrvatska; [3]*Plavi svijet* Institut za istraživanje i zaštitu mora, Kaštel 24, HR-51551Veli Lošinj, Hrvatska (bojan.lazar@hpm.hr, drasko.holcer@hpm.hr), [4]Zavod za molekularnu biologiju, Biološki odsjek, Prirodoslovno-matematički fakultet, Sveučilište u Zagrebu, Horvatovac 102a, HR-10000 Zagreb, Hrvatska (vbesend@zg.biol.pmf.hr), [5]Centar za istraživanje mora, Institut "Ruđer Bošković", G. Paliaga 5, HR-52210 Rovinj, Hrvatska (hamer@cim.irb.hr), [6]Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331, USA (selina.heppell@oregonstate.edu, scott.heppell@oregonstate.edu)

Jugoistok Europe jedno je od žarišta europske bioraznolikosti. Ona uključuje unutar- i međuvrsnu raznolikost, raznolikost ekosustava i visok stupanj endemizma. To se područje ujedno odlikuje i velikom raznolikošću u razvijenosti političkih i ekonomskih sustava, od razvijenih zemalja članica Europske unije do nerazvijenih zemalja. Problem očuvanja bioraznolikosti s jedne i potrebe suvremenog razvoja s druge strane, iznimno je zahtjevan zadatak, posebice u jugoistočnim tranzicijskom zemljama, koji zahtjeva posebno obrazovane stručnjake – konzervacijske biologe. Iako se konzervacijska biologija danas smatra znanošću 21. stoljeća i pretpostavkom suvremenog koncepta očuvanja bioraznolikosti, vrlo mali broj sveučilišta u toj regiji uključuje specijalizirane kolegije konzervacijske biologije. Kako bi potakli kontinuiranu izobrazbu stručnjaka u području znanstveno-zasnovanog očuvanja bioraznolikosti, Hrvatsko biološko društvo je 2005. godine započelo s organizacijom međunarodne poslijediplomske Škole konzervacijske biologije (*School of Conservation Biology*, SCB). Ovaj intenzivan devetodnevni tečaj polaznicima daje osnove konzervacijske biologije, od osnovne razine populacija do ekosustava, uključujući laboratorijske vježbe te terenski rad. Kroz interaktivni nastavni program Škola pruža uvid u najnovije trendove, znanstvene spoznaje i raspoložive metodologije u ciljanim istraživanjima usmjerenim na zaštitu bioraznolikosti. Odjek/uspjeh Škole analiziran je na temelju (i) evaluacija studenata, (ii) zastupljenosti studenata iz različitih europskih zemalja te (iii) mogućnosti studenata da primjene stečeno znanje u svom svakodnevnom radu.

INTERNATIONAL SCHOOL OF CONSERVATION BIOLOGY: EDUCATION TOWARDS BIODIVERSITY CONSERVATION

B. Lazar[1,2,3], V. Besendorfer[1,4], B. Hamer[1,5], D. Holcer[1,2,3], S. S. Heppell[6] and S. A. Heppell[6]
[1]Croatian Biological Society, Rooseveltov trg 6, HR-10000 Zagreb, Croatia; [2]Department of Zoology, Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia; [3]*Blue World* Institute of Marine Research and Conservation, Kaštel 24, HR-51551Veli Lošinj, Croatia (bojan.lazar@hpm.hr, drasko.holcer@hpm.hr), [4]Department of Molecular Biology, Division of Biology, Faculty of Sciences, University of Zagreb, Horvatovac 102a, HR-10000 Zagreb, Croatia (vbesend@zg.biol.pmf.hr), [5]Center for Marine Research, "Ruđer Bošković" Institute, G. Paliaga 5, HR-52210 Rovinj, Croatia (hamer@cim.irb.hr), [6]Department of Fisheries and Wildlife, Oregon State University, 104 Nash Hall, Corvallis, OR 97331, USA (selina.heppell@oregonstate.edu, scott.heppell@oregonstate.edu)

South-eastern Europe is among European hot-spot regions with high biodiversity. This biodiversity includes intraspecific, interspecific and ecosystem diversity and high endemism rate. This region is however also characterized by a high diversity of political and economical systems of individual states in the region, ranging from developed European Union members to underdeveloped countries. The problem of biodiversity conservation on one hand and modern development on the other is a demanding task, particularly in southeastern transitional countries, and requires specifically trained specialists – conservation biologists. Though conservation biology is considered the science of the 21st century and a prerequisite for effective biodiversity conservation, very few university curricula in the region offer specialized courses in conservation biology. In order to continually enhance education and capacity building in the field of scientifically sound biodiversity conservation, from 2005 the Croatian Biological Society has started with organization of an annual international graduate School of Conservation Biology (SCB). Through an intensive 9-days course, the School provides basics on conservation biology from population to ecosystem levels, including labs and field courses. Through interactive classes, SCB provides graduate students with insight in the latest trends, state of the art knowledge and available methodologies/tools in applied research focused at biodiversity conservation. The impact/success of SCB is analyzed based upon (i) student's evaluation, (ii) representation of students from different European countries, and (iii) possibility of students to apply and disseminate obtained knowledge in their work.

BIOLOGIJA U SUVREMENOJ HRVATSKOJ ŠKOLI
BIOLOGIA ET EDUCATIO
BIOLOGY IN MODERN CROATIAN SCHOOL

Uvodna tematska predavanja
Introductory Lectures

IL-21
OSVRT NA PROGRAME NASTAVE BIOLOGIJE U GIMNAZIJI

B. Borović[1] i S Ilić[2]
[1]X gimnazija, Klaićeva 7, HR-10000 Zagreb, Hrvatska (heckahr@yahoo.com), [2]III gimnazija, Kušlanova 52, HR-10000 Zagreb, Hrvatska (sanda.ilic@t.com.hr)

Na temelju dosadašnjeg iskustva rada u nastavi biologije u gimnazijama i suradnji s ostalim kolegama iz drugih gimnazija, uočen je problem u realizaciji nastavnih sadržaja biologije. Postojeće učionice za nastavu biologije još uvijek su u velikom broju škola zamišljene za frontalni oblik rada, uz nedostatak nastavnih sredstava i pribora za praktičnu izvedbu. Zbog toga predlažemo drugačiji pristup realizacije nastavnog programa koji bi učenicima omogućio lakše usvajanje gradiva, a profesorima olakšao realizaciju programa u potpunosti. Cilj te promjene je razviti kreativnost, samostalnost i individualnost učenika, rasteretiti ih od učenja suvišnih podataka i potaknuti ih na logično i sustavno usvajanje i povezivanje nastavnih sadržaja. Ujedno nam je i cilj povezivanje mastavnih sadržaja biologije s istoimenim područjima programa iz ostalih prirodnih znanosti (geografije, fizike, kemije i biokemije) i društvenih znanosti (psihologije) s tim da se postigne vremenska usklađenost programa navedenih predmeta s programom biologije. Na taj bi se način postigla i multidisciplinarnost određenih zajedničkih tema u navedenim predmetima, što je ujedno i ideja prirodoslovlja.

REFLECTING ON BIOLOGY SYLLABUS IN SECONDARY SCHOOLS

B. Borović[1] and S. Ilić[2]
[1]X Grammar School, Klaićeva 7, HR-10000 Zagreb, Croatia (heckahr@yahoo.com), [2]III Grammar School, Kušlanova 52, HR-10000 Zagreb, Croatia (sanda.ilic@t.com.hr)

On the basis of our own experience in teaching Biology in secondary schools as well as in contacts with Biology teachers from other secondary schools, we have noticed a problem in the fulfilment of Biology syllabus. In many schools the classrooms where Biology is taught still lack the equipment for practical work and are basically designed for frontal teaching. Therefore we suggest

a new approach in dealing with the syllabus, which will make the process of learning easier for the pupils and at the same time enable the teachers to fulfil the syllabus successfully. The aim of the change is to develop creativity, independence and individuality of the pupils, relieve the pupils of learning unnecessary information and encourage them to use logic while learning. At the same time, our aim is to correlate with both natural science (Geography, Physics, Chemistry, Biochemistry) and the humanities (Psychology) which will add to multiplicity of particular common topics, the basic idea of natural science.

Kratka usmena priopćenja
Oral Presentations

OP-67
ISTRAŽIVAČKA NASTAVA KAO STANDARD SUVREMENE ŠKOLE

E. Borić[1], I. Labak [2] i T. Jelić [3]
[1,2]Učiteljski fakultet u Osijeku , L. Jagera9, HR-31000 Osijek, [2]Odjel za biologiju u Osijeku, Trg Ljudevita Gaja 6, HR-31000 Osijek, [3]Alfa, Nova Ves 23, HR-10000 Zagreb

Cilj rada je poticanje istraživačke izvanučionične nastave kod djece mlađe školske dobi. Nužno je povezivanje iskustva sa stečenim spoznajama putem istraživačke nastave uz korelaciju i integraciju sadržaja sa svrhom rasterećenja učenika. Takva nastava je usmjerena na razvijanje vještina i sposobnosti kao i na usvajanje vrijednosti, stavova i navika sa svrhom stvaranja aktivnih članova društva. Primjenjena je deskriptivna metoda i postupci promatranja. Primjenjeni instrumenti istraživanja su anketa, intervju, evaluacija natave i samoevaluacija učenika. Eksperimentalni uzorak činila su djeca četvrtog razreda osnovnih škola u Osijeku (3 škole, 8 odjela, 158 učenika). Izrađen je model istraživačke izvanučionične nastave i radni listovi sa zadacima različitih razina s korelacijom i integracijom drugih predmeta. Ponuđeni sadržaji omogućili su svakom djetetu bavljenje sadržajima za koje ima najviše sposobnosti i interesa. Nastava se odvijala u neposrednom zavičaju tijekom prijepodneva na tri različita staništa. Rezultati ankete i intervjua ukazuju da učenje situirano u prirodi utemeljeno na iskustvu potiče kritičko mišljenje i samostalnost. Djeca žele učiti istražujući u prirodi jer ih takav rad motivira i manje opterećuje. Na taj se način obogatila kvaliteta nastave funkcionalnim znanjem uz primjenu alternativnih metoda poučavanja temeljenih na kritičkom mišljenju. To ih je dovelo do lakšeg i bržeg stjecanja znanja, vještina i sposobnosti. Pridonijelo je većoj učinkovitosti odgojno obrazovnog rada što je i cilj standarda hrvatske suvremene škole.

TEACHING-AS-RESEARCH AS THE STANDARD FOR CONTEMPORARY SCHOOLS

E. Borić[1], I. Labak [2] and T. Jelić [3]
[1,2]Faculty of Teacher Education in Osijek , L. Jagera9, HR-31000 Osijek, [2]Biology Department in Osijek, Trg Ljudevita Gaja 6, HR-31000 Osijek, Croatia, [3]Alfa, Nova Ves 23, HR-10000 Zagreb, Croatia

The aim of the paper is to encourage teaching-as-research outside the classroom with young school-age children. It is necessary to combine experience with the knowledge acquired through teaching-as-research along with the correlation and integration of contents and with the objective to disburden pupils. This teaching approach is focused on developing skills and abilities, as well as on acquiring values, attitudes and habits with the aim of forming active members of society. The descriptive method was applied along with observation procedures. The research instruments applied were questionnaire, interview, teaching evaluation and pupils' self-evaluation. The experimental group consisted of 158 pupils from the 4th grade of elementary schools in Osijek (3 schools, 8 classes). A model of teaching-as-research outside the classroom was developed as well as work sheets with exercises of different levels that integrated and correlated with other subjects. The subject matter offered enabled every child to deal with those contents that most fit their skills and interest. The teaching was conducted in direct surroundings during the morning and on three different locations. The results from the questionnaire and the interview show that learning in nature based on experience supports critical thinking and autonomy. The children wish to learn by doing research in nature because it is motivating and requires less strain. That way the quality of teaching was improved by functional knowledge and by applying alternative teaching methods based on critical thinking. Thus the children were enabled to acquire knowledge, skills and abilities faster and easier. Furthermore a contribution was made to the greater efficacy of educational work which is also the goal of the standard for contemporary Croatian schools.

OP-68
ISTRA I PRIRODOSLOVLJE U XVIII. I XIX. ST.

B. Staroveški[1] i J. Šikić[2]
[1]Nacionalna i sveučilišna biblioteka, Zagreb, Hrvatska, [2]Leksikografski zavod „Miroslav Krleža“, Zagreb, Hrvatska

U radu je na leksikonski način prikazano djelovanje prirodoslovaca iz XVIII. i XIX. st. na području Istre i Hrvatskoga primorja. Među njima je bilo botaničara, zoologa, agronoma, šumara i liječnika. Bilo da su hrvatskoga ili stranog podrijetla, svi su oni svojim istraživanjima i pronalascima, utemeljenjem institucija, organiziranjem izložbi i skupova te napisima u europskim znanstvenim časopisima, pridonijeli unapređenju prirodoslovlja na području Istre, ali i širenju poznavanja prirodnih bogatstava, podneblja i kulture naših krajeva.

ISTRIA AND NATURAL SCIENCES IN THE 18TH AND 19TH CENTURY

B. Staroveški[1] and J. Šikić[2]
[1]National and University Library, Zagreb, Croatia, [2]"Miroslav Krleža" Lexicographic Institute, Zagreb, Croatia

The article describes the activities of natural scientists of the 18th and 19th century in Istria and on the Croatian Coast in a lexicographic way. They were botanists, zoologists, agriculturalists, foresters and physicians. Either of Croatian or foreign origin, all of them contributed to the development of natural sciences in Istria and spreading knowledge about natural riches, climate and culture of our regions by carrying out research, making discoveries, establishing institutions, organizing exhibitions, conferences and publishing in European scholarly journals.

OP-69
USPOREDBA UČENIČKIH POSTIGNUĆA PRIMJENOM DVIJE METODE TESTIRANJA ZNANJA

D. Karakaš i S. Kapov
18. gimnazija, Mesićeva 35, HR-10000 Zagreb, Hrvatska (dubravka.karakas@zg.htnet.hr, skapov@hotmail.com)

Cilj ovog rada bio je usporediti dva različita načina pismene provjere znanja iz evolucije u četvrtom razredu gimnazije. Provjeravana su tri razreda sa ukupno 71 učenikom tijekom istog nastavnog sata. Kao prvi oblik provjeravanja primjenjen je klasični test znanja. U drugom dijelu sata, primijenjen je test izrađen u obliku problemskih zadataka. Učenicima su ponuđeni primjeri (priče) koji se odnose na problematiku zadanog područja, ali se ne nalaze u udžbeniku. Na osnovu ponuđenih primjera učenici su trebali izvući određene zaključke i odgovoriti na postavljena pitanja. Pri rješavanju problemskih zadataka učenici su se mogli služiti udžbenicima i bilježnicama. Na kraju sata učenici su ispunjavali anketu kojom se ispitivalo njihovo mišljenje o načinu provjeravanja uz rješavanje problemskih zadataka, kao i osjećaji za vrijeme pisanja testa. Iako je teško uspoređivati rezultate dobivene na ovaj način (klasični test - pozitivno ocijenjeni učenici – 53%, problemski zadaci – pozitivno ocijenjenih 77%), na osnovu rezultata može se zaključiti da su učenici pozitivno prihvatili ovakav način provjere znanja. Pri rješavanju su se osrednje koristili ponuđenom dopuštenom literaturom. Učenici su u početku bili zbunjeni jer nisu naviknuti na takve oblike rada, te su se tijekom rješavanja testa često gubili. Ipak, značajan broj njih tvrdi da su bez problema riješili

zadatke i da im je takav način rada bio izazovan i zanimljiv. Analizirajući odgovore, može se također zaključiti da većina učenika teško samostalno sklapa rečenice i formulira svoje misli. Uglavnom se oslanjaju na traženje (dijelova) rečenica iz udžbenika za koje misle da bi mogle biti odgovor na postavljeno pitanje. Također se uočava slabo ili nikakvo povezivanje sa prethodnim gradivom, npr. iz genetike, ili iz drugih, srodnih, predmeta.

COMPARISON OF STUDENTS' ACHIEVEMENTS APPLYING TWO METHODS OF EXAMINATION

D. Karakaš and S. Kapov
XVIII Gymnasium, Mesićeva 35, HR-10000 Zagreb, Croatia (dubravka.karakas@zg.htnet.hr, skapov@hotmail.com)

The aim of this work was to compare two different ways of written examination from evolution in the fourth grade of grammar school. Three classes have been tested with altogher 71 students during the same lesson. The first way of examination was a classical test. In the second half of the lesson a test made of problem solving tasks was used. The students were offered examples (stories), which relate to the issues of the set topic, but are not in the student's book. On the basis of the offered examples students were supposed to draw certain conclusions and anwer the questions. Students were allowed to use books and notebooks while doing the problem solving tasks. At the end of the lesson the students filled in a questionaire, where they were asked about their opinion about this way of examination solving the problem tasks, as well as about their feelings during the examination. Even though it is difficult to compare the results we got in this way (classical test – 53% of the students with positive marks, problem solving tasks – 77% of the students with positive marks), on the basis of these results we can conclude that the students have positively accepted this way of examination. The students were moderately using the offered literature during the examination. They were confused at the beginning because they are not used to this way of work, so they often got lost while doing the tasks. Nevertheless, a significant number of students claims that they solved the tasks without problems and that they found this way of work challenging and interesting. Analysing the answers, we can also conclude that most of the students finds it difficult to make sentences by themselves and to form their thoughts. They mostly depend on looking for (parts of) the sentences in their books, that they think could anwer the asked question. One can also notice very week or none of the linking with the previos subject-matter, e.g. with genetics, or with other related subjects.

OP-70
UČIMO BIOLOGIJU AKTIVNIM ČITANJEM

I. Labak[1,2] i E. Borić[2]
[1]Odjel za biologiju u Osijeku, Trg Ljudevita Gaja 6, HR-31000 Osijek, Hrvatska, [2]Učiteljski fakultet u Osijeku, L. Jagera 9, HR-31000 Osijek, Hrvatska

Cilj je rada pokazati način razvijanja kritičkog mišljenja u nastavi biologije procesom aktivnog čitanja i analitičkog diskutiranja a primjenom metode predviđanja na temelju pojmova. Eksperimentalni uzorak činile su četiri skupine učenika dobnog uzrasta 12 do 13 godina a odabrana tema "Zaštita ptica" dio je nastavnog plana i programa biologije šestog razreda. Svaka je skupina, koristeći se literaturnim podacima udžbenika biologije te znanstveno-popularnih časopisa, napisala svoju tematski zadanu priču. U ovom radu predstavljamo priču jedne skupine pod naslovom "U očima lastavice". Napisana priča je, koristeći se metodom predviđanja na temelju pojmova, prezentirana i obrađena s ostalim grupama. Time su učenici izricali svoja originalna mišljenja, vršili racionalan izbor između konkurentskih ideja, te u konačnici razvijali odgovornost koja vodi k pozitivnom rješavanju problema. Kod učenika se potaknulo aktivno čitanje s ciljem boljeg razumijevanja napisanog sadržaja. Ostvaren je pozitivan odnos učeničkih ideja, slika, asocijacija i emocija s nastavnom temom te u konačnici i s nastavnim sadržajem u obliku teksta koji u ovakvoj formi postaje zanimljiv i dinamičan izvor novih spoznaja.

LEARNING BIOLOGY THROUGH ACTIVE READING

I. Labak[1,2] and E. Borić[2]
[1]Biology Department in Osijek, Trg Ljudevita Gaja 6, HR-31000 Osijek, Croatia, [2]Faculty of Teacher Education in Osijek , L. Jagera 9, HR-31000 Osijek, Croatia

The aim of this paper is to point at a way to the development of critical thinking in the teaching of biology. It is accomplished through the processes of active reading and analytical discussion and through the application of the method of prediction based on terms recognition. The experimental group consists of four groups of students, aged between 12 and 13, and the topic given is "The Protection of Birds" as a component of the 6th grade curriculum. Each group of students wrote their topic-guided story by relying on the data from the biology textbook and scientific and popular magazines. This paper presents the story written by one group. The title of the story is "In the eyes of a swallow".

The written story is introduced and discussed with other groups through the method of term-based predicting. Thereby the students expressed their unique opinions, made rational choices between competitive ideas, and, eventually, worked on the development of responsibility leading to the positive solution of a problem. The students were directed towards active reading in order to comprehend the written text better. A positive relationship was established between students' ideas, pictures, associations and emotions and the teaching topic, i.e. the teaching content in the text form which turned into an interesting and dynamic source of new conceptions.

OP-71
GRUPNI RAD U NASTAVI BIOLOGIJE

Ž. Lukša, T. Dragić-Runjak i N. Sinković
Gimnazija, V. Nazora 34, HR-40000 Čakovec, Hrvatska (zaklin.luksa@ck.t-com.hr, biologija@gimnazija-cakovec.hr, nevenka.sinkovic@ck.htnet.hr)

Kompetencije koje danas učenicima trebaju za uspješan ulazak u svijet rada i cjeloživotnog učenja puno su više od samog usvajanja velikog broja činjenica. Pitanje na koje smo željeli odgovoriti je stječu li učenici grupnim radom u nastavi biologije bolje kompetencije i jesu li zadovoljniji nego frontalnim oblikom rada? Pri tome smo željeli utvrditi može li učenje koje je organizirano kao timski rad rezultirati višom razinom kompetencija i zadovoljstva učenika u odnosu na zadovoljstvo i kompetencije stečene frontalnim oblikom rada, te koliko se grupni rad koristi u nastavi biologije, kakav je stav učitelja prema njemu i koliko se oni koji bi ga trebali primjenjivati sami smatraju kompetentnim i osposobljenim za njegovo provođenje. Istraživanje je empirijsko i metodološki se zasniva na provedbi pedagoškog eksperimenta te prikupljanju podataka iz neposrednog odgojno obrazovnog rada. Istraživanje je provedeno na uzorku od 227 učenika drugih razreda koji su podijeljeni u kontrolnu skupinu (135 učenika) i eksperimentalnu skupinu (92 učenika). Zavisne varijable koje smo pratili su kompetencije učenika (uspjeh, razumijevanje, osposobljenost) i zadovoljstvo učenika, a nezavisne dob, spol, prethodni uspjeh učenika (u predmetu), predznanje i kvocijent inteligencije. Koristili smo niz instrumenata; Ravenove progresivne matrice, (za usklađivanje uzorka - proveo psiholog), anketa za profesore biologije, anketa za učenike, test za inicijalno ispitivanje predznanja, testovi za ispitivanje usvojenosti znanja. Rezultati pokazuju da ne postoji značajna razlika u postignućima učenika bez obzira na korišteni oblik rada u nastavi, ali postoji statistički značajna razlika u zadovoljstvu učenika načinom rada u nastavi.

GROUP WORK IN BIOLOGY TEACHING

Ž. Lukša, T. Dragić-Runjak and N. Sinković
Grammer School, V. Nazora 34, HR-40000 Čakovec, Croatia (zaklin.luksa@ck.t-com.hr, biologija@gimnazija-cakovec.hr, nevenka.sinkovic@ck.htnet.hr)

Competences that students nowadays require for a successful entry into the world of higher education and work are more valuable than the acquisition of a large number of facts. The question that we wanted to answer is whether the students gain more competence by using group work in biology teaching and are they more pleased with this type of work or the frontal teaching model. We also wanted to determine whether the teaching organised as team work can result in the higher level of competence and the students' pleasure in comparison with the pleasure and competence achieved in frontal teaching model, as well as how much is group work used in biology teaching, what is the teacher's attitude towards it and whether the people, supposed to enforce it, see themselves competent and trained for its enforcement. The research is empirical and is metodologically based on the implementation of a pedagogical experiment and gathering of data from the teaching process itself. The research has been carried out on a sample of 227 students in the second year of secondary education which have been devided into a control group of 135 students and an experimental group of 92 students. The dependent variables which were looked after are the student's competence (success, understanding, the level of training) and their content while the undependent variables are age, sex, student's previous success in the subject, pre-knowledge and an IQ testing. The instruments used are Raven progressive matrix (to synchronize the sample- done by a psychologist), opinion polls for biology teachers, polls for students on group work before the experiment, a test for the initial check of knowledge, tests for questioning the level of acquired knowledge ZOT1 and ZOT2, polls from the students in an experimental group after the experiment's implementation. The results show that there is no significant difference in the students' accomplishments regardless of the models of teaching used in class, but there is a statiostically relevant difference in the students' content with the teaching model used in the classroom.

OP-72
VIVARIJ U NASTAVI BIOLGIJE

I. Radanović[1] i D. Dragun[2]
[1]Zoologijski zavod, Biološki odsjek, Prirodoslovno-matematički fakultet,

Sveučilište u Zagrebu, Rooseveltov trg 6, HR-10000 Zagreb, Hrvatska (iradan@biol.pmf.hr), [2]OŠ "A. G. Matoš" Vinkovci, Ohridska 21, HR-32100 Vinkovci, Hrvatska (dario.dragun@vk.t-com.hr)

Projekti u nastavi su jedan od načina primjene vivarija u nastavi biologije. Istraživanje je provedeno u 6 gimnazijskih razreda, od kojih su dva bila kontrolni razredi dok su u četiri razreda izvođeni projekti. Ukupno je provedeno 12 projekata. Učenici su podijeljeni u radne grupe te je svakoj od grupa bio dodijeljen po jedan projekt. Svaki je projekt bio osmišljen kao malo znanstveno istraživanje u kojemu su se učenici morali ponašati poput pravih znanstvenika. Samostalno su izvodili pokuse, bilježili rezultate i izradili završni izvještaj koji je prezentiran ostatku razreda. Nakon rada na projektu učenici su pisali ispit i ispunili anketni listić. Razlike u postotku riješenosti ispita između učenika koji su radili na projektu, zatim onih koji su samo slušali izvještaje i kontrolnih razreda su znatne. Rezultati istraživanja pokazuju veliku zainteresiranost učenika za ovakvom nastavom, a samim time i povećanje interesa za biologiju kao znanost.

VIVARIUM IN BIOLOGY CLASS

I. Radanović[1] and D. Dragun[2]
[1]Department of Zoology, Division of Biology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, HR-10000 Zagreb, Croatia (iradan@biol.pmf.hr), [2]Primary school "A. G. Matoš" Vinkovci, Ohridska 21, HR-32100 Vinkovci, Croatia (dario.dragun@vk.t-com.hr)

Project-based curriculum is one of the ways to teach biology at school. This research was conducted in 6 high schools classes. Four classes were assigned projects and two acted as control groups. There were 12 projects in whole. Students were divided into work groups; each group had to work on one of the projects. Projects were designed to be a small scientific research and students were required to act as scientists. During the project students had to take notes, do all experiments and make a presentation of the project on their own. After the project was completed they had to take a test and fill out a poll concerning their work. Test score differed between students with projects, those without and the control group significantly. Results of this research show that the students are enthusiastic about this kind of curriculum and that there is an increase of interest in biology as a science.

OP-73

MULTIDISCIPLINARNI PRISTUP TERENSKOJ NASTAVI EKOLOGIJE

K. Trojko i M. Rašan
Srednja škola Prelog, Čakovečka 1, HR-40323 Prelog, Hrvatska (kresimir.trojko@ck.htnet.hr, miso.rasan@ck.htnet.hr)

Iako je ekologija proizašla iz biologije, danas je to multidisciplinarna znanost. Za pronalaženje odgovora na pitanja ekološki složene stvarnosti prijeko je potrebna suradnja stručnjaka različitih profila. Usvajanje i prihvaćanje ekoloških spoznaja u nastavnom procesu nezamislivo je bez terenske nastave. Zbog navedenog smo u Srednjoj školi Prelog odlučili provesti cjelodnevnu terensku nastavu ekologije za učenike koji slušaju program „Čovjek, zdravlje i okoliš“, razred prehrambenih tehničara i ekonomista. U tom su nam se pridružili profesori geografije i matematike. Praktični radovi na terenskoj nastavi izvedeni su uglavnom prema Globe protokolima. Svaka grupa učenika bira željeno područje istraživanja,a ponuđena područja su: GPS mjerenja, atmosferska mjerenja, fizikalno- kemijska određivanja vode, fitocenološke snimke travnjaka, određivanje visine drveća klinometrom te određivanje temperature na različitim staništima. Za svako područje istraživanja na raspolaganju je jedan mentor. Nakon obavljenih zadataka radne skupine izmjenjuju novostečene kompetencije (domaćini, gosti). U završnom dijelu terenske nastave predstavnici grupa prezentiraju rezultate svojih istraživanja pomoću postera. Završna evaluacija je vršena anketiranjem učenika pitanjima zatvorenog i otvorenog tipa. Evaluacijska anketa pokazuje da je nastava bila zanimljivija, učenici zadovoljniji, a kompetencije bolje.

MULTI-DISCIPLINARY APPROACH TO FIELD WORK IN TEACHING ECOLOGY

K. Trojko and M. Rašan
High School Prelog, Čakovečka 1, HR-40323 Prelog, Croatia (kresimir.trojko@ck.htnet.hr, miso.rasan@ck.htnet.hr)

Although ecology emerged from biology, today it is a multi-disciplinary science and to search for answers on the questions of ecologically complex reality, it is necessary for experts of various profiles to co-operate. The acquisition and acceptance of ecological ideas in the teaching process is unthinkable without field work teaching classes. This is the reason why we at Srednja škola Prelog decided to conduct a whole day field work classes in ecology for students working after the program „ Man, health and environment“, and these are food

technicians and economists. The teachers of geography and mathematics joined us in the project. Practical assignments on the field were mostly implemented according to the Globe protocols. Every group of students chooses an area of research, and these are: GPS measurments, atmospheric measurments, physical and chemical determination of water, phitocenological recordings of the grass area, determining the tree hight and determining the temperature in different habitats. For every field of research the students could contact one mentor. After the performed duties, work groups were exchanging the acquired competence. In the final stage of the field work, group representatives presented the results of their research by a poster presentation. The final evaluation was done by giving polls to students with closed and open type questions. The polls have shown that the field work was very interesting, students satisfied and their competence improved.

OP-74
PRIMJENA MATEMATIČKO STATISTIČKE METODE U EKSPERIMENTALNOM PROJEKTU UČENIKA

Lj. Vrček
Rudarska i kemijska škola, Hallerova aleja 3, HR-42000 Varaždin, Hrvatska

Eksperimentalni projekt je samostalni rad učenika u kojem učenici osim sadržaja prirodoslovlja spoznaju i prirodoznanstvenu metodu i načine istraživanja. Učenici u istraživačkom motrenju pojava postavljaju pitanja i oblikuju odgovor u formi pretpostavke koju će moći provjeriti pokusom. U ovome članku su iznesena višegodišnja saznanja o pojavama u istraživačkom radu sa učenicima. U radu su korištene deskriptivne i kauzalne metode. Cilj ovih istraživanja bio je prikupljanje podataka o čimbenicima značajnih za provjeru hipoteze, a s namjerom poboljšanja rada u eksperimentalnom projektu učenika. Temeljna značajka eksperimenta je varijabilnost rezultata koji sadrže i slučajne varijacije. U planiranju eksperimenta potrebno je raščlaniti problem, pomno odabrati uzorak i pribor za izvedbu pokusa, a potom odrediti zavisne i nezavisne veličine, te planski ispitati efikasnost primjene određenih tretmana i broja njihovih ponavljanja. Testiranje točnosti hipoteze na temelju empirijskih podataka, a koji su u većini slučajeva kvantificirani mogu se obaviti primjenom matematičko statističke metode. Statistička metoda omogućuje dvije vrste eksperimentalnih zaključaka i to: ocjenom signifikantnosti hipoteze uz grešku i zaključci dobiveni provjerom hipoteze testovima, a koji se temelje na usporedbi različitih tretmana. Budući da su zaključci na temelju eksperimenta u osnovi samo vjerojatni; uvijek postoji rizik da se prihvati pogrešna hipoteza. Stoga u eksperimentu treba ostvariti takve uvjete za pretpostavku da ona ne

zavisi o slučajnom djelovanju. Statistička metoda u planiranju eksperimenta ima za cilj provjeru hipoteze putem odgovarajućih testova čiji odabir zavisi o samom uzorku i načinu eksperimenta. Postoji mogućnost da se rezultati eksperimenta vrednuju ocjenom njihovih parametara. Statistička analiza ne može ispraviti pogrešno planiranje.

THE APPLICATION OF MATHEMATICAL STATISTICAL METHOD IN STUDENTS EXPERIMENTAL PROJECT

Lj. Vrček
Rudarska i kemijska škola , Hallerova aleja 3, HR-42000 Varaždin, Croatia

Experimental project is an autonomous students' work in which they, besides natural sciences, also learn scientific method as well as the ways of investigation. During investigational phenomena observation students put questions and give answers in the form of hypothesis which they will be able to test by an experiment. This article deals with the comprehensions of investigational results obtained by students during years of work. Descriptive and causal methods were used in it. These investigations aimed to gather the data about the factors important for testing hypothesis, in order to improve students experimental project. The basic characteristic of the experiment is variability of the results also containing unexpected variations. While planning the experiment the problem should be articulated, the sample and experimental equipment carefully chosen, and finally and then independent proportions determined. The efficiency in application of determined treatments and the number of their repeating should be planned to test. Hypothesis correctness testing based on mostly quantified empirical data can be done using mathematical statistical method. Statistical method enables two kinds of experimental conclusions: reviewing hypothesis significance with mistake and conclusions resulting from hypothesis testing based on comparison of different treatments. Since the conclusions based on experiment are basically only probable, there is always the risk of accepting the wrong hypothesis. That is why the conditions for the assumption which will not depend on unexpected action should be realised in the experiment. Statistical method in planning the experiment aims to test hypothesis by means of adequate tests the choice of which depends on the sample itself and the way of doing the experiment. There is the possibility to evaluate the experiment results with their parameter value. Statistical analysis cannot correct wrong planning.

OP-75

GLEDAM AIDS - VIZUALNI PRISTUP AIDS-u

Lj. Vöglein, S. Vučetić i A. Delić
XV. gimnazija, Jordanovac 8, HR-10000 Zagreb, Hrvatska (tinaV737@yahoo.co.uk, sanjavctc@yahoo.com, alendelic@operamail.com)

U okviru projekta *Zdravlje je naš izbor* Povjerenstvo za zdravstveno prosvjećivanje XV.gimnazije zajedno s učenicima škole te udrugom MIKS, postavilo je u mjesecu studenome izložbu *Gledam AIDS-vizualni pristup AIDS-u*. Cilj izložbe je bio biološko i psihološko osvješćivanje mladih različitih uzrasta u njihovom doživljaju AIDS-a kroz umjetnost. Mladi hrvatski umjetnici iz različitih područja umjetnosti predstavili su po jedan svoj rad na temu AIDS-a što je bio poticaj našim učenicima za vlastiti izričaj na istu temu. Oni su se pridružili izložbi svojim likovnim uradcima, posebno oblikovanim pozivnicama za otvaranje izložbe, info punktom s osnovnim pojmovima vezani uz AIDS (uzročnik,način prijenosa, simptomi, tijek bolesti, seropozitivamn, broj oboljelih u Hrvatskoj i svijetu, prevencija), slikama poznatih osoba HIV pozitivnih, oboljelih ili umrlih od AIDS-a, te Mračnom kutijom. Gledajući, razgovarajući s profesorima i međusobno, učili su o HIV-u i AIDS-u, ali i toleranciji prema različitosti Prije i poslije posjeta učenici su anketirani. Anketa je provedena u pisanom obliku. Izložba je bila otvorena i za javnost. Posjećivali su je i roditelji i učenici drugih škola uz stručno vodstvo naših profesora biologije i psihologije, te učenika učesnika izložbe. Svoje dojmove ostavili su zapisane u Knjizi utisaka. Mislimo da je izložba postigla još jedan cilj: kroz umjetnost razvijati i smisao zajedništva, ili kako je zapisao jedan roditelj "*Veliko mi je zadovoljstvo biti na izložbi koja s tako malo riječi uspjeva spojiti dva različita svijeta-svijet zdravih sa svijetom bolesnih.*".

LOOKING AT AIDS: A VISUAL APPROACH TO AIDS

Lj. Vöglein, S. Vučetić and A. Delić
XV. Gymnasium, Jordanovac 8 HR, HR-10000 Zagreb, Croatia (tinav737@yahoo.co.uk, sanjavctc@yahoo.com, alendelic@operamail.com)

Within the project " Health Is Our Choice" the Committee for health education at XV gimanzija and MIKS organization (NGO) set an exhibition " Looking at AIDS – a visual approach to AIDS" in November 2005. The aim of the exhibition was to educate teenagers,making them aware of the biological and psychological aspects of the disease in their understanding of AIDS through art.Young Croatian artists,working in various art fields,exhibited a piece of art

work each,with AIDS topic,which inspired our students to produce art work on the same topic.They participated in the exhibition with their own art work-especially designed invitation cards for the opening of the exhibition;they set up an info desk providing information regarding AIDS (its causes,transmission of AIDS,symptoms,course of disease,HIV,number of AIDS patients in Croatia, prevention,etc.).Furthermore,they displayed photos of HIV positive celebrities or those suffering from AIDS and photos of some celebrities who have died of it.Last,but not least they set up The Dark Box. We believe that the exhibition has gained an additional goal-developing a sense of unity through art,or as one of the parents wrote in the book:It gives me a great pleasure to attend an exhibition which has managed,with so few words,to bring together the world of the heathy and the world of the sick.

OP-76
VRATIMO DJECU PRIRODI – VRATIMO PRIRODU DJECI

V. Radek[1] i G. Sušić[2]
[1]Eko-centar Caput Insulae-Beli, Beli 4, HR-51559 Beli, otok Cres, Hrvatska, [2]Ornitološka postaja Cres, Hrvatska akademija znanosti i umjetnosti, Beli 4, HR-51559 Beli, otok Cres, Hrvatska (vesna.radek.bio@ck.htnet.hr, orlovlet@ri.t-com.hr)

Eko-centar Caput Insulae-Beli, koji na otoku Cresu djeluje kao međunarodni Istraživačko-edukacijski centar za zaštitu prirode već desetak godina provodi edukaciju djece osnovnoškolskog uzrasta, a kroz našu *Školu u prirodi* prošlo je već gotovo 10.000 djece. U prethodne dvije godine proveli smo projekt Europske komisije (EU) CARDS 2003: "Environmental Education", kroz koji smo osmislili edukacijski program "Učimo o Prirodi kroz prirodu". Ostvarujemo ga pomoću priručnika "Čarolija šume", radnih listića "Stablo - moj prijatelj", na poučnoj stazi "U igri s Prirodom" koja prolazi kroz drevnu hrastovu šumu. Do rezultata tog projekta, što smo ga proveli u suradnji s brojnim svjetskim stručnjacima, te s nekoliko škola iz različitih područja Hrvatske i u kojem je tijekom dvije godine sudjelovalo 2417 učenika i 227 profesora, došli smo analizom anonimnih evaluacijskih listića. Pokazalo se da postojeći školski programi ne omogućavaju djeci razumijevanje prirodnih procesa, jer gotovo uopće nema učenja *o prirodi u prirodi.* Uslijed toga sve više dolazi do gubitka sposobnosti djece da shvate međuovisnost živih bića, a kasnije i potrebu i/ili svrhu zaštite bioraznolikosti, tj. Prirode.

RECONECTING CHILDREN WITH NATURE AND NATURE WITH CHILDREN

V. Radek[1] and G. Sušić[2]
[1]Eco-center Caput Insulae-Beli, Beli 4, HR-51559 Beli, Island of Cres, Croatia, [2]Ornithological Station Cres, Croatian Academy of Sciences and Arts, Beli 4, HR-51559 Beli, Island of Cres, Croatia (vesna.radek.bio@ck.htnet.hr, orlov-let@ri.t-com.hr)

Eco-center Caput Insulae-Beli, which at the Island of Cres operates as Research and Educational Center for the Protection of Nature, runs the *School in the nature* where during the last ten years almost 10.000 children attended. Two years ago we started with the European Commission CARDS 2003 project "Environmental Education", which includes the program "Let's learn about Nature through the nature". We wrote a manual "Magic of the Forest", worksheets "Tree is a Friend of Mine" and established an educational path "In a Game with Nature". We cooperated with several international experts, several primary schools from different regions of Croatia. During two years we analyzed 2417 evaluation forms filled anonymously by children as well as 227 filled by teachers. Results show that present school programs are not promising in a way to ensure the change of existing direction: there are almost no schools *in nature about nature.* As a consequence, the lack of nature (nature-deficiency) in the lives of today's young generation produces alienation and will have a negative impact in children's development of creativity. Children's loss of regular contact with the nature can result in a biophobic future generation not interested in preserving nature and its diversity.

Erratum

BIOLOGIJA MORA
BIOLOGIA MARIS
MARINE BIOLOGY

Posterska priopćenja
Posters

P-145
METABOLIČKA AKTIVNOST MORSKIH BAKTERIJA U RAZLIČITIM UVJETIMA HRANJIVIH SOLI

D. Fuks, J. Radić, T. Radić i T. Šilović
Centear za istraživanje mora, Institut „Ruđer Bošković“, G. Paliage 5, HR-52210 Rovinj, Hrvatska (fuks@cim.irb.hr, jadranka.krstulovic@cim.irb.hr, radic@cim.irb.hr, tina.silovic@cim.irb.hr)

Samo dio ukupnog bakterioplanktona u vodenim sistemima je metabolički aktivno. Također, morske bakterije vrlo brzo mijenjaju svoje metaboličke aktivnosti ovisno o promjenama u okolini. Cilj ovog rada bio je utvrditi važnost visoko aktivne ETS (% CTC+) bakterijske frakcije, praćenjem njihove brojnosti i aktivnosti, u različitim uvjetima dostupnosti hranjivih soli i organske otopljene tvari u kontroliranim uvjetima. Planktonska zajednica uzorkovana u sjevernom Jadranu obogaćena je hranjivim solima u različitim omjerima (nedostatak fosfora; uravnotežen omjer N/P) i inkubirana tijekom dva tjedna u mesokosm-eksperimentu. Aktivnost bakterijske populacije praćena je preko: ukupne i specifične ugradnje leucina ([H^3]-Leu) i timidina([H^3]-TdR), omjera ugradnje leucina i timidina, te udjela aktivnih stanica koje mogu reducirati fluorogenu boju 5-cyano-2, 3-ditolyl tetrazolium klorid (CTC). Tijekom prvih 48 sati inkubiranja porast aktivnosti bakterija bio je podjednak u oba tretmana, dostigavši maksimum udjela CTC+ bakterija od 18-20%. Nakon toga, nesrazmjer bakterijske aktivnosti počinje „neuravnoteženim rastom“ bakterija koji neposredno prethodi maksimumu partikularne primarne proizvodnje (cvat mikrofito-planktona) u oba tretmana. Međutim do završetka pokusa, u tretmanu s uravnoteženim omjerom N/P zabilježen je značajan porast ugradnje timidina i leucina u stanice, te veliki udjel metabolički aktivnih bakterija (40% CTC+).Povećanje nesrazmjera u aktivnostima bakterijskih populacija upućuje na različitu strukturu i refraktornost proizvedene organske tvari od strane fitoplanktona u tretmanima,te na odgovor bakterijske populacije.

PROPORTION OF METABOLICALLY ACTIVE MARINE BACTERIA UNDER DIFFERENT NUTRIENT REGIMES

D. Fuks, J. Radić, T. Radić and T. Šilović
Center for Marine Research, „Ruđer Bošković“ Institute, G. Paliage 5, HR-

52210 Rovinj, Croatia (fuks@cim.irb.hr, jadranka.krstulovic@cim.irb.hr, radic@cim.irb.hr, tina.silovic@cim.irb.hr)

Nowadays it is recognized that only a fraction of aquatic bacteria is actively growing but there is little information about the factors constraining their metabolism. Marine bacterioplankton can rapidly modify their metabolic activity level in response to environmental changes. The aim of this study was to determine the importance of highly active ETS (% CTC+) fraction of bacterioplankton following its changes in abundance and activity levels in response to organic matter pools potentionally available for bacterial processing. The natural plankton communities from the northern Adriatic, amended with inorganic nutrients (P-deficient and nutrient balanced conditions, were incubated in experimental enclosures over two weeks. Indices of bacterial activity included: total and cell-specific incorporation rates of tritiated leucine ([H^3]-Leu) and thymidine ([H^3]-TdR), ratio of Leu and TdR incorporation and percentage of highly active cells as determined by detectable reduction of fluorogenic dye, 5-cyano-2, 3-ditolyl tetrazolium chloride (CTC). Patterns of change in bacterial metabolic activity were similar for both amandments up to 48 hours of incubation, approaching the maximum proportion of CTC+ bacteria (18-22%) in P-deficient as well as in nutrient balanced condotions. Afterwards, the disproportion of activity started with „unbalanced growth“ of bacteria, followed by substantial increase of TdR and Leu incorporation and CTC+ bacteria (up to 40%), respectively, in the nutrient balanced conditions. Continuous increase of disproportion in bactrial activity, started before maximum of particulate primary production, indicated different structure of organic matter available for bacteria.

P-146

UČINAK KADMIJA NA ULTRASTRUKTURU CRVENE MAKROALGE *Gracilaria longa*

D. Marić
Centar za istraživanje mora, Institut “Ruđer Bošković“, G. Paliaga 5, HR-52210, Hrvatska

Poznato je da teški metali imaju važnu ulogu u onečišćenju okoliša, a kadmij je jedan od najvažnijih zagađivala. Iako postoje mnoga istraživanja o mikroalgama, s makroalgama je provedena samo nekolicina, iako se smatraju značajnim indikatorima zagađenja zbog njihovog visokog kapaciteta bioakumulacije. Istražen je učinak kadmija na ultrastrukturu vegetativnih stanica crvene alge *Gracilaria longa* u laboratorijskim uvjetima. Talusi crvene

alge izložene su koncentracijama od 900 µM Cd^{2+}, 1200 µM Cd^{2+}, 1500 µM Cd^{2+} u trajanju od 5 dana dodavanjem kadmijevog nitrata u medij za uzgoj algi. Ultrastrukturalne promjene uslijed ad/absorbcije kadmija promatrane su TEM/SEM elektronskim mikroskopom. Mikroskopske analize pokazuju neobične promjene u plazmalemi tretiranih algi koja poprima nepravilan i atipičan izgled. Uočene su elektron transparentne vezikule koje nastaju uslijed intenzivnije sinteze polisaharida stanične stijenke. Pojava ribosoma i Golgijevih tijela, kojih u netretiranim stanicama nema u velikom broju, ukazuju na povećanu biosintezu proteina i ugljikohidrata. Stanične stijenke postaju deblje i glatke. „Elektron-dense“ mjehurići pojavljuju se na spoju stanične stijeke i plazmaleme, odnosno na samoj staničnoj stijenci i susjednom vezikularnom sistemu. Nastale su brojne male vakuole s velikom količinom kompleksa metala. Provedene analize dokazuju veliku adaptibilnost ove vrste na veliki raspon biotičkih i abiotičkih čimbenika, dok njena sposobnost bioakumulacije omogućuje korištenje ove vrste kao biofiltra u različitim uvjetima onečišćenosti voda teškim metalima.

THE EFFECTS OF CADMIUM ON THE ULTRASTRUCTURE OF A RED MACROPHYTE *Gracilaria longa*

D. Marić
Center for Marine Research, Rudjer Boskovic Institute, G. Paliaga 5, HR-52210 Rovinj, Croatia

It is well known that heavy metals play a significant role in environmental pollution and cadmium is one of the most important toxicans. There are many studies on microalge but only a few on macroalge although they are considered as valuable indicators because of their accumulation capacity. The effects of cadmium on the fine structure of the vegetative cells of the red alga *Gracilaria longa* were studied under laboratory cultured conditions. The red alga thalli were exposed to 900 µM Cd^{2+}, 1200 µM $Cd^{2+}$and 1500 µM Cd^{2+} concentration for 5 days by adding cadmium nitrate to the culture medium. Ultrastructural modifications due to cadmium ad/absorption were observed by TEM/SEM electron microscopy. Microscopy studies showed striking changes in the plasmalemma of treated algae, which became irregular and convoluted. Numerous electron transparent exocytic vesicles, possibly related to cell wall polysaccharide synthesis, were observed. The appearance of ribosomes and Golgi bodies, not significantly present in the cytoplasms of untreated cells, suggested enhanced protein and carbohydrate biosynthesis. The cell walls became smooth and thick. Electron-dense spheroids occurred in the plasmalemma-cell wall interface, on the cell wall itself and in nearby

vesicular membrane system. Many small vacuoles containing large metal complexes were formed. Conducted analyses indicate large adaptability to a considerable range of biotic and abiotic factors, while bioaccumulation capability of this species enables its use as a biofilter in various conditions of heavy metal pollution.

P-147
ULOGA MIKROFITOPLANKTONA U CVJETANJU MORA

R. Kraus
Centar za istraživanje mora, Institut "Ruđer Bošković", G. Paliaga 5, HR-52210 Rovinj, Hrvatska

Cvjetanje mora karakterizira pojava sluzavih makroagregata (dimenzija i do nekoliko metara), u gornjim slojevima vodenog stupca, te površinskih i ispod površinskih slojeva (duljine i do nekoliko kilometara), prvenstveno u frontalnim zonama između vodenih masa različitog saliniteta. Sluzava tvar makroagregata i slojeva nastaje nagomilavanjem suspendirane organske i anorganske tvari koja je uklopljena u sluzavu polisaharidnu mrežu nastalu uglavnom od izlučevina fitoplanktona, pretežno dijatomeja. Provedena je detaljna kvalitativna i kvantitativna analiza mikrofitoplanktonskih podataka u godinama cvjetanja mora (1991, 1997, 2000-2004) s ciljem boljeg razumijevanja njegove uloge u mehanizmu nastanka i razvoja ove pojave. Analiza mikrofitoplanktonskih zajednica u makroagregatima i usporedba s istim u morskoj vodi nije ukazala na postojanje određene vrste i/ili skupine vrsta koje bi bile u morskoj vodi u razdoblju koje prethodi cvjetanju, niti tijekom rane faze cvjetanja mora, što ukazuje na vjerojatnost da ne postoji jedna, a niti skupina vrsta koje bi u morskoj vodi potaknule cvjetanje mora. Vrste koje su bile dominantne u makroagregatima većinom su dominirale i u okolnoj morskoj vodi, te su uglavnom karakteristične vrste za sjeverni Jadran. Pretežno su to dijatomeje, za koje je poznato da imaju svojstvo izlučivanja sluzave tvari. Stoga se može zaključiti da ne postoje mikrofitoplanktonske vrste koje uzrokuju pojavu, već da je za nastanak cvjetanja mora neophodno da se istovremeno dogode brojni abiotički faktori koji će mikrofitoplanktonsku zajednicu u tom trenutku prisutnu u morskoj vodi potaknuti na izlučivanje polisaharidne tvari, te da će, ukoliko se nastave optimalni meteorološki i hidrografski uvjeti, doći do razvoja pojave cvjetanja mora.

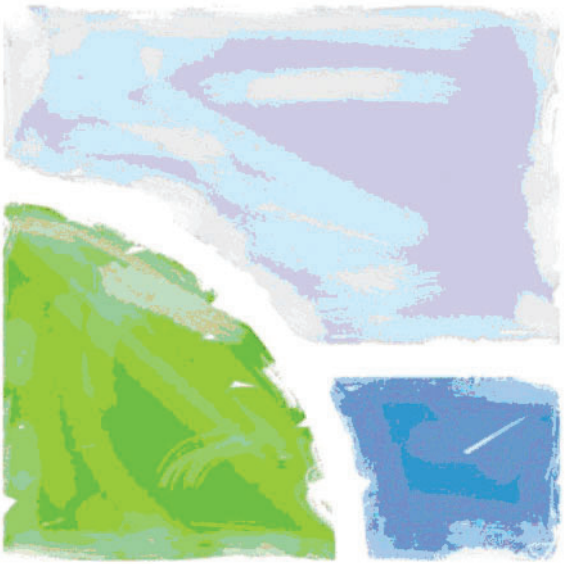
ROLE OF MICROPHYTOPLANKTON IN MUCILAGE EVENT

R. Kraus
Center for Marine Research, Rudjer Boskovic Institute, G. Paliaga 5, HR-52210 Rovinj, Croatia

Mucilage event is characterized by the formation of sticky macroaggregates (up to several meters long), predominantly in the upper water column, which are often accompanied by surface and subsurface layers (extending for several kilometres). Both form along the frontal zones between water masses of different salinity. Mucilaginous material structuring macroaggregates and layers are build-ups of suspended organic and inorganic matter, which is entrapped in a matrix generated by gelling of microphytoplankton exudated polysaccharides, predominantly by diatoms. With the aim of better understanding the role of microphytoplankton in the mucilage event, qualitative and quantitative analyses of the microphytoplankton community in the years with mucilage event (1991, 1997, 2000-2004) was completed. Analyses of the microphytoplankton community in the macroaggregates and comparison with same in seawater showed that there are no mucilage specific species, nor communities, in either the period prior to a mucilage event, or in its early phase. This would indicate that there exist no specific microphytoplankton species that trigger mucilage events. Dominant species in the macroaggregates dominated also in the surrounding water and were found to be characteristic species for the northern Adriatic. Those were primarily diatoms, known as good exudators of the mucilage matter. Therefore, it follows that no specific microphytoplankton species trigger mucilage events, but that it is necessary for several abiotic factors to coincide and induce the microphytoplankton community present at the time in the seawater to exude polysaccharide matter which, if optimal meteorological and hydrographical conditions continue, would result in the occurrence of a mucilage event.

Organizator se ispričava što su navedeni sažeci zbog tehničkih problema naknadno uvršteni u knjigu sažetaka.

PLAĆENI OGLASI
ADVERTISEMENTS



DRŽAVNI ZAVOD ZA

ZAŠTITU PRIRODE

SPONZORI
SPONZORS

Sigma je vodeći svjetski proizvođač biokemikalija, uključujući antibiotike, pufere, ugljikohidrate, enzime, forenzičke materijale, reagencije za histologiju i hematologiju, nukleotide te proteine/peptide/aminokiseline. Preko 30.000 preparata Vam stoji na raspolaganju, više informacija potrazite na http://www.bioti.hr/sial/.

SIGMA-ALDRICH BIOVIT d.o.o.

tel. 042.260.001 info@biovit.
fax. 042.260.021 http://www.biovit.

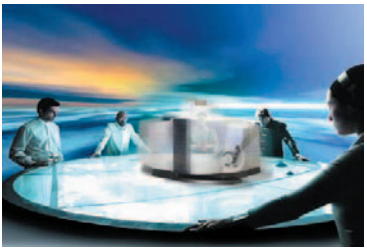
FRANK ANALAB d.o.o.
Trgovina, servis, proizvodnja i projektiranje
10000 ZAGREB, Ulica grada Vukovara 226 - HRVATSKA
Tel: 01 6137-572 Fax: 01 6137-571
E-mail: **frank-analab@zg.t-com.hr** ; www.frank-analab.hr

PRODAJNI PROGRAM

THERMO ELECTRON - USA

SPEKTROMETRIJA I KROMATOGRAFIJA

Atomsko-absorpciona spektrometrija
UV/VIS – spektrometrija
ICP-MS spektrometrija
Plinsko-masena spektrometrija (**GC/MS**)
Tekućinska-masena spektrometrija (**HPLC/MS**)
IR spektrometri (**FTIR, RAMAN**)
Tekućinska kromatografija (**HPLC**)
Plinska kromatografija (**GC**)
CHNOS analizatori
TOC analizatori



MILESTONE - ITALIJA

Mikrovalni sistemi za brzu pripravu krutih i tekućih uzoraka
Mikrovalni sistemi za brzo spaljivanje uzoraka, odredjivanje vlage i/ili hlapljivih komponenti
Mikrovalni sistemi za brze extrakcije, brze organske sinteze

SG - NJEMAČKA

Uređaji za pripravu čiste vode (ionska izmjena, reverzna osmoza, ultrafiltracija, kapaciteta od 6 - 20.000 l/sat.)

WALDNER GmbH- NJEMAČKA

Laboratorijski namještaj.

TECNIPLAST - ITALIJA

Kavezi za laboratorijske životinje, pribor, perilice kaveza

MRC - IZRAEL

Termostati, tresilice, mješalice, ultrazvučne kupelji …

LABOMAR d.o.o.

PROFIL koji se prepoznaje

školska knjiga

DODATAK
APPENDIX

Poštovane kolegice i kolege, dragi biolozi!

Čast nam je u ime Hrvatskog biološkog društva 1885 pozvati Vas na 9. Hrvatski biološki kongres koji će se održati u Rovinju od 23. do 29. rujna 2006. Želja nam je održati tradiciju najvećeg multidisciplinarnog skupa hrvatskih biologa s dvadesetpetogodišnjom tradicijom.
I ovaj ćemo Vam puta radom u posvećenim sekcijama omogućiti razmjenu postignuća, ideja i mišljenja te u poticajnom ozračju sagledati dosege suvremene hrvatske biologije. Sudjelovanjem vrhunskih predavača, znanstvenika i stručnjaka zasigurno ćemo zaokupiti Vašu pozornost i pridonijeti stvaralačkoj atmosferi.
Tišina borova u vrtu hotela Park i Eden, pogled na zvonik crkve Sv. Eufemije, uz miris tartufa i okus Istre doprinijet će biološkoj raznolikosti Vaših promišljanja.
Pozivamo Vas da svojim prilozima pridonesete našem Skupu.

Organizacijski i programski odbor

Dear colleagues,

We are honored to invite you to the 9th Croatian Biological Congres that will be held in beautiful town of Rovinj in the period from September 23 to September 29, 2006. This meeting, the largest multidisciplinary meeting in Croatia, continues a 25 year tradition dedicated to showcasing the forefront of biological research.
At tis meeting we will once again provide a forum, through dedicated sessions, for the exchange of results, ideas and opinions and foster a collegial atmosphere in which to appreciate the latest work on biology in Croatia. The contributions of our eminent speakers, scientists and experts will surely attract your attention and contribute to the creation of a stimulating atmosphere.
The serene forests surrounding the Park and Eden hotels, the view of the belltower of the St. Eufemija church, the scent of truffles and the tastes of Istria will provide a backdrop for stimulating meeting designed to enhance the diversity of your ideas and thoughts on biology.
We call on you to submit your work and enhence our meeting.

Organizing and Program Committee

ZAHVALE
ACKNOWLEDGMENTS

Hrvatsko biološko društvo 1885 zahvaljuje Zavodu za molekularnu biologiju Prirodoslovno-matematičkog fakulteta Sveučilišta u Zagrebu i Zavodu za molekularnu biologiju Instituta „Ruđer Bošković“ na tehničkoj pomoći tijekom cjelokupne pripreme Kongresa.

Hrvatsko biološko društvo 1885 zahvaljuje svim svojim članovima koji su na bilo koji način pomogli tijekom pripreme Kongresa.

Organizacijski i programski odbor zahvaljuje Mariju Beliću na izvrsnim dizajnerskim rješenjima korištenim za najavljivanje kongresa. Sanji Fulgosi i Mary Sopta na velikoj ljubaznosti tijekom lektoriranja hrvatskih i engleskih tekstova korištenih za najavljivanje Kongresa.

Croatian Biological Society would like to thank Department of Molecular Biology from Faculty of Science, University of Zagreb and Department of Molecular Biology from Ruđer Bošković Institute for the exclusive technical support during the whole preparation of the Congress.

Croatian Biological Society would like to thank all of its members that helped during the preparation of the Congress.

Croatian Biological Society would like to thank Mario Belić for the excellent design ideas used to announce the Congress, Sanja Fulgosi and Mary Sopta for the courtesy of editing the Croatian and English texts used to announce the Congress.

KAZALO AUTORA
INDEX OF AUTHORS

Acs E. (OP-18)
Adamić–Antolović Lj. (P-126)
Ahel M. (P-120)
Alegro A. (P-143)
Aleksoski J. (OP-17)
Amien A. (PL-6)
Antolić B. (OP-37, OP-43, OP-44, OP-45, OP-46)
Antolović J. (P-126)
Antolović M. (P-126)
Antolović N. (P-84, P-93, P-95, P-108, P-111, P-126)
Antolović R. (P-126)
Antonić O. (OP-57)
Atanasova-Pancevska N. (P-30, P-31)
Ayele B. (OP-22)
Babić Čegelj J. (P-36)
Babić M. (OP-52)
Bakmaz M. (P-25,, IL-11)
Bakran-Petricioli T. (OP-39, P-85, P-106, P-107)
Balen B. (OP-26)
Balić M. (OP-16)
Ballian D. (P-35)
Ban N. (PL-4)
Banham A. H. (OP-9)
Banjad Ostojić B. (P-127)
Barišić I. (IL-3, P-132)
Bartolić T. (P-134)
Bartulović V. (OP-38)
Bašić I. (OP-6, P-15, IL-11, P-78, P-80, P-81, P-82)
Batel R. OP-3, IL-17, P-119)
Batelja K. (P-128)
Bath A. (OP-64)
Bauer N. (OP-1, OP-19)
Beck R. (P-63)
Bedek J. (OP-28, P-58, P-130)
Belančić A. (P-129)
Bellmann B. (PL-6)
Benić N. (OP-29)
Benković V. (OP-6, P-15, P-78, P-81)
Benović A. (OP-41)
Beran A. (OP-51)
Berden Zrimec M. (P-89, OP-51)
Berković B. (P-85)
Bertaccini A. (IL-4)
Besendorfer V. (OP-2, P-144)
Bezić N. (P-14)
Bihari N. (IL-14)
Bilandžija H. (OP-28, P-130)
Bionda T. (IL-7)
Biruš I. (OP-1, P-1, P-7)
Blanuša M. (P-72)
Blažeković B. (P-24)
Blažević D. (P-109)
Boca I. (OP-29)
Bogdanović S. (IL-6, OP-13)
Bogunić F. (P-35)
Bogut I. (P-54, P-55)
Bojanić D. (P-86, P-131)
Bolotin J. (P-108)
Bonevski A. (P-22)
Boraska V. (P-2)
Borić E. (Op-67, OP-70)
Borics G. (OP-18)
Borović B. (IL-21)
Boršić I. ((IL-6, OP-13)
Bosak S.(OP-20)
Bossert J. (P-30)
Botti S. (IL-4)
Božić F. (OP-35, OP-36)
Bölter B. (P-20)
Brajčić D. (P-109)
Brautović I. (P-108)
Brčić-Kostić K. (P-1, P-7)
Britvec M. (OP-15)
Brkljačić-Kerhin V. (OP-4, P-4, P-10)
Brümmer F. (OP-50)
Brus R. (P-35)
Bubbola M. (P-26)
Bubić Špoljar J. (P-94)
Budzakoska-Gjoreska B. (P-73)
Buljubašić M. ((P-2, P-11)
Burghardt G.M. (PL-8)
Buršić M. (P-101)
Buzjak S. (P-49)
Car D. (OP-21)
Car H. (P-4)
Castagnone-Sereno P. (IL-1)
Cesar V. (P-91)
Chase M.W. (PL-3)
Chevaldonné P. (PL-9)
Cigić P. (IL-6, OP-13)
Clarkson J.J. (PL-3)
Coz-Rakovac R. (P-79)
Crnčević M. (P-131)
Cukrov M. (P-58)
Cvetkovska – Gjeorgievska A. (P-70)
Cvetnić Z. (P-117)
Cvitković I. (P-87)
Cvjetko P. (OP-52)
Cvjetković B. (P-87)
Čačev T. (OP-7)
Čalić V. (IL-18)
Čečuk-Jeličić E. (OP-4, P-4, P-10)
Čerba D. (P-54, P-55)
Černi S. (OP-10)
Četković H. (P-6, P-9)
Čivić K. (OP-31)
Čižmek H. (OP-39, P-107)
Čogelja Čajo G. (P-7)
Čok I. (P-126)
Čolig P. (P-56)
Čulig J. (OP-29)
Ćuk R. (P-57)

Ćurković Perica M. (P-12)
Ćurković S. (P-88, P-90, P-94, P-102, P-132, P-136)
Dabelić S. (OP-8)
Dabić M.M. (P-22)
de Jong W.W. (PL-11)
Definis-Gojanović M. (P-64)
Degobbis D. (IL-15)
Dekanić S. (OP-56)
Delić A. (OP-75)
Dermastia M. ((P-122)
Desnica S. (OP-64)
Despalatović M. (OP-43, OP-44, OP-45, OP-56, P-87)
Diadema K. (PL-10)
Dimitrieski M. (P-29, OP-23)
Divokvić A. (P-88)
Dobrović I. (IL-6, OP-13)
Dominis M. (OP-9)
Dovhanj J. (P-13)
Dragić-Runjak T. (OP-71)
Dragun D. (OP-72)
Dragun Z. (OP-55)
Dresselhaus T. (PL-6, IL-8)
Drinovec L. (P-89, OP-51)
Dubravac T. (OP-56, P-140)
Dubravčić D. (P-68)
Duić Ž. (P-83)
Dujmović Purgar D. (P-36, P-37)
Dujmović S. (OP-39)
Dulčić J. (P-91)
Dumić J. (OP-8, P-23)
Dunkić V. (P-14)
Dupčić I. P-110)
Durbešić P. (P-67, P-72, P-74, P-75)
Đakovac T. (IL-15)
Đermić D. (P-5)
Đikić D. (P-7, OP-6, P-78, P-81)
Đuras Gomerčić M. (P-59, P-69, P-88, P-90, P-92)
Đurinec M. (P-125)
Đurkić M. (P-142)
Erak Ž. (P-109)
Erben R. (OP-39, P-65)
Erk M. (OP-55)
Fabrio K. (P-143)
Falamić P. (P-68)
Ferri J. (P-91)
Filipič B. (IL-5, OP-11)
Forterre P. (PL-1)
Franković M. (P-68)
Frković A. (P-132)
Fuks D. (P-113, P-114, P-145)
Fulgosi H. (IL-7, OP-19, OP-20)
Furlan B. (P-126)
Galov A. (P-59, P-69, P-92, P-105)
Gamulin V. (P-6, P-9, OP-28)
Garaj-Vrhovac V. (OP-53, P-125)
Garić R. (OP-24)
Gebert M. (PL-6)
Gilming Vintar M. (OP-9)
Gjorgjievski M. (P-70)
Glamuzina B. (OP-38, P-110)
Glavić N. (P-84, P-93, P-108, P-111, P-131)
Gligora M. (OP-18)
Gluhaković M. (P-138)
Golani D. (P-97)
Gomerčić H. (P-88, P-90, P-92, P-94, P-98, P-102, P-105)
Gomerčić T. (P-59, P-69, P-88, P-90, P-92, P-94, P-98, P-102, P-105, P-132, P-136)
Gomerčić V. (P-94)
Goreta S. (P-128)
Gosic-Markovska B. (P-118)
Gospočić J. (OP-21)
Gottstein Matočec S. (P-130)
Gottstein Ž. (P-39, P-69)
Gračan R. (P-101)
Gradečki-Poštenjak M. (OP-65)
Gregorović G. (P-72)
Gregurić Gračner G. (P-139)
Grgić M. (OP-20)
Grigorszky I. (OP-18)
Grubelić I. (P-87)
Grubić Z. (OP-4, P-4, P-10)
Gužvica G. (P-132, P-136)
Gveroska B. (P-29, P-32, OP-23)
Hacmanjek M. (P-79)
Hagege D. (OP-25)
Hamer B. (OP-50, P-11, IL-19, P-119, P-144)
Harcet M. (P-6, P-9, OP-28)
Hazler Pilepić K. OP-16, IL-7)
Heffer-Lauc M. (P-7, P-18)
Heppell S. A. (P-144)
Heppell S. S. (P-144)
Holcer D. (P-144)
Horvat B. (P-62)
Horvat G. (OP-24)
Horvat N. (P-68)
Horvat T. (OP-1)
Horvat Knežević A. (OP-6, P-15, P-78, P-81)
Hristovski N. (P-38, P-60, P-61)
Hršak V. (P-138)
Huber Đ. (P-56, P-59, P-69, P-94, OP-64, P-132, P-136)
Hulina N. (P-37)
Humar I. (P-83)
Idžojtić M. (P-35)
Ilić S. (IL-21)
Ilieva M. (P-118)
Istenič D. (P-141)
Ivančić Baće I. (P-7)
Ivanković D. (IL-19)
Ivić D. (P-33)
Ivković M. (P-62)
Jaklin A. (OP-47, OP-49, OP-50, P-101, P-112)

Jakšić B. (OP-9)
Jakšić Ž. (IL-19, P-119)
Jalžić B. (P-58, P-130)
Janev Hutinec B. (OP-61)
Jardas I. (IL-12)
Jelaska S. (P-39, OP-19, OP-24)
Jelaska S.D. (OP-57)
Jelenić S. (P-133)
Jelić K. (OP-109)
Jelić M. (P-68)
Jelić T. (OP-67)
Jenni S. (PL-4)
Jeremić J. (OP-64)
John V. (OP-29)
Jokić M. (P-21)
Jovancev P. (P-32)
Jovanova-Hristovska E. (P-38)
Jurić S. (IL-7)
Kadereit J.W. (PL-2)
Kalinić L. (P-16)
Kamenjarin J. ((OP-14)
Kapetanović D. (OP-7, P-27)
Kapitanović S. (P-21)
Kapov S. (OP-69)
Kappé G. (PL-11)
Karakaš D. (OP-69)
Kardum Skelin I. (OP-9)
Katić J. (P-101)
Kerhin V. (P-83)
Kerhin-Brkljačić V. (P-4)
Kerovec M. (P-130)
Kezić D. (IL-10)
Kiš-Novak D. (OP-58)
Kiss K. T. (OP-18)
Kljaić K. (P-13)
Klobučar A. (OP-29)
Klobučar G.I.V. (OP-30, P-123)
Knapp S. (PL-3)
Knežević J. (IL-3)
Koce J.D. (P-122)
Kocijan I. (P-63, P-92, P-105)
Kokan B. (P-64)
Kopjar N. (OP-6, P-15, P-81, OP-53)
Korać P. (OP-9)
Koren S. (OP-11)
Korubin-Aleksoska A. (OP-17, P-40)
Kosalec I. (P-25, IL-11)
Kostadinovski M. (P-70)
Kostich D. (P-60)
Kovačec K. (P-68)
Kovačević S. (P-57)
Kovačić I. (P-98)
Kovačić M. (P-97)
Kovačić S. (P-45)
Kovarik A. (PL-3)
Kovšca A. (OP-35)
Kožul V. (P-93, P-95, P-111)
Krajačić M. (OP-10, OP-12)
Krajcar D. (OP-29)
Kralj K. (OP-18)
Kraljević M. (P-91)
Kraus R. (P-113, P-147)
Krča S. (IL-18, P-124)
Krčmar S. (P-1)
Križaić I. (OP-21)
Krsnik-Rasol M. (OP-25, OP-26)
Krulik I. (P-65)
Kružić P. (OP 39, P-96, P-99, P-100)
Kučinić M. (P-67, P-74)
Kungulovski Dz. P-30, P-31)
Kungulovski I. (P-30)
Kunštek – Kučanda T. (P-36)
Kurtović B. (P-27)
Kusak J. (P-56, P-69, P-99, P-100)
Kušan V. (P-39)
Labak I. (P-7, OP-67, OP-70)
Labar B. (OP-4, P-10)
Laćan I. (OP-66)
Lacković G. (OP-35, OP-36)
Lajtner J. (OP-30, P-65)
Lamba D. (IL-13)
Landeka N. (OP-29, P-119)
Lauc G. (P-1, P-18, P-92)
Lazar B. (P-101, P-144)
Legac M. (OP-40)
Leibundgut M. (PL-4)
Leiner S. (OP-59)
Leitch A.R. (PL-3)
Lejeusne C. (PL-9)
Leljak Levanić D. (PL-6, IL-8, OP-24)
Lepeduš H. (IL-7, P-51)
Leunissen J.A.M. (PL-11)
Liber Z. (P-45)
Likić S. (OP-12)
Lim K.Y. (PL-3)
Lisičić D. (P-15, P-78, P-79, P-81)
Ljubešić N. P-14, P-50, P-128)
Ljubičić I. (OP-15)
Ljuština M. (P-66, P-68)
Lončar J. (P-120, P-124)
Lucić A. (OP-30, P-65)
Lucić H. (P-88, P-90, P-94, P-98, P-102)
Lučić D. (OP-41, P-103, P-16)
Lučić I. (OP-62)
Lukić M. (OP-60)
Lukić-Bilela L. (P-6, P-9)
Lukša Ž. (P-134, OP-71)
Luo H. (PL-11)
Madirazza K. (P-109)
Magnus V. (IL-9, OP-22, P-52, P-53)
Maguire I. (OP-30, P-65)
Maier T. (PL-4)
Majić – Skrbinšek A. (OP-64)
Makk J. (OP-18)
Makovec T. (OP-41)
Malić-Limari S. (OP-61)

Malović L. (P-68)
Maltar T. (OP-54)
Marčelja E. (P-116)
Marić D. (P-146)
Marić S. (P-41)
Marinculić A. (P-63)
Marjanović K. (P-13)
Maršić-Lučić J. (P-104)
Márton M.L. (PL-6)
Matić- Skoko S. (P-91)
Matijević T. (IL-3)
Matyášek R. (PL-3)
Maurić M. (P-69)
McBride J.R. (OP-66)
Médail F. (PL-10)
Medak J. (OP-63)
Meljanac K. (P-22)
Melnjak A. (P-68)
Merdić E. (OP-29, P-77)
Meštrović N. (IL-1)
Miceska G. (P-29, OP-23)
Miceski T. (P-42)
Micetić V. (P-67)
Mićović V. (P-124)
Mihaljević S. (OP-22, OP-24)
Mihoković N. (P-68)
Mijatović A. (P-43)
Mikac B. (OP-48)
Mikić T. (P-35)
Milev M. (P-70)
Miličević T. (P-33)
Miloš M. (P-41)
Milošević B. (P-64)
Milosevski M. (P-30)
Milović M. (IL-6, OP-13)
Mitić B. (IL-6, OP-13)
Mitic V. (P-44, P-46)
Mitreski M. (OP-17)
Mlinarec J. (OP-2)
Modrić Ž. (P-47)
Mojsović A. (P-7)
Molinari I. (OP-51)
Monti M. (OP-51)
Morović M. (OP-16)
Müller I.M. (IL-13)
Müller W.E.G. (P-6, P-9, IL-13)
Mustać B. (OP-42)
Nagy B. (P-16)
Nerlović V. (OP-49)
Nikolić N. (P-105)
Nikolić T. (IL-6, OP-13, P-39)
Nikolić V. (OP-44)
Nikšić G. (P-45)
Njire J. (P-103, P-116)
Nolasco G. (OP-10)
Novokmet M. (IL-4)
Obarčanin A. (P-85)
Onofri V. (OP-41, P-95, P-116)
Orač F. (OP-16)
Oršolić N. (OP-6, P-15, P-25, IL-11, P-78, P-80, P-81, P-82)
Ozga J.A. (PL-5, OP-22)
Ozimec R. (OP-33, P-58, OP-62)
Pađen L. (P-69)
Palijan G. (P-54, P-55)
Papeš D. (OP-1, OP-2, OP-52)
Partl A. (P-135)
Patceva S. (P-44, P-46)
Pavelić J. (IL-3)
Pavičić I. (P-121)
Pavičić J. (IL-19)
Pavičić N. (P-51)
Pavičić-Hamer D. (IL-19)
Pavlak M. (P-139)
Pavlica M. (OP-52, P-123)
Pavlinić I. (OP-31)
Pavlović D. (P-132, P-136)
Pavoković D. (OP-25)
Peharda M. (P-109)
Peharec P. (OP-26)
Pepeljnjak S. (P-24, P-25, P-117)
Perić L. (IL-19)
Perić S. (OP-63)
Perina D. (P-9)
Peršurić Đ. (P-26)
Peruzović M. (P-2)
Petranović M. (P-2, P-5, P-11)
Petričević I. (OP-14)
Petricioli D. (OP-39, P-106, P-107)
Petrov-Rančić I. (P-96)
Pevalek-Kozlina B. (OP-21, OP-27, OP-59)
Piasevoli G. (P-137)
Pilaš I. (OP-63, P-140)
Pivčević B. (P-17, OP-54)
Plenković-Moraj A. (OP-18)
Plohl M. (IL-1)
Podrug M. (OP-55)
Poljuha D. (P-26)
Pongrac I. (P-45)
Popijač A. (OP-32)
Popović M. (P-17, P-76, OP-36)
Popović Z. (P-109)
Popovich E. (P-60)
Posavec A. (P-10)
Posavec-Vukelić V. (P-135, P-138, P-143)
Poštenjak K. (OP-65)
Požar-Domac A. (P-99, P-100, P-115)
Prebeg T. (P-50, P-128)
Precali R. (IL-15)
Prelik D. (P-70)
Prime M. (P-109)
Prukner-Radovčić E. (P-63, P-139)
Puc M. (P-83)
Radanović I. (OP-72)
Radek V. (OP-76)
Radić I. (P-99, P-100)

Radić J. (P-145)
Radić S. (OP-27)
Radić T. (P-113, P-114, P-145)
Radman M. (IL-2)
Radolović M. (OP-39, P-107)
Radović J. (IL-20, P-143)
Ramić S. (OP-6, P-15, OP-53)
Randić M. (P-47)
Rašan M. (P-134, OP-73)
Raspor B. (OP-55)
Razinger J. (P-122)
Reinecke D.M. (PL-5, OP-22)
Resanović R. (P-76)
Rešetnik I. (IL-6, OP-13)
Romanović M. (P-71)
Rusak G. (OP-12)
Ruso A. (P-16)
Sadarić I. (P-59)
Sadarić J. (P-59)
Saiz J.C. (PL-12)
Salaj-Šmic E. (P-7)
Salopek-Sondi B. (IL-9, OP-22)
Sansović I. (IL-3)
Sauerborn Klobučar R. (OP-5)
Schleiff E. (Pl-7, P-19)
Seiwerth S. (P-22)
Serkedjieva J. (P-25)
Serventi-Seiwerth R. (OP-4, P-10)
Shapkarev J. (P-73)
Sidri M. (OP-50)
Sinković N. (OP-71)
Sinovčić G. (OP-42)
Sivec I. (OP-32)
Skaramuca B. (P-84, P-93, P-108, P-111)
Skaramuca D. (P-84, P-93, P-108, P-111)
Skendrović M. (P-51)
Sladoljev S. (IL-5, OP-11)
Sladonja B. (P-26)
Slapnik R. (OP-34)
Slavikovski A. (P-68)
Smilkov S. (P-60, P-73)
Smital T. (OP-5, P-17, IL-8, OP-54, P-120, P-124)
Soll J. (P-20)
Sprunck S. (PL-6, IL-8)
Stagličić N. (P-109)
Stanić G. (P-24)
Stanić S. (P-70)
Staroveški B. (OP-68)
Stojan M. (P-127)
Stojanoska S. (P-48)
Stojanoski L. (P-48)
Stojanov A. (P-70)
Stojanovski S. (P-61)
Stritih J. (P-138)
Strunjak-Perović I. (P-79)
Sudarević N. (P-131)
Sušić G. (P-63, OP-76)
Sutlović D. (P-64)
Šantor M. (OP-16)
Šćekić V. (P-104)
Šerić Jelaska L. (P-72, P-75)
Šeruga Musić M. (P-12, IL-4)
Šikić J. (OP-68)
Šilović T. (P-114, P-145)
Šimunić Lj. (OP-45)
Škorić D. (IL-4, OP-10)
Škrabić V. (P-2)
Škrtić D. (P-88, P-90, P-94, P-102)
Šoškić M. (P-52, P-53)
Špoljarić I. (P-129)
Štajcar D. (IL-11)
Štambuk A. (OP-30, P-123)
Štifanić M. (OP-3)
Štingl K. (OP-4, P-4, P-10)
Štrbenac A. (OP-64, P-138)
Šumanovac I. (IL-8)
Šupraha S. (P-23)
Šver L. (IL-11)
Tadić Z. (P-78, P-79)
Tashkoski P. (P-29, OP-23)
Taskoski P. (P-32)
Temunović M. (P-75)
Terzić S. (IL-11)
Teskeredžić E. (P-27)
Teskeredžić Z. (P-27)
Tišler T. (OP-51)
Tkalec M. (OP-21)
Tomašević M. (P-142)
Tomašić A. (IL-9, P-53)
Tomovska Dz. (P-38, P-60, P-61)
Tomšić S. (P-95, P-110)
Topić Popović N. (P-79)
Topić R. (OP-31, IL-20, P-143)
Toth S. (IL-5, OP-11)
Trajanovski S. (P-73)
Traven L. (P-124)
Travizi A. (P-115, IL-16)
Trinajstić I. (OP-14)
Trojko K. (OP-73)
Trošić I. (P-121)
Tudor M. (P-104)
Tutman P. (P-84, P-93, P-108, P-111, P-131)
Tvrtković N. (P-101)
Vajn K. (P-18)
Valić D. (P-27)
Valpotić H. (IL-10)
Valpotić I. (IL-10, OP-35, OP-36)
van den Bosch M. (PL-11)
Vardić I. (P-27)
Včev A. (P-13)
Vejnović V. (OP-16)
Ventura R. (OP-9)
Vidaković J. (P-54, P-55)
Vidaković-Cifrek Ž. (OP-21)
Vijtiuk N. (OP-35, OP-36)

Viljetić B. (P-7, P-18, OP-29)
Vitas B. (P-66, P-68)
Vitasović Kosić I. (OP-15)
Vladimir-Knežević S. (P-24)
Vlahović K. (P-76, P-139)
Vlašić I. (P-7)
Vöglein Lj. (OP-75)
Vojta A. (P-19)
Vojta L. (P-20)
Vojvoda T. (P-115)
Vojvoda V. (P-16)
Volarević S. (PL-14)
Vrbek B. (OP-56)
Vrbek M. (P-49, P-140)
Vrček Lj. (OP-74)
Vrhovšek D. (P-141)
Vrsalović M. (P-57)
Vučetić S. (OP-75)
Vučković I. (P-57)
Vuđan M. (P-132)
Vuković S. (P-88, P-90, P-94, P-102)
Wrischer M. (P-50)
Zahradka D. (P-2, P-5, P-11)
Zahradka K. (IL-2, P-2, P-11)
Zavodnik D. (P-101)
Zemunik T. (P-2)
Zima D. (P-142)
Zlatar V. (P-68)
Zoko M. (P-109)
Zoldoš V. (OP-1)
Zrimec A. (P-89, OP-51, P-122)
Zucht W. (OP-50)
Zupan I. (P-143)
Zurak I. (P-28, P-34)
Žaja R. (OP-5, IL-18, P-120, P-124)
Žeger I. (P-143)
Želježić D. (OP-53)
Žitko T. (OP-29, P-77)
Žuljević A. (OP-37, OP-43, OP-44, OP-45, OP-46)
Žunec R. (OP-4, P-4, P-10)

9. Hrvatski biološki kongres
Croatian Biological Congress

s međunarodnim sudjelovanjem - with International Participation

Rovinj 2006. 23. rujna - 29. rujna : : September 23 - September 29

Organizira : Hrvatsko biološko društvo 1885 - SOCIETAS BIOLOGORUM CROATICA 1885
www.hbd1885.hr

Organized by : Croatian Biological Society - SOCIETAS BIOLOGORUM CROATICA 1885
www.hbd1885.hr

INFORMACIJE I REGISTRACIJA :

Organizacijski i programski odbor : Rooseveltov trg 6 HR - 10 000, Zagreb - Hrvatska

Osoba za kontakt : Dr. Sc. Dunja Leljak-Levanić (dunja@zg.biol.pmf.hr)

INFORMATION AND REGISTRATION :

Organizing and Program Committee : Rooseveltov trg 6 HR - 10 000, Zagreb - Croatia

Corresponding person : Dr. sc. Dunja Leljak-Levanić (dunja@zg.biol.pmf.hr)

Fotografija / Photo : *Drosera rotundifolia* L., okruglolisna rosika / Round Leaf Sundew, NP Plitvička jezera Photo and design : © Mario Belić (www.mariobelic.com)