



УНИВЕРЗИТЕТ У БАЊОЈ ЛУЦИ
UNIVERSITY OF BANJA LUKA



ПРИРОДНО-МАТЕМАТИЧКИ ФАКУЛТЕТ
FACULTY OF NATURAL SCIENCES AND MATHEMATICS



ZBORNIK SAŽETAKA

BOOK OF ABSTRACTS

IV SIMPOZIJUM BIOLOGA I EKOLOGA REPUBLIKE SRPSKE

sa međunarodnim učešćem – SBERS2020

Prirodno-matematički fakultet, Univerzitet u Banjoj Luci
12-14. novembar 2020.

IV SYMPOSIUM OF BIOLOGISTS AND ECOLOGISTS OF REPUBLIC OF SRPSKA

with international participation – SBERS2020

*Faculty of Natural Sciences and Mathematics, University of Banja Luka
12-14 November 2020*

Banja Luka, 2020.



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PROGRAM SIMPOZIJUMA *SYMPOSIUM PROGRAM*

Učešće online na platformi Google Classroom i Google Meet
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BOTANIKA I FIZIOLOGIJA BILJAKA ***BOTANY AND PLANT PHYSIOLOGY***

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Danijela Mišić, Branislav Šiler, Tijana Banjanac, Marijana Skorić, Uroš Gašić, Dragana Matekalo, Suzana Živković, Jasmina Nestorović Živković, Biljana Filipović, Slavica Dmitrović, Jelena Božunović, Milica Milutinović, Neda Aničić & Luka Petrović

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(BORAGINACEAE) U BOSNI I HERCEGOVINI
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(BORAGINACEAE) IN BOSNIA AND HERZEGOVINA
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WILD RASPBERRY FROM THE SERBIA – ANATOMICAL VARIABILITY OF THE LEAF

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WILD RASPBERRY FROM THE SERBIA – MORPHOLOGICAL VARIABILITY

Bojana Veljković, Violeta Jakovljević, Nataša Đorđević & Zora Dajić-Stevanović

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DIVERSITY OF NEEDLE VOLATILES OF NATIVE *Abies cephalonica* LOUDON POPULATIONS

Jelena S. Nikolić, Snežana Č. Jovanović, Bojan K. Zlatković, Jelena P. Stojanović, Gordana S. Stojanović, Petar D. Marin & Zorica S. Mitić

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Jelena P. Stojanović, Anđela B. Slavković, Jelena S. Nikolić, Bojan K. Zlatković & Zorica S. Mitić

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DIVERZITET ZMIJA OKOLINE TREBINJA

SNAKES DIVERSITY IN THE VICINITY OF TREBINJE

Goran Šukalo, Dejan Dmitrović, Sonja Nikolić & Ljiljana Tomović

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THE EFFECTS OF ESTRADIOL THERAPY ON OXIDATIVE STRESS MARKERS IN ERYTHROCYTES AND BLOOD PRESSURE IN PREECLAMPSIA

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THE EFFECTS OF MATERNAL THROMBOPHILIA ON THE REDOX HOMEOSTASIS OF AMNIOTIC FLUID AND AMNIOTIC FLUID CELLS

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Veličković

BIOHEMIJA I MOLEKULARNA BIOLOGIJA BIOCHEMISTRY AND MOLECULAR BIOLOGY

PLENARNO PREDAVANJE/PLENARY LECTURE

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Milica Milutinović & Jelena Brkljačić

USMENA IZLAGANJA/ORAL PRESENTATIONS

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Nevena Petrović & Marijana Kosanić

UČESTALOST BAKTERIJA *Escherichia coli* I *Shigella spp.* NA POVRTLARSKIM KULTURAMA NA PODRUČJU SEMBERIJE
FREQUENCY OF BACTERIA *Escherichia coli* AND *Shigella spp.* IN VEGETABLE IN THE AREA OF SEMBERIJA
Svjetlana Lolić, Radoslav Dekić, Maja Manojlović, Biljana Radusin Sopić & Jelena Antić Stanković

CHLAMYDIA AND GONORRHEA PREVALENCE AMONG MEN WHO HAVE SEX WITH MEN IN COMMUNITY BASED CENTRE IN ZAGREB, CROATIA
Petra Šimičić, Leona Radmanić, Maja Erceg Tušek, Davor Dubravić, Josip Kresović, Tomislav Beganović, Arian Dišković, Šime Zekan & Snježana Židovec Lepelj

BEZBEDNOST HRANE I ZDRAVLJE POTROŠAČA
FOOD SAFETY AND CONSUMERS HEALTH
Gordana Jovanović & Bojan Damnjanović

EKOLOGIJA BILJAKA **PLANT ECOLOGY**

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ECOLOGICAL – PHYTOGEOGRAPHICAL CHARACTERISTICS OF THE WEED FLORA OF VEGETABLES CROPS IN THE SURROUNDING OF ČENTA VILLAGE (SOUTH BANAT, SERBIA)
Marko Nestorović

CORRELATION PATTERNS IN THREE *Lamium* SPECIES GROWN IN TWO LIGHT AND THREE DENSITY TREATMENTS
Nataša Barišić Klisarić, Stevan Avramov, Danijela Miljković, Uroš Živković & Aleksej Tarasjev

SEASONAL VARIABILITY IN CORRELATION PATTERNS AMONG *Iris variegata* L. GENOTYPES GROWING IN CONTRASTING LIGHT CONDITIONS
Uroš Živković, Stevan Avramov, Nataša Barišić Klisarić, Danijela Miljković, Ljiljana Tubić, Danijela Mišić, Branislav Šiler & Aleksej Tarasjev

VARIJABILNOST SESKVITERPENA U ETARSKOM ULJU VRSTE *Teucrium montanum* L. (LAMIACEAE) SA SERPENTINITSKIH I KREČNJAČKIH STANIŠTA
VARIABILITY OF SESQUITERPENES IN ESSENTIAL OIL OF *Teucrium montanum* L. (LAMIACEAE) FROM SERPENTINITE AND CALCAREOUS HABITATS
Nenad Zlatić, Vladimir Mihailović, Marija Lješević, Vladimir Beškoski & Milan Stanković

VARIJABILNOST ANTIOKSIDATIVNE AKTIVNOSTI VRSTE *Mentha pulegium* (LAMIACEAE) SA RAZLIČITIH STANIŠTA
VARIABILITY OF ANTIOXIDATIVE ACTIVITY OF *Mentha pulegium* (LAMIACEAE) FROM DIFFERENT HABITATS
Marija Todorović, Nenad Zlatić & Milan Stanković

FANEROFITE U FLORI BILEĆE
PHANEROPHYTE IN THE FLORA OF THE MUNICIPALITY OF "BILEĆA"
Nataša Marić, Slađana Petronić & Anđela Radovanović

EKOLOGIJA ŽIVOTINJA **ANIMAL ECOLOGY**

PLENARNO PREDAVANJE/PLENARY LECTURE

ZAJEDNICE MAKROINVERTEBRATA U EKSTREMNIM STANIŠTIMA
MACROINVERTEBRATE COMMUNITIES IN EXTREME ENVIRONMENTS
Ana Savić

USMENA IZLAGANJA/ORAL PRESENTATIONS

KVALITETA ARHIVSKOG MATERIJALA ZA DNA-BARKODIRANJE
QUALITY OF ARCHIVED MATERIAL FOR DNA BARCODING
Valerija Begić, Mirela Sertić Perić, Mihaela Štargl, Matea Svoboda, Petra Korać & Ines Radanović

POSTER PREZENTACIJE/POSTER PRESENTATIONS

STANJE TAKSONA ZOOBENTOSA KAPTIRANIH IZVORA NACIONALNOG PARKA KOZARA
STATE OF ZOOBENTHOS TAXA IN CAPTURED SPRINGS OF KOZARA NATIONAL PARK
Dejan Dmitrović, Goran Šukalo, Ana Savić & Vladimir Pešić

PRVI NALAZI *Cyzicus* sp. (CRUSTACEA, SPINICAUDATA) U BOSNI I HERCEGOVINI
FIRST RECORDS OF *Cyzicus* sp. (CRUSTACEA, SPINICAUDATA) IN BOSNIA AND HERZEGOVINA
Dejan Dmitrović, Goran Šukalo & Dragana Miličić

IHTIOFAUNA DONJEG DIJELA TOKA RIJEKE VRBANJE (REPUBLIKA SRPSKA, BiH)
ICHTHYOFAUNA OF LOWER COURSE OF VRBANJA RIVER (REPUBLIC OF SRPSKA, B&H)

Svjetlana Cvijić, Dragojla Golub, Goran Šukalo, Radoslav Dekić, Desanka Kostić & Branko Miljanović

REPRODUKTIVNI CIKLUS MEDITERANSKE DAGNJE (*Mytilus galloprovincialis* LAMARCK, 1819) U BOKOKOTORSKOM ZALIVU (CRNA GORA, JUGOISTOČNI JADRAN)

REPRODUCTIVE CYCLE OF THE MEDITERRANEAN MUSSEL (*Mytilus galloprovincialis* LAMARCK, 1819) IN BOKA KOTORSKA BAY (MONTENEGRO, SOUTH-EAST ADRIATIC)

Sladana Gvozdrenović, Milica Mandić, Vladimir Pešić, Ines Peraš & Marko Nikolić

NEW RECORDS OF ENDEMIC SPECIES OF EARTHWORM THE *Allolobophora mayeri* (MRŠIĆ, 1990) (LUMBRICIDAE) IN BOSNIA AND HERZEGOVINA

Filip Popović, Mirjana Stojanović, Tanja Trakić & Jovana Sekulić

NOVI NALAZI VRSTE *Ancilus recurvus* MARTENS, 1873
U BOSNI I HERCEGOVINI

NEW FINDINGS OF *Ancilus recurvus* MARTENS, 1873
IN BOSNIA AND HERZEGOVINA

Jasminko Mulaomerović

PRIOLOG POZNAVANJU SLIJEPIH MIŠEVA BRDA MOŽURA
CONTRIBUTION TO THE KNOWLEDGE OF BATS OF THE MOŽURA HILL
Čeda Ivanović, Mihailo Jovičević & Jasminko Mulaomerović

MOLECULAR IDENTIFICATION OF GREEN FROGS (ANURA: RANIDAE: *Pelophylax*) OF WESTERN BALKANS (BOSNIA & HERZEGOVINA AND MONTENEGRO)

Adnan Zimić, Berina Vrhovac, Emina Šunje, Ana Ćurić & Belma Kalamujić Stroil

GREEN FROGS (*Pelophylax* spp.) SCREENINGS OF AMPHIBIAN EMERGING PATHOGENS *Batrachochytrium dendrobatidis* AND *Ranavirus*

Adnan Zimić, Medina Rondić, Jaime Bosch, Berina Vrhovac & Barbora Thumsová

SUBBIOCODE – RAZVOJ NOVIH ALATA ZA BRZU PROCJENU PODZEMNOG BIODIVERZITETA U BOSNI I HERCEGOVINI

SUBBIOCODE – DEVELOPING NEW TOOLS FOR RAPID ASSESSMENT OF SUBTERRANEAN BIODIVERSITY IN BOSNIA AND HERZEGOVINA

Maja Zagmajster, Špela Borko, Gregor Bračko, Teo Delić, Cene Fišer, Ester Premate, Monika Šafhauzer, Peter Trontelj & Jasminko Mulaomerović

ZAŠTITA BIODIVERZITETA BIODIVERSITY CONSERVATION

PLENARNA PREDAVANJA/PLENARY LECTURES

ULOGA NAUKE U ZAŠTITI BIODIVERZITETA
THE ROLE OF SCIENCE IN BIODIVERSITY CONSERVATION

Jelena M. Aleksić

ŽIVOTINJE VLAŽNIH I EFEMERNIH VODENIH STANIŠTA KAO INDIKATORI
GLOBALNIH KLIMATSKIH PROMENA
WETLAND AND EPHEMERAL AQUATIC ANIMALS AS INDICATORS OF
GLOBAL CLIMATE CHANGE

Dragana Miličić

UTJECAJ VIŠESTRUKIH STRESORA NA ZAVIČAJNE ZAJEDNICE
SLATKOVODNE IHTIOFAUNE
EFFECT OF MULTIPLE STRESSORS ON NATIVE FRESHWATER FISH
COMMUNITIES

Marina Piria

USMENA IZLAGANJA/ORAL PRESENTATIONS

BENTOSKE ZAJEDNICE RIJEKE NERETVE
BENTHIC ASSEMBLAGES OF THE NERETVA RIVER BASIN

Anđelka Lasić, Anita Dedić, Svjetlana Stanić-Koštroman , Dragan Škobić & Jerko
Pavličević

KATEGORIJE UGROŽENOSTI I STATUSI ZAŠTITE POJEDINIH SLATKOVODNIH
VRSTA NA PODRUČJU BOSNE I HERCEGOVINE
THREAT CATEGORIES AND PROTECTION STATUS OF CERTAIN FRESHWATER
SPECIES IN THE TERRITORY OF BOSNIA AND HERZEGOVINA

Ana Crnković, Maja Manojlović & Radoslav Dekić

PRIJEDLOG MJERA ZA REVITALIZACIJU ZAŠTIĆENOG STANIŠTA TIŠINA
PROPOSAL OF MEASURES FOR REVITALIZATION OF PROTECTED HABITAT
TIŠINA

Nataša Mazalica & Jovica Sjeničić

POSTER PREZENTACIJE/POSTER PRESENTATIONS

ALGAE DIVERSITY IN MOUNTAIN STREAMS IN THE AREA OF VRANICA
MOUNTAIN (BOSNIA AND HERZEGOVINA)

Ermin Mašić, Nadira Likić & Amela Sarajlić

DIVERZITET MEDONOSNIH BILJAKA U UZORCIMA MEDA IZ BOSNE I
HERCEGOVINE
DIVERSITY OF HONEY PLANTS IN HONEY SAMPLES ORIGINATING FROM
BOSNIA AND HERZEGOVINA

Velida Bakić, Edina Muratović, Sabina Trakić & Samir Đug

PREGLED OBJAVLJENIH RADOVA O ZAJEDNICI MAKROINVERTEBRATA U
MALIM VODENIM TELIMA NA TERITORIJI BALKANSKOG POLUOSTRVA
OVERVIEW OF PUBLISHED PAPERS ON MACROINVERTEBRATE
ASSEMBLAGE IN SMALL WATER BODIES IN BALKAN PENINSULA

Nenad Ilić & Jelena Grozdanović

**ZAŠTITA ŽIVOTNE SREDINE
ENVIRONMENTAL PROTECTION**

POSTER PREZENTACIJE/POSTER PRESENTATIONS

POREĐENJE IMTA I UZGOJA MEDITERANSKE DAGNJE (*Mytilus galloprovincialis* L.) U MONOKULTURI U BOKOKOTORSKOM ZALIVU
IMTA vs. MONOCULTURE FARMING OF MEDITERRANEAN MUSSEL (*Mytilus galloprovincialis* L.) IN BOKA KOTORSKA BAY
Sladana Gvozdrenović, Milica Mandić, Vladimir Pešić, Marko Nikolić & Zdravko Ikica

IMPACTS OF SMALL HYDRO POWER PLANT AND FISH POND ON DIATOM COMMUNITY (PRIŠTAVICA RIVER, SERBIA)
Olga Jakovljević, Sladana Popović & Jelena Krizmanić

ZAGAĐENJE VAZDUHA PRIZEMNIM OZONOM I NJEGOV UTICAJ NA ZDRAVLJE LJUDI I VEGETACIJU
GROUND LEVEL OZONE AIR POLLUTION AND ITS IMPACT ON HUMAN HEALTH AND VEGETATION
Ranka Radić, Jovana Rudić, Aleksandra Bursać & Jelena Zorić

KVALITET VODE REKA BANJE I POCIBRAVE
WATER QUALITY OF RIVERS BANJA AND POCIBRAVA
Nikola Dukić & Milica Živković

MICROPLASTICS IN WATER AND ITS IMPACT ON THE ENVIRONMENT
Kristina Manevski, Dina Tenji, Jasna Stepanov, Vesna Teofilović, Lara Dronjak, Bojan Damnjanović & Milica Živković

**BIOLOGIJA I EKOLOGIJA: POLOŽAJ U ŠKOLAMA
BIOLOGY AND ECOLOGY: POSITION IN SCHOOLS**

PLENARNO PREDAVANJE/PLENARY LECTURE

NASTAVNI PROGRAMI BIOLOGIJE U OSNOVNOJ ŠKOLI U SRBIJI I REPUBLICI SRPSKOJ
BIOLOGY SYLLABI IN PRIMARY SCHOOLS IN SERBIA AND THE REPUBLIC OF SRPSKA
Tijana Pribičević, Vera Županec & Tomka Miljanović

POSTER PREZENTACIJE/POSTER PRESENTATIONS

POTENCIJALI NASTAVE BIOLOGIJE KOJA SE REALIZUJE NA DALJINU PUTEM GOOGLE PLATFORME - PREDNOSTI I NEDOSTACI
POTENTIALS OF BIOLOGY TEACHING THAT IS CARRIED OUT REMOTELY VIA GOOGLE PLATFORM - ADVANTAGES AND DISADVANTAGES
Tihomir Lazarević, Vera Županec, Tijana Pribičević & Tomka Miljanović

ZNAČAJ I PRIMENA PROBLEMSKI ORIJENTISANE NASTAVE BIOLOGIJE U FUNKCIONALNOM OSNOVNOM OBRAZOVANJU ODRASLIH



SIGNIFICANCE AND APPLICATION OF PROBLEM-BASED BIOLOGY LEARNING
IN FUNCTIONAL BASIC EDUCATION OF ADULTS

Vera Županec, Nina Kirov, Tijana Pribičević, Tomka Miljanović & Tihomir Lazarević

TEŽNJA KA ZDRAVIM NAVIKAMA U OSNOVNOŠKOLSKOM
OBRAZOVANJU U REPUBLICI SRBIJI
STRIVING FOR HEALTHY HABITS IN PRIMARY EDUCATION
IN THE REPUBLIC OF SERBIA

Dragana Miličić, Jelena Trajković, Sofija Pavković-Lučić, Tatjana Savić & Marina
Drndarski

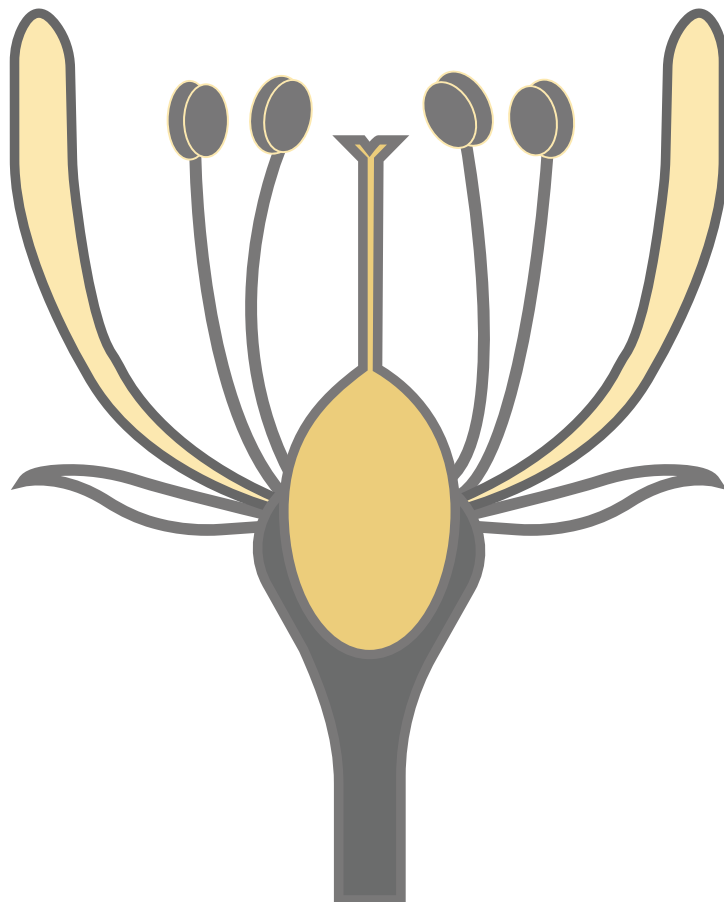
RAZVOJ EKOLOŠKE SVIJESTI KROZ EKOLOŠKO OBRAZOVANJE I
VASPITANJE UČENIKA OSNOVNE ŠKOLE
DEVELOPMENT OF ECOLOGICAL AWARENESS THROUGH ECOLOGICAL
EDUCATION AND UPBRINGING OF PRIMARY SCHOOL STUDENTS

Milica Savić Knežević & Zorana Hrkić Ilić



Botanika i fiziologija biljaka

Botany and Plant Physiology



**VRSTE RODA *Centaurium* (FAM. GENTIANACEAE) NA
BALKANSKOM POLUOSTRVU: DIVERZITET,
SPECIJALIZOVANI METABOLIZAM I EKOFIZIOLOGIJA**

Danijela Mišić*, Branislav Šiler, Tijana Banjanac, Marijana Skorić, Uroš Gašić, Dragana Matekalo, Suzana Živković, Jasmina Nestorović Živković, Biljana Filipović, Slavica Dmitrović, Jelena Božunović, Milica Milutinović, Neda Aničić & Luka Petrović

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Rod *Centaurium* Hill (fam. *Gentianaceae*) sadrži oko 25 jednogodišnjih ili dvogodišnjih biljnih vrsta mediteranskog porekla, koje poseduju dobro poznata bioaktivna svojstva. U flori Balkanskog poluostrva prisutno je pet vrsta roda *Centaurium*: *Centaurium erythraea* Rafn, *C. littorale* (Turner) Gilmour, *C. tenuiflorum* (Hoffmanns. & Link) Fritsch, *C. pulchellum* (Sw.) Druce i *C. maritimum* (L.) Fritsch. Višegodišnja istraživanja vrsta roda *Centaurium* u okviru Instituta za biološka istraživanja „Siniša Stanković“ - Instituta od nacionalnog značaja za Republiku Srbiju, Univerziteta u Beogradu, rezultovala je formiranjem kolekcije semena *ex situ*, koja dobro oslikava biodiverzitet roda *Centaurium* na Balkanskom poluostrvu. Pored priznatih taksona sa diploidnim i poliploidnim genomima, kolekcija semena koja broji ukupno 153 uzorka, sadrži homoploidne i aloploidne hibridogene jedinice različitog porekla. Ovaj neprocenjivi izvor biljnog materijala olakšao je rasvetljavanje složenih filogenetskih odnosa u okviru roda *Centaurium*, primenom morfoloških, molekularnih (EST-SSR, *trnL-F*, TRAP, etc.) i hemijskih markera, koji pokazuju visoku rezoluciju u diskriminaciji taksona. Pored toga, omogućeno je istraživanje ekoloških i evolucionih procesa (kao što su: međuvrsna hibridizacija, poliploidizacija, fragmentacija staništa, genetički drift) i njihovog efekta na biodiverzitet (genetički i hemijski) taksona koji pripadaju rodu *Centaurium*. Primena “*multi-omics*” pristupa u istraživanjima, omogućila je rasvetljavanje metabolizma sekoiridoidnih glukoza kod vrsta roda *Centaurium*, opisivanje njegovog odnosa sa celokupnom fiziologijom biljaka i njegove uslovljenosti biotičkim i abiotičkim faktorima spoljašnje sredine. Multidisciplinarni pristup istraživanjima dao je uvid u molekularne osnove i regulatorne mehanizme konstitutivne biosinteze sekoiridoida kod vrsta roda *Centaurium* pod uticajem faktora spoljašnje sredine, i na različitim nivoima organizacije: unutar- i među-vrsna varijabilnost, kao i ona na unutar-individualnom nivou.

Primenom biotehnoloških metoda u istraživanjima težimo održivoj proizvodnji bioaktivnih jedinjenja vrsta roda *Centaurium* u homologim i heterologim sistemima.

KLJUČNE REČI: *Centaurium*, sekoiridoidi, genetički diverzitet, hemodiverzitet, metabolizam sekoiridoida

***Centaurium* TAXA (FAM. GENTIANACEAE) IN THE BALKAN PENINSULA: DIVERSITY, SPECIALIZED METABOLISM AND ECOPHYSIOLOGY**

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The genus *Centaurium* Hill (fam. Gentianaceae) comprises about 25 annual or biannual species of the Mediterranean origin possessing widely recognized bioactive properties. Five species of this genus are represented within the flora of the Balkan Peninsula: *Centaurium erythraea* Rafn, *C. littorale* (Turner) Gilmour, *C. tenuiflorum* (Hoffmanns. & Link) Fritsch, *C. pulchellum* (Sw.) Druce, and *C. maritimum* (L.) Fritsch. Decades of research on the *Centaurium* species within the Institute for Biological Research “Siniša Stanković” - National Institute of the Republic of Serbia, has resulted in the establishment of *ex situ* seed collection, which fully represents the biodiversity of this genus in the Balkan Peninsula. In addition to accepted taxa with diploid or polyploid genomes, homoploid and allopolyploid hybrids of different origin are stored within the *ex situ* collection, which contains totally 153 accessions. This valuable source of plant material has facilitated resolving the complex phylogenetic relationships within the *Centaurium* genus by adopting morphological, molecular (EST-SSR, *trnL-F*, TRAP, etc.) and chemical markers with high discrimination resolution within taxa. Furthermore, it enabled studying the interplay between ecological and evolutionary processes (e.g. interspecific hybridization, polyploidization, habitat fragmentation, genetic drift), and their effects on the biodiversity of *Centaurium* taxa (both genetic and chemical). By adopting multi-omics approach we study secoiridoid glucosides metabolism and its relationship to the overall plant physiology, as well as its role in plant-biotic and plant-abiotic interactions. The multidisciplinary approach of our studies provided an insight into the molecular background and regulatory networks of constitutive secoiridoids' biosynthesis in *Centaurium* taxa as influenced by environmental factors, while resolving their complex multi-level diversity at inter- and intra-species, as well as at intra-species level. Through the implementation of biotechnology tools,



our intention is to provide sustainable sources of valuable secoiridoids in homologous or heterologous systems.

KEYWORDS: *Centaurium*, secoiridoids, genetic diversity, chemodiversity, secoiridoid metabolism