Balkan Botanical Congress 2015

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Book of abstracts

Natural History Museum Rijeka
Croatian Botanical Society
Botanical Society of Slovenia
University of Rijeka

6th Balkan Botanical Congress

Book of abstracts

Rijeka, September 14-18, 2015

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Nejc Jogan

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PBZ Card Ltd., Travel Agency
Radnička cesta 44, 10000 Zagreb, Croatia

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Faculty of Science, Department of Biology, University of Zagreb Rooseveltov trg 6, Zagreb, Croatia

PBZ Card Ltd., Travel agency
Radnička cesta 44, 10000 Zagreb, Croatia

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Exhibitors

Carl Zeiss d.o.o.
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Preface

Dear colleagues,

Natural History Museum Rijeka, Croatian Botanical Society and Botanical Society of Slovenia, together with University of Rijeka, have a great opportunity to welcome you all at the 6th Balkan Botanical Congress.

The 6th Balkan Botanical Congress, a prominent and renowned scientific gathering, aims once again to bring together botanists involved in research of plant life of the Balkan Peninsula with emphasis on the conservation of biodiversity of this extremely rich flora and vegetation. The purpose of the Congress is also to provide an excellent opportunity to hear the latest results, to share research experiences and to develop new and strengthen the existing contacts between colleagues from different countries. The program of the Congress includes four lecture days that will allow plenary, oral and poster presentations, social events, mid-congress excursions and a post-congress field trip.

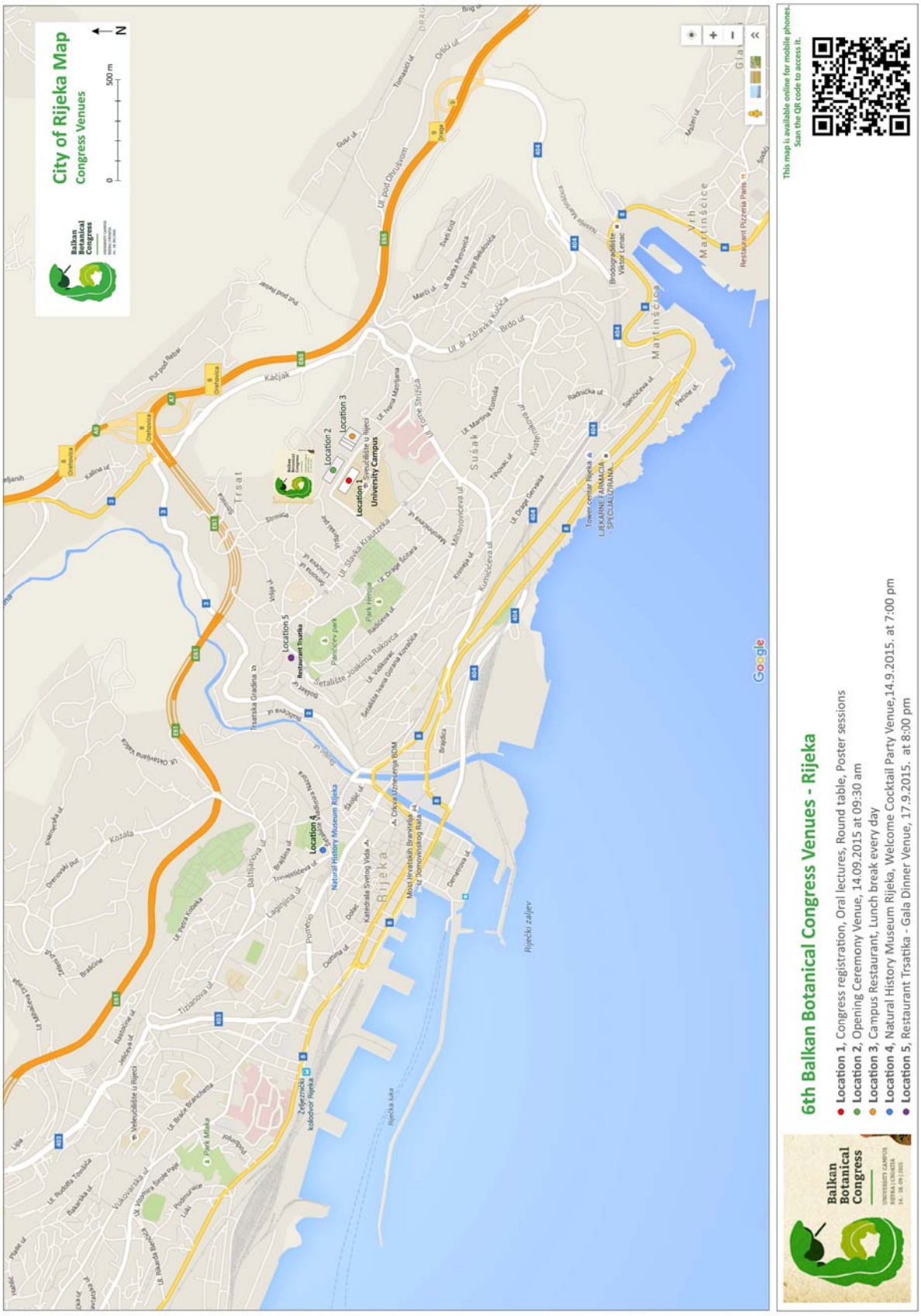
The Book of Abstracts comprises over 200 presentations by more than 500 scientists, covering the areas of plant anatomy and morphology, taxonomy, floristics, alien and invasive plants researches, phylogeography and phylogeny, conservation issues, vegetation and ecology, traditional uses of plants and ethnobatanical studies, historical and archaebotanical researches and other botanical disciplines, all contributing to better understanding of beautiful, vibrant, rich and mysterious plant life of the Balkans.

We wish you all a successful congress work, fruitful discussions and a pleasant stay in Rijeka.

Željka Modrić Surina,
President of the Organizing Committee

Table of Contents

Congress venues



Programme

Monday, September 14

8:00	Registration (location 1)
9:30	Opening ceremony (location 2)
10:00	**Surina B.** - Magnificent plant life of the Liburnian karst in light of 300 years of botanical exploration
10:30	Coffee break (location 2)
	Oral presentations (location 1)
11:30	**Strid A.** – Atlas of the Aegean Flora
11:50	**Rottensteiner W.K.** - Further intentions in the 'Flora of Istria' project
12:10	**Barina Z., Pifkó D., Rakaj M.** - A critical checklist of the Albanian vascular flora
12:30	**Tan K., Biel B.** - The flora of Samothraki with special emphasis on its phytogeographical relationships
12:50	**Jogan N.** - Is 500 species in 0, 35 km2 a lot? Flora of Ljubljanski Grad hill (C Slovenia)
13:10	**Škunca M., Mesić Z., Šteko V., Berta A., Peternel H.** - Area evaluation from the aspect of biodiversity: method designed for overcoming data gaps
14:00	Lunch break (location 3)
	Oral presentations (loaction 1)
15:30	**Dogan M., Doğan H. M., Celep F., Kahraman A.** - Investigating spatial distribution of economically important *Salvia* species in Turkey by means of GIS
15:50	**Jakovljević K., Tomović G., Vukojičić S., Stevanović V.** - Steppe flora in Serbia – distribution, ecological characteristics and centers of diversity
16:10	**Tomović G., Niketić M.** - Floristic novelties and taxonomic remarks on the genus *Viola* L. (Violaceae) from Serbia
16:30	**Humbatov Z.** - Conifer species of Azerbaijan
16:50	**Aleksic J.** - The secrets of Serbian spruce
17:30	**Poster session 1** (location 1) (cryptogams, conservation, ethnobotany, invasive alien plants...)
17:30-18:30	Round table – Do we still need classical botany? (location 1)
19:00	Welcome cocktail (location 4)
20:00	Exhibition "Josif Pančić, The Everlasting Heritage" opening (V. Stevanović) (loc. 4)

Tuesday, September 15

	Oral presentations (location 1)
9:00	**Stevanović V.** - Pančić's botanical heritage - contemporary overview
9:30	**Clementi M., Vukojičić S.** - Josif Pančić and Roberto de Visiani, joint work and correspondence
9:50	Presentation of the host Institution (location 1)
10:30	Coffee break (location 1)
	Oral presentations (location 1)
11:30	**Espinosa F., Damerval C., Deroin T., Manicacci D., Nadot S., Jabbour F.** - Development, anatomy, and genetic control of some teratological phenotypes of Ranunculaceae flowers

11:50 **Janković I., Nikolov Z., Kuzmanović N., Lakušić D.** - Morphological variability of isophylloid bellflower *Campanula versicolor* Andrews (Campanulaceae) from the Balkan Peninsula

12:10 **Srečec S., Kremer D., Karlović K., Peremin V.T., Erhatić R., Augustinović Z., Kvaternjak I.** - Morphological and micromorphological characteristics of carob seeds (*Ceratonia siliqua* L.) of "Komiža" ecotype, population of Drvenik Mali Island

12:30 **Zebec M., Modrić I., Zebec V.** - Morphological variability of *Ulmus glabra* Huds. (Ulmaceae) in northwestern Croatia

12:50 **Zorić L., Pilipović A., Perić S., Karanović D., Luković J.** - Stem xylem characteristics and their possible application in selection of poplar genotypes (*Populus* L., Salicaceae)

13:10 **Vidaković D., Jakovljević O., Radovanović S., Šovran S., Krizmanić J.** - Epiphytic and epilithic diatom communities along the Raška River – implications for the water quality

14:00 Lunch break (location 3)

Oral presentations (location 1)

15:30 **Mayrhofer H., Bilovitz P. O.** - Diversity of lichenized and lichenicolous fungi of the Balkan Peninsula

15:50 **Ozimec S.** - Lichen diversity in Gorski kotar and Kvarner littoral regions of Croatia

16:10 **Alegro A., Vedran Š.** - Bryophytes in Croatia – first attempt of databasing

16:30 **Nikolic N., Papp B., Vujičić M., Szurdoki E., Sabovljević A., Sabovljević M.** - Bryophyte conservation biology: successful European case studies on bryophytes reintroduction

16:50 **Papp B., Sabovljević M., Alegro A., Marka J., Dragićević S., Tsakiri E., Natcheva R., Ganeva A., Szurdoki E.** - Network of Southeast European bryologists in the new bryophyte Red List project of Europe

17:30 Coffee break (location 1)

18:00 **Poster session 2** (location 1)
(floristics, taxonomy)

Wednesday, September 16

Three mid-congress excursions (see descriptions on the web page)

Thursday, September 17

Oral presentations (location 1)

9:00 **Vladimirov V., Trichkova T., Tomov R., Uludag A., Rat M., Naydenova T.** - Invasive alien plants – opportunities for cooperation in the Balkans

9:30 **Kočić A., Horvatić J., Jelaska S.D.** - Morphological variability of invasive macrophyte *Elodea nuttallii* (Planch.) H.St.John along habitat and species composition gradients

9:50 **Gavrilova O., Tikhonova O.** - Apertural pollen types in the Grossulariaceae family

10:10 **Caruso G., Carpino A.** - Calabrian Native: first results and perspectives of autochthonous plant cultivation for education and sustainable nursery

10:30 **Modrić Surina Ž., Randić M.** - Five years of restoration management and monitoring of Trstenik, the only Croatian ombrotrophic mire – a happy end story?

10:50 **Rat M., Andric A., Anačkov G.** - Herbarium revision reveals neglected and misinterpreted *Ornithogalum* L. species in the Balkan Peninsula

11:10 **Rajčević N., Dodoš T., Novaković J., Janaćković P., Marin P.D.** - Chemodiversity, ecogeographic variation and taxonomic significance of essential oils in natural populations of *Juniperus deltoides* R. P. Adams from the Balkans

11:30 Coffee break (location 1)

Oral presentations (location 1)

12:00 **Biruš I., Liber Z., Radosavljević I., Bogdanović S., Jug-Dujaković Marija, Zoldoš V., Šatović Z.** - Epigenetic vs. genetic diversity of stenoendemic short-toothed sage (*Salvia brachyodon* Vandas)

12:20 **Caković D., Stešević D., Schönswetter P., Frajman B.** - How many taxa? Spatiotemporal evolution and taxonomy of *Amphoricarpos* (Asteraceae, Carduoideae) on the Balkan Peninsula

12:40 **Ćaćić T., Ljubičić I., Vitasović Kosić I., Liber Z., Šatović Z., Bogdanović S.** - Phylogeography and genetic diversity of endemic *Centaurea ragusina* L. (Asteraceae) from Dalmatia

13:00 **Di Pietro R., Lakušić D., Iamonico D., Kuzmanović N.** - The *Sesleria* sect. *Argentea* (Poaceae) in the Amphi-Adriatic area. Nomenclatural and coenological remarks

13:20 **Đurović S., Niketić M., Tomović G., Schönswetter P., Frajman B.** - Phylogenetic relationships and geographic patterns of genetic diversification in *Silene* sect. *Saxifragoideae* (Sileneae, Caryophyllaceae)

14:00 Lunch break (location 3)

Oral presentations (location 1)

15:30 **Kuzmanović N., Lakušić D., Alegro A., Frajman B., Schönswetter P.** - Intricate *Sesleria* Section *Calcariae* (Poaceae) revisited – a molecular genetic approach

15:50 **Ranđelović V., Miljković M., Harpke D.** - *Crocus novicae* sp. nov. from southern Albania (SW Balkan Peninsula)

16:10 **Rešetnik I., Frajman B., Ehrendorfer F., Schönswetter P. -** Polyploid evolution and diversification in *Knautia* (Dipsacaceae)

16:30 **Schönswetter P., Bertel C., Hülber K., Trucchi E., Paun O., Frajman B.** - Environmentally induced recurrent speciation – a driver of diversification also on the Balkans? Lessons from Eastern Alpine *Heliosperma pusillum* and *H. veselskyi* (Caryophyllaceae)

16:50 **Temunović M., Bogdan S., Šatović Z., Ivanković M., Popović M., Garnier-Géré P., Hampe A.** - Assessing standing adaptive genetic variation of Pedunculate oak populations in Croatia

17:30 Coffee break (location 1)

18:00 **Poster session 3** (location 1)
(morphology, physiology, biochemistry, vegetation science)

18:00-19:00 Round table 2 – Do we need SEE umbrella botanical NGO? (location 1)

20:00 Gala dinner (location 5)

Friday, September 18

	Oral presentations (location 1)
9:00	**Łuczaj Ł.** - Traditional use of wild vegetables in different countries and why it is worth studying
9:30	**Papa R.** - The consequence of domestication
9:50	**Yaman B., Akyol A.A.** - Identification of wood specimens from some historical mosques of Albania
	10:10 Coffee break (location 1)
	Oral presentations (location 1)
10:40	**Demir G., Ozyigit I.I., Severoglu Z., Dogan I., Yalcin I.E., Kurmanbekova G.** - The assessment of heavy metal risk in Bishkek using *Fraxinus exelsior* L. as biomonitor organism
11:00	**Šinžar-Sekulić J., Lazarević M., Tomović G., Niketić M., Siljak-Yakovlev S., Stevanović B., Stevanović V.** - Bioclimatic profiles and distribution models of three paleoendemic *Ramonda* species (Gesneriaceae)
11:20	**Bogdan S., Franjić J., Katičić Bogdan I., Krstonošić D., Sever K., Škvorc Ž., Temunović M.** - Phenotypic response to drought stress of Pedunculate oak (*Quercus robur* L.) populations along a latitudinal gradient – a first note
11:40	**Ježić M., Idžojtić M., Tkalec M., Nuskern L., Poljak I., Katanić Z., Vuković R., Krstin L., Ćurković-Perica M. -** Naturally occurring hypovirulence is necessary for the survival of the chestnut
	13:00 Lunch break (location 3)
	Oral presntations (location 1)
15:00	**Dogan I., Yasar U., Ozyigit I.I., Severoglu Z., Demir G., Yalcin I.E.** - The evaluation of seasonal variations of some trace elements in *Pinus nigra* Arnold and co-located soils collected from different habitats in Bartin-Turkey
15:20	**Gozukirmizi N., Yuzbasioglu G., Yilmaz S., Marakli S.** - Hopi/Osr27 and Houba/Tos5/Osr13 retrotransposon movements in rice
15:40	**Osma E., Çığır Y. -** Determining the effects of pharmaceuticals and personal care products (PPCPs) upon germination of *Triticum aestivum* L. (Bread Wheat) seeds
16:00	**Özel H.B., Bilir N.** - Determination of genetic gain of pyramidal black pine (*Pinus nigra* subsp. *pallasiana* var. *pyramidata*) populations in Turkey
16:20	**Severoglu Z., Ozyigit I.I., Dogan I., Kurmanbekova G.K., Demir G., Yalcin I.E.** - The screening of heavy pollution in Bishkek, capital of Kyrgyzstan using Sycamore Maple (*Acer pseudoplatanus* L.) and co-located soils
16:40	**Yasar U., Ozyigit I.I., Dogan I., Severoglu Z., Demir G., Kucukonder H., Yalcin I.E.** - Seasonal variations of heavy metal accumulation in *Pinus pinaster* Aiton and co-located soils in the vicinity of Bartin (Turkey)
17:00	Closing of 6th Balkan Botanical Congress (location 1)

Abstracts

Plenary lectures

Fri 9:00

Traditional use of wild vegetables in different countries and why it is worth studying

Łuczaj, Łukasz (lukasz.luczaj@interia.pl)

Wild green vegetables used to constitute an important food resource in springtime and be utilized in most agricultural societies, e.g. in the 19th century. Nowadays their use has survived only in some areas and cultures which are still very poor and nutrition-deficient, or where these vegetables are highly appreciated. In times of famine, the underground organs of plants were also gathered for food, but this was usually done in times of necessity as they are more difficult to find and their digging has a stronger impact on the land from where they are taken. In my lecture I would like to look at a few areas in which wild vegetables are used and the main differences in use. Among the inhabitants of the Mediterranean (including Croatia) it remains common to collect a mix of wild greens, boil it for about half an hour and serve it as salad with olive oil, sometimes also with dry ham or potatoes. The use of wild vegetables is still widespread in the Caucasus. For example, in Georgia wild vegetables are minced with walnuts and served with pomegranate seeds in a dish called *phkhali*. In central China wild vegetables are usually served boiled or fried, as a side-dish, often spiced with garlic, ginger, chilli and/or Sichuan pepper. Wild greens are often dried for winter. In Japan wild vegetables are served as boiled salads with soy sauce, while in Sri Lanka they are served with coconut in a form of salad. In Eastern Europe wild vegetables are little used now, but up until the early 20th century were usually served as a thick soup with cream, milk, potatoes, grain and/or bone stock. Although the species of weedy vegetables used are very similar throughout Eurasia, the culinary techniques differ depending on the local cuisine. Wild vegetable salads and soups usually contain a fatty component (oil, lard, coconut, walnuts), to extract fat-soluble vitamins from the dishes. Documentation of this disappearing knowledge is important from many reasons: it helps to preserve local ethnobotanical heritage, and it gives us toxicological knowledge – some of these vegetables are regarded as (slightly) toxic, however they have been eaten in large amounts for centuries. Maybe humans can process foods which contain much larger amounts of alkaloids, tannins and saponins than we presently think?

Tue 9:00

Pančić's botanical heritage - contemporary overview

Stevanović, Vladimir (vstev@bio.bg.ac.rs)

The scientific work of Josif Pančić was extremely prolific and varied, especially when viewed in context of his time and age. The importance and the size of his work should not be minimised by the fact that he explored almost completely unknown botanic and faunistic territory. On the contrary, his great scientific contribution lays in modern and comprehensive way he outlined his research. Pančić is primarily known as a botanist, thanks to his capital works "Flora Principatus Serbiae" (1874) and "Additamenta ad Floram Principatus Serbiae" (1884), along with his pioneer floristic work on flora of Bulgaria and Montenegro ("Elementa ad Floram Principatus Bulgariae" (1883) i "Nova elementa ad Flora Principatus Bulgariae"

and Montenegro (Vascularum quae aestate a 1873 in Crna Gora"(1875). It is important to note that Pančić was among the first researchers in the world who has emphasised,in 1859, the importance of serpentine bedrock for the florogenesis. His works "Something about our forests" and "Erena mobilis ejusque flora in Serbia "(1863) were excellent studies imbued with fine ecological considerations and conclusions. We should also mention his monographs "Orthoptera in Serbia","Birds of Serbia", "Fish of Serbia", "Material for the Fauna of the Principality of Serbia" (1869) which became the basis for animal taxonomy in Serbia. Today, nearly a century and a half since his death, we can critically look at his botanical explorations. Pančić is best known for the discovery of Serbian spruce (Picea omorika), but only a number of people know that he found and described over 200 taxa, out of which 65 are now accepted as a valid species or subspecies (Niketić, 2014). On this occasion Pančić's findings will be discussed in the context of the modern plant taxonomy and chorology. We will particularly analyze the importance of Pančić's plants and his contribution to the knowl-edge of the flora of the C. Balkans and the surrounding region. Pančić made the first synthetic outline of the phytogeographic division of the territory of the Principality of Serbia. In comparison with the present knowledge of the floristic division of the territory of Serbia, it is noteworthy that Pančić's phytogeographic observations were cor-rect. This interesting issue will be specifically addressed in this lecture. Josif Pančić was a scientist and naturalist of great standing who had left an undeniable im-print on the research of the flora of the central part of the Balkan Peninsula in the second half of XIX century. The importance of his scientific heritage is such that he has since become an inspiration, an incentive and a reference for the generations of naturalists until present times.

Mon 10:00

Magnificent plant life of the Liburnian karst in light of 300 years of botanical exploration

Surina, Boštjan (bostjan.surina@prirodoslovni.com)

The Liburnian karst (NW Dinaric Alps) has rather long history of botanical explorations, perhaps dating back to the beginning of the 18th century, when Zanichelli (1662 – 1729), Italian naturalist in 1722 and 1725 climbed Mt. Učka above the Kvarner bay. However, the Liburnian karst was in the botanical limelight in the second half of the 19th century, which coincides with flourishment of many early European botanical institutions and the start of the great age of exploration by European naturalists. Expeditions to explore uncharted regions were sent out by governments, monarchies, and wealthy patrons to survey and acquire new or lesser known areas, to bring back new knowledge on the plant life diversity, and to collect natural history specimens for newly established national museums, universities, research institutes as well as private collections. Many of the preserved and living specimens of plants that were brought back from the Liburnian karst by early explorers were new to science. Discovery and description of Liburnian biodiversity proceeded at a fluctuating pace and are still ongoing processes. The kaleidoscopic complexity of topographic, geological as well as past and present climatic conditions in the Northern Adriatic result in a high degree of overall biodiversity and a rapid species turnover. However, the main reason for such a high degree of biodiversity of plant life in the Liburnian karst is not only due to the overall species richness of the area, but also due to high number of endemics, some of them restricted to one or only a few known localities with specifics in ecology or geography. It is not surprising that Liburnian karst, being at the interception between the Alps and the Mediterranean, represents

one of the hotspots of endemism in Croatia. To that end, no less than eight (!) most endangered and vulnerable vascular plant taxa protected under the Habitats Directive adopted by EU governments occur in very close proximity, a unique phenomenon in Europe.

Thu 9:00

Invasive alien plants – opportunities for cooperation in the Balkans

Vladimirov, Vladimir (vladimir_dv@abv.bg), Teodora Trichkova, Rumen Tomov, Ahmet Uludag, Milica Rat, Tsvetelina Naydenova

Invasive alien species (IAS) are widely recognized as an important threat to native biodiversity and/or to human health, and as a cause of economic losses. Numerous international binding and non-binding documents appeal for control of the introductions and spread of IAS, e.g., the Convention on Biological Diversity, the Convention on the Conservation of European Wildlife and Natural Habitats, the Council Directive 93/43/EEC (Habitats Directive). Recently, the EU Regulation no. 1143/2014 has been adopted. It sets out the rules to prevent, minimize and mitigate the adverse impact of IAS on biodiversity. In response to these international initiatives and documents most of the European countries have developed national lists for alien taxa and IAS, identified the most important invasion routes and started to implement control measures. Moreover, several large European projects on invasive alien species have been conducted and some regional networks have been established. In 2011 such a regional network – East and South European Network for Invasive Alien Species (ESENIAS, www.esenias.org) – was established with the participation of most Balkan countries and with the financial support of the European Environmental Agency. The goal of the network was to develop and maintain a regional data portal and provide data on IAS, including lists of alien taxa, basic data on the biology and ecology of species, invasiveness, invasion routes, impact, species alerts, risk assessment and management, regulations, guidance, scientific references, etc. Recently, a project *East and South European Network for Invasive Alien Species – a tool to support the management of alien species in Bulgaria* (ESENIAS-TOOLS) was launched. The project is implemented by a consortium of 11 partner organizations from Bulgaria, Croatia, Greece, Iceland, Macedonia, Romania, Serbia and Turkey. The main goal would be to strengthen the regional network and to develop the necessary tools to facilitate the management of IAS in Bulgaria and in the entire region. Major tasks include the development of technical infrastructure and tools, strengthening the regional cooperation aimed at early detection of IAS, reporting and rapid response, and provision of reliable information on IAS in the region. The main activities within ESENIAS relating to alien vascular plants will be presented as well as the structure, organization and activities of the current project, forthcoming events, with emphasis on cooperation in the Balkan region. Statements will be supported by examples and case studies on IAS of vascular plants within the region. Possibilities for further cooperation will be discussed. Financial support by the Financial Mechanism of the European Economic Area (2009–2014) under the Programme BG03 ‘Biodiversity and Ecosystem Services’ is gratefully acknowledged.

Oral presentations

Tue 16:10

Bryophytes in Croatia – first attempt of databasing

Alegro, Antun (antun.alegro@biol.pmf.hr), Vedran Šegota

Bryophytes are one of lesser known plant groups in Croatian flora, without a modern summarisation of existing data. I order to fill this gap, all accessible published data concerning their occurrence in Croatia were compiled, the finding localities geocoded, the nomenclature unified and accorded to actual taxonomy. In total, the database now contains around 24.000 species-locality entries. The analysis of this data set resulted in a list of 750 bryophyte taxa (2 hornworts, 171 hepatics and 577 mosses), which significantly exceeds previously known numbers. The higher number is a result of two main reasons: intensive field research in the last few years, and re-finding of species "hidden" in old literature. The other main conclusions are: (i) territory of Croatia is very unevenly surveyed, and (ii) the great majority of existing data dates back to the last decades of the 19th century and the period before World War I. Regarding the geographical distribution of data, some areas have a dense coverage of finding localities, like the Velebit Mt in top spot, followed by areas surrounding the town of Dubrovnik, the Istria peninsula, the island of Rab and other coastal areas. On the other hand, only a minor part of the records relate to the inland parts of Croatia, with some areas without a single record or only a few (e.g. large areas of Slavonija, Međimurje, Hrvatsko Zagorje, Banovina, Kordun). It is important to note that many species have only one record, mainly those from the 19th century, what additionally stresses the urgent need of a systematic survey of bryophytes in Croatia.

Mon 16:50

The secrets of Serbian spruce

Aleksic, Jelena (aleksic_jelena@yahoo.com.au)

Serbian spruce, *Picea omorika* (Panč.) Purk., is an IUCN red-listed and strictly protected coniferous species, endemic to the Balkans. It is one of the most intriguing plant species discovered by a botanist Josif Pančić. Pančić's quest for this elusive tree lasted more than 20 years, and his excitement for such a huge botanical discovery – a new coniferous species in Europe, was impaired by the disbelieve of his respectable colleagues which initially rejected his finding. In 1876, Pančić published a monograph, 'Eine neue Conifere in den oestlichen Alpen', and afterwards, Serbian spruce was acknowledged as a new coniferous species. However, it seems that the scientific drama follows this tree to the present days, because despite more than 800 publications currently available on Serbian spruce, there is no unity regarding basically all of its biological and genetic features, origin and evolution. Therefore, I will reveal some recently discovered secrets of Serbian spruce, such as its origin, age and history, as well as past and present population dynamics and current genetic structure, and discuss prospects for its long-term survival in the changing environment.

Mon 12:10
A critical checklist of the Albanian vascular flora

Barina, Zoltán (barina@bot.nhmus.hu), Dániel Pifkó, Marash Rakaj

After the first attempt made by Ascherson and Kanitz in 1877, more monographs, lists and field guides were published which all provide checklists for the Albanian vascular flora. These works include 449-4560 taxa with only a slight overlap in their species pool. Field studies in the last 10 years resulted in hundreds of newly reported and dozens of newly described taxa from the country. At the same time, we started the revision of the material of relevant herbaria (BEO, BEOU, BP, BREM, JE, SO, SOM, TIR, W, WU) and tracked down the origin and vouchers of any taxa reported from Albania. A number of species, included in one or more monographs, proved to be erroneously reported from the flora of Albania, as their voucher(s) were mistakenly identified or interpreted (e.g. *Alnus cordata*, *Biscutella laevigata*, *Centaurium littorale*, *Cytisus spinescens*, *Doronicum grandiflorum*, *Linum narbonense*). Outstanding and unvouchered records should be treated also as erroneous (as *Anthyllis barba-jovis*, *Chionodoxa nana*, *Potentilla multifida*, *Sorbus degenii*). Hundreds of names have been reported from Albania without any localities but listed only in field guides or lists. Without vouchers and/or localities to check, and without any recent confirmation, these taxa should also be treated as questionably occurring, likely erroneously reported from Albania. The unpublished, unidentified or misidentified material of the revised herbaria also treasures new taxa for the Albanian flora, for example *Knautia dipsacifolia*, *Soldanella hungarica* and *Waldsteinia geoides* found in the herbarium of Bruno Schütt (in BREM). Available works include various numbers of crops and garden plants, frequently without underlining their status, causing confusion regarding their presence in the wild. During the compilation of the critical checklist, we consider the type of occurrence of all taxa and focus on the native and introduced taxa, while the complete listing of cultivated plants is not in our aim.

Thu 12:00
Epigenetic vs. genetic diversity of stenoendemic short-toothed sage (*Salvia brachyodon* Vandas)

Biruš, Ivan (ivan.birus@gmail.com), Zlatko Liber, Ivan Radosavljević, Sandro Bogdanović, Marija Jug-Dujaković, Vlatka Zoldoš, Zlatko Šatović

Short-toothed sage (*Salvia brachyodon* Vandas) is Illyrian-Adriatic stenoendemic and one of the rarest plant species of the Dinaric karst. *S. brachyodon* grows in Croatia and Bosnia and Herzegovina/Montenegro and only three localities have been confirmed at the present time: (1) Mt. Zmijino brdo (Sv. Ilija) near Orebić on the peninsula of Pelješac, Croatia, (2) Mt. Konavoska brda near Velji do, north of Cavtat in Konavle region, Croatia, and (3) Mt. Orjen, near Vrbanje, at the border of Bosnia and Herzegovina and Montenegro. It has been categorized as near thretened (NT) species in Croatia and as endangered (EN) in Montenegro. The habitats of *S. brachyodon* greatly differ among localities and the distinctions at the morphological and molecular levels may represent the adaptation of the plant to the specific habitat conditions. Heritable epigenetic variation could influence the course of evolution in plants, as it can affect the processes of adaptation and divergence through selection of stable

epigenetic variants without involvement of genetic variation. In order to understand the true importance of epigenetic processes in a stenoendemic plant of a very narrow range size existing epigenetic variation has been assessed and compared to genetic variation. The aim of this research was to determine genetic and epigenetic diversity and differentiation of the three known short-toothed sage populations by using molecular markers. Microsatellite markers (SSRs) and amplified fragment-length polymorphysims (AFLPs) were used to investigate the genetic diversity and structure within and among sampled natural plant populations while the methylation-sensitive amplified polymorphisms (MSAPs) were used to assess the epigenetic diversity.

18

Fri 11:20

Phenotypic response to drought stress of Pedunculate oak (*Quercus robur* L.) populations along a latitudinal gradient – a first note

Bogdan, Saša (sbogdan@sumfak.hr), Jozo Franjić, Ida Katičić Bogdan, Daniel Krstonošić, Krunoslav Sever, Željko Škvorc, Martina Temunović

Pedunculate oak is one of the economically and ecologically most valuable European widespread forest tree species. Survival of the species' in southern and south-eastern Europe is endangered by predicted climate extremes such as prolonged drought. Suggested spatial variability of climate change impacts in Europe implies that widespread species may face different levels of risks along their ranges. Peripheral populations at southern margins may face greater risk of extinction and decrease of genetic diversity, which may jeopardize the long-term adaptability and survival of the species. Thus, the species' response to changing environments could be largely determined by population responses at range margins. In contrast to the expanding edge, the low-latitude (rear) edge of species distribution is understudied, and critical importance of rear edge populations as long-term stores of unique genetic diversity and foci of speciation has been little acknowledged. This year we started a project on progenies from nine EU populations along a latitudinal gradient. The focus will be on southern and south-eastern part of the range. We will compare adaptability, epigenetic and phenotypic responses to drought stress of southernmost populations with the central and northern populations. We aim to determine: 1) neutral genetic diversity and structure of selected populations; 2) their epigenetic diversity and structure; 3) their epigenetic response to long-term drought stress; 4) their physiological, phenological, morphological, biochemical and growth response to drought stress; 5) their adaptive genetic variability, differentiation and phenotypic plasticity; 6) current ecological niche preferences and main environmental variables driving its distribution 7) future distribution under climate change scenarios based on ecological niche modelling and vulnerable parts of the contemporary distribution 8) levels of adaptability of the studied populations by comparing their genetic and epigenetic variability and phenotypic plasticity. Here we present results about some phenotypic trait response of the progeny populations (population mean heights, predawn leaf water potential and net photosynthetic activity) after a drought stress that was induced in a greenhouse trial in the first growing season.

Thu: 12:20

How many taxa? Spatiotemporal evolution and taxonomy of *Amphoricarpos* (Asteraceae, Carduoideae) on the Balkan Peninsula

Caković, Danka, Danijela Stešević, Peter Schönswetter, Božo Frajman (bozo.frajman@uibk.ac.at)

Amphoricarpos Vis. is an early diverging genus within tribe Cardueae (Carduoideae, Asteraceae), which is disjunctly distributed in the Balkan Peninsula, Anatolia and the Caucasus; the Anatolian and Caucasian taxa are sometimes treated as separate genus *Alboviodoxa*. We focus on the monophyletic Balkan populations, which have been treated very inconsistently in previous taxonomic accounts (one polymorphic species with or without varying sets of intraspecific taxa vs. two species, one of them with two subspecies). In order to disentangle relationships among populations across the entire distribution area of Amphoricarpos on the Balkan Peninsula, we employed amplified fragment length polymorphisms (AFLPs) as well as nuclear and plastid DNA sequences (ITS and rps16–trnK) to a dense sampling of populations. ITS was also used to reconstruct the genus' spatiotemporal evolution. In addition, we contrasted the genetic results with morphological data to provide a sound taxonomic revision of *Amphoricarpos* on the Balkan Peninsula. The split between the Balkan populations and the Anatolian *A. exsul* took place in the late Miocene or early Pliocene, whereas diversification within the Balkan lineage is much younger and likely started in the Pleistocene. The deepest splits seen in AFLPs and/or ITS separate the geographically disjunct northern- and southern-most populations. Divergence within the continuous distribution area in the centre is shallower, but allowed recognition of three largely allopatric clusters. Morphometric data, however, were neither in line with previous multi-taxon treatments nor with patterns of genetic divergence. We therefore refrain from recognising any of the genetic groups as a distinct taxonomic entity and rather suggest treating all Balkan populations as a single, genetically, morphologically and ecologically variable species, *Amphoricarpos neumayerianus* (Vis.) Greuter, without intraspecific taxa.

Thu 10:10

Calabrian Native: first results and perspectives of autochthonous plant cultivation for education and sustainable nursery

Caruso, Giuseppe (caruso_g@libero.it), Alberto Carpino

Calabria, the southernmost continental region of Italy, has a complex territory and a flora counting around 3,000 vascular species (and subspecies) belonging to 857 genera and 143 families. Calabria is the Italian region, islands excluded, with the highest number of endemic taxa (60 Calabrian, 270 Italian endemics). The long term conservation of this rich native flora would require a complex strategy and specific laws against the existing threats. One of the threating factors are alien invasive plants, responsible of biological pollution, introduced both casually or for gardening purposes. The local nursery market, mostly based on trading elsewhere produced plant material, actually has no supply of native plants and this apparently restrains the demand. To prevent the introduction of new alien plants, a project named Calabrian Native, for the cultivation of 15 common native shrub and tree species (*Quercus virgiliana*, *Q. ilex*, *Q. suber*, *Pistacia lentiscus*, *Arbutus unedo*, *Viburnum tinus*, *Myrtus communis*, *Cistus monspeliensis*, *Erica arborea*, *Crataegus monogyna*, *Ilex aquifolium*,

Helichrysum italicum, etc.) has been started. The autochthonous germplasm with a guessed high rate of genetic variability has been mostly collected inside the Catanzaro Mediterranean Biodiversity Park as seeds. The project's expected outcomes are: 1) education of new generations to appreciate and use native flora; 2) development of reliable agronomic protocols toward an increased cultivation efficiency; 3) spread tested cultivation techniques; 4) rise of plant material to be hopefully used in sustainable public/private gardening activity or environmental recovery projects. As part of the long term strategy against alien plants, a regional law proposal, ruling and limiting new plant introduction, will be soon presented. This would reduce new introductions, increase inner demand and hopefully the economic impact of local production (not just trading) of gardening material.

Tue 9:30

Josif Pančić and Roberto de Visiani, joint work and correspondence

Clementi, Moreno (moreno.clementi@bio.unipd.it), Snežana Vukojičić

Botanists Josif Pančić (1814–1888), director of the first Botanical Garden of Belgrade and first president of the Serbian Royal Academy and Roberto de Visiani (1800–1878), director of the Botanical Garden of Padova, first met in Vienna 1856. They soon became close friends and collaborators; their relationship would last for more than twenty years. During this time, they jointly published four works (Visiani & Pančić 1860, 1862, 1865, 1870) in which they described thirty-five new species and one new variety on specimens collected in Serbia by Pančić, most of which are still generally accepted. A series of nomenclatural works is being published in which these taxa are typified and discussed (Clementi & al., 2014, 2015). During that period, Visiani and Pančić engaged in frequent correspondence: sixty-four unpublished letters sent by Pančić to Visiani were found at the Historical Library of the Botanical Garden of Padova, which were catalogued, imaged and transcribed in year 2014. Letters sent by Visiani to Pančić were found at the Library of the Institute of Botany and Botanical Garden Jevremovac in Belgrade, which were catalogued, imaged, transcribed and published by Pančić & Tatić in 1998. Information retrieved from these sources not only provided interesting insight on their private and professional lives and the nature of their relationship, but also clarified their workflow and, in numerous cases, proved to be an essential tool to identify the original material for the taxa that they described.

Thu 12:40

Phylogeography and genetic diversity of endemic *Centaurea ragusina* L. (Asteraceae) from Dalmatia

Ćaćić, Tatjana, Ivica Ljubičić, Ivana Vitasović Kosić, Zlatko Liber, Zlatko Šatović, Sandro Bogdanović (sbogdanovic@agr.hr)

Centaurea ragusina L. (Asteraceae) is a Dalmatian narrow endemic species that grows as typical chasmophyte mostly on inaccessible vertical sea cliffs. It's represented by two subspecies: typical *C. ragusina* subsp. *ragusina* with pinnatifid basal leaves which is distributed from north to south Dalmatia (Dugi Island to Konavle), while *C. ragusina* subsp. *lungensis* has mainly entire basal leaves, present only on the islands of Dugi and Kornati

archipelago. We used amplified fragment length polymorphisms (AFLPs) to access the genetic diversity, differentiation and structure of populations across its entire distribution range (on 210 individuals from 22 populations). The aims were to test taxonomic validity of existence of two subspecies, to investigate genetic structure, to search for variations in the cpDNA sequences using *trnL-trnF* and *rpL32-trnL* markers and to quantify the genetic diversity within and among populations of *C. ragusina*. The results obtained from analyses of molecular variance (AMOVA) showed that 36.09% of genetic variation can be attributed to differences among populations. Mantel test revealed positive correlation between genetic and geographical distance between pairs of populations. Our study implies that most previous taxonomic infra-specific concepts of *C. ragusina* were artificial and according to results obtained by BAPS and STRUCTURE there is no clear genetic evidence that support existence of subsp. *lungensis* as a separate taxon from typical subsp. *ragusina*. On total of 60 samples, 16 different chloroplast haplotypes were detected. Haplotypes network indicate very fragmented distribution of *C. ragusina* that can be consequence of evolutionary history and colonization of vertical rocky cliffs during the Pleistocene sea level changes. Recommendations for conservation purposes of *C. ragusina* based on the patterns of genetic diversity were proposed.

Fri 10:40

The assessment of heavy metal risk in Bishkek using *Fraxinus exelsior* L. as biomonitor organism

Demir, Goksel (goksel.demir@eng.bahcesehir.edu.tr), Ibrahim Ilker Ozyigit, Zeki Severoglu, Ilhan Dogan, Ibrahim Ertugrul Yalcin, Gulbubu Kurmanbekova

In this work, Fraxinus exelsior was used for the assessment of pollution rate in Bishkek. For this, washed leaf (WL), unwashed leaf (UWL) and bark (B) samples from the plant and co-located soil samples were collected from eight different localities in Bishkek. The highest and lowest element concentrations of the plant parts and co-located soil samples (in mg/kg) were determined and found to be 16828.4 (B) and 9291.7 (WL) for Ca in stations 2 and 4, 1.9 (B) and 1.08 (WL) for Cd in stations 4 and 2, 5.24 (UWL) and 1.41 (B) for Cr in stations 4 and 2, 12.24 (UWL) and 6.61 (WL) for Cu in stations 4 and 2, 205.6 (WL) and 121.6 (B) for Fe in stations 4 and 2, 2631.3 (UWL) and 283.5 (B) for K in stations 4 and 2, 2451.6 (UWL) and 543.9 (B) for Mg in stations 2 and 7, 14.5 (UWL) and 7.37 (WL) for Mn in stations 4 and 2, 271.7 (UWL) and 89.5 (B) for Na in stations 4 and 2, 18.0 (UWL) and 7.99 (B) for Pb in stations 4 and 2, 60.4 (UWL) and 34.6 (WL) for Zn in stations 4 and 2 and 14944.9 and 8650.1 for Ca in stations 2 and 4, 7.05 and 4.95 for Cd in stations 4 and 2, 40.2 and 26.9 for Cr in stations 4 and 2, 55.3 and 36.8 for Cu in stations 4 and 2, 6359.5 and 4221.7 for Fe in stations 4 and 2, 3471.6 and 2310.3 for K in stations 4 and 2, 3914.9 and 2267.6 for Mg in stations 2 and 4, 259.4 and 173.8 for Mn in stations 4 and 2, 136.9 and 91.8 for Na in stations 4 and 2, 99.7 and 67.1 for Pb in stations 4 and 2, and 268.0 and 172.9 for Zn in stations 4 and 2, respectively. According to the literature, the normal limits (in mg/kg) of Cd, Cr, Cu and Pb in plants are in ranges of 0.2-0.8, 0.006-18, 5-30 and 25-150 and between or over 5-30, >100, 20-100 and 100-400 are accepted as toxic levels, respectively. According to these values, the normal limits were only exceeded for Cd but it is not in the range of toxic level in the plant in all locations. The concentrations of Cr, Cu and Pb in this study were found to be within normal limits in the plant collected from all locations.

Thu 13:00

The *Sesleria* sect. *Argentea* (Poaceae) in the Amphi-Adriatic area. Nomenclatural and coenological remarks

Di Pietro, Romeo (romeo.dipietro@uniroma1.it), Dmitar Lakušić, Duilio Iamonico, Nevena Kuzmanović

One of the most characteristic genera of *Poaceae* occurring in the Amphi-Adriatic area is genus *Sesleria* Scop. It contains approximately 48 species and subspecies, showing the highest diversity and complex taxonomy in south-eastern Europe. The morphologically similar species within the genus disintegrate into smaller groups – species aggregates. Nevertheless, single species are characterized by few morphological characters, which often leads to incorrect determinations. Sometimes even entire populations belonging to specific taxa are neglected, due to insufficient knowledge regarding not only their morphological and anatomical features, but also their type material. In view of continuing the taxonomic and nomenclatural work in the genus *Sesleria*, the present paper deals with the taxa names included in the *Sesleria* sect. *Argenteae* Deyl: *S. alba*, *S. argentea, S. autumnalis*, *S. cylindrica, S. doerfleri*, *S. elongata, S. gigantea*, *S. italica, S. latifolia*, *S. nitida, S. paparistoi*, *S. pontica*, *S. robusta*, *S. skanderbegii*, *S. skipetarum, S. tuzsoni* and *S. wettsteinii*. The species belonging to this section are almost completely distributed in the amphi-Adriatic area, with restricted extensions in northern Africa and near West Asia. Just one taxon (*S. autumnalis*) is known to occur on both sides of the Adriatic Sea, whereas the other ones exhibit a distribution which is either restricted to the Balkans (in some cases enlarged to the whole SE-Europe and West Asia) or to the Apennines (in some cases enlarged to S-France, W-Spain and Morocco). We have analysed the nomenclatural issues and made the required typifications. Nevertheless some taxonomical issues remain open, especially as regards those areas where the distribution areas of taxa having similar morphological and coenological features overlaps, e.g. *S. argentea/S. autumnalis*/*S. tuzsonii* in the northern Apennines/Apuan Alps, or *S. skipetarum* /*S. latifolia* and *S. robusta/S. skanderbegii/S. wettsteinii* in the C-SE Balkans.

Fri 15:00

The evaluation of seasonal variations of some trace elements in *Pinus nigra* Arnold and co-located soils collected from different habitats in Bartin-Turkey

Dogan, Ilhan (ilhandogan@iyte.edu.tr), Ulkuhan Yasar, Ibrahim Ilker Ozyigit, Zeki Severoglu, Goksel Demir, Ibrahim Ertugrul Yalcin

Environmental problems in Bartin have been investigated in this work. For this, washed leaf (WL), unwashed leaf (UWL), and bark (B) samples from *Pinus nigra* Arnold and co-located soil samples were collected seasonally from different urban and rural localities in Bartin. The element concentrations of the plant and co-located soil samples were determined by employing ICP-OES. The highest and lowest element values (in mg/kg) in the plant parts were found to be as 350.0 (UWL) and 28.7 (B) for Al in urban 1 in autumn and in urban 1 in winter, 31.6 (WL) and 2.3 (B) for B in rural in autumn and in urban 1 in winter, 8755.6 (B) and 566.2 (WL) for Ca in urban 1 in autumn and in rural in winter, 372.5 (UWL) and 19.7 (B) for Fe in urban 1 in winter and in rural in autumn, 2964.2 (B) and 928.2 (WL) for K in urban

1 in spring and in rural in autumn, 588.1 (UWL) and 128.7 (B) for Mg in rural in spring and in urban 1 in autumn, 54.9 (UWL) and 0.3 (B) forMn in urban 1 in autumn and in rural in winter, 250.2 (UWL) and 87.7 (B) for Na in rural in spring and in rural in autumn and 14.5 (UWL) and 0.8 (B) for Ni in urban 1 in winter and in rural in autumn, respectively. The highest and lowest element values (in mg/kg) in co-located soils were found to be as 5718.1 and 2572.6 for Al in urban 1 in autumn and in rural in winter, 16.9 and 5.7 for B in rural in autumn and in urban 1 in winter, 2899.7 and 1167.6 for Ca in urban 1 in autumn and in rural in winter, 11.919.5 and 4884.8 for Fe in urban 1 in winter and in rural in spring, 1901.6 and 1028.6 for K in rural in spring and in rural in winter, 2184.9 and 1100.8 for Mg in rural in winter and in urban 1 in autumn, 275.2 and 148.8 for Mn in urban 1 in autumn and in rural in winter, 254.9 and 122.1 for Na in urban 1 in winter and in rural in summer and 29.1 and 3.1 for Ni in urban 1 in winter and in rural in autumn, respectively. At the end, environmental pollution is real forBartin and necessary measurements has to be taken.

Mon 15:30

Investigating spatial distribution of economically important *Salvia* species in Turkey by means of GIS

Dogan, Musa, Hakan Mete Doğan (hmdogan@hotmail.com), Ferhat Celep, Ahmet Kahraman

In this study, we investigated the spatial distribution of the economically important *Salvia* species that have been consumed as tea in Turkey. Totally, we determined 279 locations throughout the field studies between 2000 and 2004. Sampling locations were geo-referenced by utilizing Global Positioning System (GPS), and collected geo-referenced data were evaluated in geographic information systems (GIS). Consequently, geographic distribution of these economically important species were determined and mapped. Totally 7 species have been found economically important namely; *S. fruticosa*, *S. tomentosa*, *S. pomifera*, *S. aramiensis*, *S. cryptantha*, *S. aucheri* var. *aucheri*, and *S. sclarea*. Among these species, *S. cryptantha* and *S. aucheri* var. *aucheri* were determined as endemic. *S. fruticosa* has been consumed widely throughout the country, while *S. aramiensis*, *S. aucheri* var. *aucheri* and *S. sclarea* have been consumed in some regions of Turkey. Results were interpreted in ecological point of view.

Thu 13:20

Phylogenetic relationships and geographic patterns of genetic diversification in *Silene* sect. *Saxifragoideae* (Sileneae, Caryophyllaceae)

Đurović, Sanja (sdjurovic@bio.bg.ac.rs), Marjan Niketić, Gordana Tomović, Peter Schönswetter, Božo Frajman

Silene sect. *Saxifragoideae* comprises ca. 25 taxa distributed in the mountain ranges of southern Europe. Its diversity centre is the Balkan Peninsula, where also many stenoendemics occur. Several taxa have been classified differently in the past and their position within sect. Saxifragoideae as well as their reciprocal relationships were unclear. About ten morphologically similar taxa were often included in the S. saxifraga group, but phenotypic variability and transitional forms blur the boundaries among them. As stated in the Flora

Europaea, the *S. saxifraga* group is thus "a difficult group of closely related, variable species that requires further revision, especially in the Balkan Peninsula". We used the sequences of the nuclear ribosomal internal transcribed spacer (ITS) and the plastid rps16 intron as well as amplified fragment length polymorphisms (AFLPs) to elucidate phylogenetic relationships among the taxa belonging to or hypothesized to be closely related to sect. *Saxifragoideae*, covering the entire geographical range of the section. Preliminary results show that *S. barbeyana, S. cephallenia, S. paeoniensis* and *S. schwarzenbergeri* are more closely related to the members of sect. *Saxifragoideae* than *S. falcata*, *S. oreades* and *S. urvillei*, which were positioned in the outgroup. The morphologically clearly delimited *S. cephallenia, S. linoides, S. multicaulis*, *S. schwarzenbergeri* and *S. waldsteinii* are genetically well differentiated, forming clear lineages in all three datasets. In contrast, the *S. saxifraga* group appears to be polyphyletic, but the relationships among taxa are poorly resolved. Genetic differentiation shows some geographical patterns rather than congruence with the morphology-based classification probably as a result of recent rapid radiation and range expansion, as well as convergent morphological evolution triggered by similar environments. The Balkan Peninsula is certainly the centre of genetic diversity of the group.

Tue 11:30

Development, anatomy, and genetic control of some teratological phenotypes of Ranunculaceae flowers

Espinosa, Felipe, Catherine Damerval, Thierry Deroin, Domenica Manicacci, Sophie Nadot, Florian Jabbour (fjabbour@mnhn.fr)

Teratological organisms originate from developmental anomalies, and exhibit structures and a body organization that deviate from the species standard. In plants, teratological forms are often of horticultural interest. However, besides their aesthetic value, these monsters give essential clues about the formation and evolutionary significance of the wild-type groundplan. We focus on flower terata, which can be affected in their sterile and/or fertile organs, with special emphasis on the Ranunculaceae. The diversity of perianth shapes and organizations in flowers of this family is huge, and is even increased when anomalies occur during organo- and/or morphogenesis. To begin with, we synthesize the observations and research conducted on the Ranunculacean floral terata, following a phylogenetic framework. Then, we report results regarding the morphology of developing meristems, the anatomy of buds, and the genetic control of selected teratological phenotypes of Ranunculaceae flowers. We focus on species and horticultural varieties belonging to the genera *Aquilegia*, *Delphinium*, and *Nigella*. Wild-type flowers of these species are actinomorphic (*Aquilegia*, *Nigella*) or zygomorphic (*Delphinium*), spurred (*Aquilegia*, *Delphinium*) or with pocket-like petals (*Nigella*). Last, we discuss the evolutionary potential of such teratological phenotypes when they occur in the wild.

Thu 9:50
Apertural pollen types in the Grossulariaceae family

Gavrilova, Olga (gavrilova@binran.ru), Olga Tikhonova

The Grossulariaceae is a small family that consists of 150-200 species of shrubs from temperate zone and mountainous regions. Previously there were recognized two genera in the family (*Ribes* and *Grossularia*), now two genera are combined into one genus *Ribes*. Different species are widely used as ornamental, fruit, medicinal and honey plants. Numerous cultivars are of different origin, sometimes they fall out of cultivation and spontaneous hybrids appear. The species grown in Europe are not only local. Pollen morphology of 39 wild species from Northern hemisphere has been studied using light, confocal laser scanning and scarnning electron microscopes. Palynological material was obtained from Herbarium and collections of Komarov Botanical Institute as well as from genetic collection of Vavilov Research Institute of Plant Industry. Only one species *Ribes horridum* (subgenus *Grossularioides*) has simple pollen apertures (pores). Grains are 3-4-pantoporate, spheroidal, medium sized, with echinate ornamentation. The species from other subgenera have complex apertures with different form and disposition. Pollen of all gooseberry (subgenus *Grossularia*) species are zonoaperurate. Grains have from 4 to 6 colpa, the colpus includes 2 pores (regular disposition) or one-three pores (irregular disposition). Zonocolporate pollen with irregular pores disposition occurs in part of gooseberry species, all species of section *Heritiera* and *R. pulchellum*. The ornamentation differs from psilate, microperforate to rugulate, rarely microechinate. Three species from the section *Ribesia* have pantoporate-pantocolporate pollen. Other currant species have 6-12 porate-orate grains with regular or irregular disposition of ectoapertures and endopori. So, apertural type in the family is of diagnostic and taxonomical importance. This research was supported by RFBR grant N 15-04-06386.

Mon 16:30
Conifer species of Azerbaijan

Humbatov, Zaur (zaurgumbatov@yandex.ru)

Conifers have been preserved up to now as relict and endemic species in natural refidiums of the territories of Azerbaijan where contrast climate and soil condition dominates. 10 conifer species from 3 families are spread in different geographical areas and ecological zones. Conifers have presently 0.2% share in the flora of Azerbaijan. These species are *Pinus eldarica, P. hamata., Juniperus pugmaea., J. poluycarpos., J. foetidisma., J. rufescens., J. sabina., J. depressa., Taxus baccata., T. taluschensis*. These plants have not only grown in different botanical and geographical areas of Azerbaijan with ancient geomorphological history, but also created new subspecies, natural varieties and hybrids. The species of Taxus taluschensis has been preserved so far in MSL 2000m of Talysh Mountains for the amount of approximately 90 plants. Conifers have been a major plant formation of Azerbaijan in the Third (Tertiary) Period and afterwards. Paleobotanical and other researches proved that distribution areas of conifers were fragmentary and disjunctive. Generally, conifers have been developed by microphyll progress line and widely spread with the influence of ecological factors. Although conifers absolutely differs from other groups (Polypodiopsida and Angiospermae) of higher plants, but for a long time the conception of Angiospermae derivation from Gymnospermae prevailed according to the archeological remains. Thus, the

taxon of Gymnospermae was considered as paraphyletic. Monophyletic taxa (groups that include all the descendants of a common ancestor) are tried to be determined according to the modern cladistical taxonomy. Besides that some DNA researches note that gymnosperms are included to the monophyletic group.

Mon 15:50

Steppe flora in Serbia – distribution, ecological characteristics and centers of diversity

Jakovljević, Ksenija (kjakovljevic@bio.bg.ac.rs), Gordana Tomović, Snežana Vukojičić, Vladimir Stevanović

Steppe flora and vegetation represents the significant part of Euroasian temperate grassland biome. In the SE Europe (Panonian and Danube plains and central and eastern part of the Balkan Peninsula) steppe flora is distributed at western limit of steppe biom in western Palearctic. Recent distribution of steppe flora in Serbia is significantly changed reflecting in the decreasing of steppic species ranges, primarily due to the loss of natural habitats, and their substitution with cultivated and ruderal ones, that are strongly impacted by development of agriculture and urbanization. The recent investigation of steppe flora in Serbia was mainly related to their distribution and ecology on serpentine bedrock, while this study includes the other type of geological substrata, also very suitable for steppe species development (loess, sandy soils, silicate and limestone). The main object of this study is to complete data on distribution and ecological preferences of ca. 350 steppe plant species in Serbia and to determine centers of steppe flora richness and diversity. The summary distribution maps of steppe taxa and map of centers of diversity of steppe flora in Serbia will be presented.

Tue 11:50

Morphological variability of isophylloid bellflower *Campanula versicolor* Andrews (Campanulaceae) from the Balkan Peninsula

Janković, Ivana (ijankovic@bio.bg.ac.rs), Zoran Nikolov, Nevena Kuzmanović, Dmitar Lakušić

Campanula versicolor Andrews is one of the constituents of the *C. pyramidalis* species complex, along with *C. pyramidalis* L., *C. austroadriatica* D.Lakušić & Kovačić and *C. secundiflora* Vis. & Pančić. It is mostly distributed in the southern parts of the Balkan Peninsula: in Greece, Albania and Macedonia, to Kosovo in the north and Mt Konjevska (Bulgaria) in the northeast. Small disjoint parts of the area are in the southern Apennines, in Italy. During the last two centuries, 15 additional taxa at specific and intraspecific level have been described, however, in the relevant modern floristic literature they are neglected and mostly considered as synonyms of *C. versicolor*. Considering this, the main aim of this study was to get insight into the morphological variability of populations of *C. versicolor* based on quantitative characters of flowers, leaves, stems and inflorescences. Our sampling included the material unambiguously corresponding to some of the previously described taxa: *C. mrkvickana* Vel., *C. versicolor* var. *tomentella* Hal., *C. versicolor* var. *thessala* Boiss., *C. versicolor* f. *matkae* Nikolov, *C. plasonii* Form etc. On the basis of the obtained resultes morphologic and taxonomic implications are discussed.

Fri 11:40
Naturally occurring hypovirulence is necessary for the survival of the chestnut

Ježić, Marin, Marilena Idžojtić, Mirta Tkalec, Lucija Nuskern, Igor Poljak, Zorana Katanić, Rosemary Vuković, Ljiljana Krstin, Mirna Ćurković-Perica (mirna.curkovic-perica@biol.pmf.hr)

Cryphonectria parasitica Murill Barr is an introduced ascomycete pathogen that caused serious destruction of chestnut trees (*Castanea sativa* Mill.) in Europe since its introduction in the first half of the XX century. It has spread throughout the entire chestnut areal in Europe and around the Mediterranean. It was reported in Croatia in 1955 and quickly spread though the country causing canker wounds and dieback of the infected trees. Fortunately, a virus which reduces fungal virulence was also introduced in Europe – *Cryphonectria hypovirus* 1, which induces a phenomenon called hypovirulence – reduction of the fungal aggressiveness and reproduction capacity: the mycelia no longer expands as quickly, and healing cankers which close the wound are induced. However, *C. parasitica* populations in Croatia and surrounding countries have a high genetic diversity, which may hinder natural spread of this biocontrol agent. We have selected two chestnut populations infected with *C. parasitica* and observed the disease progress on the infected trees over the year: Buje in Istria and Hrvatska Kostajnica in continental Croatia. Previous studies have indicated high proportion of naturally occurring hypovirulent fungal isolates in H. Kostajnica – 50.8%, and low in Buje – 12.7%. Our recent observations in 2014 indicate this number remains high in H. Kostajnica: 34.4% and low in Buje: 12.8%. We have also assessed the condition of the trees and cankers in the sampled chestnut populations and found more active cankers in Buje (60.3%) than in H. Kostajnica (42.9%). Over the year the number of active cankers in Buje decreased only slightly to 49.2%, while in H. Kostajnica about 14.5% of cankers could still be considered as active, while many stopped growing, becoming superficial. In H. Kostajnica active cankers increased in size on average by about 5.3% while in Buje by 33.6%. Furthermore, in Buje 11 out of 63 trees died since 2014, while none in H. Kostajnica. In conclusion, the chestnut forest in Istria is in much worse state than in H. Kostajnica, probably because the naturally occurring hypovirulence is not well established and the most aggressive fungal strains are unhindered, destroying the trees.

Mon 12:50
Is 500 species in 0, 35 km^2 a lot? Flora of Ljubljanski Grad hill (central Slovenia)

Jogan, Nejc (nejc.jogan@bf.uni-lj.si)

In Slovenia standard grid used for floristic mapping is Central European »MTB« grid of which quarters of base fields (so called »quadrants«) are used, each covering about 35 km2. The avereage number of vascular plant species recorded per quadrant is around 400 and the expected number estimated to around 1000 per quadrant. Study area of Ljubljanski Grad covers about 1% of the quadrant size and until 1990 about 400 species had been recorded. In more than 200 years of floristic activity of course there are some old records of species, which are today extinct and as study area is in the city centre of Ljubljana, also human impact has been intense since ancient times. So results of floristic study conducted in 2013 and 2014 were quite surprising: 500 species recorded. Precise analysis of the list reveals, that the huge

majority of the species are in fact quite widespread taxa common in the adjacent areas, there are only wery few rare species and also not a big number of rare ephemerophytes. And also habitat type diversity in the study area is not big: geological structure is not very diverse (paleozoic sandstones and schist), altitudes are between 300 and 370 m a.s.l., wet habitat types are completely destroyed, forests quite degraded. So what does 500 species recorded mean? It seems that very intense floristic work (alltogether c. 50 working days, but each represented by only 0,5-4 hour of floristic activity, with 6-408 records per day) covering all the seasons and as much as accessible all the corners of the study area resulted in virtualy extremely high score. Of course number of newly recorded taxa per working day has been gradually decreasing to 0-1. Average redundancy for the whole area per taxon is c. 10 and average redundancy for the 30 mapping sub-units 1,67. For the 30 sub-units the average number of recorded taxa is 99. Can we imagine the quality of information if it would be possible to cover each km2 of the country?

Thu 9:30

Morphological variability of invasive macrophyte *Elodea nuttallii* (Planch.) H.St.John along habitat and species composition gradients

Kočić, Aleksandra (aleksandra_kocic@yahoo.com), Janja Horvatić, Sven D. Jelaska

In period 2006-2009, the linear spreading of invasive macrophyte *Elodea nuttallii* was noted along the drainage channel system of Baranja (Croatia). To determine the morphological variability of invasive *E. nuttallii* in relation to habitat characteristics and species composition during its invasion phase, sites were monitored in a three year period with sampling in summer 2007 and spring and summer in 2008 and 2009. Multiple factor analysis shows that morphological variability of *E. nuttallii* is mostly linked to the species composition and partly to habitat conditions. In shallow waters, with free-floating vegetation and higher concentrations of nutrients, *E. nuttallii* had narrower and longer leaves and internodes and in deeper water, with submerged vegetation and lower concentrations of nutrients, it had broader and shorter leaves and internodes. The high morphological variability allows *E. nuttallii* to survive and establish in different environmental conditions and increases the potential of spreading in favourable conditions. Even in highly unfavorable conditions in free-floating vegetation, high morphological variability enables the survival of *E. nuttallii*. In our research the resistance of the ecosystem through the native macrophyte composition is highlighted as the main factor in decreasing impact of the invasive species.

Thu 15:30

Intricate *Sesleria* Section *Calcariae* (Poaceae) revisited – a molecular genetic approach

Kuzmanović, Nevena (nkuzmanovic@bio.bg.ac.rs), Dmitar Lakušić, Antun Alegro, Božo Frajman, Peter Schönswetter

The Section *Calcariae* within the genus *Sesleria* (Poaceae) was introduced by the Czech botanist Miloš Deyl in 1946, who, based on detailed study of morpho-anatomical and ecological characters, distinguished five "turmae" (i.e., series) within the section: *Calcaria*, *Coerulans*, *Phleoides*, *Rigida* and *Uliginosa*. Regarding the number of taxa, section *Calcariae* has its center of diversity in SE Europe. As the considerations of Deyl were obviously not based on a molecular genetic approach, the main aim of our study was to elucidate the

relationships among populations of the taxonomically intricate Sesleria Section *Calcariae* using Amplified Fragment Length Polymorphisms (AFLPs). We evaluated structure of the AFLP data using Principal Co-ordinate Analysis (PCoA) based on a matrix of Jaccard distances and split network analysis (neighbour-net). In addition, we used Bayesian Analysis of Population Structure (BAPS) to infer genetic population structure and to define the main genetically divergent groups. The AFLPs revealed three main groups of populations, which are informally named for the purpose of this research as *Calcaria* group, *Coerulans* group and *Tenuifolia* group. Except for the geographically most isolated species *S. phleoides* (Near East) and *S. insularis* (W Mediterranean islands), which were in the BAPS analysis singled out as distinct entities, the three remaining genetically differentiated groups correspond to the three mentioned groups defined by AFLP. The existence of genetically mixed individuals in the contact zones of these groups suggests hybridization. The results of our study show that phylogenetic relationships among species within *Sesleria* sect. *Calcariae* are different and more complex than previously inferred based on morphological and ecological traits.

Tue 15:30

Diversity of lichenized and lichenicolous fungi of the Balkan Peninsula

Mayrhofer, Helmut (helmut.mayrhofer@uni-graz.at), Peter Othmar Bilovitz

The biodiversity of lichenized and lichenicolous fungi of the Balkan Peninsula is still poorly known. During the last twenty years H. Mayrhofer, his students and colleagues intensified lichenological activities by establishing projects with local scientists. Publications started with floristic papers, followed by catalogs based on a thorough evaluation of the floristic and taxonomic literature for Slovenia (2000, supplement: 2006), Crete (2001), Bulgaria (2005), Montenegro (2009), Bosnia & Herzegovina (2011) and FYROM (2013). Printed checklists by other authors are available for Serbia (2006), Albania (2007) and Greece (2009) and a preliminary online version is available for Croatia (2010). A checklist for Kosovo, an updated one for Serbia and supplements for Bulgaria and Crete are almost finished. The catalogs and checklists stimulated other scientists to contribute and improve the knowledge mainly with floristic papers. The extensive virgin forests (e.g. Biogradska gora in Montenegro and Perućica in Bosnia & Herzegovina) are hot spots of lichen biodiversity. Today Greece (without Crete) has a known lichen diversity of c. 1250 species (Crete c. 685, but most of them also known from mainland Greece and the Aegean Islands), Bulgaria c. 1090, Slovenia (including the Southern Alps) c. 1030, Croatia c. 1000, Montenegro 787, Bosnia & Herzegovina 632, Serbia 611, FYROM 597, Kosovo 458, Thracia c. 400, and Albania, the least known, only 396. Data concerning lichenicolous fungi are even more lacunose and only available from Greece (c. 80 species), Slovenia (59), Montenegro (44), Albania (35), Kosovo (24), FYROM (22), Bosnia & Herzegovina (17), Bulgaria (15) and Serbia (5).

Thu 10:30

Five years of restoration management and monitoring of Trstenik, the only Croatian ombrotrophic mire – a happy end story?

Modrić Surina, Željka (zeljka@prirodoslovni.com), Marko Randić

Trstenik mire in NW Croatia is an acidic ombrotrophic peat moss mire in ecological and hydrological sense and according to floristic and phytociological evidence. Although it has great importance as the only remnant of ombrotrophic mire in Croatia, it has been subjected to natural succession facilitated by melioration since the 1950s. Since 2010 restoration measures including ditch blocking and spruce trees removing have been applied, followed by designed experiments and monitoring activities in order to detect effects of restoration as well as possible effects of experimental removal of *Molinia coerulea* and planting of *Spagnum* ssp. on the target ombrotrophic indicator species and floristic composition in general, ground water level and fluctuation. The results after the first five-year period show a strong directional change of the species composition in time, with this change being influenced by *Molinia coerulea* removal and with the experimental plots having different extent and direction of vegetation development compared to control ones. Unfortunately, the results also suggest a significant temporal trend in vegetation development towards drier *Molinia* meadows and a decline in ombrotrophic elements.

Tue 16:30

Bryophyte conservation biology: successful European case studies on bryophytes reintroduction

Nikolic, Nada, Beata Papp, Milorad Vujičić, Erzsebet Szurdoki, Aneta Sabovljević, Marko Sabovljević (marko@bio.bg.ac.rs)

Bryophytes are often neglected in conservation initiatives. However, they suffer from the sever habitat alternation, climate change or simply decline in nature for some other reasons, as the other living beings. The reasons for declining in nature are important, but hard to identified especially for the species that are highly threatened, few, and close to complete loss i.e. extinction. Thus, the urgent reaction plays important role in species saves. Many bryophyte species are critically endangered or threatened not only in national, but also in regional or pan-European level, and are in urgent need for protection and active conservation. Here we present the case studies on axenical propagation, acclimation, acclimatization, and reintroduction to potential natural sites for three selected moss species of specific habitats, namely *Hamatocaulis vernicosus* (listed in Bern Convention, the European Union Habitats and Species Directivelisted species) (Amblystegiaceae), *Entosthodon hungaricus* (Funariaceae) and *Henediella heimii* (Pottiaceae). *Hamatocaulis vernicosus* is a species of continental wetlands, and shallow waters, while *Entosthodon hungaricus* and *Henediella heimii* inhabit salt grasslands. The problems, solutions and results achieved for these species in all phases of conservation (form selection of start material till release in nature) will be presented and discussed.

Fri 15:40

Determining the effects of pharmaceuticals and personal pare products (PPCPs) upon germination of *Triticum aestivum* L. (bread wheat) seeds

Osma, Etem (eosma@erzincan.edu.tr), Yavuz Çığır

PPCPs were started to be discussed with other hazardous chemicals as result of manufacturing new pharmaceutics and personal care products in market and determination of these chemicals in aquatic ecosystems. Active ingredients of pharmaceutics transmit to waste water from human excrement and hospital waste water, and mix into underground water from leaks in wastewater systems. The stores hospital wastes are collected and pharmaceutic manufacturing areas are among the important sources. Most of these substances can transmit to water and to the underground water without any removal in treatment facilities. The studies have proved that active ingredients of pharmaceutics mix to water resources. The effects of micro-pollutants created by PPCPs in the environment were started to be searched through the improvement of new technologies in the last 20 years. In our study, bread wheat was used as the sample organism. The effect of active pharmaceutic ingredients such as Gemfibrozil, Acetaminophen, β-estradiol, and Caffeine upon the germination of bread wheat was analyzed. PPCPs were administered to wheat seeds at different concentrations (control, 5 mg/mL, 25 mg/mL, and 125 mg/mL). Twenty seeds were planted to petri plates at equal size. At the end of the 3rd day, germinated seeds were counted and germination percentage was calculated. When the data were analyzed, seed germination percentage was noticed to be decreasing due to the increase at concentration of PPCPs. It was also determined that these micro-pollutants caused serious product losses depending on transmitting to water used for the irrigation of agricultural areas. Consequently, further studies related to legal regulations for decreasing the use of these pharmaceutics and minimizing the effects of these substances upon the environment of these pollutants should be carried out.

Tue 15:50

Lichen diversity in Gorski kotar and Kvarner littoral regions of Croatia

Ozimec, Siniša (sinisa.ozimec@pfos.hr)

Based on literature records, studied herbaria collections in Croatia and abroad, and undertaken field surveys, currently known epiphytic and terricolous lichen mycota of Gorski kotar and Kvarner littoral regions of Croatia comprises 264 taxa (260 lichenized and 4 non-lichenized fungi), classified into 110 genera. The lichen mycota of Gorski kotar consists of 184 taxa, and of Kvarner littoral contains 170 taxa. The most diverse lichen genera are: *Cladonia* (20 taxa); *Caloplaca* and *Lecanora* (12 taxa each); *Pertusaria* (11); *Collema* (10) and *Peltigera* (9 taxa). Nine taxa are new records for the lichen flora of Croatia; 24 for Gorski kotar and 3 are new to Kvarner littoral. In Gorski kotar, lichens growth on 27, and in Kvarner littoral on 36 various organic and inorganic substrates. Main trees supporting epiphytic lichens in Gorski kotar are: *Acer pseudoplatanus* (84 taxa); *Abies alba* (74); *Fagus sylvatica* (69) and *Ulmus glabra* (25 taxa); while in Kvarner littoral main trees are: *Quercus pubescens* (83 taxa); *Populus* sp. (31); *Carpinus orientalis* (22); *Acer monspessulanum* (15); *Fraxinus ornus* and *Alnus* sp. (14 taxa each). Lichens indicating montane and oroboreal vegetational belt prevails in Gorski kotar, while in Kvarner littoral dominates lichens indicating submediterranean belt. The highest lichen diversity in (137 taxa) is confirmed in zone of Dinaric beech and fir forests, and in

submediterranean forests of pubescent oaka and oriental hornbeam (132 taxa). The epiphytic lichen alliance Lobarion pulmonariae, which consists of some rare lichen species and old-forest indicators, is still present in Gorski kotar, on some places in optimal conditions.

Fri 9:30
The consequence of domestication

Papa, Roberto (r.papa@univpm.it)

The evolutionary impact of agriculture on crop species resulted in plant populations modified to various extents with respect to their wild progenitors to adapt to new agricultural environments (agro-ecosystems) and to fulfill human demands for food and other uses. During crop domestication, a very similar set of traits were selected over a wide range of plant species, so-called domestication syndrome, providing numerous examples of convergent phenotypic evolution. However, domestication studies have been limited to the analysis of few phenotypic traits while recent works suggest that many different traits have been the target of selection. Here I will present the recent results obtained in the common bean and in tetraploid wheat using a combination of genomics, molecular phenotyping and high throughput phenotyping where domestication show not only a deep impact on the genetic diversity and phenotypic expression of crops species but also on the architecture of the whole phenotypic expression suggesting that domestication and breeding had a much larger genetic basis and complex consequences that previously observed.

Tue 16:50
Network of Southeast European bryologists in the new bryophyte Red List project of Europe

Papp, Beáta (pappbea@nhmus.hu), Marko Sabovljević, Antun Alegro, Jani Marka, Snežana Dragićević, Evdoxia Tsakiri, Rayna Natcheva, Ana Ganeva, Erzsébet Szurdoki

A Red List project for Europe has began in the frame of a LIFE project lead by IUCN and ECCB (European Committee for Conservation of Bryophytes). ECCB regional assessors, working together with all the ECCB country contacts and other experts, to produce a scientifically-based Red List that will have official IUCN status and therefore be a really useful tool in bryophyte conservation Europe-wide. For Southeast Europe the regional coordinator is the Hungarian Natural History Museum. Last 15 years a network of bryologists from SE Europe has been developed, dealing intensively with the Balkan area, from where there is still relatively little data. They have organised joint field trips, paying special attention to the habitats of rare species; with visits to suitable sites, making collections, listing the bryophyte flora and estimating the population sizes of rare species. More than 14.500 specimens are deposited in the Hungarian Natural History Museum collected during these joint field trips and 62 papers were published on the basis of this material. Voucher specimens of 534 species can also be found in HNHM, which were reported for the first time from the various countries of Balkan.

Thu 11:10

Chemodiversity, ecogeographic variation and taxonomic significance of essential oils in natural populations of *Juniperus deltoides* R. P. Adams from the Balkans

Rajčević, Nemanja (nemanja@bio.bg.ac.rs), Tanja Dodoš, Jelica Novaković, Peđa Janaćković, Petar D. Marin

Juniperus deltoides R. P. Adams is recently recognized as a cryptic species belonging to complex *J. oxycedrus* s.l. Its natural range is in the Mediterranean region, from Apennines in the west to Asia Minor and the Black Sea in the east. One of the markers used to identify this cryptic species was the composition of needle essential oil. The composition of the essential oils isolated from needles of thirteen natural populations of *J. deltoides* from different areas of Balkan Peninsula was determined by GC-FID and GC-MS analyses. In total, 208 compounds were identified, representing 95.4-98.7% of the total oil. The oils were dominated by monoterpene hydrocarbons (55.9%), followed by sesquiterpene hydrocarbons (20.2%). Two monoterpenes, α-pinene and limonene were the dominant constituents, comprising on average 46.7% of the total oil. The relative abundance of these two compounds varied significantly between populations. Univariant and multivariant statistical methods were deployed to determine diversity of the terpene classes and the common terpenes between the investigated populations across the Balkans. Statistical analyses showed differentiation of continental and coastal populations - in continental populations oil was dominated by α-pinene, while limonene dominated in oil from east Adriatic coast populations. Further statistical analyses revealed the existence of three chemotypes within all populations (i.e. α-pinene, limonene and intermediate type), where α-pinene chemotype is dominant in continental, and limonene chemotype in coastal populations. Taxonomic and ecogeographic aspects of obtained data are further discussed in relation to all available data on *J. oxycedrus* s.l. throughout its entire area of distribution.

Thu 15:50

***Crocus novicae* sp. nov. from southern Albania (SW Balkan Peninsula)**

Ranđelović, Vladimir (vladar@pmf.ni.ac.rs), Milica Miljković, Dörte Harpke

Crocus novicae V. Randj. & M. Miljk. sp. nov. (Iridaceae) is described and illustrated as a new species. *Crocus novicae* was found in Nemerçkë Mountain near the border to Greece growing in alpine grasslands around snowmelts. We here provide diagnostic morphological characteristics, results of molecular analyses, detailed descriptions and illustrations of this new species and compared it with its relatives *C. jablanicensis*, *C. cvijicii* and *C. veluchensis*. Morphological, *C. novicae* can be distinguished from its relatives by its white flower with lilac stripe at the perigon base and its higher number of leaves (>3). While it is morphologically close to *C. jablanicensis*, molecular analysis revealed a close affiliation to *C. veluchensis*. The new species is named after the most prominent researcher of the genus *Crocus* of the Balkan Peninsula Novica Ranđelović.

Thu 10:50

Herbarium revision reveals neglected and misinterpreted *Ornithogalum* L. species in the Balkan Peninsula

Rat, Milica (milica.rat@dbe.uns.ac.rs), Andrijana Andric, Goran Anackov

In taxonomy, every revision starts from herbarium collections. Data about plant names, plant distribution, but as well other characteristics are stored in them for centuries. However, every revision brings new insights and often species identification is difficult. Damaged material and missing or illegible labels are one part of complexity. Since there is no general method for collecting plant material, many collectors gathered material in various phenophases and without all parts of a plant. In the literature, on the other hand, taxon characteristics are given according to authors' priority, and it is not uncommon that data are superimposed among description of several taxa. Hereof, herbarium revisions can be complicated and unachievable. In the Balkan Peninsula, *O. gussonei* Ten. and *O. tenuifolium* Guss. are ubiquitous in all herbariums. Former is strict Mediterranean species, distributed in eu-mediterranean region, while latter is an illegitimate name. Revision of material, if bulb is preserved, reveals mainly *O. umbellatum* L. or *O. kochii* s.l. On the other hand, several species, with similar morphological characters are usually misinterpreted, and as a consequence some are neglected. Bulb with bulbils is characteristic for *O. umbellatum*, *O. divergens* Bor. and *O. refractum* Willd. Disregarding inflorescence characters, *O. umbellatum* - *O. divergens* and *O. refractum* - *O. divergens* are usually misinterpreted. In this series, *O. divergens* is the most frequently neglected. All listed species are difficult to distinguish as fresh and particularly in herbarium. For this reason, characters that are required for the determination of plant material in the herbarium collections are defined. The identification key includes characters chosen based on the analyses of *Ornithogalum* material in collections that are important for the Balkan Peninsula flora.

Thu 16:10

Polyploid evolution and diversification in *Knautia* (Dipsacaceae)

Rešetnik, Ivana, Božo Frajman (bozo.frajman@uibk.ac.at), Friedrich Ehrendorfer, Peter Schönswetter

The genus *Knautia* L. comprises 50–55 species with the highest species diversity in southern and southeastern Europe, especially the Alps and the Balkan Peninsula. Traditionally *Knautia* has always been considered taxonomically difficult due to the widespread occurrence of polyploidy and the high incidence of recurrent hybridization, which blur species boundaries. The aim of this study was to provide insights into spatiotemporal diversification of the genus by using nuclear ITS and plastid petN(ycf6)-psbM regions as well as AFLPs and flow cytometry. Our molecular data unambiguously support the monophyly of *Knautia* and the presence of three main lineages. The diploid annual sections *Knautia* and *Tricheroides* comprise only a few taxa; the former is resolved at a basal position. The majority of species belong to the mostly perennial section *Trichera*, where polyploidisation up to the tetra- and hexaploid levels occurred within almost all traditionally recognized groups. Large-scale ploidy-level screening revealed multiple cytotypes within some taxa as well as similarity of genome sizes across different taxa belonging to the same ploidy level, with the exception of some Iberian taxa with divergent genome size. The overall shallow structure in plastid and

nuclear datasets suggests a relatively young age of the diversification of section *Trichera*, and the occurrence of the same plastid haplotypes across large geographical distances implies recent and fast range expansion. The plastid and nuclear datasets are only partly congruent possibly due to hybridisation among different taxa, and genetic relationships reflect the geographic origin of the included populations at least to some extent. Furthermore, sequence as well as AFLP data suggest that infrageneric classification and circumscription of traditional groups are not congruent with actual evolutionary lineages and that polyploidisation was an important speciation mechanism within most species groups within section *Trichera*.

Mon 11:50

Further intentions in the 'Flora of Istria' project

Rottensteiner, Walter K. (wk.rottensteiner@gmail.com)

The „Flora of Istria“ project started in 1987 and found it's first result in the „Exkursionsflora für Istrien“ (Verlag des Naturwissenschaftlichen Vereins für Kärnten, Klagenfurt“) in 2014. The work on the Istrian flora will be continued with about 60 authors and several collaborators. Beginning with July 2014 we are just updating the excursionflora with corrections and additions for a 2nd edition. Several taxa new for Istria have been found in the meantime. These intermediary results will be published as papers in the magazines „Fritschiana (Graz)“ and „Joannea Botanik (Graz)“. Additionally the determination keys will lead also to those genera, which are only known as cultivated in Istria. New drawings of plants will faciliate the plant determiation (e.g. *Achillea tanacetifolia*). For the next 3 years we also work on the edition of a photo book (not a complete atlas) of the most important and characteristic Istrian plants with the aim to be published in 2018. After the 2nd edition of the excursion flora, we begin to translate it into English language. This English edition of the excursion flora shall be edited about 1 year after the 2nd German edition. With the results of the latest distribution data a chorological atlas of all Istrian plants will be published, first with the distribution in area maps, later in dot maps.

Thu 16:30

Environmentally induced recurrent speciation – a driver of diversification also on the Balkans? Lessons from Eastern Alpine *Heliosperma pusillum* and *H. veselskyi* (Caryophyllaceae)

Schönswetter, Peter (peter.schoenswetter@uibk.ac.at), Clara Bertel, Karl Hülber, Emiliano Trucchi, Ovidiu Paun, Božo Frajman

Variation in biotic and abiotic conditions in heterogeneous environments can lead to the formation of distinct populations adapted to their specific habitat. The altitudinal vicariants *Heliosperma pusillum* and *H. veselskyi* in the Alps are examples of morphological and functional adaptation to wet habitats as creeks and moist calcareous screes in the alpine belt on the one hand and dry growing sites below rock overhangs and shallow caves in the montane belt, on the other hand. Although phenotypic divergence remains stable in two consecutive generations in a common garden, both taxa are not divergent in their DNA sequence (RADseq data) and are able to interbreed as revealed by crossing experiments.

Moreover, the genetic similarity is correlated with geography rather than taxonomy, suggesting recent and recurrent divergence of both types, resulting from middle- to short-term adaptive processes under the influence of the environment. We also present preliminary results based on bisulfite RADseq to test for genome-wide differences in DNA methylation correlated with the striking phenotypic differentiation and discuss the possible role of epigenetics in the initial phase of divergent evolution. Finally, the results obtained from the Alpine populations will be discussed in the light of the striking diversification of the species group of *H. pusillum* seen on the Balkan Peninsula.

36

Fri 16:20

The screening of heavy pollution in Bishkek, capital of Kyrgyzstan using Sycamore Maple (*Acer pseudoplatanus* L.) and co-located soils

Severoglu, Zeki (zseveroglu25@gmail.com), Ibrahim Ilker Ozyigit, Ilhan Dogan, Gulbubu Kurmanbekova Kurmanbekova, Goksel Demir, Ibrahim Ertugrul Yalcin

In this work, *Acer pseudoplatanus* was used to monitor heavy metal pollution in Bishkek, the capital of Kyrgyzstan. For this, the plant parts and co-located soil samples were collected from eight different localities in Bishkek. The element concentrations of the plant and co-located soil samples were determined by employing ICP-OES. The highest and lowest element values (in mg/kg) in the plant were found to be 3509.4 (B) and 1033.1 (F) for Ca in stations 2 and 4, 2.01 (WL) and 0.87 (F) for Cd in stations 4 and 1, 6.22 (UWL) and 1.55 (B) for Cr in stations 4 and 2, 13.32 (B) and 5.86 (F) for Cu in stations 4 and 2, 226.1 (WL) and 102.23 (F) for Fe in stations 4 and 2, 2398.44 (WL) and 257.6 (B) for K in stations 4 and 2, 2210.8 (UWL) and 485.9 (B) for Mg in stations 2 and 4, 16.65 (UWL) and 6.71 (F) for Mn in stations 4 and 2, 286.0 (UWL) and 57.75 (F) for Na in stations 4 and 2, 19.34 (UWL) and 6.3 (F) for Pb in stations 4 and 2, 77.24 (WL) and 20.52 (F) for Zn in stations 4 and 2 and the highest and lowest element values (in mg/kg) in co-located soils were found to be 11068.1 and 6452.8 for Ca in stations 2 and 4, 7.30 and 4.82 for Cd in stations 4 and 2, 45.3 and 30.12 for Cr in stations 4 and 2, 60.34 and 39.46 for Cu in stations 4 and 2, 6889.4 and 4553.0 for Fe in stations 4 and 2, 3265.0 and 2155.3 for K in stations 4 and 2, 3762.8 and 2164.7 for Mg in stations 2 and 4, 299.1 and 195.9 for Mn in stations 4 and 2, 151.3 and 100.7 for Na in stations 4 and 2, 100.96 and 66.7 for Pb in stations 4 and 2, 366.1 and 247.9 for Zn in stations 4 and 2, respectively. According to the literature, the normal limits (in mg/kg) of Cd, Cr, Cu, and Pb in plants are in ranges of 0.2-0.8, 0.006-18, 5-30, and 25-150 and between or over 5-30, >100, 20-100, and 100-400 are accepted as toxic levels, respectively. According to these values, the normal limits were only exceeded for Cd and Cu and are in the range of toxic level in the plant in all or some locations. The concentrations of Cr and Pb were within normal limits in the plant collected from all locations.

Tue 12:10

Morphological and micromorphological characteristics of carob seeds (*Ceratonia siliqua* L.) of "Komiža" ecotype, population of Drvenik Mali Island

Srečec, Siniša (ssrecec@vguk.hr), Dario Kremer, Ksenija Karlović, Tomislava Peremin Volf, Renata Erhatić, Zvijezdana Augustinović, Ivka Kvaternjak

Carob seeds (*Ceratonia siliqua* L., Fabaceae) are very important source of galactomannan oligosaccharide. However, it was believed that the weight of individual carob seed is constant and weighs about 200 mg each. So, that was the reason why the carob seeds were used as a measure for carat in the past. Because of hardness of carob seeds and consequently specific demands for their processing, numerous researches of their morphological and micro morphological characteristics were carried out. Within research project TEUCLIC ("Taxonomy ecology and utilization of carob tree and bay laurel in Croatia, financed by Croatian Foundation for Science) the total of 1309 individual carob seeds, separated from the carob pods collected from different carob trees on the Island of Drvenik Mali, were investigated during the first research year. The average weight of individual seed is 191 mg (SD=0.044, SEM=0.0012). Our results of micro morphological studies showed the very high share of mechanical tissue both in pods and seeds. However, achieved results of morphological and micro morphological characteristics of carob seeds correspond with the results of previous researchers who investigated the seed morphology of carob tree populations in Mediterranean countries.

Mon 11:30

Atlas of the Aegean Flora

Strid, Arne (arne.strid@youmail.dk)

An Atlas of the Aegean Flora has been completed some 70 years after Rechinger's Flora Aegaea. It comprises two volumes totalling c. 1,500 pages. One volume contains detailed distribution maps for all species of vascular plants in the area (c. 3,200); the maps are mounted four to a page (in A4 format), with data on ecology, flowering time and general distribution appearing in a label inset. The other volumes has keys and brief descriptions as well as a photo appendix featuring c. 450 of the most interesting species. A brief account is given of the project, with examples of characterstic distribution patterns. The area is rich in endemics with the highest percentage in the mountains of Crete. The flora of the East Aegean Islands has an Anatolian character, with a pronounced biogeographical borderline towards the Cyclades which are slightly impoverished floristically. The North Aegean Islands house many Central European taxa not penetrating further south. A North African element is prominent in the hottest and driest areas in the south-east. Maps and other data have been extracted from the Flora Hellenica Database which has been built up over a period of 30 years. A quantitative biogeographical analysis of the Aegean flora will be published separately.

Fri 11:00

Bioclimatic profiles and distribution models of three paleoendemic *Ramonda* species (Gesneriaceae)

Šinžar-Sekulić, Jasmina, Maja Lazarević (majat@bio.bg.ac.rs), Gordana Tomović, Marjan Niketić, Sonia Siljak-Yakovlev, Branka Stevanović, Vladimir Stevanović

Monophyletic genus *Ramonda* comprises three species, *R. myconi*, *R. nathaliae* and *R. serbica*, remnants of the late Tertiary mountain flora and the rare resurrection plants of Northern Hemisphere. *Ramonda myconi* is the endemic species of the NE Iberian Peninsula, while *R. serbica* and *R. nathaliae* are restricted to the Balkan Peninsula. All three species inhabit similar habitats, such as northern mountain slopes, canyons and gorges. However, certain ecological characteristics point to *R. nathaliae* as more xeromesomorphic than *R. serbica*. In order to analyze the impact of climate on the current distribution, as well as to reveal potential refugia during the Last Glacial Maximum (LGM), we implemented ecological niche modeling on the available distribution data for the three *Ramonda* species. The bioclimatic profiles of *Ramonda* species were defined on the basis of the 19 BioClim layers at a spatial resolution of 30 arc s retrieved from the WorldClim database. The same database was used for the extraction of the LGM climate data layers at a spatial resolution of 2.5 arc min. Bioclimatic profiles were analyzed with the software Statistica 5.1. Current and the LGM distribution models were generated with MAXENT 3.3.3k. The obtained results confirmed the existence of differences in bioclimatic profiles of the analysed species concerning the water availability, with *R. nathaliae* occurring in the driest habitats. Furthermore, distribution models of the three *Ramonda* species were mostly affected by environmental predictors that characterize limits of their climatic tolerance (Precipitation and Mean Temperature of Driest Quarter), as well as seasonality of climate (Isothermality, Temperature Annual Range and Precipitation Seasonality).

Mon 13:10

Area evaluation from the aspect of biodiversity: Method designed for overcoming data gaps

Škunca, Marina (mskunca@geonatura.hr), Zrinka Mesić, Višnja Šteko, Alen Berta, Hrvoje Peternel

Projects regarding nature and environment protection usually require evaluation of the area's importance for biodiversity conservation. When the actual data about the area's biodiversity are insufficient, evaluation is often based on the evaluation of present habitats. There are numerous methods for habitat evaluation based on detailed information about the area characteristics or based on comprehensive species and/or habitat data collected through intensive or long-term surveys (that are generally not pre-calculated in the project duration and cost estimates). Therefore, a simple method for area evaluation was developed based on remote sensing habitat mapping and available spatial data regarding the project area, habitats and species. Analyses were carried out in GIS environment. After the production of the project area's habitat map, the value of each habitat was considered on three levels: (1) national, (2) local and (3) habitat unit (polygon) level. Importance of each habitat unit for biodiversity conservation was evaluated and scored according to 13 criteria (e.g. vulnerability and rarity of certain habitat, its importance for ecological network and/or local biodiversity,

level of unit degradation and possibility of restoration, etc.). Final evaluation of each unit was obtained by the cumulative sum of points assigned by each criterion and, accordingly, the Map of the area's biodiversity value was produced. Described method was used to determine the importance of the project area for biodiversity conservation, to define areas with specific targets for biodiversity protection (as part of the landscape and spatial identity study of Veli Brijun Island) and to select the most suitable location for the ground-mounted photovoltaic power plant on the Island of Unije.

Mon 12:30

The flora of Samothraki with special emphasis on its phytogeographical relationships

Tan, Kit (kitt@bio.ku.dk), Burkhard Biel

The flora of Samothraki, a small but phytogeographically distinct island in the North Aegean area, is presented. The total number of native and naturalized species of vascular plants is 1441, belonging to 559 genera and 123 families. Geomorphological, climate and land use aspects are emphasized, as well as the botanical history of the island and phytogeographical relationships. Island endemics and regional endemics are noted as are recent introductions and alien taxa. Of special interest is the flora of the central Saos mountain ridge (1624 m at peak of Fengari) which has alpine and subalpine elements and a number of characteristic and rare species. Also noteworthy is the flora of several permanent springs and streams leading down from the ridge and supplying some coastal wetlands in the northern part of the island. Some floristic areas of special interest are indicated together with current and future potential threats, and the necessary steps for safeguarding and protecting these areas are discussed. The island of Samothraki still holds a surprisingly great diversity of flora and vegetation in a relatively small area.

Thu 16:50

Assessing standing adaptive genetic variation of Pedunculate oak populations in Croatia

Temunović, Martina (martina.temunovic@gmail.com), Saša Bogdan, Zlatko Šatović, Mladen Ivanković, Maja Popović, Pauline Garnier-Géré, Arndt Hampe

Pedunculate oak (*Quercus robur*) is one of the widely distributed and valuable hardwood tree species in Europe, both economically and ecologically. Increasing drought stress driven by modern climate change has been identified as a major threat for the performance and persistence of Pedunculate oak forests in the southern and southeastern parts of the species' distribution range. The potential of Croatian Pedunculate oak populations to cope with a rapidly changing environment and increasing drought stress depends largely on their standing genetic variation, particularly at evolutionarily relevant loci. Hence, assessing levels of genetic variation of populations at loci potentially under selection can provide important insights into their levels of local adaptation and their intrinsic capacity to cope with predicted climatic trends. We here investigate patterns of genetic variation assessed by SNPs located in candidate genes related to drought resistance and phenology for populations residing near the species' southeastern range margin in Croatia. Our objectives are to: a) quantify levels of differentiation at potentially adaptive loci; b) detect possible signatures of natural selection

and c) identify environmental drivers triggering adaptive divergence. We assessed imprints of natural selection by two alternative methods (Mcheza and BayeScan) for identifying FST outlier loci. In addition, we regressed allele frequencies of SNPs loci under selection against different environmental variables related to temperature and precipitation. The obtained results should help with developing genetically informed guidelines for a climate-change integrated management of Croatian Pedunculate oak forests.

Mon 16:10

40

Floristic novelties and taxonomic remarks on the genus *Viola* L. (Violaceae) from Serbia

Tomović, Gordana (gtomovic@bio.bg.ac.rs), Marjan Niketić

Genus *Viola* L. is one of the most diverse and taxonomically most complex genera in the flora of the Balkan Peninsula. Of five sections of the genus listed in the Flora Europaea, representatives of three sections are present in Serbia: within the *V.* sect. *Viola* there are 14 native as well one adventive species (*V. obliqua* Hill.); *V.* sect. *Dischidium* Ging. is represented by a single species (*V. biflora* L.) and within the *V.* sect. *Melanium* Ging. 11 native species are present in Serbia. In the past several years, intensive field survey and the inspection and revision of the plant material from two herbarium collections (BEOU and BEO) revealed the presence of two new species of the *V.* sect. *Viola* for the Flora of Serbia: *V. chelmea* Boiss. and *V. jooi* Janka. *V. chelmea* was found in Mt Ošljak in southern Serbia and this locality represents the most continental founding of this high-mountain endemic plant in the Balkan Peninsula. *V. jooi* was found in Mt Homoljske Planine (Veliki Vukan peak) in northeastern Serbia and so far it is the only locality of this Carpathian-Altai plant in the Balkan Peninsula and southernmost findings of the species distribution range. In addition, *V. pumila* Chaix and *V. elatior* Fr. were rediscovered in vicinity of Brestovačka Banja spa, and Smederevska Palanka respectively. These species are first mentioned by Josif Pančić more then century ago, and the rediscovered locality of *V. pumila* is the only certain and confirmed locality of this Eurasian plant in Serbia. *V. elatior* was last found in Serbia in the second half of the last century, only on two places. Apart from these floristic novelties, in this study a certain taxonomic remarks on several taxa from the *V.* sect. *Melanium* in Serbia, e.g. *V. aetolica* Boiss. & Heldr., *V. elegantula* Schott, *V. dacica* Borbás and *V. tricolor* L. are provided.

Tue 13:10

Epiphytic and epilithic diatom communities along the Raška River – implications for the water quality

Vidaković, Danijela (daca.vidakovic@yahoo.com), Olga Jakovljević, Sanja Radovanović, Sanja Šovran, Jelena Krizmanić

We compared epiphytic and epilithic diatom communities in the Raška River, and their use in river biomonitoring. The material was collected in April, June, August and November 2011, and March 2012 from 5 localities along the Raška River. The result showed high variation of the diatom species composition between this two micro-habitats. The most abundant genera were *Navicula*, *Gomphonema* and *Nitzschia*, but with higher diversity in epiphytic diatom

community. During first season, *Achnanthidium minutissimum* and *Gomphonema tergestinum* were dominant taxa in epilithic, while *A. minutissimum* and *Diatoma vulgaris* in epiphytic diatom community. Epilithic diatoms are the favoured community for monitoring water quality. However, at any river, diatom species are located on various substrates at the same sampling site. For diatom diversity assessment it is necessary to investigate all micro-habitats. Our results point to a difference in values of TDI diatom index between macrophytes and stone samples. Is it necessary to investigate all micro-habitats, or is the type of substratum independent for water quality monitoring?

Fri 9:50

Identification of wood specimens from some historical mosques of Albania

Yaman, Barbaros (yamanbar@gmail.com), Ali Akın Akyol

For the implementation phase of restoration project of a historical wooden building, it is a crucial role to identify old wood specimens taken from different parts of the building, and there is a need to select correctly the wood to be used for parts of the building to be restorated. For identification of old wood specimens on the basis of wood anatomy, which are mostly destroyed by insects, fungi, bacteria, wetness etc., different preparation and investigation methods depending on sample conditions are needed such as reflected light microscopy without taking thin section and/or light microscopy with taking thin section. Moreover, one of the most important procedures in identification process is to compare an unknown wood specimen to both prepared thin sections of wood specimens in xylarium and to wood anatomy atlases in case of need. This work presents the identification study of historical wooden artifacts from the mosques in Tirana and Berat cities in a project conducted by The Turkish International Cooperation and Development Agency (TIKA) in Albania mission. In terms of protecting cultural heritage, documentation, restitution and restoration projects have been carried out by TIKA, which is responsible for organization of the bulk of Turkey's official development assistance to developing countries. In this context, the fourteen old wood specimens were sampled and analyzed from Bachelor's Mosque, King's Mosque and Helvetie Teke in Berat and Ethem Pasha Mosque in Tirana in the project of documentation, restitution and restoration of these historical buildings. The samples were taken when this operation does not appreciably modify any part, or change the integrity of the wooden artifact in question. As a result, the woods were identified as *Pinus*, *Picea*, cf. *Cupressus*, *Fagus*, *Quercus*, *Populus* / *Salix*. Some species of the genera are typically used for the construction for a long time at that region in Albania.

Fri 16:40

Seasonal variations of heavy metal accumulation in *Pinus pinaster* Aiton and co-located soils in the vicinity of Bartin (Turkey)

Yasar, Ulkuhan (ulkuhanyasar@hotmail.com), Ibrahim Ilker Ozyigit, Ilhan Dogan, Zeki Severoglu, Goksel Demir, Hande Kucukonder, Ibrahim Ertugrul Yalcin

Pinus pinaster Aiton (Maritime pine) shows widespread distribution throughout Mediterranean. On Anatolian peninsula of Turkey, it occupies large areas in coastal regions of

the Black Sea, the Marmara and Aegean. This evergreen coniferous tree grows up to 35 m tall and presents at elevations ranging from sea level to 2000 m. Bartin is a small city situated on the Black Sea Coast and has a humid subtropical climate with high and evenly distributed rainfall the year round. Summer seasons are very warm and humid and winter seasons are cool and damp. In recent years, utilization of the poor quality coal, exhaust gases from engines and industrial activities have led to high level of pollution in the city affecting natural environment negatively. In this study, washed-unwashed leaf (WL-UWL) and bark samples of the plant and co-located soil samples collected from 10 different localities were used for understanding of heavy metal pollution rate in Bartin. Heavy metal (Cd and Pb) and nutrient element (Ca, Mg and Ni) measurements in all samples were done using Inductively Coupled Plasma Optic Emission Spectroscopy (ICP-OES). According to our results, the lowest and highest values (in mg/kg) in the plant parts and co-located soils were varied between 592.23 (WL)-8722.12 (barks) in winter and autumn and 1203.26-3155.67 (soils) in winter and autumn for Ca, 0.084 (WL)-4.52 (barks) in autumn and winter and 2.001-7.035 (soils) in autumn and winter for Cd, 111.32 (barks)-590.91 (UWL) in autumn and spring and 932.46-2174.27 (soils) in summer and winter for Mg, 0.92 (barks)-21.72 (unwashed leaves) in autumn and winter and 3.26-37.33 (soils) in summer and winter for Ni, 2.12 (WL)-22.17 (UWL) in autumn and winter and 46.03-181.73 (soils) in spring and winter for Pb, respectively. The data proved that there is dangerous situation for people living in Bartin in the future and monitoring of environmental pollution in Bartin must be continued.

Tue 12:30

Morphological variability of *Ulmus glabra* Huds. (Ulmaceae) in northwestern Croatia

Zebec, Marko (mzebec@sumfak.hr), Ines Modrić, Vladimir Zebec

Threats to biodiversity of European elms can be mainly attributed to the destruction of habitat by exploitation of natural goods, introduction of new elm species and spontaneous hybridization with ornamental species. The great danger lies in extremely high susceptibility of elms of the Ulmus Heybr. section to the *Ophiostoma novo-ulmi* Brasier pathogenic fungus, which has resulted in immense dieback of adult trees throughout Europe. In this research, our goal was to assess interpopulation and intrapopulation variability of the wych elm in northwestern Croatia. Material for the morphometric analysis was sampled in 5 natural populations (Ivanščica, Kalnik, Macelj, Medvednica, Strahinščica). We measured 10 foliar morphological traits and analysed data by means of modern multivariate statistical methods. Overall variability coefficient ranged from 11,95 % for angle between the main leaf vein and the line defined by the leaf base, and the point of the leaf edge where leaf lamina is widest to 52,50 % for the leaf base asymmetry trait. Partitioning of variance indicated that differences among trees in a single population accounted for the most of variability determined. Accordingly, the amount of variation attributable to differences among populations was considerably smaller. Cluster analysis and UPGMA dendrogram proved that the most similar populations were Ivanščica and Strahinščica, followed by population Macelj, whereas populations Kalnik and Medvednica formed distant group.

Tue 12:50

Stem xylem characteristics and their possible application in selection of poplar genotypes (*Populus* L., Salicaceae)

Zorić, Lana (lana.zoric@dbe.uns.ac.rs), Andrej Pilipović, Sonja Perić, Dunja Karanović, Jadranka Luković

Poplar trees are fast growing, with high phytoremediation potential, easily harvested and regrown. They are usually used for biomass production, as an energy source and in the paper industry. Xylem anatomy has great influence on plant growth and vigor, as well as on vulnerability to cavitation and embolism. In this work stem anatomical properties of nine hybrid poplar clones (B-81, Bora, 129-81, 181-81, Antonije, PE4-68, PE19-66, 665, Pannonia) were examined, with special emphasis on xylem parameters, in order to determine variations among genotypes, to examine correlations between xylem anatomy and vigor and analyse whether anatomical parameters of xylem can be used in genotype selection. For this purpose, cross sections of one-year-old stem branches were examined using light microscopy and measurements performed using Image Analysing System. The results of our analyses showed that genotypes B-81, PE19-66 and Bora had small number of large diameter vessels. All three genotypes had high theoretical hydraulic conductance (kh), and were highly productive ones, with high growth rates. For genotypes 181-81, 129-81 and PE4-68, which had high growth rates only at the juvenile stage, the lowest kh, values, due to small vessel diameter, were obtained. Pannonia was characterized by the medium growth potential, but high regrowth potential due to the high rooting ability. This might be connected to the presence of high number of small lumen vessels in stem xylem. Genotypes with the highest number of individual vessels also had the highest number of grouped vessels. On the basis of the obtained relationships between stem xylem and vessel parameters on one side and vigor and growth rates of poplar trees on the other, we concluded that anatomical data, especially the number and diameter of vessels and proportion of xylem, could be used as additional tools in preselection process, for the prediction of poplar tree growth and vigor.

Poster presentations

Thu, 345
Dry grassland vegetation of Serbia

Aćić, Svetlana (acic@agrif.bg.ac.rs), Urban Šilc, Milica Petrović, Zora Dajić Stevanović, Gordana Tomović

Dry grasslands are ecosystems of significant biodiversity and great importance for livestock production in Serbia. Phytocoenological relevés from all relevant literature sources and our own investigations were stored in the Vegetation Database of Serbia (EU-RS-002). The final dataset contained 1897 relevés and 1323 species. Numerical classification revealed four vegetation groups: Pannonian sand dunes and grasslands on loess, grasslands on extremely rocky sites, Balkan montane steppic grasslands and grasslands developed on deep soils over siliceous or calcareous bedrock. The dry grasslands of Serbia exhibited high floristic diversity (1323 plant species) and are characterized by large number of Balkan endemic species (204).

Mon, 129
Wild plants using as tea, Ayranci (Turkey)

Akdağ, Turan (turanakdag570@gmail.com), Süleyman Akdağ

The aim of the study was to identify wild plant species which used as tea by local people living in the villages located around Ayrancı (Karaman). The material of the study constitutes plant samples which used by villagers whom collected between April and September 2014. Wild plant species of the traditional tea are located in district of Ayrancı (Karaman). Giving local names, plant usage forms and plant usage portions were determined with face to face interviews. Dried herbarium specimens that obtained from plant material were identified according to "Flora of Turkey and the East Aegean Islands". As a result of the study, total of 17 taxa belonging to 5 families have been identified in the research area. According to results of the study, the largest taxon as tea was belonging to family of Lamiaceae.

Tue, 233
Leaf anatomy of *Allium* L. species from Serbia, comparative studies and phylogenetic relationships

Anačkov, Goran (goran.anackov@dbe.uns.ac.rs), Lana Zorić, Pal Boža

The basic elements of the anatomic structure of leaf (position and orientation of vascular bundles, characteristics of mesophyll, epidermis, position of stomata etc.) in the genus *Allium* enables more precise defining of infrageneric placement of each species. Studies on leaf anatomy in *Allium* species were performed on 29 taxa of the genus *Allium* from Serbia. Besides the species and subspecies (27), the analysis also included two varieties appearing in different habitat types than their typical forms. The analyzed characteristics were coded for needs of correspondent canonical analysis. The multivariate statistical analysis was performed by using the software set Statistica, ver. 12.0. Position of each analyzed taxon was determined

according to positions of its leaf structure type within the evolutionary series of leaves in the genus *Allium*. The anatomic and micromorphological characteristics of leaves in the genus *Allium* comprised five groups of taxa in Serbia. The phylogenetic pathways in evolution of the genus *Allium* are noticeably not corresponding with the paths of evolutionary differentiation of leaves. The processes of evolutionary changes in leaves of the genus *Allium* were parallel in several evolutionary clades, so representatives of certain evolutionary lines have passed simultaneously through the same stages in the processes of evolutionary differentiation of dorsoventral leaves.

Mon, 132

A highly invasive *Echinocystis lobata* (Cucurbitaceae) as an invader of riparian forests in Serbia

Anđelković, Ana (ana.andjelkovic21@gmail.com), Milica Živković, Danijela Pavlović, Dragana Marisavljević, Snežana Radulović

Invasive vine species are strong competitors of native tree species, for both above and belowground resources. Often reaching high abundances, especially along the forest edges and within forest gaps, they have the tendency to shade out the canopies of native trees. In addition to their invasive behaviour, due to the effects they have on the biodiversity of autochthonous forest species, invasive vines have been marked as species of important silvicultural concern. An extensive field study was performed during the summer/autumn period of 2013 and 2014, encompassing riparian areas along the rivers in Serbia. The aim of the study was, among other things, to record the presence and abundance of invasive vine species. River stretches, along which the field surveys were carried out, were chosen according to the RHS (River Habitat Survey) methodology. Of the invasive vine species present in Serbia (*Echinocystis lobata*, *Parthenocissus quinquefolia* and *Vitis riparia*), the results have shown a strikingly high incidence of *E. lobata*. This highly invasive species was recorded along the course of 81% of the 31 rivers studied. It was registered in 43.5% of the total number of river stretches observed, with its cover reaching up to 60% of a 100 m long transect, in some of the cases. Such a high presence of *E. lobata* indicates that a significant proportion of Serbian rivers are strongly invaded by this invasive vine species. Bearing in mind its tendency for intensive, "weedy" growth and rapid spread, its further expansion can be expected in the following years.

Thu, 311

Hypobaric pressure effects on gene expression, as a physiological response of Canola varieties (*Brasica napus* L., Brassicaceae)

Arican, Ercan (earican@istanbul.edu.tr), Bilge Çelik

The main purpose of our study was to determine the expression levels of genes, which respond to low pressure in canola (*Brassica napus* L.) varieties Californium, Orkan, Jura and Elvis. Study Design: Canola varieties (Californium, Jura, Orkan and Elvis) placed within specially designed low pressure cabinets were exposed to low pressure (40 Torr ≅ 53 kPa) for durations of 1, 2 or 3 days. Total RNA was isolated from the plants analyzed for genes,

OsNCED, OsABA8, OsZEP and TMAC2 by RT-PCR technique. For control, housekeeping gene β-actin was used. As a result OsABA8ox 1, 2, 3 and OsNCED showed increase in expression levels. Methodology: Canola varieties Californium, Orkan, Jura and Elvis were provided by the Black Sea Agricultural Research Institute, Samsun – Turkey. Seeds were sown and placed in the plant growth chamber. The 14 days old plants were exposed to low pressure in the low pressure cabinet. RT-PCR reactions were performed in one-tube reaction according to manufacturer's protocol (Access Quick RT-PCR System, Promega, A1701). Results: The PCR products of OsNCED, OsZEP, OsABA, TMAC2 separated by 2% agarose gel electrophoresis were found to be approximately between 200-300bp. The PCR products of OsABA8 gene (~750bp) in Jura was determined to be increased compared to that of control group. Change of expression of OsABA8 gene (~750bp) in varieties of Jura and Orkan were determined and compared to that of control group. OsABA8 gene region (~300bp) in varieties of both Californium and Elvis, whose expression of OsNCED gene region only (~300bp) in varities of Jura and Orkan were determined and compared to that of control group. Conclusion: Any changes have been determined in the expression of TMAC2 gene which supports the other studies in the literature. As a consequence of this, results obtained from our study have the feature that can give a new direction to other studies. In addition to this, because of there is no yet such a study related to low atmospheric conditions, this study has the characteristics of being the first and fundamental study with this speciality.

Mon, 122

Condition and threats to the populations of three Balkan endemic plants on Mt Falakron, North-Eastern Greece

Asenov, Asen (asenasenov71@yahoo.com)

Mt. Falakro (2232 m) is situated between Rhodopes and Aegean Sea. Basic rocks are marbles, soils are rendzinas, which is reason for rich flora. The climate is Transitional Mediterranean. Mt Falacron is a treasury of world wealth. Bringing together a lot of Balkan endemics one small place, we can considered Falakron as a natural museum. This is indication of the great conservation importance of Mt Falakron. The aim is to investigate population of three endemic plans: *Abies borisi-regis, Saxifraga ferdinandi-coburgi* and *S. stribrnyi*. Field trips were performed in the period 2011-2015. Results: (1) *Abies borisi-regis*: One population was found, on the north-west slopes of Choros and Anonomi summits, on altitude 1500-1650 m. The population is composed of one fragment, covered 1200 m² area, growing on 45°degree inclination, having big density and good reproductive potential. The population is threatened by felling and fires; (2) *Saxifraga ferdinandi-coburgi*: form a vast mosaic population growing on grassy and stony terrains on the higher parts of the mountain (1700-1900 m), cover area of 8 000 m² on subalpine–alpine belts. The population is threatened by livestock grazing; (3) *S. stribrnyi*: only 3 single individuals were found, growing at 560-2020 m: at 560 m – one generative plant on rocks of the Sousitsa river valley was found, close to Pirgi village; at 1467 m – on the rocks of the road Volakas – Ski center, in the region of Pefkonas. One generative individual was found; at 2020 m – on the north slopes of Profitis llias peak – one generative plant. Individuals are threatened by livestock grazing.

Tue, 229

Morphogenesis and polyvariation of development of some taprooted species (*Nepeta* sect. *Spicata,* Lamiaceae) in Central Asia

Astashenkov, Alexey (astal@bk.ru)

The volume of the section contains 17 species according to Flora of the SSSR (Poyarkova, 1954). The species of this section is represented by polycarpics, mainly taprooted caudex herbs and more rarely dwarf semishrubs. *Nepeta podostachys, N. maria, N. bucharica, N. maussarifii, N. kokanika* and *N. pamirensis* growing in the mountains of Tajikistan are chosen as model species. Individuals of the studied species develop by sympodial long-shoot model of shoot formation. As a rule, plants have monocyclic shoots of renewal. Ontogenesis of *N. maria*, *N. bucharica*, *N. maussarifii, N. pamirensis* individuals is simple, that of *N. kokanika* – complicated. Morphogenesis phases – initial shoot→original bush are characteristic of *N. maria, N. bucharica, N. maussarifii* species. Morphogenesis phases initial shoot→original bush→clon or initial shoot→original bush are characteristic of *N. podostachys* and *N. kokanika* species. N. pamirensis individuals have three life forms: herbaceous, dwarf semishrub and cusionlike one. Morphogenesis phases – initial shoot→main axis→original bush are typical of the herbaceous form. Morphogenesis phases - initial shoot→main axis→original bush→clon are typical of dwarf semishrub and cusionlike forms. On the monocarpic shoots there are a lower zone of inhabitation, a zone of renewal, a zone of enrichment and a zone main inflorescence. The zone structure of shoots changes in species with a labile life form (*N. pamirensis*). Structural polyvariation of shoots depends on the position and extention of separate zones. The main modes of morphological transformation of a life form from a caudex herbaseous perennial to a dwarf semishrub are offered for individuals of *N. pamirensis*. They are considered as medial deviation of individuals in ontogenesis along with basal prolongation and abbreviation of their shooting systems. Study of ontogenesis allowed to reveal mechanisms of adaptation and to assume ways of somatic evolution of individual taxa. This work was supported by the Russian Foundation for Basic Research, project no. 15-04-02857a and 14-04-31483.

Tue, 228

Diversification of *Luzula* sect. *Luzula* (Juncaceae) on the Balkan Peninsula – a cytogenetic approach

Bačič, Tinka (martina.bacic@bf.uni-lj.si), Božo Frajman, Jasna Dolenc Koce

Luzula sect. *Luzula* is one of the taxonomically most intricate groups of angiosperms, where diversification is mostly driven by true polyploidy and agmatoploidy (fission of chromosomes) leading to three different karyotypes (whole chromosomes AL, half-sized chromosomes BL and quarter-sized chromosomes CL). Morphologically, the taxa are often difficult to distinguish and genome size data coupled with karyological investigations are currently the most reliable way for their identification. For the Balkan Peninsula, one of the botanically least studied areas of Europe, ten taxa from this section have been reported, but little is known about their distribution. We here estimated the nuclear DNA amount (genome size, GS) using interphase-peak DNA image cytometry and counted the chromosomes for 33 populations of five species of *Luzula* sect. *Luzula* mostly from mountainous areas of the Balkan Peninsula and the adjacent southeastern Alps. Five taxa have been confirmed, of

which *L. divulgatiformis* is new for Croatia and *L. exspectata* for Macedonia and Serbia. The most common species in the Dinaric mountains appears to be diploid (2n=12 AL) *L. taurica*, for which the GS (2C-value=0.83 pg DNA; fitting well in the range of previously determined values of diploid taxa) has been determined for the first time. The GS and karyotypes of other taxa (*L. campestris*, *L. divulgatiformis*, *L. exspectata*, *L. multiflora* subsp. *multiflora*) correspond well to previously published values. An identification key for the Balkan taxa of *Luzula* sect. *Luzula* was also compiled.

48

Tue, 220

Investigation of morphological and anatomical characters of subsp. of the *Salvia candidissima* Vahl (Labiatae)

Bağcı, Yavuz (ybagci66@gmail.com), Nermin Elmalı, Süleyman Doğu

In this study the morphological and anatomical properties of *Salvia candidissima* Vahl subsp. *candidissima* and *S. candidissima* subsp. *occidentalis* Hedge species which belong to Lamiaceae family were investigated. In morphological studies of these two subspecies, parts of stem, leaves, flower and fruit were measured and given as tables. In anatomical investigations of these two subspecies were taken section from root, stem, leaves by microtome and hand. These sections were painted and were made constant slide. After that they were taken photograph of these slides with assist of microscobe which has camera. Stomatal characteristics were examined by section taken superficial from these plants leaves and stomata index was calculated.

Mon, 134

Potentially invasive species *Fallopia baldschuanica* and *F. multiflora* (Polygonaceae) in Slovenia

Balant, Manica, Simona Strgulc Krajšek, Nejc Jogan (nejc.jogan@bf.uni-lj.si)

The Russian vine (*F. baldschuanica*) and Chinese knotweed (*F. multiflora*) are vines that originate in Asia and were first brought to Europe in the 19th century. Even though Russian vine has already been recognized as an invasive species in many European countries (including Slovenia), little is known about its ecology. *F. multiflora* is still very rare in Europe, and is also poorly studied. It was first recorded in Slovenia during the field work for this research. Focus of our study was in the distribution and ecology of both species in Slovenia. During the study, we discovered both species in 55 localities, *F. baldschuanica* in 46 localities, all over Slovenia but mostly in warmer SW part, and *F. multiflora* in 9 localities in the Coastal region. Both species are well naturalized in Slovenia and are locally invasive. Because basic knowledge of species ecology is crucial for successful eradication of invasive species, we made several experiments to better understand their ecology. We tested the pollen and seed viability and found that both are more viable in the *F. multiflora* plants. In the field studies we noted that both species can reproduce vegetatively so we also tested rooting of woody underground and aboveground parts and found out that *F. baldschuanica* was more successful. In all our experiments, we had a relatively small number of samples. In order to obtain more precise data for the ecology analysis of both species, additional surveys should be

made with larger number of plants. The main sources for invasive spread of both species in the future remain garden centres (where both are still for sale) and random displacement by construction works or mechanical trimming along road banks. To minimize the spread of both species, we need to educate the employees and consumers in both sectors about the proper management of these invasive plants. The results obtained in this research, therefore, give us the basis for further studies of both species.

Tue, 236

Pollen morphology of some *Centaurea* species (Asteraceae) in Turkey

Bancheva, Svetlana (sbancheva@yahoo.com), Zafer Kaya

The genus *Centaurea* is one of the largest and the richest in endemics in the Turkish flora. Moreover, the territory of Turkey is a major center of origin and distribution of the representatives of the genus. In *Centaurea* there are still a number of unresolved taxonomic problems. One of the most appropriate methods to clarify its taxonomy is the pollen morphology. The current work includes the results of the pollen morphology of 13 *Centaurea* species from Turkey by light and scanning electron microscopy: *Centaurea arenaria*, *C. cariensis* subsp. *microlepis*, *C. cuneifolia*, *C. diffusa*, *C. elazıgensis*, *C. fenzlii*, *C. gigantea*, *C. jacea*, *C. nemecii*, *C. salonitana*, *C. stenolepis*, *C. thracica* and *C. urvillei* subsp. *armata*. The study presents micrographs of pollen grains, together with descriptions of the characteristics of their structure. The results show that the pollen characters (shape, exine structure, sculpturing) are very useful for the classification of the taxa.

Tue, 224

Phylogenetic relationships among and morphological comparision of European taxa of *Gymnospermium* (Berberidaceae)

Barina, Zoltán (barina@bot.nhmus.hu), Danka Caković, Dániel Pifkó, Peter Schönswetter, Gabriella Somogyi, Božo Frajman

Gymnospermium is a relatively small genus of early spring-flowering tuberous plants including around ten species distributed from East Asia to Southeastern Europe. Until recently only *G. altaicum* occurring also in the Caucasus and Central Asia was recognised for Europe, ranging from the Balkans (southern Montenegro to northern Peloponnese in Greece) to the Black Sea region (from the Crimea and SW Ukraine to the Dobrogea area in eastern Romania); these populations were from 1970 sometimes treated as *G. odessanum*. More recently, the Balkan populations were included in three species, i.e. *G. maloi, G. peloponnesiacum* and *G. scipetarum*, based on morphological variation. We will present phylogeographic relationships among the Balkan populations and their relationships to *G. odessanum* from the area north of the Black Sea using amplified fragment lenght polymorphisms (AFLPs) and infer their relations to *G. altaicum* and some other Asian taxa using plastid and nuclear DNA sequences. Results of a detailed morphometrical analysis of one population of *G. maloi* and two populations of *G. scipetarum* and their comparison with all other European and some Asian taxa revealed that the morphological characters used for the delimitation of taxa, especially the shape and the size of the basal and cauline leaves, have

a limited significance and their variability within populations can be much higher than differences between populations.

Mon, 106

Diversity of diatom on mine pit lake Vrtlište (Kakanj, Bosnia and Herzegovina)

Barudanović, Senka, Ermin Mašić (erminmasic@hotmail.com)

The area of Bosnia and Herzegovina is characterized by a high diversity of habitats which are incorporated into a variety of landscapes. In addition to the natural ecosystems, there is also a diversity of anthropogenic ecosystems in Bosnia and Herzegovina. The group of these landscapes includes abandoned surface mine areas and landfills of barren soil material that are located in the vicinity of mines and thermal power plants. At the abandoned open-pit mines, anthropogenic swamp ecosystems are in process of establishment. The formation of anthropogenic wetlands is a process opposite to the trend of extinction of wetlands in the world. Research for this study was conducted at mine pit Lake Vrtlište near Kakanj. Fieldwork was carried out during the summer (July) and autumn (October) seasons in 2013 and 2014. Physical and chemical parameters of water are also analyzed. A total of 126 taxa, classified in 46 genera, were identified. The most represent genera were: *Pinnularia* (12), *Nitzschia* (11), *Navicula* (8), *Cymbella* (7), *Gomphonema* (7), *Eunotia* (6) and *Gyrosigma* (5). The most significant species of the investigated mine pit lake are: *Amphipleura pellucida* Kützing, *Brachysira neoexillis* Lange-Bertalot, *Denticula kützingii* Grunow, *Cymbella cistula* (Ehrenberg) Kirchner, *Cymbopleura amphicephala* Krammer, *Encyonopsis microcephala* (Grunow) Krammer, *Eunotia bilunaris* (Ehrenberg) Schaarschmidt, *Eunotia minor* (Kützing) Grunow in Van Heurck, *Navicula radiosa* Kützing, *Pinnularia borealis* Ehrenberg, *Rhopalodia gibba* (Ehr.) O.Müller, *Sellaphora pupula* (Kützing) Mereschkowsky etc. Based on conducted research of mine pit lake we discussed about the importance of anthropogenic water bodies. They currently represent new habitat for establishment and protection of wetland biodiversity. Using different restoration activities which involve removing of heavy metals and neutralization by biological features, these water bodies could be used as a medium for constructed wetlands.

Thu, 305

Pollen morphology of *Crocus reticulatus* Steven ex Adams (Iridaceae)

Bekić, Bojana (bojana_b@iep.bg.ac.rs), Marina Mačukanović Jocić

Pollen of wild saffron (*Crocus reticulatus* Steven ex Adams) was analyzed using scanning electron microscope in order to contribute to palynomorphological and taxonomic research of apiflora of Serbia. *Crocus reticulatus* is a herbaceous perennial plant, growing from 5 to 15 (18) cm in height, with usually solitary pale-lilac to whitish flowers with 3 wide stripes on the outer surface of the tepals. This species belongs to the Pontian-Mediterranean floral element, inhabiting dry grassy or rocky slopes, steppe meadows, sandstone, and bright forests. In Serbia, it is usually found growing in the vicinity of Belgrade, on Vršac Hill and Mt. Fruška Gora, near Kladovo and Kostolac and also in Deliblato Sands where material for this analysis was collected from. The following morphological characteristics of pollen were examined:

polarity, shape, size (pollen diameter), apertures, ornamentation and symmetry. Observations and measurements were performed on a sample of 25 pollen grains for each of the analyzed morphological characters. Pollen grains of *C. reticulatus* are radially symmetrical, spheroidal in shape and large-sized. The average pollen diameter is 66.71±1.57 μm. The exine has extensive or spiral shallow furrows (spiraperturate). Exine ornamentation is microechinate-microperforate. The tectum is covered with minute ehini averaging 0.69±0.15 μm in height, irregularly distributed between the perforations. The microechini average number per sample area of 5 μm x 5 μm is 5.9 ± 0.87.

Tue, 208

Flora and urbanization – differences and similarities smong urban floras in SE Europe

Bokić, Bojana (bojana.bokic@dbe.uns.ac.rs), Boris Radak, Milica Rat, Marjana Gavrilović, Slobodan Jovanović, Pal Boža, Goran Anačkov

Urban flora draws researcher's attention for a long time. Back to centuries, in many old cities in Europe, flora in urban and neighbouring areas was recorded. By now, urban floras in SE Europe were analysed primarily from floristic and ecological perspective, lacking results comparison. Therefore, we decided to integrate the data and analyze the differences and similarities among urban floras. Additionally, urban flora structure is compared with urbanization to define the potential patterns of changes. For the analyses, 11 cities in Southeast Europe: from the South Pannonia to Central Balkans are chosen. Cities differ in population size, travel network development and distance from major rivers. Remarkable is the difference in the species number, presence of unique species and aliens, and the most noticeable in the urban flora of Belgrade, city with the highest urbanisation level. Concerning floristic structure, Kosovska Mitrovica, Grocka and Požarevac stood out. These cities have big number of species, and low ratio of the aliens, with regard to urbanisation. On the other side Kovin, Novi Sad and Vranje are grouped by similar floristic structure, relatively similar proportion of alien species and approximately similar number of unique species in relation to the total number of species. In all analysed urban floras, dominant plant strategy types were: disturbing tolerant plants, weeds and generalists. It is verified that urban floras have therophytic-hemicryptophytic character, with predomination of the therophytes in almost all cities, which can be mainly explained by urban heat effect that impact urban flora structure. From the results follows that other factor beside urbanisation have important effects on floristic structure. Exception is presence of aliens, which is highly positively correlated with urbanization. The complex interaction of the environment and human, even in cities closely located provides specific conditions, resulting in specific and rich urban floras.

Mon, 131

***Phytolacca acinosa* Roxb. (Phytolaccaceae), a new alien species of the Croatian flora**

Borak Martan, Valentina (valentina.borak@gmail.com), Renata Šoštarić

Phytolacca acinosa Roxb. is an East Asian origin, naturalised in many parts of European continent. In summer 2014 it was found for the first time in Croatia. *Ph. acinosa* is located in two anthropogenic habitats in the Varaždin city. In Croatia, there is a species *Ph. americana*

L. in cultivation and naturalised, but so far no other species of the genus have been recorded on Croatian territory. Ph. acinosa is a much smaller plant than *Ph. americana*, with an erect inflorescence and broader leaves. *Ph. acinosa* always has erect infructescence with usually eight distinct carpels. Racemes are erect even after flowering. *Ph. americana* has arcuate or drooped inflorescence which drooped after flowering with usually 10 concrescent carpels.

Thu, 325

Metal accumulation of some endemic serpentinophytes in a site in Central Serbia

Branković, Snežana (pavsnez@yahoo.co.uk), Radmila Glišić, Zoran Simi

The aim of this study was to determine the concentrations of 7 metals in the soil and in the endemic serpentinophytes that grow on it, to determine the ability of the plant species in accumulation of researched metals on one serpentine site (Central Serbia). The researches have included the following endemic serpentine plants: *Artemisia alba* Turra (*Artemisia lobelii* All.), *Euphorbia glabriflora* Vis., *Alyssum markgrafii* O. E. Schulz, *Potentilla visianii* Pančić and *Silene sendtneri* Boiss. The concentration of researched elements in the soil had this order: Mg>Fe>Ca>Ni>Cr>Mn>Zn. The concentrations of Ni and Cr in the investigated soil were above remediation values, the maximum allowable concentration, as well as of prescribed limit value of substances in the soil according to regulation of Republic of Serbia. The concentrations of researched metals in plants were variable, dependent on the plant species and types of metals. The metal uptake does not necessarily correlate with metal content in the soil. Metal uptake by plants depends on the bioavailability of the metal in soils, which in turn depends on the retention time of the metal, as well as the interaction with other elements and substances. However, the most Mg and Ca were found in species *P. visianii*; Mn and Zn in *E .glabriflora*, and Fe, Ni and Cr in A. markgrafii. In the *E. glabriflora*, *A. markgrafii*, *P. visianii*, *S. sendtneri* it were determined the biological absorption coefficients greater than 1 for Ca and Zn, also in the species *E. glabriflora* for Mn. Obtained results present the momentary picture of investigated locality, open a lot of questions connected with relationships soil/plant, contents of elements in both systems, their interactions and influences and represented the base for further research.

Thu, 326

Two different types of winter acclimation of photosynthetic apparatus of evergreen woody angiosperms

Bulysheva, Maria M. (massha_b@mail.ru), Nuria K. Koteyeva, Olga E. Mirgorodskaya

Winter acclimation of ever- and wintergreen plants of temperate zone occurs in many scales including physiological, biochemical and structural changes in photosynthetic apparatus. One aspect of structure-function adjustments is chloroplast structure rearrangement. It has been reported that during winter conifers down-regulate photosynthesis in association with decrease in number of grana and thylakoids in grana. Thylakoid unstacking throughout the winter has been discussed in the context of photoinhibitory inactivation of PSII in order to limit reactive-oxygen formation and to facilitate strong thermal dissipation under the severe cold conditions coupled with high intensities of solar radiation. In contrast, some herbaceous

angiosperms instead exhibit well-developed grana system or even increase the thylakoid number showing different strategy of photoprotection. The information about evergreen woody angiosperms of temperate zone is missing. To evaluate the levels of flexibility of seasonal responses of photosynthetic apparatus in different systematic groups the chloroplast ultrastructure was studied during annual cycle in two species of ever/wintergreen woody angiosperms, *Rhododendron ledebourii* Pojark. and *Mahonia aquifolium* (Pursh) Nutt. *R. ledebourii* chloroplasts show predominance of single thylakoids and grana consisting of two thylakoids during the winter with grana restoring towards the summer. Chloroplasts maintain their position mainly along the mesophyll cell wall. In contrast, chloroplasts of *M. aquifolium* mesophyll cell tend to move to the proximal end of the cell during the winter. In *M. aquifolium* number of grana and thylakoids in grana are higher during the winter comparing the summer; this can specify the different mechanism of photoprotection associated with anthocyanins accumulation characteristic to this species. Our findings indicate two different ways of winter acclimation of photosynthetic apparatus between woody angiosperms in temperate zone.

Tue, 245

How many *Goniolimon* Boiss. (Plumbaginaceae) species do we have in Croatia?

Buzurović, Uroš (uros_buzurovic@yahoo.com), Sandro Bogdanović, Marjan Niketić, Gordana Tomović

According to the previously published literature data, the genus *Goniolimon* Boiss. being represented in the Croatian flora by only one narrow endemic species, *G. dalmaticum* (C. Presl) Rchb. f. Additional chorological analysis has shown that it considered to be distributed at several localities of the Adriatic coastal area: Vir, Pag, Rab and Silba islands, surroundings of the cities Nin, Trogir and Split (Marjan and Poljud hills) as well as near Seline village near the NP "Paklenica". The only two continental sites were known near settlements Grabovac and Zadvarje (3-8 km from coast) in Dalmatia. However, more recent field research has revealed that *G. dalmaticum* actually does not grow on these two localities, where the occurrence of Pontic-Mediterranean *G. tataricum* (L.) Boiss. has been found and that is a new species in the Croatian flora. Comparing individuals of these two species from the mentioned localities, it can be concluded that they differ in the following morphological characters: length, width and shape of inner and outer bracts, length of outer and inner bract mucros as well as in length of calyx. In addition, these two species grow on different habitat types. *G. dalmaticum* grows on saline sandy-gravelly substrate near the coast, while *G. tataricum* grows on xerophilous pastures and rocky grounds in hilly regions. Similar habitat types of *G. tataricum* were recorded in Serbia, Republic of Macedonia, western Bulgaria and northern Greece. Therefore, two *Goniolimon* species: *G. dalmaticum* and *G. tataricum* are present in the Croatian flora.

Tue, 244

Micromorphology based classification of *Acantholimon* Boiss. (Plumbagınaceae) from Turkey

Candan, Feyza (feyzacandan2002@yahoo.com), Musa Doğan

According to this investigation, micromorphological features of 62 taxa collected from Anatolia regarding *Acantholimon* genus belonging to the family Plumbaginaceae was examined with scanning electron microscope (SEM). Calyx, Calyx tube and outer bracts of all taxa were investigated in the point of their micromorphological peculiarities. Especially, surface structural characters of sepals, bracts and flower tube were determined in a detailed way. All the characters concerning surface ornemantation and hair types of all investigated taxa were important and valuable to use in the identifying key for the genus.

Mon, 121

Inclusion of Habitat 92C0 *Platanus orientalis* and *Liquidambar orientalis* woods (*Platanion orientalis*) into Calabria (S Italy) NATURA 2000 network

Caruso, Giuseppe (caruso_g@libero.it)

Calabria is the southernmost administrative region of Italian Peninsula. The regional Natura 2000 network counts 178 SCI and 6 SAC for a total 328,078 hectares, covering 21.5% of the total regional surface. The distribution of the SCI is therefore heterogeneous at province level, depending on the distribution of natural areas but, unfortunately, also on the lacking scientific knowledge at the moment of the establishment of Natura 2000 network in the area. The network formerly excluded the habitat 92C0 "*Platanus orientalis* and *Liquidambar orientalis* woods (*Platanion orientalis*)", that, very rare in Southern Italy, absolutely deserves law protection. Because detailed data about the geographical distribution of *Platanus orientalis* are quite recent, at the moment no part of this habitat, at regional level, is included in any protected area or Natura 2000 sites. The increasing investigation of poorly known areas of Calabrian territory highlighted that Presila Catanzarese (an hilly area located southward of Sila Massif, inside the Catanzaro administrative province) is rich of areas with high natural value (including many Southern Italian endemics and the narrow endemic *Centaurea calabra* recently described) deserving inclusion in the Natura 2000 network. The Uria Stream, crossing in N-S direction the Presila Catanzarese, hosts the best structured *Platanus orientalis* riparian woods of the whole region. This justifies the present proposal of establishment of a new SCI, named "Valle del Torrente Uria". On the other hand, the long term conservation of this rare habitat, as well as the protection of a compound natural system (including many other surrounding habitats listed in the Directive 92/43/CEE) found in the area, would better deserve a more complex and wide SCI proposal, named "Valli della Presila Catanzarese" and here presented.

Tue, 227

Insights into the genetic diversity of model xerothermic species: the Balkan Peninsula versus Central and Eastern Europe

Cieślak, Elżbieta (e.cieslak@botany.pl)

The European xerothermic species form very interesting group in the context of development of species ranges, with continuous ranges extensive enough to cover both South European refugial areas and northern glacial areas. Such extents, including both southern and northern regions, provide a perfect model for studies of the history of species ranges in the aspect of its dynamic in the Quaternary. Analysis was carried out for *Carlina acanthifolia* subsp. *utzka*, taking into account different types of markers: AFLP and sequencing (ETS region and cpDNA). Results of AFLP and ETS show distinction of two groups of populations; the first one representing Central and Eastern Europe and the northern part of the Balkan Peninsula, and the second one from the southern part of the Balkan Peninsula. On the other hand, cpDNA sequencing indicates differences between populations from the Dinaric Alps and from the SE part of the Balkan Peninsula. Additionally, cpDNA haplotypes characteristic for geographic regions, such as Małopolska, Lubelska or Volhynian Uplands were recorded in the disjunctive area. Moreover, the haplotype from the SE part of the Balkan Peninsula was also found in populations from the E part of the Podolian Upland. Such different patterns of genetic divergence within the Balkan Peninsula and in other parts of Europe evidence dynamics and diversity of spatial processes affecting genetic variation in these areas. Results obtained for various markers indicate that in a spatio-temporal scale genetic variation of C. acanthifolia subsp. utzka was affected by different factors in both discussed geographical regions. Research was founded by National Science Center (Poland); grant no NN304300940.

Mon, 114

Bryophyte flora of Albania - nine years after

Colacino, Carmine (carmine.colacino@unibas.it), Enza Evangelista

Albania is still a relatively underexplored country, as far as her bryophyte flora is concerned. Since the publication of a preliminary checklist nine years ago several new reports have increased the number of species. In this paper all new reports are included in addition to our own. The distribution of all new species for Albania is indicated to the level of District, Department, and Region (as in the preliminary checklist mentioned above) and presented in table and map form. The number of species reported for Albania has increased from 327 species to more than 450 in the nine years from the publication of the checklist, that is an increase of more than one third, even though the actual number of species reported is probably still a fraction of the actual number.

Tue, 204

Presence of *Tragopogon balcanicus* Velen. (Asteraceae) in Turkey

Coşkunçelebi, Kamil (kamil@ktu.edu.tr), Serdar Makbul, Mutlu Gültepe

Tragopogon balcanicus Velen. is an endemic species to Balkans and reported from European Turkey based on two flowering specimens (Bauer & Spitz. 935, Bauer, Fitz & Spitz 2765) by C.A. Matthews. During a project investigating *Tragopogon* species in all over Turkey, hundreds of *Tragopogon* samples originated from Turkey were carefully examined by the present authors. Following carefully examination of the samples stored in both several national (244 samples) and international (101 samples) herbaria as well as comparison with our own specimen (≈450) stored in KTUB and RUB, it was indicated that this cited flowering specimens should be *T. porrifolius* L. subsp. *longirostris* (Sch. Bip.) Greuter which is widely distributed in European Turkey and characterized by purple flowers and linear leaves as in the *T. balcanicus*. Also *T. porrifolius* subsp. *abbreviatus* (Boiss.) Coşkunç. & M.Gültepe which is not common in European Turkey, shares similar leaves and flower characters with *T. balcanicus*. However it is well know that it is almost impossible to identify the species without adequate knowledge of mature achenes and ligules color. Thus *T. balcanicus* was excluded from the list of *Tragopogon* species distributed in Turkey. This study was supported by TUBITAK (KBAG-110T954).

Mon, 154

***Cistus incanus* vegetation in the southern Balkans**

Čarni, Andraž (carni@zrc-sazu.si), Vlado Matevski, Urban Šilc

Vegetation dominated by two subspecies of *Cistus incanus* L. (*C. incanus* ssp. *incanus* and *C. incanus* ssp. *creticus* (L.) Heywood) occurring in the southern Balkans has been studied. Among these two subspecies, we can detect an ecological diversification within the lineage of the genus *Cistus*. We sampled the communities according to the standard central European method and found out that *C. incanus* ssp. *incanus* dominated community (*Diantho-Cistetum incani*) can be classified into the *Trifolion cherleri*, A*stragalo-Potentilletalia* and the class of dry grasslands *Festuco-Brometea*. The other community dominated by *C. incanus* ssp. *creticus* (*Calicotomo villosae-Cistetum cretici*) can be classified within the *Hyperico olympici-Cistion cretici*, *Cisto-Micromerietalia julianae* and the class of eastern Mediterranean hedgehog-heaths and low-grown broom phryganas of the *Cisto-Micromerietea julianae.* As the communities dominated by type subspecies of *C. incanus* can be found in the inland areas and form communities that can be classified with the vegetation types of Euro-Asian character and subspecies *creticus* dominated communities appear in the coastal regions and can be classified within syntaxa of Mediterranean character, we can suggest that the reason for this diversity is an adaptive radiation. As increasing number of research papers speak about rapid evolutionary response to environmental change recently, we can thus hypothesize the possibility of beginning of allopatric speciation in genus *Cistus* in the Balkans, although further genetic analysis should be done to confirm such an assumption.

Thu, 349

Phytosociological analysis of weed plant communities near the wild landfills in Sarajevo (Bosnia and Herzegovina)

Čorbo, Adis (adischoky@hotmail.com), Irma Mahmutović, Aljoša Dizdarević, Samir Đug

In the area of Sarajevo has been detected about 50 wild landfills, mainly in the vicinity of settlements, traffic routes and the river beds. Wild landfills are frequently inhabited by weed plants which are characterized by: overproduction and dormancy of the seeds, resistance to adverse environmental factors and disease, polyploidy, and a whole range of morpho-anatomical adaptations caused by the life in habitats under strong anthropogenic influence. The main goal of this study was syntaxonomic determination of phytocoenoses detected in 16 selected localities in two vegetation seasons. Investigation is realized through the fieldwork and laboratory research, using the method of phytocenologic recordings, conversion of the obtained data in the numerical scale, analysis of ecological distance by clustering, and statistical analysis. Results showed that ivestigated vegetation could be classified into 11 associations from four different vegetation classes. Seven plant communities are described within the class Chenopodietea Br.-Bl. 1951, representing the vegetation of nitrophilous habitats. Withing the class Plantaginetea maioiris R.Tx. et Prsg. 1950, there is one newly described plant community for analyzed area, *Poetum annuae* Lakušić et al. 74. *Trifolietosum campestre* prov., representing progradational stage of previously described association. This represents a significant phytocoenological diversity considering the nature of biotic and abiotic components of the investigated habitats. Results of the cluster analysis indicate the existence of several related groups of localities, which is a consequence of different environmental factors, including anthropogenic impact. Analyzed localities have about 55% of similarity, and the highest obtained similarity percentage was 61.04%. This study represents a significant contribution to the understanding of ruderal flora of investigated area, and could be used for further phytosociological analysis of weed plant communities.

Thu, 316

Variation in flavonoids content of Mentha aquatica L. exposed to heavy metal contaminated water of Bosna River

Dahija, Sabina (sabina_dudevic@yahoo.com), Erna Karalija, Adisa Parić, Edina Muratović, Samir Đug

Increasing urbanization and industrialization is one of the leading causes of environmental degradation and pollution. Some of the most toxic pollutants, which show hazardous effects on all living organisms, are heavy metals such as Pb, Zn, Cu and Cd. The present study was focused on flavonoids content variation in leaves and root methanol extracts of *Mentha aquatica*, exposed to heavy metal contaminated water. At three sampling sites of Bosna River water was collected and heavy metal concentrations (Pb, Zn, Cu, Cd) were measured by atomic absorption spectrometry. *Mentha aquatica* plants were placed in tanks containing heavy metal contaminated water and after 15-day period content of flavonoids in plant extracts were determined by spectrophotometric using aluminium chloride method. In tested water samples concentration of Cd was the highest, while Cu had the lowest value. Analysis of flavonoids content showed that concentration of flavonoids in leaves of *M. aquatica* increased after exposure of plants to heavy metal contaminated water compared to plants

cultivated in non-contaminated water. On the other hand, concentration of flavonoids decreased in roots of *M. aquatica* after exposure to heavy metal contaminated water. The overall results of this study showed that the flavonoid compounds play an important role in heavy metal defence in *M. aquatica*.

Thu, 317

Micropropagation of critically endangered *Bellevalia edirnensis* (Hyacinthaceae)

Dayan, Sergun (sergundayan@trakya.edu.tr), Adnan Çolak, Hayati Arda, Necmettin Güler, Ayhan Aytaç

There are major problems (overgrazing, agricultural activities, urban development, water and soil pollution) at habitat of *Bellevalia edirnensis* and number of individuals are gradually decreasing. There is a need of fast and efficient production method for protection of this species. Because of this, the effects of different sucrose and plant growth regulator concentrations on micropropogation of B. edirnensis were investigated in this study. Plants were collected from their habitat in April 2013 and stored in refrigerator for three months. After sterilization stage (running tap water for an hour, 20% commercial bleach solution for 17 minute, 70% ethanol for 5 minute, respectively) bulb scale explants consisting of two or four scale segments with basal plate were isolated. Explants were cultured on Murashige & Skoog (MS) medium including different concentrations of Naphthalene acetic acid (NAA) and Benzylaminopurine (BAP). At the end of the five months, in vitro bulblet production was successfully (100%) occurred on all tested medium. The best results for leaf length, bulblet diameter and number of bulblet per explant were observed on MS medium containing 4 mg/l BAP and 1 mg/l NAA (2.5 cm, 0.6 mm, 3.55 respectively). Five months old bulblets were transferred to MS medium including different concentrations of sucrose, NAA or BA for further growth and rooting. After 30 days, the best growth of bulblet diameter (67.7%) was observed on MS medium containing 1 mg/l NAA, 1 mg/l BA and 60 g/l sucrose. Maximum rooting ratio (75.8%) was occurred on hormone free MS medium including 30 g/l sucrose. On the same medium, mean root length was 5 cm and number of roots per shoot was 3.5. Rooted and well developed bulblets were successfully acclimatized to greenhouse. Due to the limited number of plants, all experiments were only started with 8 mature bulbs. After 18 months from the beginning of the study, 79 healthy plants were obtained. As a result of this, it is believed that micropropagation technique is more efficient than conventional production methods. This research was supported by Trakya University Academic Research Projects Unit (Project number: TÜBAP 2012-192).

Thu, 324

Relationship between polyamines and hydrogen peroxide under drought stress

Demiralay, Mehmet, Asım Kadioglu (asimkadioglu@gmail.com), Aykut Saglam

The expression levels of the genes, which take part in polyamine metabolism, such as arginine dekarboxylase, agmatine iminohidrolase/deaminase, spermidine synthase, S-adenosyl methionine decarboxylase, diamine oxidase/copper amino oxidase and polyamine oxidase were determined by RT PCR under drought stress after exogenous hydrogen peroxide (H_2O_2),

diphenyleneiodonium chloride, difluoromethyl arginine and difluoromethyl ornithine treatments. Polyamine levels (putrescine, spermidine and spermine), our critical parameter in determining the relationship were measured by HPLC. According to data, exogenous H_2O_2 induced polyamine synthesis by up regulating polyamine synthesizing genes and down regulation polyamine degredating genes. In conclusion, exogenous H_2O_2 that was applied at a certain contentration affected polyamine metabolism toward sysnthesis. On the contrary the polyamine degredating genes were affected adversly by H_2O_2. It was determined that H_2O_2 started a signaling cascade in polyamine metabolism.

Mon, 117

Soluble and cell wall bound peroxidases in *Atrichum undulatum* and *Hypnum cupressiforme*

Dimitrijević, Dragoljub, Jelena Janković, Tijana Cvetić Antić (tcvetic@bio.bg.ac.rs)

Peroxidases catalyze oxidoreduction between H_2O_2 and a wide range of reductants. They are involved in antioxidative defense as well as many developmental and stress-related processes; cell wall (CW) bound peroxidase isoforms are thought to be involved in monolignols dimerization and cross-linking in vascular plants. Peroxidases in bryophytes have not been extensively studied; investigating these activities in mosses could help in clarification of bryophyte cell wall and antioxidative metabolism. Proteins ionically and covalently bound to CW were isolated from *Hypnum cupressiforme* and *Atrichum undulatum* gametophytes collected from nature. Peroxidase activities were determined spectrophotometrically and CW bound activities compared to soluble peroxidases from the same plant material. Guaiacol, quercetin, ABTS, p-coumaric acid and ferulic acid, were tested as peroxidase substrata. In both species, soluble peroxidase specific activity was highest with quercetin, followed by ABTS. Specific peroxidase activity of soluble protein fraction was higher in *Hypnum* than *Atrichum*, while ionic CW peroxidase had higher specific activity in *Atrichum*. Covalent fractions, obtained after 2 h enzymic CW digestion, generally had very low peroxidase activity; the only significant activity (0.21 U gDW-1) was found in *Hypnum* covalent fraction with quercetin as substrate. Para-coumaric acid was effective as a substrate only for *Atrichum* ionic CW and *Hypnum* soluble peroxidases. Guaiacol and ferulic acid could be used as substrate by both species' soluble fractions and *Atrichum* ionic peroxidases.

Tue, 248

Chemotaxonomc significance of leaf n-alkanes in *Satureja montana* L. and *S. subspicata* Bartl. ex Vis.

Dodoš, Tanja, Nemanja Rajčević (nemanja@bio.bg.ac.rs), Petar D. Marin

The genus *Satureja* L. (Lamiaceae) is distributed in Mediterranean area, tropical Africa, Asia and the Americas. The exact number of species is still uncertain, due to the considerable taxonomic confusion associated with the generic limits of the so-called "Satureja complex". Leaf n-alkanes have been extensively used as chemotaxonomic markers within various plant families. The aim of this study was to determine composition, variability and taxonomic significance of leaf n-alkanes of *Satureja montana* L. and *S. subspicata* Bartl. ex Vis.

collected from natural populations in eastern Adriatic region. Leaf n-alkane compositions of individuals from nine populations of *Satureja montana* and eleven populations of *S. subspicata* were characterized by GC-FID and GS-MS analyses. In the leaf waxes, 15 n-alkane homologs with chain length ranging from C21 to C35 were identified. Univariant and multivariant analyses (ANOVA, PCA, DA) were deployed to infer differentiation of populations and species. Out of 14 different localities sampled, *S. montana* and *S. subspicata* were sympatric at only two localities (Jadranovo and Zlobin), so these two populations were further analyzed. Results from statistical analyses showed clear separation of populations and species based on leaf cuticular n-alkanes. Furthermore, the separation of these two species was greatest when only sympatric populations were examined. Chemotaxonomic implications are further discussed.

Tue, 237

Comperative anatomical studies among four *Hyacinthella* Schur species (Asparagaceae) growing in Turkey

Doğu, Süleyman (suleymandogu@gmail.com), Muhittin Dinç

In the present study, along with scape, leaf surface and mesophyll anatomy of four *Hyacinthella* species, *H. hispida* (J.Gay) Chouard, H. venusta K. Pers., *H. nervosa* (Bertol.) Chouard, *H. siirtensis* B. Mathew, were studied and the obtained features were compared among the species. The results show that scape anatomy is similar in the studied species, but differing from the other species, the epiderma has papillose protuberances only in *H. nervosa*. The leaf mesophyll is equifacial in *H. venusta* and *H. siirtensis*, unifacial in *H. hispida* and dorsiventral in *H. nervosa*. Some mesophyll cells contain raphide crystals. While leaves are amphistomatic with anomocytic stomata in all species, indumentum and epidermal cell bigness of the surfaces show difference among the species.

Thu, 315

Uptake of trace elements in three subspecies of *Silene parnassica* (Caryophyllaceae) growing on ophiolitic substrate in Greece and Serbia

Đurović, Sanja (sdjurovic@bio.bg.ac.rs), Ksenija Jakovljević, Uroš Buzurović, Marjan Niketić, Nevena Mihailović, Gordana Tomović

Soils with excess concentrations of metal ions are not unusual habitats for the species of the genus *Silene*, but little is known about their accumulation potential. In this study samples from five populations (two from Serbia and three from Greece) belonging to three subspecies of Silene parnassica growing on ophiolotic substrates are analyzed. For comparison of the trace elements profiles and the differences in uptake and translocation of trace elements in plants bioconcentration and translocation factors are used, as well as Spearman's rank correlation coefficients for concentrations of elements in root and shoot samples. Chemical characteristics of the soil samples (pH, organic C, P_2O_5, K_2O, Ca, Fe, Mn, Ni, Zn, Cu, Cr, Co, Cd and Pb) and plant samples (P_2O_5, K_2O, Ca, Fe, Mn, Ni, Zn, Cu, Cr, Co, Cd and Pb) are presented, as well as bioconcentration and translocation factors and correlation matrices. The examined populations of *Silene parnassica* show different patterns of trace elements uptake,

translocation and accumulation. The differences exist not only among the subspecies, but also between populations of the same subspecies. They can be interpreted as the result of the different trace elements concentrations in the investigated ophiolitic soil samples. However, they can also be the consequence of different responses and/or tolerance mechanisms in the plants from the examined populations. All the three subspecies act as strong Ni accumulators, with equal concentrations of Ni in roots and shoots, the values being several times higher than 100 mg kg^{-1}, exceeding concentrations of available Ni in the soil. Contents of Cr and Cu in the aboveground plant tissues in samples from three localities are several times higher than expected, even for plants growing on metaliferous soils, multiple times exceeding available concentrations in the soil samples.

Tue, 210

Vascular flora of mires in Rhodopi Mountain Range (Greece)

Eleftheriadou, Eleni (eelefthe@for.auth.gr), Konstantinos Theodoropoulos

Mires are present in the Mediterranean region, but far less widespread than in the rest of Europe and they are often restricted to mountainous areas. The phytodiversity of ten mires occurring in the Greek part of Rhodopi Mountain Range, at an elevation of above 1200 m, was investigated. The vascular flora of the investigated area consists of 100 taxa, which belongs to 71 genera and 31 families. The richest families are Poaceae (15 taxa), Cyperaceae (12 taxa), Rosaceae (8 taxa), Juncaceae and Rubiaceae with 7 taxa, Fabaceae and Ranunculaceae with 6 taxa, whereas 11 families contribute with only one taxon. The richest genera are Carex with 8 taxa, Galium with 5 taxa, Juncus and Ranunculus with 4 taxa, whereas 54 genera with only one taxon occur. Most of them are Hemicryptophytes (66%), followed by Geophytes (21%), Therophytes (6%), Chamaephytes (4%), and Phanerophytes (3%). The high percentage of Hemicryptophytes reflects the continental character of the flora. The majority of the taxa (81 taxa) are widespread (25% Europaean-SW Asien, 18% Euro-Siberian, 10% Boreal etc.). Some of them (e.g. Carex flava, Drosera rotundifolia, Succisa pratensis) reach the Northeast (6 taxa) or Northern (8 taxa) part of the country, without extending to the southwards. The Mediterranean unit is poor – 9% (5 taxa Mediterranean, 3 taxa Mediterranean-European and 1 taxon Mediterranean – Atlantic). The Balkan unit represents the 11% of the flora (Balkan with 5 taxa, Balkan-Anatolian with 4 taxa and Balkan-Italian with 2 taxa). These are mostly taxa of the continental part of the country.

Thu, 319

Role of plant peptide hormones CLE in root crop development in radish (*Raphanus sativus* L., Brassicaceae)

Gancheva, Mariia (vaiagan@mail.ru), Irina Dodueva, Ludmila Lutova

CLE peptides (CLAVATA3/endosperm surrounding region) are a group of plant peptide hormones that play a role in regulation of various types of meristems: shoot apical meristem (SAM), root apical meristem (RAM), cambium, nodule meristem and meristem-like structures, such as galls and tumors. In our work, we focused on the role of CLE-peptides in the secondary root growth in radish (*Raphanus sativus* L.). Radish is widespread vegetable

with xylem-type storage roots composed of upper part of root and lower part of hypocotyl. The mature radish root contains wide zone of secondary xylem, narrow cambial zone and secondary phloem. Further activity of the xylem parenchyma results in the development of secondary cambium foci that give rise to tertiary xylem and phloem ("meristematic zones"). Activity of secondary cambium supplements the function of the primary cambium in root development in radish. We identified several radish RsCLE genes mainly expressed in roots. The expression of some RsCLEs changed after initiation of root crop development. In addition, we found phloem/cambium-, xylem- and meristematic zones-specific expression of some RsCLEs. We suggested that CLE peptides encoded by these genes regulate root thickening. To check this hypothesis we carried out the experiments with overexpression of some RsCLEs and exogenous CLE peptides treatment. Composite radish plants with changed expression level of RsCLEs in roots and plants after RsCLE peptide treatment have changes in the number of meristematic zones and elements of the secondary xylem. Thus, we suggest that some of CLEs play role in root crop development.

Tue, 242

Pollen morphology of some European *Viola* (Viloaceae) hybrids

Gavrilova, Olga (gavrilova@binran.ru), Dmitri Britski, Ganiil Gornov

Pollen heteromorphism (producing of grains with different aperture number by one plant) is described in the genus *Viola* (Violaceae). The most part of pollen heteromorphic species were found in the section *Melanium*. There is an opinion that the diversity of pollen forms is evidence of plant hybrid origin. Pollen of the *Melanium* section differs from other *Viola* species by size, apertural number and ornamentation. Pollen of 3 hybrids (*V. oreades* x *V. orthoceras*, *V. arvensis* x *V. tricolor*, *V. saxatilis* x *V. oreades*) and 5 its parent species from the *Melanium* section and 3 hybrids (*V. accrescens* x *V. canina*, *V. canina* x *V. reichenbachiana*, *V. canina* x *V. mauritii*) and 4 its parent species from the *Viola* section have studied by light microscope and a part of grains have been investigated by confocal laser scanning and scarnning electron microscopes. Pollen was obtained from Herbarium of Komarov Botanical Institute. Grains of 3 patterns of 2 hybrids from *Melanium* section are normal 4-colporate (95%), like pollen of parent species. Among the pollen of *V. arvensis* x *V. tricolor* have been found only 10% of normal 4-colporate grains. Among *Viola* section pollen of *V. accrescens* x *V. canina* and *V. canina* x *V. mauritii* demonstrate 50-60% deviated 2 or 4-6 colporate grains. The first pattern of *V. canina* x *V. reichenbachiana* has 95% of 3-colporate grains which are typical in the section, but the second one shows deformed pollen grains and 40% of deviated pollen apertural forms. The exine structure has also changed. Pollen characteristics of hybrids and the possibility to confirm hybrid origin on the morphiological basis are discussed. This research is supported by RFBR grant N 15-04-06386.

Thu, 306

Cypselae anatomy and micromorphology of *Amphoricarpos neumayerianus* (Asteraceae)

Gavrilović, Milan (mgavrilovic@bio.bg.ac.rs), Dragana Rančić, Petar Marin, Pedja Janaćković

In this work anatomy and micromorphology of outher and inner cypselae of *Amphoricarpos neumayerianus* (Vis.) Greuter were investigated using light and scanning electron (SEM) microscopy. This endemic taxon for Dinaric Alps is a tertiary relict with complex taxonomic status. Heterocarpy is present. Inner cypselae, diverging from central hermaphrodite flowers are tetrangular, concave, with starisch pappus. The pappus consists of bristles diverging above their base. The bristles held together by the detached upper part of pericarp. Cypselae are dense hair-covered with straight/lateral-adaxial type of insertion. Outher cypselae, diverging from lateral female flowers, are flat, hair-covered, with lateral wings which are ending surmountly above basal part of pappus. Outher cypselae have straight/basal type of insertion. Pappus in both cypselae is barbato-aristate. The hairs on both cypselae are dual ostensible, forked at the tip. The differences in cypselae anatomy are also found. Inner cypselae have large amount of sclerenchyma bundles in the pericarp layer. Parenchymatous cells occur in the pericarp and testa. First layer of testa consists of cells with thickened walls. In the pericarp layer of outher cypselae sclerenchyma cells are distributed in the parenchymatous cells of pericarp, especially dense in the wings of the cypselae. This is a first report of anatomy and micromorphology of cypselae of this taxon. Observations among the cypselae examined here could be useful in resolving relationships of the *Amphoricarpos neumayerianus* and other taxa of the *Amphoricarpos* - small but very complex genus from taxonomic and phylogenetic point of view.

Tue, 202

New data for endemic, rare or protected plants of Shebenik – Jabllanica National Park, Albania

Gjeta, Ermelinda (ermelindagjeta@live.com), Alfred Mullaj, Peci Naqellari, Blerina Pupuleku

This study presents some new data for endemic, rare or protected plants of Shebenik – Jabllanica National Park, (S.E. Albania), after extensive field work (from 2010 – 2014) and critical literature review. Shebenik – Jabllanica National Park lies in north – east of Librazhdi town, in the border between Albania and Macedonia. It has a surface 33, 927. 66 ha and the altitude varies from 300 m to 2244 m a. s. l. The vascular native flora of Shebenik – Jabllanica National Park comprises 794 taxa, 20 of which are endemics and subendemics of Albania, 96 are endemics and subendemics of Balkan, while many taxa are reported here for the first time. The known distribution of the Albanian endemic, rare or protected plants *Festucopsis serpentini* (C.E.) Melderis, *Forsythia europaea* Deg. et Bald., *Cistus albanicus* E. F. Warburg, *Campanula hawkinsiana* Hausskn. & Heldr., *Viola dukadjinica* W.Becker et Kosanin, *Genista hassertiana* (Bald.) Bald. ex Buch., *Bornmuellera baldaccii* (Degen) Heywood L. is expanded and reported for the first time for the Shebenik – Jabllanica National Park. New data for endemic, rare or protected plants – *Epipogium aphyllum* (Schmidt) Swartz, *Soldanella pindicola* Hausskn., *Lathraea squamaria* L. etc. on the territory of the Park has been studied. *Epipogium aphyllum* is reported here for the first time on the territory of Albania. New populations of *Soldanella pindicola* Haussk, have been established. The

presence of relict species *Aesculus hippocastanum* L., *Taxus baccata* L., *Ramonda serbica* Pančić, *Viscum album* L., *Morina persica* L. and *Ilex aquifolium* L. for the Park flora has been confirmed and the number of the known populations of the Near Threatened *Lathraea squamaria* is increased. The condition of all registered populations has been assessed and measures outlined for their further protection.

Mon, 152

Genus *Edraianthus* (Campanulaceae) - testing biogeographical patterns in the Balkans

Glasnović, Peter (peter.glasnovic@zrs.upr.si]), Martina Temunović, Dmitar Lakušić, Valentina Brečko Grubar, Boštjan Surina

The genus *Edraianthus* (Campanulaceae) has the centre of its distribution in western Balkans with disjunctions in the Apennines, Sicily and S Carpathians. It has been extensively studied since the end of the 19th century. Initially particular interests were raised to taxonomical and chorological problems, while recent research efforts have been focused on phylogenetic and phylogeographic relationships both between the closely related genera and within the genus. Furthermore, Quaternary range shift patterns of some representatives were studied based on the molecular data. Consequently, accurate published data on *Edraianthus* species occurrences are today available along with existing herbarium specimen collections. The development of GIS software allows us to properly collect and process such data and when combined with environmental data and ecological niche modelling (ENM) we can predict species distribution in a geographic space according to a prediction of their current and past environmental space. Here we present the results of our work on the distribution and geographical structure of certain taxa in the genus *Edraianthus* using a combination of taxonomic and spatial methods (ENM, GIS). This approach allowed us to characterize current distribution patterns.

Mon, 146

Hopi/Osr27 and Houba/Tos5/Osr13 retrotransposon movements in rice

Gozukirmizi, Nermin (nermin@istanbul.edu.tr), Gozde Yuzbasioglu, Sibel Yilmaz, Sevgi Marakli

In this study, Hopi/Osr27 (gypsy) and Houba/Tos5/Osr13 (copy) retrotransposon movements were investigated in 10-day-old-root and leaves of *Oryza sativa* cvs. Ipsala, Beser and Osmancik-97. Seeds of three cultivars were germinated between filter papers in Petri dishes during 10 days. In each cultivar, three biological independent samples were germinated. Then, roots and leaves grown from same rice plant were harvested and used for genomic DNA isolation. IRAP-PCR was performed with each DNA template for Hopi/Osr27 and Houba/Tos5/Osr13 retrotransposons. Polymorphism ratios were evaluated both among cultivars and roots-leaves from same cultivar. We found 0-17% polymorphisms with Hopi/Osr27 however 10-87% with Houba/Tos5/Osr13. Results obtained at retrotransposon and varietal level indicated that retrorotransposon type and genotype dependence are responsible occurrence of different variations. Transposable elements (TEs) are very important to understand relationships among cultivars and even evolution, our findings are

expected to contribute to our understanding of spontaneous genomic insertion events and their effects of genetic and epigenetic changes during rice development.

Thu, 323

Germination rate of stinkwort (*Dittrichia graveolens* (L.) Greuter) and false yellowhead (*D. viscosa* (L.) Greuter, Asteraceae) in relation to salinity

Grašič, Mateja, Sabina Anžlovar, Simona Strgulc Krajšek (simona.strgulc@bf.uni-lj.si)

Stinkwort (*Dittrichia graveolens*) is a plant species belonging to the family Asteraceae. It originates in the Mediterranean region and was first detected in Slovenia in 2008, where it has been spreading rapidly along the motorway ever since. As a result, it has been characterized as an invasive alien species in the Slovenian area. False yellowhead (*D. viscosa*) is also included in the Asteraceae family. Unlike stinkwort, it is known as an indigenous species in Slovenia. However, it only thrives in the Slovene Istria region near the seaside. According to all these facts, we hypothesized that it is very likely both species grow mainly on sites with higher level of salinity. We carried out germination tests on agar plates to determine germination rate of stinkwort and false yellowhead in three different concentrations of NaCl (2.5, 5 and 10 g NaCl/l) and distilled water as control. As a positive control, we planted salad seeds (*Lactuca sativa* L.) on agar plates with aforementioned NaCl concentrations. In addition to germination rate we also monitored the opening of cotyledons in plantlets. All the tested species germinated under all salinity conditions. Nevertheless, they germinated best in control treatment (distilled water) and their germination rate declined with increasing NaCl concentration. Stinkwort and false yellowhead had much lower germination rates (53 and 52% in control treatment, respectively) in comparison with salad (97%). The opening of cotyledons showed similar trend as germination rate. The highest percentage of plantlets with opened cotyledons in all three species was observed in control treatment (65% in salad, 33% in stinkwort and 19% in false yellowhead) and declined with increasing salinity. There were many infections with fungi and bacteria that could have lowered germination rate and disrupted the following development of plantlets. We can conclude that both stinkwort as well as false yellowhead are very tolerant regarding salinity.

Tue, 214

A new record for the flora of Turkey: *Clematis integrifolia* L. (Ranunculaceae)

Guler, Necmettin (nguler@trakya.edu.tr), Huseyin Ersoy, Vildan Salik

A new record, Clematis integrifolia L., for the flora of Turkey is reported for the first time. The genus Clematis L. (Ranunculaceae) is currently represented by 6 species in Turkey with the addition of this new record. It has been reported in previous studies for C. integrifolia, which occurs both in Europe and Asia, that the species had a possible distribution throughout northwest European Turkey. The specimens were collected for the first time from an oak forest located in an area between Kalkansöğüt and Hacıdanişment in Lalapaşa, Edirne near the Bulgarian border. The specimens are kept at EDTU Herbarium. A short description and figures of the species were given.

Tue, 238

Seeds morphology of some *Orchis* L. species (Orchidaceae) growing in Edirne province (Turkey)

Guler, Necmettin (nguler@trakya.edu.tr)

In this study the seeds of the eight *Orchis* L. species growing around Edirne province (Europe in Turkey) were investigated morphologically using the light microscopy and SEM (Scanning Electron Microscopy). The slides prepared with glycerin jelly were investigated using a light microscope and the seeds were measured with a micrometric ocular and seed testa characteristics were observed with SEM in fine detail. Seeds of investigated *Orchis* species were fusiform shaped and in different shades of brown. Their lengths and widths ranged between 0.263-0.640 mm and 0.118-0.208 mm respectively and they were also differentiations among the species. Testa surfaces of *O. simia* Lam., *O. pinetorum* Boiss. & Kotschy and *O. purpurea* Hudson are smooth while *O. morio* L., *O. tridentata* Scop., *O. laxiflora* Lam., *O. coriophora* L. and *O. papilionacea* L. are reticulate. In this study, we suggest for the first time an identification key based on seeds morphologies and sizes, and testa structures in *Orchis* genus growing in Edirne province. The result of our study showed that morphological structures of *Orchis* seeds could be used as diagnostic characters.

Tue, 240

***Tragopogon porrifolius* L. (Asteraceae) in Turkey in respect to molecular data**

Gültepe, Mutlu (mutlugultepe61@gmail.com), Kamil Coşkunçelebi, Serdar Makbul

Tragopogon porrifolious L. (Lactuceae) is a widespread species distributed throughout the Mediterranean region from Turkey to Spain. Some of the subspecies cultivated as an ornamental and edible plant in Europe. It consists of five morphologically variable subspecies in the world and three subspecies (*T. porrifolius* subsp. *abbreviatus* (Boiss.) Coşkunç. & M.Gultepe, *T. porrifolius* subsp. *eriospermus* (Ten.) Greuter, and *T. porrifolius* subsp. *longirostris* (Sch.Bip.) Greuter) in Turkey. Several specimens belong to Turkish representatives of *T. porrifolious* were collected during the revisional study of *Tragopogon*. Fifteen populations representing of three subspecies of the *T. porrifolious* were analysis based on ITS (Internal Transcribed Spacer) sequences. The analysis revealed that although the three Turkish subspecies of *T. porrifolius* fall into same clade, *T. porrifolius* subsp. *abbreviatus* endemic to Turkey were located at distinct subclade together with *T. balcanicus* which is endemic to the Balkan Peninsula. The results obtained from the phylogenetic analyses congruent with our morphological interpretation of *T. porrifolius* subsp. *abbreviatus*. Thus *T. porrifolius* subsp. *abbreviatus* should be considered as distinct species and transferred to specific level. This study was supported by TÜBİTAK (Project no: 110T954).

Mon, 127

Medicinal plants used in Uzunköprü Town from Turkey

Güneş, Fatma (drgunes@gmail.com), Çiler Meriç

In this study, the utilization of the plants by the local people in Uzunköprü and surrounding villages were investigated. Interviews were carried out face-to-face with the community. At the end of the field studies, 95 taxa included in 32 families, which are medicinal used, were recorded. The most commonly used species; *Arum maculatum* (yılanotu), *Cotinus coggyria* Scop. (tetre), *Datura stramonium* L. (tatala), *Ecballium elaterium* (acıkelek), *Ficus carica* (incir), *Hypericum perforatum* (sarı kantaron), *Laurus nobilis* (defne), *Melissa officinalis* L. (arıotu, oğulotu), *Menta spicata* L. subsp. *spicata* (nane), *Momordica charantia* (kudret narı), *Plantago major* L. (sinirliot), *Prunus spinosa* L. (güvem), *Pyrus elaeagnifolia* subsp. *bulgarica* (ahlat), *Rosa canina* L. (kuşburnu), *Rubus sanctus* (karamık), *Tilia cordata* Mill. (ıhlamur). The scientific names of the plants, local names, families, usable parts and forms of utilization were listed alphabetically in the tables.

Thu, 328

Chemical composition of the essential eils of *Pinus heldreichii* H.Christ originated from different locations in Kosovo

Hajdari, Avni (avni.hajdari@uni-pr.edu), Edona Kabashi, Behxhet Mustafa

The main objective of this work was to study the chemical composition of the essential oil obtained from leaves and twigs of *Pinus heldreichii* H.Christ. and its natural variation between wild populations in Kosovo. Essential oil was analysed using GC and GC-MS analysis. Plant material was collected in seven locations from July to September 2013 in Sharri and Albanian Alps Mountains in Kosovo. Sixty-four compounds were identified in order of their elution from a HP-5MS column. The yield of essential oil differed depending on the population origins and plant organs; it was ranged from 0.2 to 0.8% v/w in leaves and 0.8-1.6% v/w young stems. The main components were D-Limonene (leaves: 22.8-49.8%; twigs: 44.3-73.3%), germacrene D (leaves: 22.8-33.6%; twigs: 1.4-3.4%), and alpha-pinene (leaves: 5.8-9.3%; twigs: 8.7-17.7%). The Hierarchical Cluster Analysis was used to identify the differences between plant organs and possible geographical variations in essential oil composition. The dendrogram generated from the Euclidean distances performed on the essential oils compounds obtained from leaves and twigs of *P. heldreichii* showed the existence of two main clusters. The fist cluster group essential oil obtained from leaves, whereas the second group essential oil obtained from twigs of *P. heldreichii*. This tells that the biggest differences in chemical composition were found between the leaves and twigs. With aim to estimate natural variability between each population the Hierarchical Cluster Analysis were performed separately on essential oil obtained from leaves and twigs. Thus, the dendrogram showed the existence of three main clusters in leaves and in twigs too.

Thu, 327

Heavy metal content in *Reynoutria x bohemica* Chrtek and Chrtková in urban areas

Hlavati Širka, Vesna (vesnahsirka@gmail.com), Ksenija Jakovljević, Nevena Mihailović, Slobodan Jovanović

Heavy metal contamination of soil represents serious threat to ecosystem sustainability. In the urban areas this problem is even more pronounced and presents a greater challenge for the plants, because increased environmental pressure additionally modifies soil features. The aim of this study was to determine chemical composition and differences in uptake and translocation of trace elements in invasive alien knotweed *Reynoutria* × *bohemica* Chrtek and Chrtková from five populations exposed to different level of anthropogenic pollution. To estimate the potential for trace elements accumulation of analyzed *R*. × *bohemica* population, we used accumulation and translocation factors as well as Spearman's rank correlation coefficients for concentrations of elements in root and aerial parts. Accordingly, the concentrations of major and trace elements in soil samples and plant tissues (root, shoot and leaves) are presented (N, P, K, Ca, Mg, S, Fe, Al, Mn, Ni, Zn, Cu, Cr, Co, Cd, Pb, V). The distribution and accumulation patterns of trace elements vary considerably for each element. Differences in concentrations between the populations are obvious, as a direct consequence of the different levels of human influence and different sources of pollution. Within the each population the differences are much smaller and values are fairly uniform.

Tue, 218

Contribution to the knowledge of plant diversity of the planned Regional Park „Hrvatsko zagorje“

Hruševar, Dario (dario.hrusevar@biol.pmf.hr), Petra Siladi, Anita Vucić, Božena Mitić

In floristic research carried out during the vegetation season 2011, the area of 4 square km between the villages Cerje, Jesenjsko, Šaša, Pašnik, Vrbno and Ježovec was included. So far there was not recorded floristic data for this part of northwest Croatia, which is planned to be included in the future Regional Park „Hrvatsko zagorje“. In total, 392 taxa of vascular plants from 78 families were found. The most abundant families are Asteraceae sensu lato (11.5%), Fabaceae (9.2%), Poaceae (7.7%), Lamiaceae (6.1%) and Rosaceae (5.1%). In the life form spectrum hemicriptophyta are predominant (50.3%) followed by therophyta (16.6%), phanerophyta (14.3%), geophyta (10.7%) and chamaephyta (6.4%). Due to the lack of water bodies, the hydrophyta and helophyta share together less than 2%. Phytogeographical analysis has shown that Euroasian floral element encompasses 32.9% of taxa, followed by Cosmopolites (22.4%), European (11.7%), South-European (11.5%) and Circumholarctic (6.9%). Other floral elements encompass less than 15% of taxa. According to the Red list of vascular plants one taxa is vulnerable, six taxa are near threatened and two taxa are of least concern. Ten taxa are strictly protected and one species *Cardamine waldsteinii* Dyer is endemic. Alien flora is represented by 27 taxa including 12 invasive plants.

Mon, 115
Urban bryoflora of the Vranje City (Serbia)

Ilić, Miloš (milos.ilic@dbe.uns.ac.rs), Srdjan Arsić, Ružica Igić, Dragana Vukov

The survey of bryophyte flora covered the territory of the Vranje city (south Serbia) without the suburban surrounding area was done. Total number of 85 taxa was recorded (11 liverworts and 74 mosses). Liverworts belong to 10 genera and 7 families, while mosses belong to 39 genera and 21 families. The diversity of bryophyte flora can be explained by variety of different habitats such as gardens, parks, greens, roofs, public fountains, river coasts and other microhabitats. One species was listed in Red data book of European Bryophytes, and three species were listed in the Bryophyte red list of Serbia and Montenegro. Vranje has not been bryologically investigated since the beginning of 20th century, and therefore this research represents a valuable insight into the bryophyte flora and diversity of Vranje city and South Serbia.

Tue, 249
Micromorphological, anatomical and cytogenetical studies in endemic *Crepis macropus* Boiss. & Heldr. (Asteraceae) from Turkey

Inceer, Huseyin (inceer@ktu.edu.tr), Nursen Aksu Kalmuk, Kemal Vehbi Imamoglu, Ozge Duman, Sema Hayirlioglu-Ayaz, Gokhan Arslan

Crepis macropus Boiss. & Heldr. is an endemic species that is mainly distributed in central Anatolia, Turkey. It grows in chalk or shaly rocks or slopes, steppe, fieldsides and roadsides. In the present study, micromorphological structure of achene, pappus and style, stomatal characteristics, anatomy of stem and achene together with chromosome number and nuclear DNA content of *C. macropus* are provided in order to expand its taxonomic knowledge. Our scanning electron microscopy (SEM) studies in this species show that dense spiny cells are found on the achene surface, pappus bristle has 3-5 spikes and the style possesses slender papillae. Its stem structure is composed of epidermis, collenchyma, parenchymatous cortex and pith. The species has anomocytic stomata in both upper and lower surface of the leaves. The pericarp in its achene is mainly composed of several layers of parenchymatous and sclerenchymatous cells. In this species, chromosome number is 2n=2x=8 and 2C nuclear DNA content is 12.96 pg. These data are presented here for the first time and their taxonomic values are discussed.

Tue, 252
Morphological observations of seed and fruit in Romanian *Draba* species (Brassicaceae)

Ion, Roxana (roxanaion85@gmail.com)

Seed and fruit morphology offer useful characters for identification of species in Brassicaceae Family. Thus, based on fresh and herbarium material, 7 Romanian rare and endemic *Draba* species were investigated using stereo and scanning electron microscopies. We found that fruit trichomes pattern along with fruit shape and size, style length, stigma type proved to be

significant characters used to distinguish between *Draba* species with similar morphologies. Excepting seed size and color that do not greatly differ among species, the examination relying on seed surface ornamentation have an important taxonomic value, indicating consisting data in species separation. This study supports the use of seed and fruit morphological features important in *Draba* species differentiation. An identification key based on fruit macro and micromorphological characters of studied species is provided.

Mon, 103

The application of benthic diatoms in water quality assessment (Mlava River, Serbia)

Jakovljević, Olga (olga.jakovljevic@bio.bg.ac.rs), Danijela Vidaković, Jelena Krizmanić

Biological factors such as diatoms, aquatic invertebrates, fish and macrophytes are essential for water quality monitoring. The European Union Water Framework Directive requires the use of benthic diatoms in water quality assessment. The main objective of this study is to evaluate the water quality of the Mlava River (Serbia) and to present application of diatom indices in water quality assessment. Benthic samples were taken during three seasons (April, July and September 2011) from 5 localities along the river. Diatom frustules were cleaned using standard method with concentrated sulfuric acid. The five diatom indices (IPS, EPI-D, CEE, IBD and TDI) are calculated based on the indicator values of identified taxa using the OMNIDIA software. Quantitative analysis showed that, in the first season, Achnanthidium minutissimum was dominant at each locality, except on the fifth site, where *Amphora pediculus* was dominant. In the second and third season, *Achnanthidium pyrenaicum*, *Amphora pediculus*, *Denticula tenuis* and *Cocconeis placentula* var. *lineata* dominated. Based on the average values of the IPS, CEE and IBD diatom index, water of the Mlava River belong to I water class during all three seasons. Values of the EPI-D index indicated the class II water quality, although these values were on the border with the values indicating the class I water quality. According to calculated TDI values, we can conclude that the water of the Mlava River was characterized by intermediate nutrient concentrations during three seasons. TDI values during the first and second season were on the border with the values indicating the high nutrient concentrations. Values of all five indices increase in the second and third season, which indicates the improvement of water quality. The high correlation between indices values suggests their use for water quality evaluation and routine monitoring.

Mon, 128

Traditional use of native medicinal plants from Mt. Tara (Western Serbia) - Ethnobotanical study

Janaćković, Pedja (pjanackovic@bio.bg.ac.rs), Milica Milutinović, Milan Gavrilović, Zora Dajić Stevanović, Petar D. Marin

This work reports the uses of medicinal and edible plants from Mt. Tara, Western Serbia, and their ethnobotanical importance. The aim of the study was to collect and preserve the knowledge on traditional uses of indigenous flora by local population and to assess the list of the most valuable medicinal and edible plants of the studied region. The group of local inhabitants of the Mt. Tara, belonging to the area of the National park, was interviewed by

semi-structured questionnaires to identity the uses of the native medicinal and edibble plants in folk medicine, veterinary and as food. There are 69 plant species of traditional use recorded. The most used species belong to the following plant families: Rosaceae, Lamiaceae and Asteraceae. All parts of plants are equally used for a different remedy treatments. The most reported medicinal uses of herbal drugs include remedies for respiratory and digestive system. The results suggest that the *Hypericum perforatum*, *Thymus serpyllum*, *Taraxacum officinale*, *Sambucus nigra*, *Pinus silvestris*, *Teucrium chamaedrys*, *Gentiana lutea* and *Juniperus communis* were the most popular medicinal plants. For about 700 plant taxa in Serbia it is supposed that have a medicinal value, out of for about 400 plant taxa the medicinal usage was documented. The ethnobotanical heritage of the Balkan region needs to be documented and preserved as it represents a platform for further phytochemical and phrarmacological studies enabling validation of new bioactive compounds of natural origin. Raising awareness on tradicionally used plant taxa and the proper way of their sustainable use will strongly contribute to conservation of its biodiversity.

Mon, 125

Online database of the plants that are in the traditional use in Vojvodina (Serbia)

Janjić, Đurđica (djurdjica.simin@dbe.uns.ac.rs), Neda Gavarić, Milica Rat, Nebojša Kladar, Boris Radak, Bojana Bokić, Goran Anačkov, Biljana Božin

Online database of the medicinal flora of the Province Vojvodina (northern Serbia) is integrated information collection about herbs in this regions, that were and are still are use in traditional medicine and phytotherapy. It is base for further research in field of rationalisation and efficient use of herbal raw material for pharmaceutical and food industry. Integrated sets of data represent economic significance of herbs as general resource and wide spectrum of their usage in modern phytotherapy. Database is open for changes, and will be updated annually. Data are collected according to available literature. Each taxon is presented by sets of attributes classified in several categories. The search is categorised in eight criterions. Database includes more than 400 taxa, classified in 100 families, and Lamiaceae family is most frequent among them. Most of the taxa in the medicinal flora database are representatives of euroasian areal and have hemicryptophyte character. Historic, socio-economic and cultural diversity of Vojvodina reflect tradition of the ethnic groups that live in this region for ages and use herbal species differently. Also, cohabitation of nations and colonisations in last two centuries have brought innovation in traditional use of medicinal herbs.

Thu, 351

Emergent macrophytes as indicators of physicochemical properties of wetland habitats in SE Serbia

Jenačković, Dragana (draganaj@pmf.ni.ac.rs), Ivana Zlatković, Vladimir Ranđelović, Dmitar Lakušić

In ecological researches, evaluation of the environmental condition can be equally well done on a basis of one out of two types of biological indicators, species or communities. The

primary aim of this study is to define indicator species which can be used in assessment of physicochemical properties of habitats. Accordingly, we have summarized ecological preferences of species recorded on researched territory: *Bolboschoenus glaucus*, *Bolboschoenus maritimus, Carex riparia, Eleocharis palustris, Phalaroides arundinacea, Phragmites australis, Schoenoplectus lacustris, Schoenoplectus lacustris* subsp. *glaucus*, *Sparganium erectum, Typha angustifolia, Typha latifolia*, *Stachys palustris, Xanthium orientale* subsp. *italicum*, *Lemna minor* and *Potamogeton lucens* in regard to water (water depth, pH, dissolved O_2, EC, NH_4^+, NO_3^-, PO_4^{3-}, total P, SO_4^{2-}, total hardness, HCO_3^-, CO_3^{2-}, Ca^{2+}, Mg^{2+} and Cl^-) and substrate properties (water content, pH in water and 1M KCl, EC, available phosphorus and potassium, Cl^-, HCO_3^- and CO_3^{2-}). The statistical analyses show that the habitats of *Bolboschoenus maritimus* and *Schoenoplectus lacustris* subsp. *glaucus* are particularly different from the habitats of other species in terms of alkalinity, electro conductivity and nutrient amounts.

Mon, 147

Do emergent macrophyte communities show seasonal changeability in regard to species composition?

Jenačković, Dragana (draganaj@pmf.ni.ac.rs), Ivana Zlatković, Vladimir Ranđelović, Dmitar Lakušić

Plant assemblages could be defined as dynamic systems whose changes are needed for shorter or longer time periods depending on the kind and duration of modifications in abiotic components of ecosystems which parts they are. Emergent macrophyte communities are placed at buffer zones between two ecologically different environments due to which the probability of seasonal variability of its compositions is increased. This study gives an insight in the results of statistical tests whose goal is to determine the existence and type of seasonal variability in macrophyte communities recorded at the region of south-eastern Serbia. All analyses are done for *Bolboschoenus maritimus, Carex riparia, Glyceria maxima, Eleocharis palustris, Phalaroides arundinacea, Phragmites australis, Schoenoplectus lacustris, Schoenoplectus lacustris* subsp. *glaucus*, *Sparganium erectum, Typha angustifolia, Typha domingensis* and *Typha latifolia* community defined according to UPGMA classification analysis. The assessment of qualitative and quantitative species composition changeability during the researched time period (spring, summer and autumn) is based on the results of permutational analysis of variance. Both, qualitative and quantitative species composition differences are recorded for *Bolboschoenus maritimus* community while *Eleocharis palustris* community shows only quantitative variability along temporal gradient. Opposite to them, within *Carex riparia* and *Phragmites australis* community the presence of other forms of structural variability is established. This structural variability refers to communities which include changes of α-diversity and life form composition.

Mon, 105

Occurence of alien cyanobacteria *Sphaerospermopsis aphanizomenoides* (Forti) Zapomelová, Jezberová, Hrouzek, Hisem, Reháková & Komárková in Serbia

Jovanović, Jelena (jelenajov88@gmail.com), Vesna Karadžić, Dragana Predojević, Slađana Popović, Ana Blagojević, Gordana Subakov Simić

Sphaerospermopsis aphanizomenoides, invasive and potentially toxic cyanobacteria, was first recorded in Serbia in 2008. Since then, it has been found in 7 more locations – the Ečka fishponds (2012), Pariguz lake (2013), the Zasavica River (2013), the Brestovac Reservoir (2014) and three lakes in northern Vojvodina: Palić, Ludaš and Krvavo Lake (2014). All the localities in Serbia where *S. aphanizomenoides* was found are small, shallow, eutrophic water bodies with a low water flow, as well as a low transparency of water, a high level of turbidity and organic inlet. It was mostly found in a community with *Cylindrospermopsis raciborskii* during summer months. Morphometric characteristics of this species do not differ greatly from those given by other authors. Nevertheless, further research needs to be done in order to monitor the expansion of this invasive and potentially toxic species in our water bodies.

Mon, 135

Distribution and prediction of the spread of invasive *Reynoutria* taxa (Polygonaceae) in SE Europe

Jovanović, Slobodan (sjov@bio.bg.ac.rs), Vesna Hlavati Širka, Jasmina Šinžar-Sekulić, Nejc Jogan, Toni Nikolić, Paulina Anastasiu, Vladimir Vladimirov, Dmitar Lakušić

Distribution, spreading and the rate of invasion of the alien *Reynoutria* taxa in the SE Europe are presented at regional and local spatial scale. According to Hayek (1927-1931), *R. japonica* was not found on Balkan Peninsula, while, as indicated by Greuter at al. (1984), it was naturalized in the area of Former Yugoslavia. The first indication that *R. japonica* Houtt. and *R. sachalinensis* (F. Schmidt) Nakai were naturalized in the Balkans was published in Jalas and Suominen (1979). During the last decade, massive and fast spreading of this aggressive species has been observed and studies of its distribution in the SE Europe are intensified. The aim of this paper was to integrate all available data and to establish the number of localities occupied by these taxa in SE Europe as well as to predict in which habitats and areas its future spread can be expected. The data on the distribution of *Reynoutria* taxa were obtained from an extensive field mapping in 2006–2015, as well as from the literature and herbarium sources. Field mapping was done by the method of GPS positioning, while the literature and herbarium data were also georeferenced. During this period 3855 localities in Serbia, Montenegro, Slovenia, Croatia, Bosnia and Herzegovina, Bulgaria, Romania and Kosovo have been recorded, most frequently in riparian and human-made habitats. Modelling the distribution for predicting future dispersal is done by various measures of the rates of spread derived from distribution data. The geographical analysis included chorological data (latitude, longitude, altitude), while ecological analysis included climatic data that were derived from the WorldClim spatially interpolated worldwide climate data set. In addition to standard cartographic, numerical and statistical analysis, GIS tools were used for spatial data analysis. Ecologically suitable range for *Reynoutria* was predicted using MAXENT. Results of this study showed that the most frequent *Reynoutria* taxa in SE Europe are: *Reynoutria japonica* var. *japonica* and hybrid *R.* × *bohemica*. Moreover, this research predicts which areas without

data on the distribution of *Reynoutria* taxa are most likely to be invaded or are at risk of becoming invaded and make suggestions on where to focus management effects, especially in protected areas.

Tue, 254

Adaptive genetic diversity in Dalmatian sage (*Salvia officinalis* L., Lamiaceae)

Jug-Dujaković, Marija (marija.jug-dujakovic@krs.hr), Zlatko Liber, Martina Grdiša, Sandro Bogdanović, Zlatko Šatović

One of the main challenges in molecular ecology and population genetics is the detection of genes, or genomic regions, that have been targeted by natural selection. The aim of this study was to quantify the relative contribution of natural selection in shaping the genetic variation observed among Dalmatian sage (*Salvia officinalis* L.) populations. Genetic diversity of 25 Dalmatian sage populations from Croatia and Bosnia and Herzegovina, each consisting of 20 to 25 plants, was assessed using AFLP markers. Two alternative methods for the identification of F_{ST} outlier loci have been used: the frequentist methods implemented in Mcheza and the Bayesian method implemented in BayeScan. Moreover, the spatial analysis method as implemented in Samβada was used to compute multiple univariate logistic regressions to test the probability of presence of an allelic variant for a polymorphic marker given the environmental conditions of the sampling locations. The climate data for the sampling locations were obtained from the WorldClim database. The ecological characteristics were described using 19 bioclimatic variables representing the annual trends, seasonal variations and extremes in temperature and precipitation. The comparison of the outlier marker loci detected by the three approaches could help to identify the factors that are responsible for the observed spatial structuring of genetic diversity in Dalmatian sage populations.

Tue, 225

Comparative morpho-anatomical analysis of populations species *Daphne blagayana* Freyer (Thymelaeaceae) from Serbia and Montenegro

Jušković, Marina (marinaju@pmf.ni.ac.rs), Perica Vasiljević, Ana Savić, Branka Stevanović

Daphne blagayana Freyer is an evergreen, low, prostrate shrub distributed in the mountains south-eastern Europe and some adjacent regions. The aim of this study was investigated and described the intraspecific variation populations species *D. blagayana*. The comparative morpho-anatomic investigations have included six distantly separated populations from Serbia and Montenegro. The morphological and anatomical analysis involved 22 quantitative parameters of leaf and stem. Analysis of variance of the individual character of the populations *D. blagayana* shows that all the characters have a high statistical significance in the formation of the difference between populations. Results of multivariate analysis of variance (MANOVA) showed that all group characters have a statistically significant contribution to the morphological differentiation of populations. Principal component analysis (PCA) indicates a very complex structural variability dominated the first two basic components with the characters related to the morphology and anatomy of the leaf. Canonical

discriminant analysis (CDA) and cluster analysis using the Mahalanobius' distance of morpho-anatomical characteristics of the leaves and stems have shown a clear distinction between populations. Populations of Mt. Kopaonik and Mt. Zlatibor most distant, while the greatest similarity between the populations from Mt. Goč and Mt. Tara.

Thu, 350

Stipa tirsa dominated stands in Serbia

Kabaš, Eva (ekabas@bio.bg.ac.rs), Nevena Kuzmanović, Snežana Vukojičić, Dmitar Lakušić

This work aims at providing the distribution and the overview of *Stipa tirsa* Steven dominated grassland communities across the Serbian territory. On the basis of literature sources *S. tirsa* is known to be present only in a two singular localities in Northeastern and Southeastern Serbia, both on basic geological substrate. Furthermore, according to the last comprehensive overview of the Serbian vegetation there are only two syntaxa known on association and subassociation levels dominated by *S. tirsa*. During our field investigations we found one new locality in Western Serbia where *S. tirsa* forms stands on serpentinite bedrock. Here we made new relevés according to Braun-Blanquet methodology. The new relevés along with the published ones dominated by *S. ti*rsa were subjected to numerical analyses in the Software package PAST in order to detect floristic structure and differentiation of analyzed syntaxa. The differences between them were obtained with the help of SIMPER analysis, showing the taxa primarily responsible for the differentiation. The significance of these differences was tested by ANOSIM analysis, based on Bray-Curtis distance. Synoptic table and selection of diagnostic (Dg), dominant (Dm) and constant (C) species were done in Juice software.

Mon, 101

The influence of microhabitat on algal community structure in spring habitats of mountain Konjuh (Bosnia and Herzegovina)

Kamberović, Jasmina (jasmina.kamberovic@untz.ba), Anđelka Plenković Moraj, Koraljka Kralj Borojević, Dubravka Hafner

Algal samples from three different spring microhabitats: epilithon, epibryon and epipelon were analyzed. The sampling was conducted during three seasons (spring, summer and autumn) in 2013 on twenty springs located on mountain Konjuh (NE Bosnia and Herzegovina). Springs are located from 402 to 1003 m ASL and are characterized by moderate continental climate, low alkaline values and moderate conductivity. In total of 196 samples, 234 species of algae were determined with diatoms being the most abundant (187 taxa - 79.9%) and followed by cyanobacteria (34 taxa - 14.5%). Epibryon, epilithon and epipelon communities have 83 common taxa. Nonparametric Kruskal-Wallis and Man-Whitney U tests have revealed statistically significant difference ($p<0.05$) between microhabitats for abundance of 26 taxa. Species *Achnanthidium minutissimum* (Kützing) Czarnecki and *Planothidium dubium* (Grunow) Round & Bukhtiyarova were better represented in epilithon while epibryon was dominated by *Diatoma*, *Meridion*, *Navicula*, *Planothidium* and *Encyonopsis* species and epipelon by *Nitzschia*, *Amphora* and *Surirella*

species. Shannon-Wiener diversity index showed greater average values for epibryon and epipelon (1.97 and 2.01, respectively) in relation to epilithic (1.43) samples.

Thu, 313

Variation of flavanols content in *Hypericum perforatum* in Bosnia and Herzegovina

Karalija, Erna, Emina Bašić, Sabina Dahija, Adisa Parić (adisacausevic@hotmail.com)

Hypericum perforatum is a well-known medicinal plant, usually used as a remedy for burns as well as antidepressant. Flavanols content was analysed in 16 populations from Bosnia and Herzegovina. All plants were collected during flowering phenophase. Methanol extracts of leaves and flowers showed variation in flavanols content between different localities. The highest recorded value for leaves as well as for flower extracts wasin population collected on Mt. Trebević. In leaf extracts collected in Podveležje the lowest flavanols content was recorded, and flower extracts population collected in Novi Šeher showed the lowest value of flavanols content. Statistically significant differences between localities can be attributed to differences in altitude, geological substrate as well as microclimate conditions.

Tue, 222

Biosystematic study on the genus *Hedysarum* L. (Fabaceae) in Iran

Karamian, Roya (R_karamian@basu.ac.ir), Nayereh Olanj, Nika Ranjbar

The genus *Hedysarum* L. comprises about 200 species distributed in temperate to boreal regions of the Northern Hemisphere. Although a main center of its diversity is in Middle Asia, another in N America and the genus also occurs in Europe and the Mediterranean region. Plants of the genus occur in various habitats such as alpine and arctic meadows, strong grasslands, deserts or seashores. Many species are also cultivated as fodder or for their ornamental value. The genus has 19 species in Iran, 12 of which are endemic. Biosystematic study of the genus on 50 species populations was conducted to reveal inter- and intra-specific relationships. The study were carried out using morphological, palynological, karyological and electrophoretic pattern of seed storage proteins and all data were analyzed by MVSP 3.1 and SPPS 9.0 softewares. Results from morphological analysis on 70 quantitative/qualitative characters of vegetative and reproductive organs showed that all taxa divided in 5 main groups, the fifth one includes 5 subgroups and 2 separate species. Pollen morphology using polar axis, equatorial diameter, colpus length, colpus width, thickness of the wall at poles and equator, mesoculpium, apoculpium and shape index resulted in 2 main groups with 5 subgroups. Meiotic study was performed on the taxa concerning meiotic chromosome counts, ploidy level, chiasma frequency/distribution, chromosome association and segregation. The taxa studied possessed 2n = 16 and 32 chromosome number, many of which are reported for the first time. Meiotic abnormalities observed included laggard chromosome formation, stickiness, desynapsis and cytomixis. Cluster analysis of morphometric and meiotic data and ordination of species based on the first two principal component axes grouped the taxa with similar characteristics. Grouping resulted from electrophoretic pattern of seed storage proteins of different taxa was confirmed nearly by morphology.

Thu, 322

In vitro plant regeneration and interactive effects of salicylic acid with osmotic and cold stress on antioxidative responses in *Glycyrrhiza glabra* and *Meristotropis xanthoides* (Fabaceae)

Karamian, Roya (R_karamian@basu.ac.ir), Narges Soltani

Glycyrrhiza L. (Fabaceae) consists of perennial herbs grow in sandy soils with hard lightness. *G. glabra* L. is well known in English as Licorice and its root extract includes flavonoids and Glycyrrhizin used widely in medicine, food industry and tobacco products. *Meristotropis* Fisch. & C. A. Mey with only species of *M. xanthoides* Vassilcz, is the most closely related genus. For weak germination potential, propagation of both species needs a long time, so in vitro propagation can be helpful for maintaining germplasm, shortening duration of development and accessing uniform and pathogen free clones. Micropropagation of the species was studied by culture of different explants excised from seedlings on MS medium containing different hormonal combinations. Neoformant shoots produced roots and then regenerated to plants. On account of medicinal importance of the species, total phenol and glycyrrhizic acid contents were compared in wild and regenerated plants by spectrophotometry and HPLC, respectively. Results showed considerable but lower amounts of these compounds in regenerated plants than wild species. In addition, the interactive effects of SA with drought and cold stress on total protein and proline contents and also PPO, PRX and PAL activities in seedlings were studied by spectrophotometry and electrophoresis methods. Total protein content was decreased by cold and drought stress, but some stress-inducible proteins were expressed. SA pretreatment increased protein content during stress. Cold stress did not affect PPO activity, but SA decreased it during stress. Drought stress caused reduction PAL activity and SA improved this response. In addition, PRX activity was decreased in cold stress with SA, while increased by drought stress with SA. PAL activity was decreased by drought stress in M. xanthoides, while increased in G. glabra. However, SA increased PAL activity. PAL activity was decreased in cold stress in both species. SA decreased PAL activity in *G. glabra*, while increased in *M. xanthoides*. Proline content was decreased by increasing drought stress and SA promotes it. Cold stress decreased proline content in both species and SA promoted proline accumulation.

Tue, 223

Morpho-anatomical features of fruit and receptacle of four genera of the tribe *Inuleae* (Compositae), with notes on their taxonomic significance

Karanović, Dunja (dunja.karanovic@dbe.uns.ac.rs), Lana Zorić, Bojan Zlatković, Pal Boža, Jelena Lazarević, Jadranka Luković

The delimitation of the genera within Inuleae is controversial and has been the subject of a significant number of studies. Despite being paraphyletic, genus *Inula* L. is also heterogeneous with respect to several diverse characters; consequently, delimiting some *Inula* taxa is difficult. *Dittrichia* Greuter, *Limbarda* Adans. and *Pulicaria* Gaertn. were previously assigned to different sections within Inula, but later they were recognized as separate genera. Recent molecular, morphological and karyological data, suggested that type species of genus,

Inula helenium L., should be segregated in a separate genus. In this study, micro-morphological and anatomical characters of cypsela and receptacle were evaluated using stereoscopic, light and scanning electron microscopy. For anatomical observation cross sections were obtained from the middle part of fruit using cryotechnic procedure. The results provided criteria useful for delimitation of taxa, which are often misidentified due to their morphological similarities. Also, it was indicated that the species from different genera were clearly delimited on the basis of their carpological and receptacular micro-morphological and anatomical characteristics. Receptacle features and organisation of sclerenchyma tissue in a fruit are traits that tend to be diagnostic for genera. This was confirmed using Multivariate correspondence analysis, where analysed samples formed five separate groups. Inula species were homogeneous group but the centroids of *I. helenium* were clearly detached and distant from the remaining *Inula* species. We thus concluded that separation of *I. helenium* from the genus Inula is reasonable from a carpological and receptacular morpho-anatomical aspect with equally small percentage of statistical support as *Dittrichia*, *Limbarda* and *Pulicaria* had.

Thu, 329

Female gametophyte development in *Fritillaria stribrnyi* Velen. (Liliaceae)

Kartal, Ciler (cilermeric@yahoo.com)

Fritillaria stribrnyi Velen. (Liliaceae) is an endangered plant that naturally grows only in southern Bulgaria and Turkey in Europe. In this study, the development of megasporangium, megasporogenesis, megagametogenesis and the female gametophyte of *F. stribrnyi* were investigated, both cytologically and histologically, by light microscope. Materials were collected from natural habitats (in Edirne, Turkey), from 10:00–10:30 am between February–April in 2010-2011, and immediately fixed in the field in 3:1 (v/v) ethanol:glacial acetic acid solution. The buds were incubated in fixative at room temperature for 24 h, and transferred to 70% ethanol before they were stored in a refrigerator until needed. Standard methods of dehydration, infiltration, paraffin embedding, microtoming and staining were followed. Serial sections of ovaries were cut at a thickness of 10–12 microns and stained with alcian blue – nuclear fast red. The ovary of F. stribrnyi is trilocular and the ovules are arranged in two rows on an axile placenta in each loculus. The mature ovule is anatropous, bitegmic and tenuinucellate. The micropyle is formed by the inner integument. The archesporial cell develops directly into a megasporocyte. The embryo sac is tetrasporic and eight-nucleate and the development is of the *Fritillaria* type. In the mature embryo sac, the egg cell and synergids are surrounded by a complete cell wall. The antipodal cells degenerate before fertilization and the polar nuclei do not fuse before fertilization.

Thu, 304

Morphological characteristics of *Clinopodium acinos* and *Clinopodium suaveolens* (Lamiaceae) growing in Turkey

Kaya, Ayla (aykaya@anadolu.edu.tr)

A group of Lamiaceae that has caused confusion over its generic boundaries are those species belonging to the complex surrounding the genera *Satureja*, *Calamintha*, *Micromeria*,

Clinopodium and *Acinos*. In the current study, morphological characteristics of *Clinopodium acinos* (L.) Kuntze and *C. suaveolens* (Sm.) Kuntze previously treated as *Acinos* in the Flora of Turkey are presented. *C. suaveolens* grows in North-West and West Anatolia and has strongly odorous while *C. acinos* is recorded from North Anatolia and has slight odorous. They are studied for the first time and detailed descriptions and illustrations of general appearance of plants and their, leaf, bract, flower, calyx, corolla and nutlet shapes are described and illustrated.

Tue, 226

Chromosome numbers for some *Erodium* L'Hér (Geraniaceae) species from Iran

Keshavarzi, Maryam (neshat112000@yahoo.com), Ehteram Najafian

Erodium (Geranaiceae) species are distributed in different habitats of Iran. Some species are of medicinal importance while some are well known weeds. There are no chromosome counts for Erdoium species of Iran. Chromosome numbers are given for six taxa of *Erodium* (Geraniaceae) from Iran: *E. cicutarium* (L.) L'Her. ex Aiton (2n=36), *E. ciconium* (Jus1.) L'Her. ex Aiton, (2n=18), *E. malacoides* (L.) L'Her. ex Aiton (2n=20), *E. moschatum* (L.) L'Her. ex Aiton (2n=20), *E. neuradifolium* Delile ex Godron, (2n=20), *E. oxyrrhynchum* M.B., (2n=20). Chromosome numbers of six studied taxa were recorded for the first time from Iran. Observed chromosome numbers are mainly in concordant with previous data. Different ploidy in each species was not observed.

Tue, 230

Comparative morphological and anatomical studies on *Lactuca* L. (Lactuceae, Asteraceae) species in European Turkey

Köse, Bedia, Feruzan Dane (feruzandane@yahoo.com)

In this study, morphological and anatomical properties of *Lactuca saligna* L., *L. serriola* L., *L. viminea* L., *L. viminea* subsp. *ramossima* (All.) Bonnier, *L. virosa* L four relative and morphologically similar species growing in European Turkey, were investigated. The specimens of plants were collected from natural habitats in Edirne in European Turkey during 2012-2013 years. Some plants were prepared as herbarium materials and voucher specimens deposited in the Herbarium of Trakya University, Edirne (EDTU). Stems and leaves were placed into 70% alcohol for anatomical examinations. Free hand sections were taken from the stem and leaf. Cross-sections of stems and leaves were dyed with a mixture of 1% safranin-Alcian blue 8GX at a ratio of 4:6. Leaf portions of 5 mm^2 were taken and cleansed in a solution of % 2.5 sodium hypo chloride (bleaching agent) for 4 hours. The stained and unstained sections were mounted in glycerine-gelatine to make permanent preparations. In the anatomical study; leaf was equifacial. Stomata type was anomocytic. All species were found to be amphistomatic. The stomata index of species were calculated. Stomata index is different in all species. The vascular tissues of leaves were collateral. Mesophyle is the thickest in *L. serriola*. In the surface section, epidermis cells of leaves is very undulate in *L. virosa* but less undulate in *L. saligna* and *L. viminea* subsp. *viminea*. Upper epidermis is pentagonally or hexagonally shaped of *L. seriola* and *L. viminea* subsp. *ramossima* while the lower epidermal

cells is undulate. The existence of crystal was determined only in leaves of *L. virosa* which do not exist in other taxa. The anatomic features of the species are similar with pecularities of the family Asteraceae studied. Distinguisable endodermis (one layers) was seen between cortex and vascular tissue. The vascular tissues were bicollateral type. Cambium is distinguishable in *L. serriola* which do not exist in other taxa. Periderm of root of *L. saligna* is more thick layer from the other taxa. Secretory structure was found in the vegetative organ of all taxa. The result of anatomical data will also contribute to filling in the gaps in the knowledge of Turkish *Lactuca*.

Thu, 321

The content of phenolic compounds in *Geranium dalmaticum* (Beck) Rech. f. and *G. macrorrhizum* L. (Geraniaceae)

Kremer, Dario (dkremer@pharma.hr), Iztok Košir, Tanja Potočnik, Andreja Čerenak, Ivan Kosalec, Siniša Srečec

Geranium dalmaticum (Beck) Rech. f. (family Geraniaceae) is an endemic Illyric-Balcanic species which grows at the edges of karst valleys and cracks, and in crevices of calcareous rocks in Croatia Montenegro and Albania at altitudes from 200 m to 961 m. It is a perennial herb up to 15 cm high with dull purplish-red flowers. On the other hand, *G. macrorrhizum* L. is a perennial herb up to 50 cm high with larger leaves and dull purplish-red flowers. *G. macrorrhizum* grows in mountainous and shady places on calcareous soils in France, Italy, Austria, Balkan Peninsula, Romania, and west Russia. The aim of this study was to get insight in content of phenolic compounds using HPLC in ethanol extracts of above ground part of *G. dalmaticum* from Mt Sv. Ilija (Croatia), and G. macrorrhizum from Mt Velebit (Croatia). Only quercetin (0.230%) was identified in G. dalmaticum herba, while only rutin (1.116%) was found in *G. macrorrhizum*. On the other hand, the naringenin, and caffeic, coumaric, ferulic, rosmarinic, and sinapic acid were not identified in investigated species. The obtained results present worth additional knowledge on the genus *Geranium* L. in general, and particularly on the endemic *G. dalmaticum*.

Thu, 320

The content of phenolic compounds in *Moltkia petraea* (Tratt.) Griseb. (Boraginaceae)

Kremer, Dario (dkremer@pharma.hr), Iztok Košir, Tanja Potočnik, Andreja Čerenak, Ivan Kosalec, Siniša Srečec

Moltkia petraea (Tratt.) Griseb. (Boraginaceae) is an endemic, lithophytic, xerothermic Illyric–Balkan species distributed along the Adriatic Coast in Croatia, Bosnia and Herzegovina, Montenegro, Albania, and Greece, mostly in Mediterranean and sub-Mediterranean regions. It is very interesting species from the horticultural point of view which possesses the notable antioxidant activity. But, the data about chemical constituents of this species are very limited. The aim of this study was to investigate content of phenolic compounds using HPLC in ethanol extracts of leaves, flowers and stems of *M. petraea* from two mountainous localities (Mt Biokovo and Mt Sniježnica) in Croatia. Seven phenolic compounds (naringenin, quercetin, rutin, and caffeic, ferulic, rosmarinic, and sinapic acid)

were identified and quantified. Among them naringenin and rosmarinic acid were identified in all extracts. On the other hand, quercetin (0.006%) was found only in leaves from Mt Biokovo, while ferulic acid (0.007%) was identified only in stems from the same locality. The most abundant compound was naringenin and its concentration ranged from 1.473% in stems from Mt Sniježnica to 4.241% in flowers from Mt Biokovo. The obtained results present worth additional knowledge on the genus *Moltkia* Lehm. in general, and particularly on the endemic *M. petraea*.

Tue, 216

Rubus laciniatus Willd. (Rosaceae), a new species in the flora of Serbia and the Balkan Peninsula

Krivošej, Zoran (zoran.krivosej@gmail.com), Danijela Prodanović, Bojana Veljković, Nusret Preljević

Rubus laciniatus Willd. (Rosaceae), a new species in the flora of Serbia was found in the vicinity of Raška, on the right bank of the Ibar River. Compared to the other taxa from this genus, this species can be distinguished by easily recognizable feathery divided leaves which also show its decorative properties. According to the data provided for the genus *Rubus* from the monograph Atlas Florae Europaeae 15, the species *R. laciniatus* mostly prevails in northern and middle Europe, so the first traces of this species in south-western Serbia may also be considered as new localities in the Balkan Peninsula.

Mon, 112

Expansion of invasive diatom species *Didymosphenia geminata* (Lyngb.) M.Schmidt and *Diadesmis confervacea* (Grun.) Hustedt in the waters of Serbia

Krizmanić, Jelena (kjelena@bio.bg.ac.rs), Dragana Predojević, Ivana Trbojević, Danijela Vidaković, Olga Jakovljević, Gordana Subakov-Simić

For the first time in Serbia, the presence of *Didymosphenia geminata* was recorded in lakes of the Šar Planina mountain (Urošević, 1994). Subsequently, it was observed in the rivers Danube, Tisa, Sava. Detailed range of *D. geminata* spreading in the waters of Serbia was given by Subakov-Simić et al. (2006). Throughout monitiring rivers and channels in Serbia we recorded expand of this species in norther part of Serbia, Vojvodina, in the channel Novi Sad-Savino Selo. *Diadesmis confervacea* is diatom with a mainly tropical distribution. Majority of the findings in Europe originate from quiescent waters of botanical gardens and it is common in power plant discharges (Coste and Ector, 2000). They suggest it is invasive species that may spread further if global warming persists. While monitoring rivers and channels of Serbia from 2002 till 2013 we noticed the rapid expansion of distribution of *D. confervacea*. It occupied new habitats and nowadays can be found in the rivers Jegrička and Zasavica, as well in the channals Bački Petrovac-Karavukovo, Bečej-Bogojevo and Kikindski kanal in Vojvodina.

Thu, 312

Influence of Cd and/or Zn induced heavy metal stress on photosynthetic parameters and lipid peroxidation in *Glycine max* leaves

Kucukoduk, Mustafa (mkucukoduk@selcuk.edu.tr), Ceyda Ozfidan-Konakci, Evren Yildiztugay

Toxic levels of cadmium (Cd) and zinc (Zn) can cause protein denaturation and oxidative stress, which result in membrane damage and changes of electron transport system in photosynthetic machine. Photosynthetic parameters including the maximum photochemical efficiency (Fv/Fm), the photochemical quenching coefficient (qP), non-photochemical quenching (NPQ) and the actual quantum yield (ΦPSII) negatively changes in plants exposed to heavy metal stress. Cadmium (Cd; 150 μM) and/or zinc (Zn; 500 μM) treatment alone or in combination were given to hydroponically grown soybean seedlings (Glycine max L.) for 72 h (hours). The relative water content (RWC) was found to be significantly lower in the soybean leaves under Cd and Zn stress and more reduction in plants with the combined stress form. Interestingly only Cd treatment did not change in Fv/Fm. Except for this group, the all stress treatments caused a reduction in Fv/Fm, qP and ΦPSII, but NPQ increased with stress treatments. The more obvious changes in the activity of photosynthetic parameters were observed in combination stress treatment than in treated-stress alone. TBARS is one of the most frequently used indicators of lipid peroxidation. TBARS content was induced by stress treatments during the experimental period. After Cd plus Zn application, soybean plants had more reduction in TBARS. Results suggested that heavy metal stress influences water content, photosynthetic machine and lipid peroxidation in soybean leaves.

Tue, 241

Insight into morpho-anatomical variability of *Festuca violacea* group (Poaceae) on the Balkan Peninsula

Kuzmanović, Nevena, Dmitar Lakušić (dlakusic@bio.bg.ac.rs)

The genus *Festuca* represents one of the most taxonomically critical grass genera in the European flora due to its high morphological variability and complexity. The investigated *F. violacea* group belongs to *Festuca* sect. *Aulaxiper* Dumort. (≡ sect. *Extravaginales* vel *mixtae* Hackel), in which 13 high-mountain taxa are present in central and southern Europe, as well as one arctic-circumpolar species (*F. baffinensis* Polunin). As reported by some authors, representatives of this group have the most conservative morphological and karyological traits, according to which they can be considered as the potential ancestral group of narrow-leaved fescues. After comprehensive survey of the genus published by Markgraf-Dannenberg in Flora Europaea, a number of contributions regarding the taxonomy of *F. violacea* group in the Alps and the Apennines have been published. However, the investigations regarding the Balkan representatives are very scarce. According to the latest taxonomic treatment of the taxa belonging to *F. violacea* group, on the Balkan Peninsula are distributed *F. nitida* subsp. *macranthera*, *F. picturata, F. violacea* subsp. *violacea*, as well as closely related *F. korabensis* and *F. peristerea* from the mountains in Macedonia, Albania, southern Bulgaria and northern Greece. The taxonomic status of *F. violacea* subsp. *handellii* considered as endemic of Greece remained unclear. Taking all this into consideration, the main aim of our

study was to provide the insight into morpho-anatomical variability of the populations of *F. violacea* group from the Balkan Peninsula.

Mon, 139

Effect of buckwheat extract on germination and early development of selected invasive species, family Asteraceae

Küzmič, Filip, Simona Strgulc Krajšek (Simona.strgulc@bf.uni-lj.si)

Since it had become well accepted that invasive plant species represent serious threat to environment, we have decided to test a potentially effective method for suppression of these plants. It has been observed that disturbed habitats, such as abandoned crop fields, are especially prone to invasion by certain invasive plant species. We chose 4 such species of plants: *Solidago gigantea*, *Solidago canadensis*, *Erigeron annuus* and *Conyza canadensis*, in addition to *Lactuca sativa*, a known model plant, all from family Asteraceae. We performed a bioassay in a form of germination test to test the allelopathic effect of water extracts from common (*Fagopyrum esculentum*) and tartary (*Fagopyrum tataricum*) buckwheat on germination and early development of the seedlings. For each buckwheat species two extract concentrations have been used: 2.5% and 5%. For 12 days all the seeds that germinated and the seedlings that opened their cotyledons had been counted each day. On the last day, pictures of the Petri dishes have been taken to measure root length of each seedling. For the latter results, an ANOVA test had been used and for the germination and cotyledon development, survival tests had been performed. Overall results indicated that both buckwheat species suppress early life stages of all the chosen plant species. Germination and cotyledon opening rates had been reduced and/or the process itself had been delayed, except for *Erigeron annuus* and *Solidago gigantea*, where effect hasn't been overall negative. However, far more evident effect has been observed on the roots, growth of which had been strongly inhibited for all of the species and had been concentration dependent. As predicted, tartary buckwheat showed stronger effect. Our findings suggest that buckwheat could be considered as a tool for controling the invasion of species discussed above, especially on abandoned fields, although further research needs to be performed in the field in more realistic environment.

Thu, 318

Environment-related variations of the composition of the essential oils of Dalmatian Sage (*Salvia officinalis* L., Lamiaceae) in the Balkan Peninsula

Lakušić, Branislava, Mihailo Ristić, Violeta Slavkovska (violetas@pharmacy.bg.ac.rs), Jasmina Šinžar-Sekulić, Dmitar Lakušić

Composition of the essential oils of 42 accessions of Dalmatian sage (*Salvia officinalis* L.) with different geographical origin (14 sites from wide range of Balkan peninsula – Croatia: Učka, Rijeka, Lika, Hvar, Vis; Montenegro: Luštica, Valdanos, Morača; Albania: Bence, Cikes; Greece: Nemerecka; Serbia: Belgrade, Pleš; FYR Macedonia: Jablanica) was determined by GC/FID and GC/MS. Sites are located in four climatic zones (wet Mediterranean, wet sub-Mediterranean, wet sub-Continental and dry sub-Continental), four

vegetational zone (Quercion ilicis, Ostryo-Carpinion, Quercion frainetto, Carpinion betuli) and three biogeographical regions (Eu-Mediterranean, Sub-Mediterranean and Mid-Europaean). Multivariate analysis was performed to identify the structure of variability and to measure the distances between groups. First, the UPGMA (unweighted pair-group average linkage) clustering method was used to determine the similarities between each measured unit. Second, principal component analysis (PCA) and canonical discriminant analysis (CDA) was conducted to evaluate the overall chemical variation and relationships between samples. The regression analyses (simple linear regression and stepwise multiple regression) were performed to identify the level of dependency of variation of chemical composition of essential oils with respect to the basic orographic and bioclimatic characteristics of habitats and the geographic position of each population. Our spatial analysis shows that the differentiation of essential oils of Dalmatian sage very well fit into the general ecological and biogeographic characteristics of habitats from which the samples were taken for analysis.

Tue, 235

Edraianthus stankovicii (Campanulaceae), a neglected taxon of the Balkan peninsula - Evidence from molecular, genome size and morphometric study

Lakušić, Dmitar (dlakusic@bio.bg.ac.rs), Saša Stefanović, Sonia Siljak-Yakovlev, Tamara Rakić, Boštjan Surina

The taxonomically intricate *Edraianthus dalmaticus-serbicus* group within *E. tenuifolius*-complex in the Balkan Peninsula is reviewed using molecular, genome size and morphological data based on extensive sample of populations across the species range. The phylogenetic analyses based on Amplified Fragment Length Polymorphisms (AFLPs), plastid DNA (*trnL-F* region and *rbcL-atpB* spacer) and nuclear nrETS sequences confirm the monophyly of *E. serbicus* and revealed two allopatrically distributed genetically divergent entities. The genome size and morphological analysis, performed on the same widespread sample of populations largely correspond with molecular results, allowed us to establish *E. stankovicii*, previously described as *E. serbicus* subsp. *stankovicii* by R. Lakušić, as stenoendemic species for Mts Veliki Krš and Stol in north-eastern Serbia.

Thu, 301

Two different ways to deal with hostile serpentine substrate: case study of _Bornmuellera dieckii_ Degen (Brassicaceae) and _Saponaria intermedia_ Simmler (Caryophyllaceae)

Lazarević, Maja (majat@bio.bg.ac.rs), Lana Jovanović, Konstantin Ilijević, Predrag Lazarević, Tamara Rakić, Ivan Gržetić

Ultramafic soil covers significant areas in the Balkans providing habitat for c. 335 endemic taxa. Among them, there are two species, local endemic *Bornmuellera dieckii* and regional endemic *Saponaria intermedia*, confined to certain serpentine habitats of Scardo-Pindhic Mts. In this research, mineral and trace metals composition in the soils, as well as roots, stem and leaves of these two endemic species is presented for the first time. Soil and plant material were collected from the serpentine habitat in Šara Mt. Examined soil expressed typical characteristics of serpentine substrate: low level of nutrients, extremely unfavourable Ca/Mg

ratio (below 0.10) and high concentration of several trace elements (Al, Fe, Ni, Cr, Mn). Both species managed to concentrate Ca in the shoots despite the low level of this element in the soil, maintaining high values of Ca/Mg ratio (>1), especially in the leaves of *B. dieckii*. Two species express different ways of dealing with high level of heavy metals. Thus, *B. dieckii* is characterized by up to 3 times higher Ni concentration in the leaves than in the soil and it turned to be another nickel hyperaccumulating species of this interesting genus. On the contrary, *S. intermedia* is a metal-tolerant plant with low levels of metal absorption and their decreasing concentration from roots to leaves.

Tue, 239

Comparative anatomical studies on *Sonchus* L. (Asteraceae) species in European Turkey

Leventer, Sinem (si_lev@hotmail.com), Feruzan Dane

In this study, anatomical features of Sonchus asper (L.) Hill, *Sonchus oleraceus* L., and *S. tennerrimus* L. belonging to family Asteraceae growing in European Turkey, were investigated. Plants sample were prepared as herbarium materials and voucher specimens deposited in the Herbarium of Trakya University, Edirne (EDTU). For anatomical study, materials were fixed in %70 ethyl alcohol at room temperature. Anatomical observations were performed on the cross-sections of stem and leaves, and surface sections of leaves taken by free-hand. Cross-sections from stem were dyed with a mixture of 1% safranin-Alcian blue 8GX at a ratio of 4:6. Cross-section and surface section from the leaf (the upper and the lower) were stained with Lugol. The stained and unstained sections were mounted in glycerine-gelatine to make permanent preparations. Also, the existence of crystals were investigated. The samples were treated with %25 commercial bleach for 4 h. After washing in a 96% ethanol for 10 min., the samples were infiltrated with xylene for 10 min., mounted in entellan on slide. The slides were examined with an Olympus microscope, the selected images were photographed. In the anatomical study; leaves are bifacial. Stomata cells that are anomocytic and stomata type is hipostomatic. The vascular tissues of leaves are collateral. Palisade and spongy parenchyma are not distinct, that is, mesophyll tissue is homogeny. Mesophyle is the thickest in *S. asper*. In the surface section, epidermis cells of leaves are very undulate *S. oleraceus* and *S. tenerrimus*, but epidermis cells of leaves belonging to *S. asper* were showed straight cells. Cells of upper epidermis belonging to *S. tenerrimus* are more undulate than lower ones. The existence of crystal was determined in leaves of all species. A transverse section taken from the middle part of the stem was observed as follows. The epidermis consists of a single layer and it is surrounded by a cuticle layer. Underneath the epidermis, there is angular collenchyma. Angular collenchyma continues through the entire row in *S. tenerrimus*, it is accumulated vascular tissues above in other species. Sclerenchyma layer is the thickest in *S. asper*. The existence of crystal was determined in stem of all species.

Mon, 109

Patchy distribution of phytoplankton pigments in South Adriatic oligotrophic environment - winter 2015

Ljubešić, Zrinka (zrinka.ljubesic@biol.pmf.hr), Sunčica Bosak, Ivana Bošnjak, Maja Mejdandžić, Iva Mikac, Ivona Cetinić

Chlorophylls and associated carotenoid pigments are being used to map the chemotaxonomic composition of phytoplankton in the oceans. Compared with larger eukaryotic cells, photosynthetic picoplankton possesses better nutrient uptake capabilities which result in its domninace and higher level of importance with increased oligotrophy. In order to determine spatial distribution of phytoplankton pigments in olygotrophic environment in winter conditions an oceanographic cruise was conducted in southern Adriatic from February 28th till March 3rd 2015. Two major transects were investigated: (i) Dubrovnik to 1000m isobath, and (ii) 1000m isobath to Lastovo island. Total of 45 CTD casts was performed in order to compare bio-optical measurements of chlorophyll fluorescence (Chl F) with pigment concentration. A total of 117 samples were collected on the basis of CTD profile and fluoresces signal and analysed by high-performance liquid chromatography (HPLC). Pigment concentration was extremely low (chlorophyll *a* maximum concentration was 190ng/L) reflecting oligotrophy of the environment. Fluorescence signal was detected in depths up to 450m, which was also confirmed by HPLC pigment analyses of Chl *a*. Beside Chl *a*, most frequently detected and in highest concentrations were 19' hexanoyloxyfucoxanthin, fucoxantin, 19' butanoyloxyfucoxanthin, zeaxantin and one unidentified pigment. All pigments showed high patchiness in their spatial distribution. The unidentified pigment was detected at 500m depth, i.e. in the layer where Chl *a* was not detected any more. Its identification is the following step in the research.

Mon, 130

Distribution and chorological relationship of Balkan endemic orophytes from South European - and Central European mountain groups in the Bosnia and Herzegovina

Lubarda, Biljana, Vladimir Stupar, Đorđije Milanović, Vladimir Stevanović (vstev@bio.bg.ac.rs)

Analysis included 181 taxa of the Balkan endemic orophytes at the species and subspecies rank that occur in the mountains of Bosnia and Herzegovina. Floristic element for each endemic taxa was determined and its belonging to the wider chorological groups that correspond to the Southern European Mountain (SEM) and/or Central European Mountain (CEM) floristic subregions of Central-South European mountain region. The distribution of each taxon was mapped in the network of MGRS squares (10x10 km). The largest number of the Balkan endemic orophytes belongs to Dinaric (67 - SEM and 32 - CEM) and Dinaric-Balkan (45 - SEM and 37 - CEM) floristic elements. The dominance of SEM in relation to CEM representatives has been confirmed in the mountains of outer chain of littoral Dinarides (Velež, Gatačka Bjelašnica, Orjen), as well as on the Prenj, Čvrsnica and Čabulja. Further inland, this ratio is approximately equal (Dinara Mt), while in western parts of Bosnia (mountains Osječenica, Klekovača), region of central Bosnia (mountain Vranica) and eastern Bosnia, number of CEM elements is greater than the number of SEM ones. The ratio between SEM and CEM elements could be very important regarding distinction between SEM and

CEM subregions on territory of Central Dinaric Alps of W. Balkans. In addition for further differentiation of phytochoria, types of vegetation regarding altitude, especially upper forest border is taken into consideration. Additionally, the analysis of floristic similarity was run on the basis of distribution of Dinaric and Dinaric-Balkan elements. The results of this analysis could be very useful for definition of floristic provinces and district boundaries within the SEM and CEM floristic subregions.

Thu, 308

Micro-morphological and anatomical leaf traits of the *Halimione portulacoides* (L.) Aellen (Chenopodiaceae)

Luković, Jadranka (jadranka.lukovic@dbe.uns.ac.rs), Dubravka Milić, Milana Bikić, Lana Zorić

Halimione portulacoides has a high competitive ability and tolerance to salt amount oscilation in soil. Due to the ability of accumulating heavy metals it is considered suitable in the process of phytoremediation. Inspite of the facts mentioned, the biology of this species is insufficiently known. Therefore, the attention of this research has been focused on the micro-morphological and anatomical leaf traits. Plant material was collected during the flowering season from the Mediterranean. Leaves from the middle part of the plants were sampled. Light microscope and scanning electron microscope were used for the observation. The leaf surface is covered with vesicular trichomes which in the earlier stages of the leaf development constitute a very dense indumentum. Vesicular trichomes consist of a narrow, unicellular or uniseriate stalk and a large bladdery, thin-walled unicellular head. Amphistomatous leaf blade has an isolateral structure. Photosynthetic tissue is made of 2-3 layers of short palisade cells, constructing peripheral ring which is discontinuous in the main vein zone. Water storage tissue is in the central part of the leaf with larger cells in the zone of the main vein. The main vascular bundles and 12-20 lateral bundles of different sizes, are arranged in the water storage parenchyma, in the central leaf blade plane. Regular rows of conductive elements, of a small diameter and a strong thicker wall were observed in the main vein xylem. Phloem is partially or fully sclerified. Thick-walled, nonlignified sclerenchyma fibers are predominantly found adjacent to the main vein bundle. Smaller groups of collenchyma are found subepidermaly in the middle part of the leaf and on the tip of the leaf. Calcium oxalate crystal druses are dominantly present. Based on the results three structural leaf types were described: halomorphic, halomesomorphic and haloscleromorphic. Structural leaf differentiation was also confirmed by the results of PCA and DCA analyses.

Tue, 234

Genome size, ploidy level and reproductive mode variation of *Cotoneaster integerrimus* Med. (Rosaceae) in Bosnia and Herzegovina (Balkan Peninsula)

Mahmutović, Irma (irma.contagium@gmail.com), Alma Hajrudinović-Bogunić, Elma Silajdžić, Sonja Šiljak-Yakovlev, Edina Muratović, Faruk Bogunić

In certain plant groups, polyploidy is closely associated with changes in the mating systems. *Cotoneaster integerrimus* (Rosaceae) is considered as apomictic tetraploid species. The flow

cytometry was used to asess genome size and ploidy level, and flow cytometric seed screenings (FCSS) to identify mating system in C. integerrimus populations from Bosnia and Herzegovina. The total nuclear genome size values (2C DNA) ranged from 1.25 pg to 3.35 pg for approximately 200 individuals from ten populations. Such genome size variation is related to presence of di-, tri-, tetra- and pentaploid cytotypes within analyzed populations. The intrapopulational distribution of cytotypes was uneven and, those harboured either single or mixed cytotypes. The tetraploid cytotype was prevalent (85%) in populations followed by diploids (10%). The tri- (3%) and pentaploids (2%) were quite rare and occurred in few populations. The FCSS confirmed that seeds of *C. integerrimus* polyploids were mostly of apomictic origin (pseudogamous apomixis). A small portion of sexually originated seeds was detected. The endosperm ploidy of seeds from polyploid mothers indicated different pathways of endosperm formation due to a number and ploidy of contributing spermal cells. Both balanced and unbalanced endosperm was observed. Geographic prevalence of apomicts relative to their related sexuals in Bosnian populations imposes important evolutionary questions at global scale for ecological and reproductive success and long-term survival of *C. integerrimus*.

Tue, 232

Taxonomical contributions to Turkish *Epilobium* L. (Onagraceae) taxa based on trichome features

Makbul, Serdar (smakbul@hotmail.com), Kamil Coşkunçelebi, Seda Okur

In the present study, 26 *Epilobium* L. taxa collected from Turkey was examined by light microscope (LM) in terms of pubescence features. All samples used in the study were obtained from herbarium materials deposited in RUB (Herbarium of Recep Tayyip Erdogan University, Department of Biology) and KTUB (Herbarium of Karadeniz Technical University, Department of Biology). Types, presence and distribution of trichomes on stem, leaf and fruit for the each taxon were observed in detail. As a result of this study, it was found that while all aerial parts are glabrous or consist of glandular and/or non-glandular hairs, hirsute, sericeous and crisped pubescence was observed on the stem, inflorescence axis, leaf and calyx. This study is the first report dealing with trichome features of all Turkish Epilobium taxa and our results also indicated that types and distribution of trichomes should be useful in separating the examined *Epilobium* taxa. This study was supported by Scientific and Technological Research Council of Turkey (TUBITAK, Project number: 109T972).

Thu, 353

Treeless biotops of montane brooks and rivers of Crimea (Ukraine)

Mala, Julia (mala.yulichka@gmail.com)

The Crimean Mountains are young, folded mountains of the Alpine mountain system located in the southern part of the Crimea. Including the foothills, they cover one-fifth of the peninsula's area. They extend for about 150 km from Sevastopol to Feodosia and are 40–50 km in width. The Crimean Mountains consist of three long, parallel ranges, separated by valleys. The mountains are built mainly of sedimentary deposits of sea origin: sand-clayey

schist, conglomerates, and sandstones and limestones of the Permian-Triassic and Jurassic periods. The rivers are short and of irregular incline. They are fed by precipitation and subterranean waters. On the northern slopes are flowing the Chorna River, Belbek River, Kacha River, Alma River, Salhyr River, and on the southern slopes, the Uchansu River, Avunda River, and others rivers, streams, brooks, springs, many big and small waterfalls. Treeless freshwater biotops of the Crimean Mountains consist of 14 ecological groups, such as: 1. Macrophyte vegetation of naturally eutrophic still water (*Lemna gibba, Spirodela polyrrhiza*), 2. Charopyceae communities, 3. Mesothermophilic communities with *Fontinalis antipyretica,* 4. Thermophilic communities gravel banks with *Riccardia chamaedryfolia*, 5. Macrophyte vegetation of naturally eutrophic still waters (*Nymphaea candida, N. odorata*) and its variant - without macrophyte species valuable for nature conservation (*Batrachium trichophyllum*, *Potamogeton berchtoldii, P. gramineus, P. trichoides*), 6. Macrophyte vegetation of shallow still waters with *Callitriche hermaphroditica*, 7. Reed beds of eutrophic still waters (*Phragmites australis*), 8. Reed vegetation of brooks (*Glyceria notata, Sparganium emersum*), 9. Halophilous reed (*Bolboschoenus maritimus, B. planiculmis, Scirpus tabernaemontani*), 10. Petasites fringes of montane slow-flowing rivers and brooks, 11. Bryophyte communities of rocks in streams, springs an on wet rock-faces, frequently in nutrient-rich situation with *Rhynchostegium riparioides*, 12. Bryophyte communities of calcareous springs and rills with *Palustriella commutata*, 13. Bryophyte communities on wet soils beside montane rivers, streams and springs with *Brachythecium rivulare* and 14. Vegetation of wet disturbed soils (*Carex cuspidata, Juncus inflexus, Mentha longifolia*).

Mon, 108

Preliminary results of a biodiversity of Blue-green algae (Cyanobacteria) along the karstic river Cetina (Croatia)

Malešević, Nikola (nikola712@gmail.com), Nikola Koletić, Maja Mejdandžić, Martina Blinkova

Blue-green algae or cyanobacteria are photosynthetic microorganisms that can be found in most habitats and have ability to multiply quickly under specific conditions. Nitrogen and phosphorus enriched water in combination with higher temperature, lower water level and anthropogenic pressure enhances effects of algal blooms. Reservoirs and slow moving rivers can provide suitable conditions for cyanobacterial bloom development, which may decrease water quality and affect various biological communities. Investigation of cyanobacterial diversity and composition was conducted along the karstic river Cetina and artificial reservoir Peruča in the sub mountain Croatia. Samples were collected in August 2012 along the river (~ 32.5 river kilometers) on 23 study sites including spring and main flow of the river Cetina (upstream and downstream from the reservoir Peruča). A total of 22 taxa were found of which *Anabaena* sp., *Chroococcus* sp., *Gleocapsa* sp., *Merismopedia* sp., *Nostoc* sp., *Oscillatoria* sp. and *Pseudanabaena* sp. were dominant. Moreover, five taxa with toxic properties: *Anabaena* sp., *Lyngbya* sp., *Microcystis* sp., *Nostoc* sp. and *Oscillatoria* sp. have been recorded. Generated taxonomical list of cyanobacteria provided insight information on biodiversity of the researched area. Also, diversity in algological flora as a result of dynamics in environmental conditions. Physical parameters which were recorded along the research sites showed that the pH of the river and the reservoir were similar and ranged from 5.6 to 6.3 units what corresponded to the ecological status of the observed water system due to external factors, physical parameters and a large amount of degraded organic matter with dominance

of cyanobacterial taxa in the water column. Furthermore, research on the river Cetina indicates how this type of aquatic habitat operates and it can point out how some similar ecosystems can function. Planning and preparedness with respect to cyanobacterial investigations will therefore remain important for the foreseeable future.

Thu, 342

Gene expression analyses during homobrassinosteroid alleviation of salt-stressed barley roots

Marakli, Sevgi (sevgi.marakli@istanbul.edu.tr), Nermin Gozukirmizi

In our previous research, we observed salt concentration caused negative effect on root germination, protein content and mitotic activity of barley. On the other hand, homobrassinosteroid (HBR) application alleviated these negative effects. In this study, we investigated eight different genes related to abiotic stress (HvPIP1.1, HvPIP1.2, HvPIP1.3, HvPIP1.5, CYCD3, DREB2, WAK) and brassinosteroid metabolism (DWARF4) expressions with qPCR under only salt (150 mM and 250 mM), only HBR (0.5 μM and 1 μM) and salt + HBR conditions for 48 h and 72 h to analyse the effects of salt and HBR treatments at molecular level. Salt stress decreased HvPIP1.2 and WAK but enhanced DREB2 expression. After 150 mM salt application, HvPIP1.3 was up-regulated 4.3 fold at 48 h and DWARF4 was up-regulated 3.57-fold at 48 h and 3-fold at 72 h. Moreover, CYCD3 expression was also increased 3.5-fold at 48 h and 4-fold at 72 h under low salt treatment. Other genes indicated varying results. Only HBR application up-regulated expressions of HvPIP1.1, HvPIP1.2, HvPIP1.3, HvPIP1.5 and DWARF4 genes. In addition, WAK expression enhanced 1.54-fold under high hormone concentration (1 μM) at 48 h. On the other hand, CYCD3 and DREB2 expressions showed differences related to HBR concentration and application duration. When compared to control, HvPIP1.1, DREB2 and DWARF4 expressions increased but HvPIP1.2 expression decreased after salt + HBR applications. Moreover, HvPIP1.3, HvPIP1.5, CYCD3, and WAK expressions increased or decreased in a dose- and time- dependent manner. The interactions of these genes might be responsible for salt stress tolerance in plants.

Mon, 113

Archaeobotanical research of Roman harbour in the Flacius Street in Pula (Istria, Croatia)

Mareković, Sara, Renata Šoštarić (rsostar@biol.pmf.hr), Ida Koncani Uhač, Marko Uhač

A total of 27 samples, collected from the part of excavated Roman port in Flaciusova Street in Pula, were archaeobotanicaly researched and 9809 plant macrofossils were isolated and analysed. The most numerous are the remains of figs (*Ficus carica*), pines (*Pinus pinea*), grape-vines (*Vitis vinifera*), blackberries (*Rubus fruticosus* agg.) and olives (*Olea sativa*). All these taxa are widespread in the Mediterranean area and represent gladly consumed food for local population. The number of found ruderal and weed species is relatively high (34), but as they came to the site accidentally, the number of those macrofossils is far smaller than the number of (cultivated and wild) useful species. Elements of evergreen forest vegetation and plants of aquatic habitats at the site was low (2+1), but their findings still confirm the

existence of this type of vegetation in the area of the site in ancient times. Only for the species *Cordia myxa* it is assumed that it came to the port by international import from Africa. Our conclusion about import of that species is based on the fact that *Cordia myxa* is not native for Croatian Adriatic coast and the fruit stone was found in the same stratigraphic unit as African amphorae. For other useful plant species it can be assumed that they could have been cultivated near the site and that they arrived to the port as the food for the local population (and/or sailors) or even as an export product, which from Pula could have been transported to other areas.

Mon, 120

The Pashtrik Mountain, a potential protected Landscape area (Kosovo)

Mustafa, Behxhet (behxhet.mustafa@uni-pr.edu), Avni Hajdari, Xhavit Mala, Zeqir Veselaj, Bledar Pulaj

The Pashtrik Mountain is one of the biodiversity centres in Kosovo and in the Balkans too, but so far there has not been a proper study with the aim to designate this area as a protected area. The natural values of this area changed dramatically during the last decade, especially in terms of biodiversity. With the aim to evaluate the current situation of the biodiversity, its flora, fauna, and plant communities were investigated. Its biodiversity values were assessed based on the review of the available relevant literature sources as well as the field research conducted during the period 2012-2014. Study results show that the Pashtrik Mountain is rich in biodiversity values associated with a high diversity of ecosystems, landscape and other natural values. On the other hand, due to the lack of protection status and appropriate biodiversity conservation programs, many of the species are threatened and some of them are critically endengered. Taking into consideration the natural values, biodiversity and landscape of the area and based on the provisions of the Law for Nature Conservation of Kosovo (Law No.02/L-18) Pashtrik should be declared as "Protected Landscape" that belongs to the category V protected areas according to IUCN, with an area of 25,060.00 hectares. Within the proposed protected area, a territory of 282 hectares should be declared as Strict Nature Reserve (Ist category of protected areas of IUCN), since it is an area inhabited by the population of the steno-endemic plant species *Cynoglossum krasniqii* T.Wrab. Furthermore, the area needs the development of its spatial and management plan covering all aspects of vegetation, biodiversity, water, energy, waste, building and infrastructure in consultation and participation of all stakeholders, addressing related problems such as: illegal logging, constructions, transport, waste management etc.

Thu, 354

The chorology, ecology and phytosociology of the underwoods plant communities in the Parang Montains (southern Carpathians, Romania

Niculescu, Mariana (mniculescum@yahoo.com), Marius Fagaras, Luminita Buse-Dragomir

The territory that we have been studying is situated in the Parang Mountains, part of the Southern Carpathians, Romania. In this paper, we present the underwoods plant communities identified in this massif, framing two site of Community importance: ROSCI 0188 Parang and

ROSCI 0128 North-Eastern of Gorj. In the territory under research, in the hilly floor and the lower mountain sub-floor, one can find underwood plant communities: *Pruno spinosae-Ligustretum vulgarae* Tx. 1952; *Rubo plicatae-Prunetum spinosae* Web. 1974 em. Oberd. 1992 and *Pruno spinosae-Crategetum* (Soó 1927) Hueck 1931. The underwoods edified by spiraea, belonging to the plant community: *Spiraeo-Coryletum* Ujv. 1944 and are frequently met in the mountain floor, on Galbenul Valley, Oltet Valley and Gilort Valley. *Pinus mugo* forms thick and difficult to cross underwoods, at an altitude between 1,700 and 2100 m. We find on the Mt. Papusa, Mt. Tidvele, Mt. Micaia, Mt. Muntinu, Mt. Mohoru, Mt. Setea Mare, Mt. Setea Mica, Mt. Carbunele, Mt. Dengheru and Mt. Musetoaia. The shrubs of *Juniperus communis* ssp. *alpina*, are frequently found to the upper limit of the spruce tree forests, on the Mt. Papusa, Mt. Tidvele, Mt. Micaia, Mt. Muntinu, Mt. Mohoru, Mt. Setea Mare, Mt. Setea Mica, Mt. Carbunele, Mt. Dengheru. In the sub-alpine floor, the plant community *Junipero-Bruckenthalietum spiculifoliae* Horv. 1936 is also frequently found. The short underwoods of Ericaceae, are also well represented in the Parang Mountains. On the mild crests of the versants, the meadows are interrupted, here and there, giving birth to thick and short clusters of *Loiseleuria procumbens*. The underwoods, which belong to the association *Rhododendro myrtifolii-Vaccinietum* Borza (1955) 1959 em. Boşcaiu 1971, vegetate on the sunny versants on the Mt. Papusa, Mt. Tidvele, Mt. Micaia, Mt. Muntinu, Mt. Mohoru, Mt. Setea Mare, Mt. Setea Mica, Mt. Carbunele, Mt. Dengheru and Mt. Musetoaia. Taking into account the Interpretation manual of European Union habitats - Eur 28 and Romanian Manual for Interpretation of Natura 2000 Habitats in Romania (2008), there can be noticed that the habitat in the studied territory is mentioned 4060 Alpine and Boreal heaths; 4070* Bushes with *Pinus mugo* and *Rhododendron hirsutum* (*Mugo-Rhododendretum hirsuti*) and 4080 Sub-Arctic Salix spp. schrub.

Thu, 302

The influence of orographic and bioclimatic factors on morphological variability of analyzed population of *Jovibarba heuffelii* (Schott) A. Löve & D. Löve (Crassulaceae)

Nikolić, Danijela (danid@pmf.ni.ac.rs), Jasmina Šinžar-Sekulić, Vladimir Ranđelović, Dmitar Lakušić

The goal of this paper was to determine the extent of morphological variability in species *J. heuffelii* caused by orographic and bioclimatic factors. Samples were collected from 14 populations of species *J. heuffelii*, from the territories of Serbia, Macedonia, Bulgaria and Romania. Cluster analysis (UPGMA) was performed on bioclimatic parameters recorded in habitats where samples were collected. Each determined cluster of bioclimatic parameters was compared with corresponding cluster determined of morphological characters in order to determine any similarity in population grouping. The goal of regression analysis was to determine the influence of orographic and bioclimatic factors on variability of morphological characters in *J. heuffelii*. The cluster analysis of bioclimatic factors has shown that the study area was clearly differentiated into three main clusters: cluster with semiarid temperate-continental or subcontinental climate, cluster with continental mountain climate and cluster with humid mountain climate. The cluster analysis of morphological characters has shown that all populations were differentiated into four clusters and that the distribution of individual clades did not match the distribution of populations determined in the cluster analysis of bioclimatic parameters. This type of distribution indicates that morphological characteristics were under stronger influence of seasonal temperature and precipitation dynamics than of

either the total precipitation or mean annual temperature. Among the orographic factors, the greatest influence on morphological characters of species *J. heuffelii* was determined for altitude, exposition and slope of the terrain. The mean temperature of the wettest quarter (BIO8) and temperature seasonality (BIO4) have shown the greatest influence on the morphological characters of *J. heuffelii*.

Mon, 141
135 years old fungi models of Heinrich Arnoldi

Novak, Špela (snovak@pms-lj.si)

Natural history collections in museums are a three-dimensional archive of the natural world and relationships of societies with their environments. Most of the specimens for museum collections are gathered in nature, but not all. Because many dry fungi carpophores (mushrooms) don't have the same structure as fresh ones, the first fungi researchers have also drawn fungi. In the 19th century in Gotha the Arnoldi family (owners of a porcelain-manufacturing company) was making fruit (Arnoldie Obstcabinette) and latter also fungi models out of a special composition mass. At that time models were a popular instructive and educational tool in Germany. But they were not just teaching tools, their creators made them for collectors of art and natural history objects. In the years 1870-1880 Heinrich Arnoldi (1813-1882) made fungi models in order to show people, which mushrooms are edible and which poisonous. These models were sold in 35 series of 12 models, altogether 420 models, representing 236 fungi species. Each species was presented with one or more (up to three) fungi stages and each stage/model had a handwritten number. On each model there was also a glued tag with the name of the fungi species in German and Latin. The Arnoldi family issued a catalogue with a list of the models, where the numbers fit to the numbers written on the model. In four series they issued also detailed descriptions about edible and poisonous fungi. Today the fungi models are preserved in 4 museums in 4 countries: Slovenian Museum of Natural History (Slovenia), Museum of Nature Olten (Switzerland), Museum of Natural History Coburg (Germany) and Santos Museum of Economic Botany (Adelaide, Australia). The Slovenian Museum of Natural History keeps almost the whole collection of Heinrich Arnoldi's mushroom models. The models are well-preserved and at first glance they look like real mushrooms. In 2015 they were cleaned and photographed. A list was made and the fungi were given Latin and Slovenian names according to the newest nomenclature.

Thu, 303
Morphological differentiation of *Centaurea atropurpurea* (Asteraceae) from Serbia

Novaković, Jelica (jelica@bio.bg.ac.rs), Bojan Zlatković, Dmitar Lakušić, Petar D. Marin, Pedja Janaćković

Centaurea atropurpurea Waldst. & Kit. (=*Centaurea calocephala* Willd.) is one of the members of the *C. atropurpurea* complex, an informal group which belongs to subgenus *Acrocentron*, subtribe *Cardueae* (Asteraceae). It is Carpatho-Balkanic species, mostly distributed in the central parts of the Balkan Peninsula: in Romania, Serbia, Bulgaria, Albania and Macedonia, with few isolated populations in Croatia, Bosnia-Herzegovina and

Montenegro. This paper presents results of multivariate morphometric study of morphological characters of plants from 10 populations of *C. atropurpurea* in Serbia, that occur in different biogeogrpahic (illyrian vs. moesian) and geologic (carbonate vs. limestone) condition. Morphometric study included following populations, that have been selected as "a priori" defined groups in statistical analysis: Maglič, Rtanj, Raška, Iron Gates, Ibar canyon, Bor, Knjaževac, Paraćin, Zaječar and Zlatibor. We analyzed 47 traits, including morphometric, meristic and qualitative characters. The measurements included 241 individuals from natural populations. Multivariate statistics (PCA, CDA, CA) were performed. According to statistical analyses we recognized three groups of populations. The investigation showed that population from locality Zlatibor was morphologically very different from all other studied populations.

Thu, 341

Irrigation based determination of electrolyte leakage and lipid peroxidation concentration in grown tomatoes (*Lycopersicon esculentum* Mill)

Osma, Etem (eosma@erzincan.edu.tr), Salih Mutlu, Ahmet Aksoy, Veli İlhan

Plants can be exposed to stress under the effect of several negative conditions affecting their growth and development negatively in environments they are grown at any period of their life. Plants respond to stress enabling their biochemical and physiological mechanisms. In this study, tomatoes were grown using Karasu River water used for agricultural activities of our region. Lipid peroxidation and electrolyte leakage was determined in grown tomatoes. The tomatoes were grown in 3 different localities, and river water and mains water were used for irrigation. No different parameters (pesticide, fertilizer, etc.) except from water were used: I Soil of field and mains water, II Soil of field and river water, III Riverbank soil and river water. Tomatoes were planted in May, and irrigation was maintained until the beginning of September when the samples taken from tomatoes were started to be analyzed. In test tubes, 0.1 g fresh leave was put in 4 ml distilled water and kept at 4^{o}C for 24 hours. Then, ion amounts were measured using electrical conductivimeter. Implementations were read at 532 nm and absorbance level for non-specific absorption at 600 nm was determined. When the data were analyzed, electrolyte leakage and lipid peroxidation concentration in the 1^{st} locality was determined to be more than the concentrations in other localities. Accordingly, content of river water was noticed to be more productive than normal water. Because river water can easily be polluted, it is necessary to be analyzed at specific intervals. At the end of the research, we consider that content and quality of water used for growing plants is essential.

Thu, 340

Determination of genetic gain of pyramidal black pine (*Pinus nigra* subsp. *pallasiana* var. *pyramidata*) populations in Turkey

Özel, Halil Barış (halilbarisozel@yahoo.com), Nebi Bilir

Pyramidal black pine is a variety of Anadolu black pine. This variety have widest natural distribution area in Turkey in the world. But it has done incorrectly silvicultural practices, fires, storms and snow damage due to the generation of this variety is faced with the danger of disappearing. Therefore it said some of the special protection measures should be implemented to continue the generation of this variety. For this purpose pyramidal black pine

basic genetic information is needed about the larch. With this research, the seedlings obtained from seeds collected from natural range varieties in Turkey has been a common garden plants and seedlings length and some branching character in terms of genetic gain amount that can be obtained for different selection intensities with heritability of individual and family level was estimated. According to the obtained results, measured in terms of population in need characters both among domestic population it has appeared on the differences statistically significant. In addition, the branch angle, branch thickness and the estimated heritability at the individual level in terms of number of branches (hi2>0.56), family heritability of (hf2>0.84) have been lower. The opposite is the case for seedlings height (hi2=0.87; hf2=0.76). The estimated total earnings ratio varies in terms of genetic characters in length measured with the highest genetic gains seedlings (80.56%- 63.37%) were estimated.

Thu, 339

The elucidation of effects of photosynthetic parameters, water status and lipid peroxidation in soybean exposed to gallic acid under cold stress

Ozfidan-Konakci, Ceyda, Evren Yildiztugay, Mustafa Kucukoduk (mkucukoduk@selcuk.edu.tr)

Cold stress (CS) is becoming the major concern for plant scientists worldwide due to the changing climate. CS may affect several aspects of crop growth; photosynthesis, water transport, growth, and finally crop yield. Photosynthetic parameters including the maximum photochemical efficiency (Fv/Fm), the photochemical quenching coefficient (qP), non-photochemical quenching (NPQ) and the actual quantum yield (ΦPSII) negatively changes in plants exposed to CS. The aim of our study was to examine whether exogenously applied with gallic acid (GA) enhances the tolerance of Glycine max L. subjected to cold stress. After soybean plants were hydroponically-grown for three weeks, seedlings were treated with/without GA (1 and 2 mM) and cold stress (5 and 10oC) for 72 hours. Results showed that CS-treated soybean seedlings had a reduction in growth rate (RGR) and water content (RWC). However, stress plus GA applications alleviated the decreased levels of RGR and RWC. The all stress treatments caused a reduction in Fv/Fm, qP and ΦPSII, but NPQ increased with stress treatments. These changes in photosynthetic parameters occurred by CS treatments alleviated with exogenous GA application. Besides, GA alone had any effects on the photosynthetic parameters. On the other hand, the levels of lipid peroxidation (TBARS) were pronounced in all the stress treatments. However, addition of GA under CS not only improved water status and growth, but also caused a reduction in lipid peroxidation. The present findings reveal that GA has a positive effect on cold stress mitigation by mainly regulating the growth, water status and photosynthetic parameters.

Thu, 338

Antioxidant activity of methanolic extracts from leaves of six *Rosa* species

Ozsoy, Nurten (nozsoy@istanbul.edu.tr), Sukran Kultur, Sezin Anıl

The genus *Rosa* L. is represented by 26 species in Turkey and some of them are used in traditional medicine as tonic, expectorant, stomachic, diuretic and for the treatment of diarrhoea, dyspepsia, nephritis, cold, flu, couhg, bronchitis and diabetes. Methanolic extracts

from leaves of six *Rosa* sp. (*R. iberica, R. micrantha, R. pisiformis, R. phoenicia, R. gallica* and *R. pulverulenta*) were tested in vitro for their polyphenolic contents and ability to scavenge DPPH, ABTS and superoxide radicals, reduce Fe (III) to Fe (II) and to inhibit peroxidation of phophatidylcholine liposomes, induced with ascorbate/Fe (III). The results showed that leaves of all *Rosa* sp. contain high amounts of phenolic compounds and possess significant antioxidant activity wich may be attributed to a strong reducing power, DPPH•, ABTS•+ and superoxide radicals scavenging and lipid peroxidation inhibitory activities. It was concluded that the extracts might be a potential sources of antioxidant phytochemicals with assotiated health benefits.

Thu, 336

Determination of mineral nutrient and heavy metal accumulation status of *Colchicum bivonae* Guss. from Abant/Bolu (Turkey)

Ozyigit, Ibrahim Ilker (ilkozyigit@marmara.edu.tr), Sedat Karadeniz, Fatih Tabanli, Recep Vatansever, Mehmet Emin Uras, Ibrahim Ertugrul Yalcin, Nuzhet Cenk Sesal, Goksel Demir

Colchicum spp. are perennial flowering plants distributed around the world. The species of this genus have been used as medicinal plants for centuries and now. In this study, we have investigated the mineral nutrient status and heavy metal concentrations of *C. bivonae* plant. Plant samples (bulb, stem and flower) were collected from grassland in two different localities of Abant/Bolu, Turkey. In plant samples, Ca, Cd, Cu, Fe, K, Mg, Mn, Na, Ni, Pb and Zn concentrations were analyzed. The measured highest and lowest concentrations follow as; Ca (lowest in bulb with 4405 mg/kg; highest in flower with 10721 mg/kg), Cd (lowest in flower with 0.043 mg/kg; highest in stem with 0.962 mg/kg), Cu (lowest in flower with 6.066 mg/kg; highest in bulb with 9.772 mg/kg), Fe (lowest in stem with 190.483 mg/kg; highest in flower with 277.004 mg/kg), K (lowest in stem with 11502 mg/kg; highest in bulb with 16844 mg/kg), Mg (lowest in flower with 3005 mg/kg; highest in stem with 4206 mg/kg), Mn (lowest in flower with 16.366 mg/kg; highest in bulb with 26.955 mg/kg), Na (lowest in stem with 192.266 mg/kg; highest in bulb with 268.950 mg/kg), Ni (lowest in stem with 0.952 mg/kg; highest in bulb with 2.805 mg/kg), Pb (lowest in flower with 1.522 mg/kg; highest in bulb with 2.645 mg/kg) and Zn (lowest in stem with 25.884 mg/kg; highest in bulb with 49.045 mg/kg). Study implicated that *C. bivonae* could accumulate Ca in higher amounts. In addition, Cu, Fe, K, Mg, Na, Ni and Zn were in acceptable ranges. Furthermore, Cd was high while Pb was in acceptable limits.

Thu, 330

Mineral nutrient status of *Cirsium byzantinum* Steud., a narrow endemic species from Istanbul (Turkey)

Ozyigit, Ibrahim Ilker (ilkozyigit@marmara.edu.tr), Bulent Eskin, Mehmet Emin Uras, Sedat Karadeniz, Recep Vatansever, Fatih Tabanli, Mustafa Keskin, Goksel Demir, Ibrahim Ertugrul Yalcin

Cirsium sp., which are members of Asteraceae family, have valuable economic importance because of their secondary metabolites. This study aims to investigate mineral nutrient status

of *Cirsium byzantinum* Steud., which is a narrow endemic species, and its soil-plant interactions. Plant and soil samples were collected from five different localities of Anatolian side of Istanbul (Turkey). The amount of some mineral nutrients (B, Ca, Fe, K, Mg, Mn, Na and Zn) were analyzed in soil and plant (root, stem, leaf and flower) samples by using an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES). As a result of the measurements, the average values (mg.kg-1 dw) of mineral elements measured in five different localities follow as: for soil, B (100.507), Ca (100.507), Fe (1855.570), K (1263.979), Mg (6109.591), Mn (156.034), Na (141.595) and Zn (21.685), for root, B(15.693), Ca (4466.252), Fe (33.771), K (6489.533), Mg (504.153), Mn (15.730), Na (53.441) and Zn (22.481), for stem, B(6.854), Ca (2069.973), Fe (15.359), K (3881.483), Mg (299.829), Mn (5.456), Na (29.786) and Zn (10.806), for leaf, B(13.860), Ca (3150.352), Fe (33.704), K (5862.236), Mg (483.763), Mn (12.156), Na (43.620) and Zn (15.278), and for flower, B (6.351), Ca (2028.235), Fe (152.561), K (3553.337), Mg (239.484), Mn (4.298), Na (26.693) and Zn (7.807). Overall, *C. byzantinum* showed a unique adaptation capability with its biotic/abiotic environment (Anatolian side of Istanbul), like many narrow endemic species.

Mon 148

Mapping the extent of occurrence of winter aconite (*Eranthis hyemalis* (L.) Salisb.) in Special Nature Reserve "Bagremara" (Serbia: Vojvodina)

Panjković, Biljana (biljana.panjkovic@pzzp.rs), Vida Stojšić, Ranko Perić, Sara Rilak, Alen Kiš, Aleksandra Vujasinović

Winter aconite (*Eranthis hyemalis* (L.) Salisb.) is an critically endangered and strictly protected species in Serbia which is recently known only from one locality near Bačka Palanka (Vojvodina) where it is occurring in black locust forest stand called "Bagremara" which was protected by state as Special Nature Reserve "Bagremara". Since its first discovery in 1996 the extent of occurrence of winter aconite population has never been fully studied. Based on our fieldwork conducted during the late winter 2014. as well as on our previous observation originating from the period 1996-2006. we were able to make the first complete map of the winter aconite extent of occurrence in the Bagremara. Its individuals are scattered along the 48 bigger groups (represented with polygons) and 33 smaller clumps (representing points). Overall population covering area is 14,615958 ha with estimated population size with more than 10 000 individuals. In the central part of the protected area are more common reproductive individuals while in buffer area are more frequent vegetative ones. The results of our research have substantial importance for the future planning of protection and improvement of the only winter aconite population as well as its habitat in Serbia.

Thu, 352

Long-term effects of fragmentation on spatial distribution of dry grasslands in a traditional Central European agricultural landscape

Paušič, Igor (igor.pausic@um.si), Danijel Ivajnšič, Mitja Kaligarič

Long term changes in grassland proportion and their relation to physical features (geographical parameters) were analysed within a typical agricultural landscape of Goričko Nature Park (NE Slovenia). Small-scale patchiness and its diversity reveal the typical

traditional agricultural landscape, which became fragmented due to changed socio-economic reasons at the end of the 18th and in the 19th century. Grasslands still dominated the landscape at the end of the 18th century. By 2012, 50% of the former grassland areas had been lost. 9.9% of the total study area comprises ancient grasslands; these areas were never changed. Nowadays grazing is virtually absent in the research area, and regularly-mowed semi-natural dry grassland fragments represent a kind of relict agricultural stage. On average, the largest remaining dry grassland fragments are those that are regularly mowed (managed). The remaining regularly managed grassland fragments in the research area are located closest to buildings, while abandoned fragments in early succession stages are the most distant. The latter clearly shows that abandonment processes first affect the fragments that are most distant (from human infrastructure in general). The area covered with forest changed little over the last 230 years. The analysed geographical parameters alone (altitude, aspect, inclination and distance to settlement) do not explain recent spatial distribution of the remaining dry grassland fragments in the research area according to the land use treatment regime. Their simultaneous effects, together with socioeconomic agents caused the recent distribution pattern in this studied landscape. Past and present decision-making by local farmers, together with the physical features of the landscape determine the spatial distribution pattern of dry grasslands in Goričko Nature Park.

Thu, 334

Effect of deficit irrigation on tomato fruit anatomy

Pećinar, Ilinka (ilinka@agrif.bg.ac.rs), Dragana Rančić, Sofija Pekić Quarrie, Radmila Stikić, Nadia Bertin, Catherine Cheniclet

One of the options for significant water saving used in agriculture is implementation different irrigation treatment such as regulated deficit irrigation, especially when apply to widely-grown crops, like tomato. Effect of water deficit conditions on fruit growth is usually reducing fruit size, but there are only a few references dialing fruit cell number and cell size. In aim to investigate responses of cellular traits in tomato fruit growth to deficit irrigation (DI) we used wild type (WT), Ailsa Craig and its flacca mutant deficient in plant stress hormone absissic acid (ABA). Plants were grown in chamber condition in control conditions. Roots were divided into approximate halves and repotted into two hydraulically separated pot compartments, they were subjected to two irrigation treatments: full irrigation (FI), and regulated deficit irrigation (DI). Cytological investigations of fruit pericarp were performed: Total cell number and mean cell size were determined using the method of cell separation by pectinase solution described by Bertin in 2002. Cell size measurements were done using "analyze particles" tool of Image J., after manually adjusting the segmentation threshold. We specifically addressed how pericarp thickness, cell number, size and setup of pericarp cell layers were affected by DI during fruit development. In WT plants exposed to DI fruits were significantly smaller with lower number of pericarp cells. In flacca DI induced a strong negative effect on cell division and expansion at an early stage, but in ripe fruit the effects of DI were similar in flacca and WT.

Tue, 253

Population variability of sweet chestnut *(Castanea sativa* Mill.) in Croatia according to the fruit morphology

Poljak, Igor, Marilena Idžojtić (midzojtic@sumfak.hr)

The sweet chestnut (*Castanea sativa* Mill.) is a noble hardwood providing multiple economic benefits. In Croatia sweet chestnut grows in very diverse ecological conditions, in various forest communities, on an area of about 35,000 ha. It is spread in two main, split areas in different climate zones. In the last few decades, chestnut blight has been causing the drying and decay of sweet chestnut trees, while its management is significantly influenced by man, which could lead to the loss of genetic diversity. For that reason, the sweet chestnut is on the list of priority species for the conservation of genetic resources. The aim of this study was to accesses the interpopulation and intrapopulation variability of sweet chestnut populations in Croatia according to the morphology of fruits. Nuts were sampled in 14 natural populations, from the whole area of sweet chestnut distribution range in Croatia. Ten morphological traits and four derived ratios were analyzed. Univariate and multivariate statistical techniques were used to evaluate the differences among and within populations. It was concluded that the analyzed morphological traits were very variable. There were significant differences among trees inside populations and among populations for all measured fruit traits. Populations from climatically different and geographically distant habitats, in other words from the Mediterranean and the continental region, differed for three studied characteristics. The research of variability is important for preparation and implementation of measures for the conservation of sweet chestnut genetic resources, whereas the morphological research of fruits is, along with chemical analysis, important as the first step in selecting trees as candidates for future autochthonous best-quality sweet chestnut cultivars.

Thu, 307

Morphology of extrafloral nectaries of *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae)

Poljuha, Danijela (danijela@iptpo.hr), Ines Kralj, Tea Zubin Ferri, Vanja Stamenković, Nikola Ljubešić, Barbara Sladonja

Ailanthus altissima (Mill.) Swingle (Tree of Heaven) is a deciduous tree in the Simaroubaceae family. It is a highly invasive plant, present on the IUCN list of 100 worst invasive species. Native to China and North Vietnam, today it is widespread on all continents, except Antarctica. It is most abundant in European and North American urban areas and along transport corridors where it damages pavement and building foundations. It can also invade natural habitats where it crowds out native species. Its allelopathic and medicinal effects are widely investigated. *A. altissima* has different types of floral and extrafloral nectaries. Three types of extrafloral nectaries that have been described occur on cataphylls, foliage leaves and pseudostipules. The first leaves have stalked nectaries with apical pores located at the base of the petioles. The completely developed pinnated leaves bear nectaries on the abaxial surface of the lamina, along the basal margins of the leaflets. Also the adaxial surface of the lamina has stalked nectaries. Extrafloral nectaries are major components of *A. altissima* secretory system but our knowledge of their morphology and role in tree physiology is limited. The aim of this research is to explore morphology of extrafloral nectaries in detail, using techniques of

light and scanning electron microscopy. We will use our results to compare earlier theories and discuss possible role and function of nectaries in excretion and elimination of excess sugars and regulation of photosynthetic activity.

Mon, 104

Cyanobacteria, algae and microfungi from Degurić cave, west Serbia

Popović, Slađana (spopovic.bio@gmail.com), Gordana Subakov Simić, Miloš Stupar, Nikola Unković, Dragana Predojević, Ana Blagojević, Milica Ljaljević Grbić

Biofilm forming cyanobacteria, algae and microfungi were investigated from samples taken from the entrance of the Deguric Cave in western Serbia. Measured ecological parameters, i.e. temperature, relative humidity and light intensity, had similar values at each sampling site. Chlorophyll *a*, water content, and content of organic and inorganic matter were determined from each biofilm sample, and their correlation was demonstrated using principal component analysis. Chl *a* showed correlation with biofilm weight and organic matter. Cyanobacteria, with prevalence of the species from the order *Chroococcales*, dominate the biofilm samples. The most frequently encountered were species from the genus *Gloeocapsa. Leptolyngbya* and *Nostoc* species were commonly documented *Oscillatoriales* and *Nostocles*, respectively. Only few green algae were documented, with *Desmococcus olivaceus* observed at the most of sampling sites. Mycological analyses revealed the dominant presence of Hyphomycetes of genera *Aspergillus*, *Cladosporium*, *Epicoccum*, *Penicillium* and *Trichoderma*, while Zygomycetes (*Mucor* spp. and *Rhizopus* spp.) were less abundant. Fungal spores documented on cave entrance most likely originated from surrounding vegetation, soil, and are deposited via air flow onto cave walls. Detrended correspondence analysis of cyanobacterial, algal and fungal taxa inhabiting Degurić cave was also performed.

Mon, 145

Survey of the lichen collections in the Croatian herbaria

Prlić, Dragan (prlicdragan@gmail.com), Siniša Ozimec

One of the activities of the „EU Natura 2000 Integration Project (NIP)“ in Croatia was collection of all available records with an aim to give an accurate inventory of lichen mycota in Croatia. Lichen collections and voucher lichen specimens were surveyed in two national public herbaria, both located in Zagreb: Croatian herbarium (ZA) at the Botanical Institute, Faculty of Science, and Fran Kušan herbarium (HFK) at the Faculty of Pharmacy and Biochemistry. In the Croatian herbarium (ZA), a total of 2,163 voucher specimens were found and registered, comprising 410 lichen taxa (383 species, 11 subspecies and 16 varieties). The earliest sample dates back to 1884, collected by Dragutin Hirc at Mt Viševica in Gorski kotar, while most of the specimens had been collected by Croatian lichenologist Fran Kušan (818 samples) and Austrian lichenologist Julius Baumgartner (372 samples). Most frequently collected lichen taxa were: *Caloplaca aurantia* (71 samples) and *Cladonia rangiformis* (67 samples). In the Fran Kušan herbarium (HFK), a total of 385 voucher specimens were found and registered, comprising 135 lichen taxa (123 species, 6 subspecies, 6 varieties). The oldest lichen sample was collected in 1908 (village Mokošica in the Dubrovnik region). Among the

voucher specimens, *Lecidella elaeochroma* was most numerous with 14 samples, and the majority of the lichen material was collected by Croatian lichenologist Fran Kušan (262 samples). Most of the lichen material kept in both herbaria originated from the island of Hvar in Central Dalmatia (341 samples in ZA; 214 samples in HFK), followed by Gorski kotar region (124 samples in ZA; 80 samples in HFK). Blank vouchers and those identified only to the genus rank were also found, usually taxa within the genus *Verrucaria*. The nomenclature of many taxa was outdated, therefore it was necessary to check the names and make nomenclatural revision.

Thu, 333

Effects of thyme essential oil on germination of wheat seeds

Pršin, Tjaša, Sabina Anžlovar, Matevž Likar, Jasna Dolenc Koce (jasna.dolenc.koce@bf.uni-lj.si)

Wheat is one of the most important cereal crops and seed infection can severely affect the harvest during post-harvest storage. Previously it was shown that direct exposure of wheat seeds to thyme essential oil (EO) for 24 hours significantly reduces fungal contamination as well as seed germination and therefore could be used as antifungal preservative. The aim of this study was to ascertain the conditions of germination of wheat seeds treated with the thyme EO. Wheat seeds were subjected to 0.2% thyme EO for three exposure times: 6, 12 and 24 hours. After the treatment, seeds were placed into germination chambers for 10 days. At the end, germination rate, shoot and root fresh weight, shoot height and root length were measured. The medium (12 h) and longer (24 h) EO treatment decreased and delayed germination while shorter (6 h) treatment had no effect on germination. Longer time of EO treatment caused stronger inhibition of germination and the negative effect was pronounced for the majority of the parameters measured in the seedlings. The inhibitory effects of EO were most pronounced for 24 h treatment that reduced size and fresh weight of shoots and roots. The 12 h treatment showed effects similar to the 24 h treatment but did not significantly lower the root fresh weight. The 6 h exposure reduced only shoot height and fresh weight, indicating greater tolerance of root to the thyme essential oil.

Mon, 151

Historical and contemporary demography of *Salvia officinalis* (Lamiaceae) as revealed by microsatellite (SSRs) markers

Radosavljević, Ivan (ivan.radosavljevic@biol.pmf.hr), Jelena M. Aleksić, Radiša B Jančić, Romeo Di Pietro, Marija Jug-Dujaković, Dmitar Lakušić, Danilo L. Stojanović, Zlatko Šatović, Zlatko Liber

Salvia officinalis L. is a perennial shrub native to eastern Adriatic coast and central and southern Appenines. Although well-known and valued for its high essential oils content, there is a significant lack of knowledge regarding its past and present native distribution. To obtain evidence of population genetic structure and phylogeography of this species, 62 natural populations sampled throughout entire distribution area were analysed using eight SSR markers. Majority of the populations grouped together in accordance with their geographical position. The highest levels of genetic variability and allelic richness were observed in

populations from the central and southern Adriatic. In contrast to populations from the Balkan Peninsula, Apennine populations are characterized by high differentiation levels suggesting their long-lasting genetic isolation. Based on obtained results, three glacial microrefugia were identified, two in Balkan Peninsula and one in southern Apennines. Possible dynamics and directions of post-glacial recolonization paths of *S. officinalis* were discussed.

Mon, 116

The effect of short- and long-termed salt stress on the moss *Atrichum undulatum* (Hedw.) P. Beauv.

Rajčić, Marija (rajcha.bgd@gmail.com), Vesna Nerić, Milorad Vujičić, Aneta Sabovljević, Marko Sabovljević

Salinity is an important environmental factor that affects all aspects of plant growth and development. Photosynthesis is especially sensitive to salt, as salt ions rupture thylakoid membranes, inactivate enzymes and break down chlorophyll. Chlorophyll retention under salt conditions can be used as a parameter to describe species salt tolerance. The ancesor of bryophytes belong to the first terrestrial plants. Thus, many of them express a high degree of abiotic stress tolerance, and able them to survive in the harsh environment. In this study, the effects of short- and long-termed salt stress on growth and development of the moss *Atrichum undulatum* (Hedw.) P. Beauv. were examined. Italian genotype of the moss *A. undulatum* was choosen and axenically grown in the in vitro conditions. The shoots were exposed for 4 days (short-term stress) or 28 days (long-term stress) to different NaCl concentrations (0-500 mM) to the basal medium. In the case of short-termed stress, after NaCl exposure for 4 days, plants were transferred onto salt-free media and grown for another 24 days to assess recovery. The results obtained by survival, indices of multiplication, secondary protonemal diameters, and biochemical parameters such as chlorophyll and carotenoid contents clearly showed the differences among *A. undulatum* reaction to short- and long-term salt stress exposure. These parameters characterized Italian (high mountain) genotype to be resistant to salt stress. Although the multiplication index and new shoots appearances decrease strongly with the salt concentration increase, plants survived up to 80% even at high NaCl (200 mM) content in the medium. When treated with 500 mM of NaCl, 50% of *A. undulatum* plants survived. Index of multiplication in moss declined with increasing salt concentrations, both under the short- and long-term salt stress. Chlorophyll a, b and total chlorophyll and carotenoid content were significantly affected by NaCl, and dependent on the stress duration.

Tue, 215

Pešter plateau`s species diversity (SW Serbia)

Ratknić, Mihailo (mihailoratknic@yahoo.com), Ljubinko Rakonjac, Tatjana Ratknić, Sonja Braunovć

Pešter plateau area is inhsbited with 1009 taxons (species and subspecies) gathered in 330 genuses, 85 families, 54 orgders and 5 clases. Divisio Pteridophyta is presented with 26 taxons, gatheresd in 14 genuses, 9 families and 2 orders. Gymnospermae have 8 taxons in 5 genus, 3 families and 2 orders. Angyospermae has been presented with 975 taxons, 325

genus, 76 families and 48 orders. Within the Angyospermae divisio Dicotyledones class is presented with 800 taxons, 262 genus, 67 families and 41 orders, while Monocotyledones have 175 taxons with 63 genus, 9 families and 7 orders. Percentage presence is as it follows: Pteridophyta have 2.67%, Gymnospermae with 0.7%, and Angyospermae 96.63% (from which Dicotyledones with 79.29%, and Monocotyledones with 7.34%). This points out absolutely domination of Angyospermae, Dicotyledones. Concerning Raunkier life forms as indicator of environmental conditions Hemicryptophytes dominates with 57.66%, while Phanerophytes takes significantly 12.88%. Geophytes are presented with 5.45%, Chamephytes with 8.24%, Therophyta 7.08% and Therophyto/chamephytes 8.70%. Total number of wooden species on Pešter plateau is 113, from which 58 trees and 55 shrubs. There is significant amount of single areal types (76). There are Central European floristic elements (25.29%), Euroasiatic floristic elements (20.92%), Submediterrenian (19.25%) and Ponto-Centralasiatic floristic elements (14.36%). There are 24 endemic and 3 subendemic plants, as well as terciar relicts. According to IUCN classification 76 endengered species were found. Flora`s richness and diversity have ben counted quantitatively throught ratio of given flora to investigated area. Result (0.993) has been significantly higher that average value for Serbia (0.718), Bosnia and Hercegovina (0.759), Montenegro (0.844), Albania (0.780), Bulgaria (0.704), Romania (0.657), Italy (0.684) and United Kingdom (0.601). Biodiversity protection of this area is partialy provided throught protected natural areas: Reserve Paljevine, Reserve Gutavica, special natural reserve Uvac River Canyon and Natural Park Golija.

Tue, 246

Phylogeography of *Campanula fenestrellata* s.l. (Campanulaceae) in the eastern Adriatic

Rešetnik, Ivana, Zlatko Liber, Zlatko Satovic, Sandro Bogdanović (sbogdanovic@agr.hr)

Campanula fenestrellata Feer subsp. *fenestrellata* and *C. fenestrellata* Feer subsp. *istriaca* (Feer) Federov belong to the morphologically and phylogenetically well established amphi-Adriatic group *Campanula* ser. *Garganicae* Trinajstić. Those two endemic taxa are distributed on the north-eastern Adriatic islands and coast. *C. fenestrellata* subsp. *istriaca* is present from Istria to Jablanac (Velebit littoral) and on the northern Adriatic islands, while *C. fenestrellata* subsp. *fenestrellata* is distributed from Jablanac southwards to Krka river. Their taxonomic status varies and they have been treated as separated species by some authors. Although recently several molecular phylogenetic studies revealed poorly resolved relationships between taxa in the ser. *Garganicae* as well as conflicting relations between the nuclear ITS and chloroplast DNA sequences, the two *C. fenestrellata* taxa always formed a distinct lineage. In order to further study the relationships among *C. fenestrellata* s.l. populations and to gain insight into genetic basis of taxonomic separation established on morphology we examined amplified fragment length polymorphisms (AFLPs) as well as nuclear and plastid DNA sequences (ITS and trnL-F). The sequence data revealed a shallow structure and no distinction between two taxa was observed. The AFLPs separated populations geographically and STRUCTURE analysis resulted in an optimal partition with eight clusters. Admixed populations were evident in the geographic area around Jablanac and Karlobag where the two taxa overlap indicating the presence of hybridization, while the northern and the southernmost populations were assigned to uniform separate clusters indicating the longer isolation of respective populations.

Mon, 142

Species richness and diversity of lichen communities by conservation through religion

Rohrer, Alexander, Vasiliki Kati, Helmut Mayrhofer, Lucia Muggia (lucia.muggia@uni-graz.at)

Sacred groves are ancient sacred natural sites in the Epirus mountains (North West Greece), which were preserved through religious rules. They represent localities with significant culture and biodiversity. The sacred groves of Epirus are usually located above settlements and function as protective forest belts shielding from landslides and torrents. In the today's abandoned cultural landscape their presence near villages is not very striking but it contrasted dramatically with the surrounding overgrazed and deforested landscapes during the prewar period, as documented by aerial photographs. The lichen biodiversity was studied as a part of a comprehensive project which aimed if the sacred groves of Epirus follow patterns associated with locally-adapted management practices and their value for local people and for biodiversity conservation. The species richness and diversity of epiphytic lichen communities in eight selected sites were analyzed by comparing sacred groves forests and surrounding managed forests, both consisting mainly of oak species. One hundred and fifty three lichen species were found but nearly half of them, 71 species, were only sampled once. The 'long tailed' distribution recovered in the species rank-abundance plot and the lack of a normal distribution in the log abundance plot are indicative of a low evenness of the species distribution. This effect is addressed to the limited number of sampled sites which were not characterized by homogeneous vegetation. Further, the high lichen diversity does not always correlate with the protected religious sites. Some of the sacred groves are shadowed forest consisting of old, big oak trees whose dense canopy reduces the light and the trunks are almost completely covered by bryophytes. Alternatively, some managed forests are particularly rich in lichen species, especially in cyanolichens of the order Peltigerales.

Mon, 136

Influence of alien species reforestation on herb and mycodiversity

Rućando, Marko (marko.rucando@dbe.uns.ac.rs), Milana Rakić, Maja Karaman, Miroslav Marković, Dragana Vukov, Ružica Igić

The research represents the beginning of a long-term study on the mountain Vidlič (southeastern Serbia) in protected natural area. In past, after frequent fires, reforestation was usually done by planting allochtonous species, usually *Pseudotsuga menziesii*. The main aim of this study was to estimate the influence of reforestation on the herbaceous and fungi species composition, species richness and diversity in autochthonous and allochtonous forest stands, including their resilience to climate change. Starting in 2011, two different forest stands in beech habitat were compared on the basis of plant and macrofungal diversity. Permanent plots (P1 – natural beech stand, P2 – planted stand of Douglas fir; 1000m^2 each; divided on smaller plots) were established for monitoring purposes. In first three years of research, higher plant species richness is noticed in P2 plots, but with general tendency to become lower during the vegetative seasons, due to competitive and opportunistic species like *Pteridium aquilinum* and *Rubus caesius*. In P1 plots, species richness was lower in spring, but with more stability during rest of vegetative period. Fungal diversity, during all three years, reflect the constant higher values for beech stand, with more or less dynamics, due to seasonal

climate change. Overall, this research may indicate that reforestation by allochtonous species, among other consequences, reflect in lesser evenness and more dynamics in understory layer with loss of fungal diversity. Further investigations will provide more information about the ability of studied herbaceous layer and fungal communities to cope with the changes in their habitat and impact of climate change, allowing recommendations for conservation management.

Thu, 346

River flow alteration driven differences in aquatic vegetation and species composition of the Begej River (Serbia)

Rućando, Marko (marko.rucando@dbe.uns.ac.rs)

The river Begej originates in the Carpathian Mountains of Romania, and with its lower part passes through Serbia in the region of Banat, where it eventually becomes a tributary of the river Tisza, hence becoming a part of the Danube River basin. Through history, the river Begej basin suffered numerous alterations driven by high human activities. During the 16th century, the river basin passing through the Municipality of Zrenjanin was significantly modified by connecting existing meanders, forming three islands and two river peninsulas. The main alterations took place back in the 18th, 19th, and the 20th century, resulting in many new formed river locks and connecting channels, making the river Begej a part of the large Danube-Tisza-Danube Hydro-system. Today, the river Begej basin comprises of the channel Begej, old river basin and three town lakes, as residues of the old river flow. The main aim of this study was to estimate the influence of human driven disturbances on the aquatic and semiaquatic species composition, species richness and diversity both in channel and remaining old parts represented by town lake complex. Results were compared to similar research in old part of the river Begej, now included in the Special Nature Reserve "Carska bara". The lowest species richness is presented in three town lakes, singling out one lake with partly built concrete bank; followed by protected part of old river in Special nature reserve, and finally the channel Begej with highest species richness values. Increased species richness and diversity index values in channel Begej are explained by positive effect of being a part of flowing stream with its water and sediment dynamism, but with greater openness for a highly competitive species. After severe human-induced changes on river stream, the main negative consequence, among others, are loss of sensitive species and an overall reduction in diversity due to multiple stressors.

Tue, 255

Pollen morphology of *Linum* L. (Linaceae), sect. *Syllinum* Griseb. from Turkey

Şafak Odabaşı, Nevin (nsafak@gmail.com)

Pollen morphology of 15 taxa belonging to the section *Syllinum* of the genus *Linum* from Turkey was investigated using light and scanning electron microscopy. Pollen grains are tricolpate, spheroidal and suboblate in shape and medium to large in size. Distyly predominantly present, with monomorphic exine in the short-styled flowers and with

dimorphic one in the long-styled. The only homostylic is *L. nodiflorum* which has dimorphic exine. Exine sculpture composed of gemmae and/or clavae.

Tue, 251

Are epicuticular waxes useful characters in differentiation of infraspecific taxa of *Pinus nigra* J.F. Arnold?

Šarac, Zorica (saraczorica@gmail.com), Bojan Zlatković, Snežana Jovanović, Gordana Stojanović, Srdjan Bojović, Petar Marin

The composition and micromorphology of epicuticular waxes of nine populations of three *Pinus nigra* subspecies (tentatively identified as *P. nigra* J.F. Arnold ssp. *nigra*, *P. nigra* ssp. *banatica* (Borbas) Novák, and *P. nigra* ssp. *pallasiana* (Lamb.) Holmboe), from Romania and central Balkan peninsula were analysed using GC-MS and GC-FID chromatography, scanning electron microscopy, and multivariate statistical techniques in order to test their taxonomic validity. In the needle waxes, four primary alcohols and fourteen n-alkane homologs with chain-lengths ranging from C21 to C33 were identified. The predomination of n-alkanes C27 and C25 was confirmed in all populations of ssp. *nigra* and ssp. *banatica*, while the major wax compounds in ssp. *pallasiana* populations were either n-alkanes C27 and C25 or primary alcohol cis-9-octadecen-1-ol. Statistical analyses (CDA; CA; post-hoc tests) indicated existence of three well-defined *P. nigra* groups, although ssp. *pallasiana* was characterized by the greatest degree of variability of cuticular wax composition pattern. The composition and micromorphology of epicuticular waxes are discussed in the light of their utility in taxonomy, as well as with regard to the biogeography of this extremely variable and complex pine species. According to data obtained, endemic Banat black pine deserves status of a separate taxon, which is closer to Crimean black pine (ssp. *pallasiana*) than typical subspecies (ssp. *nigra*).

Thu, 331

Antioxidant activity, phenolic and flavonoid contents of methanol extract of *Pyrus pyraster* fruit

Savić, Aleksandra, Ana Alimpić, Sonja Duletić Laušević, Petar D. Marin (p.d.marin@bio.bg.ac.rs)

Pyrus pyraster (L.) Burgsd. (Syn. *P. communis* subsp. *pyraster* (L.) Ehrh.), European wild pear, belonging to the family Rosaceae, is widespread across Europe, occurring in a scattered distribution pattern as single individuals or in small groups. It exists mostly at the edge of forests or in farmland hedges. The species shows great phenotypic variation. *P. pyraster* is thought to be one of the main wild ancestors from which the cultivated European pear (*P. communis* L.) has evolved. Pear fruits were collected in Southwest Serbia near Priboj during august 2013. Whole fruits were stored at −20°C, and subjected to extraction with methanol, separately flesh and peel, as well as the whole pericarp, to obtain crude extracts. Antioxidant activity of extracts was evaluated using DPPH, ABTS and FRAP assays, while total phenolic and flavonoid contents were determined spectrophotometrically. The extracts were tested at concentrations of 25 μg/ml for DPPH, FRAP assays and flavonoid content, and 2.5 μg/ml for

ABTS assay and phenolic content. The peel methanol extract showed higher DPPH activity (1729 μg/ml) comparing to flesh (4083 μg/ml) and whole pericarp extract (8234 μg/ml). ABTS test showed stronger activity of peel comparing to flesh (1.1 mg AAE/g and 0.76 mg AAE/g, respectively) and whole pericarp extract (0.77 mg AAE/g). Similarly, higher FRAP capacity was obtained for peel (1641 mmol FeII/g) comparing to flesh (613 mmol FeII/g) and whole pericarp extract (741 mmol FeII/g). The peel extract showed higher phenol (45 mg GAE/g) and flavonoid (41 mg QE/g) content comparing to flesh (20.2 mg GAE/g and 12 mg QE/g, respectively) and whole pericarp extract (22.2 mg GAE/g and 21 mg QE/g respectively). The higher phenol content correlate well to antioxidant activity obtained for peel extract. The presented findings indicate that *P. pyraster* can be exploited as healthy natural food, and potential source of natural bioactive compounds.

Mon, 126

Ethnobotanical survey and sraditional use of local pear varieties (*Pyrus communis* L.) from Southwest Serbia

Savić, Aleksandra, Sonja Duletić Laušević (sduletic@bio.bg.ac.rs), Zora Dajić Stevanović

The region of Southwest Serbia, Polimlje, is rich in naturalized and indigenous pear varieties (*Pyrus communis* L.) that are considered to be originated from Iran and Asia Minor. Although rare, they are still to be found as single trees in households or in small plantations. During field research, eleven localities and villages were explored. The interviews were done with 40 farmers, among them 75% were over 55 years, 22% between 30-50 years, and 3% up to 30 years. The farmers cultivated pears as an organic production for their needs. The great diversity of pear varieties with different shape, color, taste, ripening period, as well as local names, such as: “vodenjača”, “jeribasma”, “arpadžik”, ”karamanka”, “šećerka”, “bronzara”, “leskovača”, “kasidolka”, “kolačić”, “rskavac”, “zelenika”, “zimnjača”, “lisičica”, “ranica”, “mirisavac”, “ječmenka“, “sijerak”, “takiša”etc. were noted. Among surveyed varieties, “takiša” pear might be a good example of traditional use. This variety produces a small, hard and bitter fruits, which should be stored for a while until softening, and being suitable for usage. Characteristic “takiša” beverage prepared for decades is “vodnjika”, a sweet, slightly carbonated fizzy drink, rich in fruit acids. It is believed that “vodnjika” has a beneficial effect on lowering blood pressure. The other traditional domestic product of Polimlje is “sita”, the thick brown apple and pear syrup prepared from pulp of sweet or sour juicy fruits (karamanka, vodenjača, šećerka, etc). “Sita” is obtained by squeezing and boiling fruit juice from the pulp. It is consumed in sweets, diluted in water as juice, also in pancakes, or with mild milk cream. Domestic pear fruits are traditionally used fresh or for making pies and cakes, processing into juice, jam, as dried fruits, and especially for high quality local pear brandy. Many rural households have been preserved the traditional way of processing fruits as they have made the pear products during the past centuries.

Mon, 102

In situ microscopy in cultural heritage deterioration: Case study of ancient Roman stele

Savković, Željko (zexsavkovic@gmail.com), Miloš Stupar, Nikola Unković, Maja Franković, Tatjana Nedeljković, Dušan Maksimović, Dunja Davidović Gnjatović, Milena Jovanović, Jelena Vukojević, Milica Ljaljević Grbić

Microfungal community of ancient Roman stele from Kostolac, Serbia was investigated in situ, using ShuttlePix-Nikon microscope. Mycelium and reproductive structures of several fungal species were observed. Rock fragments were covered with hyaline and melanised mycelium, documented as distinctive network of hyphae. Melanised dyctiospores of *Alternaria* species were observed in conidial chains, arising from pigmented mycelium. Dark pigmented, lemon-shaped conidia of Acremoniella atra were observed in scattered masses, adjacent to hyaline mycelium. Presence of fungal growth on stele surface suggests potential deteriorative action on rock substrata via hyphal penetration and production of various pigments or acids. In contrary to actively growing micromycetes, several other fungi were isolated using traditional cultivation methods: *Chaetomium*, *Cladosporium, Fusarium, Mucor, Rhizopus, Trichoderma,* and *Trichotecium* species. Presence of various microfungi on deteriorated stele suface, along with documented lichens and mosses, demonstrates high level of biological colonisation and deterioration process in progress. In vitro microscopy resembles practical contemporary method for rapid detection of potential biological deteriogens present on solid substrata in natural environment and on cultural heritage objects.

Tue, 213

Changes in vascular flora on the island of Molat (northern Dalmatia) during 60 years period caused by land abandonment

Sedlar, Zorana (zorana.sedlar@biol.pmf.hr), Antun Alegro, Renata Šoštarić, Vedran Šegota, Vladimir Hršak

The eastern Adriatic coast is highly indented with many islands and peninsulas. This area is floristically very rich and many endemic species are recorded. However, although many parts of this area are well researched, some have been neglected. One of these is the island of Molat for which only two floristic researches have been made, one by Domac in 1950's and current one. The island is situated in Zadar archipelago, in eumediterranean zone, characterized by holm oak forest as climazonal vegetation, but mostly covered in maquis, and only partially in garrigue and rocky grasslands. Molat has been exploited as much as possible by local inhabitants, especially in the first half of the 20th century. However, in the last 60 years number of inhabitants has diminished which resulted in vegetation succession. In this process floristic changes have been recorded. During this research we recorded a total of 357 plant taxa on the island of Molat out of which 157 were confirmed from previous research made by Domac, 205 plant taxa were new for the island, while 136 taxa previously recorded were not found. With these results the island of Molat has 493 plant taxa recorded on it. Analysis of plant taxa endangerment and protection categories showed that 23 plant taxa known for the island of Molat are at some level of endangerment, 25 taxa are strictly protected and 28 protected in the republic of Croatia. Within these, 9 taxa at some endangered level, 6 strictly protected and 7 protected species were not confirmed while 8 taxa at some level of endangerment, 12 strictly protected and 11 protected taxa were new for the island. The

changes in vascular flora of the island of Molat recorded during this research are mainly caused by island depopulation (977 inhabitants in 1948 diminished to 197 inhabitants in 2011) and abandonment of traditional agriculture. This way habitats present on the island have been altered which was reflected on vascular flora.

Tue, 243

Anatomical structure of the leaf and stem of species of genus *Calamintha* Miller (Lamiaceae) from the central part of the Balkan Peninsula

Slavkovska, Violeta (violetas@pharmacy.bg.ac.rs), Branislava Lakušić, Dmitar Lakušić, Radiša Jančić

In this study was examined the anatomical structure of the leaf and stem of four species of genus *Calamintha*: *C. grandiflora* (L.) Moench (5 populations), *C. sylvatica* Bromf. (9 populations), *C. vardarensis* Šilić (1 population) and *C. glandulosa* (Req.) Benth. (5 populations). Taxonomic nomenclature by Ball and Getliffe (1972) and Šilić (1979) was used in the paper. The anatomical characteristics were analysed using light and scanning electron microscopy. The results of the analysis of surface leaf structures, leaf thickness, height of adaxial and abaxial epidermis cells, thickness of the palisade tissue, thickness of the spongy tissue, the stem radius, cortex thickness, thickness of the vascular cylinder, phloem thickness, xylem thickness and pith radius were processed by standard and multivariate analysis of variance (ANOVA), principal component analysis (PCA), canonical discriminant analysis (CDA) and UPGMA clustering method based on Mahalanobis' distances. The analysis of the anatomical structure of the leaf and stem of species of genus *Calamintha* ascertained that the species have resolved the problem of survival in their habitats by different ways. All the analysed species exhibit pronounced adaptive characteristics to specific habitat conditions. The shoot structure exhibits a transition from mesophytes with mesomorphic structure (*C. grandiflora*), via mesophytes with mesoxeromorphic structure (*C. sylvatica*) to xerophytes with xeromorphic structure (*C. vardarensis* and *C. glandulosa*).

Thu, 332

Defence response of *Degenia velebitica* (Brassicaceae) to solar UV radiation

Stamenković, Vanja (vstamen@botanic.hr), Saša Likić, Mirta Tkalec

Degenia velebitica (Degen) Hayek, a steno-endemic perennial plant which inhabits limestone crevices and screes exposed to intense solar radiation in the Mediterranean mountains of Croatia, was used as a model plant. The study was designed to distinguish the effects of solar UV from those of excessive PAR and to investigate acclimation responses of *D. velebitica* to solar UV radiation. Plants were separated into three experimental groups; plants grown under constant UV exclusion (UV-), plants grown under UV exclusion and then exposed to UV stress (UVs) and plants continuously exposed to the sun (UV+). The effects on oxidative stress parameters, activities of antioxidative enzymes, chlorophyll and carotenoid concentrations and the expression of proteins involved in the photosynthetic process as well as changes in flavonoids, possible UV filters and antioxidants, were investigated. No significant changes in hydrogen peroxide concentrations or damages to lipids and proteins

were observed in UVs plants compared to UV- plants. Activities of ascorbate peroxidase, catalase, superoxide dismutase and peroxidases were mostly similar in investigated plants. Also, changes in D1 and RuBisCO protein content were not observed suggesting that exposure to solar UV stress did not cause structural or functional damage to the photosynthetic apparatus. Still, increased accumulation of LHCII protein, chlorophyll a, chlorophyll b and carotenoids was detected in UV-exposed plants compared to UV- plants. Furthermore, concentrations of quercetin, kaempferol and isorhamnetin were significantly higher in UVs plants compared to UV- plants after 173 hours of exposure. Fluorescence microscopy showed that flavonoids were localised in epidermal trichomes, vacuoles and cell walls of epidermal cells, and in the palisade parenchyma on both the abaxial and adaxial sides of the leaves. Finally, we suggest that chlorophyll a, chlorophyll b, carotenoids and flavonoids constitute part of a response system in *D. velebitica* intended to serve as a defence from oxidants and excessive light energy. This mechanism could be a general acclimation mechanism for most Mediterranean plants exposed to intense solar UV radiation.

Mon, 138

Distribution of invasive plant species and floristical diversity of their habitats in the Ramsar areas of Vojvodina (Serbia)

Stanković, Vera (vera.batanjski@gmail.com), Eva Kabaš, Nevena Kuzmanović, Ranko Perić, Snežana Vukojičić, Dmitar Lakušić, Slobodan Jovanović

Wetlands are complex and fragile ecosystems, which are rare and endangered nowadays. Greater presence of invasive plant species in these habitats leads to changes of the native floristic diversity, so as the characteristics of its habitats. The aim of this study was the mapping invasive plant species, determining the native floristic diversity, as well as invasibility evaluation of different habitat types within the five protected Ramsar sites in the Northern Serbia (Vojvodina): Ludaško jezero, Slano Kopovo, Carska bara, Koviljsko-petrovaradinski rit and Obedska bara. A total of 17 tree, shrub and herbaceous invasive aliens that prefer riparian habitats in the wider sense, are selected. Recorded relevés were made according to Braun–Blanquet methodology, and georeferenced. Research was conducted in the period 2011-2015. A total of 376 relevés were made, where one or more invasive species were present. Assessment of habitat invasibility was based on the level of invasion which refers to the real number or proportion of alien species in the habitat, by determining the number of invasive plant species in the function of coverage and share in the general coverage. Habitat types were defined according to EUNIS codification. The results of the susceptibility analysis for invasions show that the largest number of invasive aliens is present in different types of forest habitats, within all studied areas. The most represented are *Acer negundo* L., *Fraxinus pennsylvanica* Marshall, *Amorpha fruticosa* L., *Bidens frondosa* L. and *Aster lanceolatus* Willd. Permanent establishment of invasive species in the grass habitats is limited by controlled grazing and mowing. As the wetlands are one of the two most endangered ecosystem types in the world, the importance of monitoring of invasive species for management of these internationally protected areas is of great importance and one of the first steps in protection.

Mon, 124

Representatives of the vascular flora of Serbia in Annex II of the Habitats Directive

Stojanovic, Verica, Ivana Jelic, Drgana Nedeljkovic, Ranko Peric, Vida Stojisic, Klara Sabados, Sara Rilak, Vladan Djordjevic, Zivko Vukasovic, Predrag Lazarevic (predrag.lazarevic@zzps.rs)

On the territory of the Republic of Serbia, which covers 1.8% of the European continent, 19% of vascular plant representatives of Europe are growing (3730 taxa). The greatest significance of all European legislations relating to the conservation of rare and endangered plants and their habitats, for the preservation and protection of plants and their habitats in Serbia has Council Directive 92/43 / EEC on the conservation of natural habitats and of wild fauna and flora. Three supplements of these Directives for Serbia noted 37 species and two genera of higher plants (*Lycopodium* and *Sphagnum*), making a total of 66 species. In Appendix II of the Habitats Directive there are 29 species of higher plants, the same number is in Annex IV and there are 34 species from Serbia in Annex V. In this paper, only representatives of vascular flora of Serbia with Annex II of the Directive will be considered, regarding 26 species of vascular plants in the Republic of Serbia for which there is an obligation to propose Natura 2000 sites before joining the European Union.

Tue, 207

***Myosotis refracta* Boiss. (Boraginaceae): a new, unexpected forget-me-not in Slovene flora**

Strgulc Krajšek, Simona (simona.strgulc@bf.uni-lj.si), Marko Accetto, Nejc Jogan

During the revision of herbarium material from Herbarium LJU, an unexpected species of forget-me-not was discovered. The specimens of *Myosotis refracta* were collected by Marko Accetto in years 1999 and 2007 in the valley of river Kolpa, border river between Slovenia and Croatia. All three specimens were previously determined as *M. stricta*. They have been collected in the tree different localities, all on foothill of overhanging rocks, in warm, calcareous habitats. The habitus of *M. refracta* plants is much different to all other forget-me-nots in Slovene flora. Plants are annuals with very delicate long and thin branches, leaves are up to 4 cm long and lanceolate. Inflorescence is long comparable to stem length, flowers are small, only up to 1.5 mm in diameter and pale blue. During ripening, the calyces elongate to cca. 4 mm and their pedicels become deflexed. Calyx is densely covered with patent hooked hairs. Hooked hairs on the base of calyx are strongly deflexed towards very short petiole. The distribution range of *M. refracta* is spreading from Mid-Asian mountainous ranges (Pakistan) on the East, to Western Mediterranean coast (Spain), in the Balkan Peninsula it is reported from Montenegro, Macedonia and Greece. So the gap between the known distribution range and the newly discovered localities is more than 500 km. Due to early flowering and extreme ecological conditions of *M. refracta* habitats it is highly possible that it could have been overlooked in similar habitats along the Western Balkan mountain ranges.

Tue, 250

Taxonomic revision of *Myosotis sylvatica* group (Boraginaceae) in Slovenia

Sušnik, Polona, Nejc Jogan, Simona Strgulc Krajšek (simona.strgulc@bf.uni-lj.si)

There have been 10 recorded species of the genus *Myosotis* in Slovenia so far. Our taxonomic research is focused on wider *Myosotis sylvatica* group: *M. sylvatica* s. str. and *M. decumbens* together with *M. alpestris* s. str. *M. alpestris* had been included in the research because of morphological similarity and frequent confusion with *M. sylvatica*. The main goals of our study were to clarify morphological and ecological differences between all three species, to confirm presence of all three in Slovenia and especially to make a simple and reliable determination key. Morphological characters from the literature that covers *Myosotis sylvatica* group in Europe were chosen for the analysis. We have also revised all the material in the herbarium of University of Ljubljana (LJU) and prepared a provisory determination key compiled from various sources. Herbarium material was supplemented with our field collections. Measurements of the morphological characters were the main part of our study and provided data for statistical analysis. Presence of all discussed species has been confirmed for the studied area. We confirmed weak morphological delimitation of the species included in research. The main distinguishing characters were the size of pollen grains and length of hooked trichomes on calyx. However, a large group of populations with somehow intermediate pollen grain sizes had been unexpectedly recognized. The morphometric traits of these specimens were mostly intermediate between *M. sylvatica* and *M. decumbens*. Almost all these specimens were collected in central and western part of Slovenia. We assume that we are dealing with a new taxon and further analyses are in progress. The new distribution of *M. sylvatica* s. str. is now limited only to central and eastern Slovenia. In conclusion our study suggests new *Myosotis* taxon that had not been recognized yet. Our study is just another proof of diversity of the Slovenian area, consequently high biodiversity and important reason for better nature conservation.

Mon, 123

On the edge of disappearance – case study of steppic grassland flora of the NATURA 2000 site near Bapska (E Croatia)

Šegota, Vedran, Nikola Koletić, Antun Alegro (antun.alegro@biol.pmf.hr)

On the easternmost part of Croatia, the steppic grasslands (alliance Festucion valesiacae Klika 1931) are the seminatural type of vegetation, due partially to low annual precipitation, which disables the forest formation. Owing to very fertile soil, over the time the majority of natural grasslands have been transformed into arable land. Small oases of steppic grasslands have been maintained for decades mainly as pastures, and occasionally by coppicing, with the short break during the war in 1990-ies, when traditional land use rapidly decreased. Barely three NATURA 2000 sites have been established recently in Croatia in order to preserve these remnants of steppic vegetation, flora and fauna, among which "Steppic habitats near Bapska (HR2001500)" is the largest one. During 2014 the preliminary survey of vascular flora of the site was performed. In total 79 taxa were recorded, among which several steppic elements (*Euphorbia segueriana* Neck., *Festuca valesiaca* Schleich. Ex Gaudin, *Scabiosa ochroleuca* L., *Xeranthemum annuum* L., *Potentilla cinerea* Chaix ex Vill., *Thymus pulegioides* L. ssp. *carniolicus* (Borbas) P.Schmidt). Besides characteristic steppic elements around 18 % of the

flora is of (sub) Mediterranean origin (e.g. *Alyssum alyssoides* (L.) L., *Medicago minima* (L.) Bartal., *Teucrium chamaedrys* L., *Verbascum phlomoides* L. etc.), especially the locally dominant grasses (*Chrysopogon gryllus* (L.) Trin. and *Dichanthium ischaemum* (L.) Roberty). The south-eastern part of the site is in rather good condition, due to intensive grazing by approximately 400 sheep on not more than 20 ha. The northern part is, on contrary, facing the process of vegetation succession, e.g. overgrowing by woody species (e.g. *Rosa canina* L., *Cornus mas* L., *Robinia pseudoacacia* L., *Prunus spinosa* L., *Ligustrum vulgare* L., *Crataegus monogyna* Jacq. etc.). Pasturing should be maintained and/or introduced onwards as traditional land use, however revitalising of former steppic areas is necessary, in order to ensure habitat requirements for the regionally extinct ground European souslik (*Spermophilus citellus* Linnaeus, 1766), flag species of the steppic grassland.

Tue, 206

Vicia loiseleuri (M. Bieb.) D. Litv. (Fabaceae) in Croatian flora

Šegota, Vedran (vedran.segota@biol.pmf.hr), Vladimir Hršak, Antun Alegro, Zorana Sedlar

Several specimens of unknown *Vicia similar* to *V. hirsuta* (L.) Gray, yet different from it, where found recently on the island of Mljet (southern Croatia). This raised questions about the presence of *V. loiseleuri* (M. Bieb.) D. Litv. in Croatian flora, initiating literature, herbaria and field investigation. While *V. hirsuta* has a wide European distribution, *V. loiseleuri* is restricted mostly to the Mediterranean area, Crimea and the Caucasus. Although known in neighbouring Slovenia and Montenegro, it has been broadly overlooked and misidentified by Croatian botanists. Despite being mentioned in literature at the end of 19th century, the species was overlooked in the Index florae Croaticae and Flora Croatica database. The herbarium revision of the V. hirsuta group from the ZA, ZAHO, CNHM and ZAGR revealed the city of Rijeka (1872) and the island of Lastovo (1966) as two historical finding places of the species. Furthermore, the recent synthesis of flora of Istria (Exkursionsflora für Istrien) finds *V. loiseleuri* rather common on the entire peninsula, as well as on the island of Krk. Therefore, *V. loiseleuri* should undoubtedly be added to the Croatian flora. Based on our material collected on the island of Mljet and on previously collected herbarium specimens from Rijeka and Lastovo, a morphological comparison between *V. hirsuta* and *V. loiseleuri* was made. The obvious differences in legume hairiness, shape of stipules, peduncle length and colour of flowers in Croatian populations strongly support *V. loiseleuri* as a morphologically clearly separated and easily identifiable species. Therefore, we proposed a determination key for the *V. hirsuta* group in Croatia. Further studies should include phaenological differences, already observed in other countries.

Tue, 212

Floristic and habitat diversity of Lipovo polje (Lika, Croatia)

Škunca, Luka (lskunca@geonatura.hr), Marina Škunca, Ana Đanić, Hrvoje Peternel

Lipovo polje is a karstic field in Lika region (Croatia), located north of the village of Gornji Kosinj and accumulation “Kruščica” on Lika River. It is situated at the mean elevation of 485 m a.s.l., covering area of almost 1500 ha with Lika river flowing through it. Currently, there is

no available floristic and habitat data for Lipovo polje, according to the Flora Croatica Database. The field work was carried out during one vegetation season in 2012, with 67 sampled localities. A total number of 189 taxa have been identified belonging to 56 families, with Poaceae, Asteraceae and Cyperaceae having the highest number of recorded taxa. Alongside the floristic research, a habitat map of Lipovo polje (in scale 1:5.000) has been created containing 19 habitat types classified according to the National Habitat Classification. The most dominant habitats are mesophilous grasslands, cultivated fields and oak woodlands. High floristic and habitat diversity of Lipovo polje could be attributed to the variations in microtopography and land use features present in the research area. The presented results represent the data from only one year study and therefore a more detailed survey is needed for mapping the complete floristic and habitat diversity.

Mon, 137

Cvjetka's School Of Nature – the saga of invasive alien species

Škunca, Marina (marina.skunca@udrugapopulus.hr), Luka Škunca

In order to make the educational content of biological themes accessible to the general public, in 2011 the Association Populus developed the program "Cvjetka's School of Nature“. The program encourages participants to spend more time outdoors, explore biodiversity and adopt a positive attitude towards environment and nature protection, whilst developing their creative and intellectual abilities at the same time. One of the goals of the program is raising awareness about the impact of invasive (plant) species on biodiversity. Therefore, as part of the program in 2014, picture book „The Anecdotes of Cvjetka Papratić – Saga of Invasive Alien Species“ was published in pdf format, available for free download from the Association's website. Moreover, several workshops for different age groups, with an emphasis on primary school children, were held on various manifestations - Days of Open Doors of Croatian NGOs, Pogonizacija and 3rd Science Picnic. The above mentioned workshops and publication will be presented in detail in the poster.

Thu, 335

Population variability of external flavones in some *Thymus* L. (Lamiaceae) species from Serbia

Šoštarić, Ivan (sostaric@agrif.bg.ac.rs), Jelena Arsenijević, Zora Dajić Stevanović, Renée J. Grayer, Petar D. Marin

Regarding number of species, the genus *Thymus* is one of the most important genera within the Lamiaceae family. The number of species may vary depending on the approach of the author, but if the concept of minimal variability is chosen 215 species have been described. Reproductive isolation between species seems to be weak, which makes taxonomical studies in this genus even more difficult. This genus is divided into 8 sections. In Flora of Serbia, 31 species and more than 100 infraspecific taxa have been described, all of which belong to section *Serpyllum*, except *Thymus comptus* and *T. striatus* (Sect. *Hyphodromi*) and *T. vulgaris* (Sect. *Thymus*). The aim of this work was to provide better insight into relationships among the populations and species of the genus *Thymus* from Serbia by analysis of surface flavones.

This work included populations of *T. pulegioides* (Subsect. *Alternantes*), *T. glabrescens*, *T. maschallianus* and *T. pannonicus* (Subsect. *Isolepides*), *T. balcanus* and *T. praecox* (Subsect. *Peudomarginati*). Analysed populations can be divided into two main profile groups; the first group comprises populations containing generally low and medium concentrations, as well as those with trace concentrations of surface flavones. In this group the dominant flavones were with a 5,6-diOH-7-OMe and 5,6-diOH-7,8-diOMe A-ring substitution pattern. The second group comprises populations containing generally low quantities of surface flavones, and with dominant 5-OH-6,7-diOMe and 5-OH-6,7,8-triOMe A-ring substitution pattern. *T. pulegioides*, *T. glabrescens* and *T. balcanus*, and some populations of *T. pannonicus* belong to the first, while *T. marschallianus*, some populations of *T. pannonicus* and *T. praecox* belong to the second group. Although flavone profiles do not correspond completely with taxonomic delimitation of subsections within the section *Serpyllum*, they can provide additional characters at species and subsection levels as well as in detecting of hybrid taxa.

Thu, 310

Features of development of species of *Thymus* L. (Lamiaceae) in Siberia (Russia)

Talovskaya, Evgeniya (kolegova_e@mail.ru)

Thymus L. is one of the largest genera in the flora of Russia. Because of the high variation of morphological characters most of species slightly differ from each other. In the flora of Siberia 35 closely related species were determined (Doronkin, 1997). For the purpose of identifying Siberian species, monitoring of the development of plants in different habitat conditions was conducted. Objects of research were *T. baicalensis* Serg., *T. jenisseensis* Iljin, *T. iljinii* Klok. et Schost. *T. jenisseensis* is a vegetatively-semimobile dwarf subshrub. It is found in the steppes on screes and shingles near river beds. The ontogeny of individuals consists of ontogenesis of a genet and ramets. Vegetative reproduction begins in the young generative state and continues until the old generative one. Particles are rejuvenated to the virginal state. Self-reproduction of the coenopopulation is mixed, performed equally by seeds and vegetatively. The duration of ontogeny is 5-6 years. *T. baicalensis* is a cushionlike dwarf shrub. It grows in sandy steppes on dune slopes and deflated planes. Cushionlike structure is formed in the mature generative state. Senescent particulation takes place in the old generative state. Self-reproduction of the coenopopulation is by seeds, vitality of seedlings is low. The duration of ontogeny is more than 40 years. *T. iljinii* is a vegetatively-mobile trailing dwarf shrub. It is found in the bunchgrass true and sandy steppes. The ontogeny consists of ontogenesis of a genet and ramets. Vegetative reproduction begins in the virginal ontogenetic state and lasts until the subsenil state. Ramets are rejuvenated to the immature state. Increase in the number of the coenopopulation and its self-reproduction happen due to ramets. The study showed that the characteristics of ontogeny of *Thymus* species were different. They can be used as additional criteria for determining taxonomic species. This study was financially supported by the Russian Federal Property Fund (Project no. 15-04-02857).

Thu, 309

Anatomical and palynological studies on Turkish endemic *Haplophyllum telephioides* Boiss. (Rutaceae)

Tekin, Mehmet (mtekin2280@gmail.com)

Haplophyllum telephioides Boiss. is an endemic species for Turkey. For anatomical investigations, cross section of root, stem and leaf, and superficial sections of abaxial and adaxial surface of the leaf were taken with razor blade. The sections were stained with Alcian blue and Safranin in the rate of 3/2. For palynological investigations under an optical microscope, the pollen slides were prepared by Wodehouse method. In the root cross section, outermost layer is multilayered periderm. The parenchymatous cortex is 7-9 layered. Cambium is distinguishable and 2-3 layered. Beneath the cortex, there is phloem layer which consists of 5-8 cell layers. The xylem tissue consists of the major part of the root. In cross section of the stem, there is single layered epidermis. The cortex consists of 8-13 cell layers. There are also schyzogenic gland sacs in the cortex layer. Thin phloem tissue consists of 3-5 cell layers. Cambium is distinguishable and consists of 1-3 flattened cell layers. Pith region is parenchymatous. There are single layered epidermises on both surface of the leaf. Leaf is ecvifacial. Upper palisade parenchyma is 2 layered and lower palisade parenchyma is 2-3 layered. There is 1-3 layered, narrow spongy parenchyma between two palisade. There are wide schyzogenic gland sacs beneath upper and lower epidermis in mesophyll tissue. There are anomocytic and sunken type stomata. The pollen grains of *H. telephioides* are radial symmetrical, isopolar and tricolporate. Pollen shape is prolate-spheroidal. Polar axis (P) 38.37 µm, equatorial diameter (E) 35.52 µm, P/E ratio 1.08, colpus longitude (Clg) 27.22 µm, colpus latitude (Clt) 3.54 µm, pore longitude (Plg) 10.93 µm, pore latitude (Plt) 9.77 µm, exin thickness 1.56 µm, intin thickness 0.81 µm. Exine sculpturing is striate under optical microscope. In this study, anatomical and palynological properties of *H. telephioides* were investigated in detail for the first time.

Thu, 344

Large-scale changes in surface area of important grasslands in the eastern part of Goričko Natura 2000 area between 2004 and 2012

Trčak, Branka (branka.trcak@ckff.si)

Goričko is a hilly region in the NE part of Slovenia with the lowest yearly precipitation in the country (under 900 mm). Its area is 462 km^2. The Goričko Nature Park was established in 2003. In 2004, the Goričko region became a part of the Natura 2000 Network. Non-forest habitats of Goričko were mapped according to Physis classification in 2003 and 2004 at 1:5000 scale. The eastern part of the area (258 km^2) was mapped again in 2010-2012 at 1:3000 scale. In 2012, we assessed the condition of individual grassland map polygons, based on overgrowth, presence of invasive species and species diversity. In 2012, important grasslands (Habitats Directive Annex I habitat types 6210(*), 6410, 6510 and 6230*) covered 14% (18 km^2) of non-forest areas of Eastern Goričko. The average surface area of each grassland map polygon was 0.002 km^2. Between 2004 and 2012 the total area of important grasslands was reduced by 28% (7 km^2). This change includes both destroyed and newly established grasslands. 16% of former important grasslands were converted into fields and another 7% were converted into improved grasslands. 7% of former important grasslands are

not mowed and are overgrowing with trees and shrubs, while another 5% are overgrowing with invasive species (primarily *Solidago gigantea*). A new 2.3 km^2 of important grasslands was formed on former intensive agricultural land, which proves that some important grasslands ($6210^{(*)}$ in 6230*) can be reestablished. The reasons for loss of important grasslands lie on one hand in intensification of agriculture (more fields and improved grasslands), and on the other in abandonment of agricultural use and consequential overgrowing. Overall, conservation measures for important grasslands in Goričko can be considered to have failed.

Tue, 247

Comparative anatomical studies on *Viola* L. (Violaceaee) species in European Turkey

Türkoğlu Koç, Müge (mugeturkoglu@hotmail.com), Feruzan Dane, Nuran Ekici

In this study, *Viola odorata* L. (Subgen. *Viola*), *V. kitaibeliana* Roem. & Schultes and *V. tricolor* L., *V. arvensis* Murray (Subgen. Me*l*anium) belonging to family Violaceae were compared by their anatomical features. The samples of examined taxa were collected from European of Turkey in 2012-2013. Plants sample were prepared as herbarium materials and voucher specimens deposited in the Herbarium of Trakya University, Edirne (EDTU). For light microscopy, materials were fixed in %70 ethyl alcohol at room temperature. Hand-sections were made from fixed stems and leaves. Cross-sections of stems were dyed with a mixture of 1% Safranin-Alcian blue 8GX at a ratio of 4:6. Surface section from the leaf (the upper and the lower) were dyed with Lugol. The stained and unstained sections were mounted in glycerine-gelatine to make permanent preparations. Also, the existence of crystals were investigated. The samples were treated with 2%5 commercial bleach (2.5% sodium hypochlorite) for 4 h. After washing in a 96% ethanol for 10 min., the samples were infiltrated with xylene for 10 min., mounted in entellan on slides. Crystals were examined in cleared tissues with a light microscope. The leaves were found out to be bifacial with stomata cells that are anamocytic. All species were found to be amphistomatic. In the surface section, epidermis cells of leaves is very undulate in *V. odorata, V. arvensis* and *V. kitaibeliana* but less undulate in *V. tricolor*. The stem anatomic features of the species are similar with pecularities belong species of the family Violaceae studied. The pith region of the stem is empty in Subgen. *Melanium* but it is not Subgen. *Viola*. Endodermis (one layers) was seen between cortex and vascular tissue but it was less distinguisable in Subgen. *Melanium*. *V. odorata* (Subgen. *Viola*) has not endodermis. The vascular tissues were collateral type and cambium is not distinguishable in all taxa. Sclerancimatic ring was not seen in *V. odorata*. It was thicker in *V. arvensis* while it has the less thickness in the *V. tricolor* and *V. kitaibeliana*. The presence of crystal was found in the vegetative organ of all taxa. The result of anatomical data will also contribute to filling in the gaps in the knowledge of Turkish *Viola*.

Mon, 144

Aeromycological monitoring of the old Church of the Holy Ascension (Veliki Krčimir, Serbia)

Unković, Nikola (nidzobio@gmail.com), Milica Ljaljević Grbić, Gordana Subakov Simić, Miloš Stupar, Željko Savković, Jelena Vukojević, Aleksa Jelikić, Dragan Stanojević

To assess the problems associated with biodeterioration, and subsequently enable adequate safeguard of monuments and sites of cultural heritage, mycological investigations based on defined standards are indispensable. The present paper reports the results of the analysis of biological particulates of fungal origin, and the assessment of the degree of variability of airborne fungal spore concentrations, as indicative of the level of air contamination in the exonarthex and nave of the old Church of the Holy Ascension in Veliki Krčimir (Serbia). Viable fungal propagules were sampled from altar portion of the nave and exonarthex, in summer and winter of 2013, via air sampler MAS-100 Eco (Merck Eurolab) set to 100 l min-1 air flow, and utilizing Petri plates with standard nutrient media - MEA. A total of 21 taxa were determined, of which the most abundant were, in descending order: *Aspergillus*, *Alternaria, Penicillium, Cladosporium* and *Fusarium*. Highest contamination, 1380 ± 226.27 CFU m^{-3} indoor and 2295 ± 91.92 CFU m^{-3} outdoor, was detected in the summer, while significantly lower degree of air contamination, 430 ± 84.85 CFU m^{-3} in the nave and 715 ± 59.62 CFU m^{-3} in the exonarthex, was documented in the winter. Although, to our knowledge, there are no universally accepted standards for permissible levels of fungal propagules in church environments, it is generally accepted that all indoor sites of cultural heritage with contamination above 300 CFU m^{-1} are considered highly contaminated. Furthermore, many microfungi documented in this survey are known biodeteriogens, and are associated with many symptoms of respiratory tract diseases.

Tue, 201

***Limonum korakonisicum* (Plumbaginaceae), a new species from Zakynthos Island (Ionian Islands, Greece)**

Valli, Anna-Thalassini (thalassinivalli@yahoo.gr), Rea Artelari

Limonium korakonisicum, a new species from Zakynthos Island (Ionian Islands, Greece), was discovered in September 2014 and its only known population is located in the southwestern coast of the island (locality Korakonisi). Korakonisi is an isolated rock connected to the main island by a narrow land-bridge and it is characterized by impressive geological formations. The species forms there a small population, which includes 100 individuals (complete census), while the 67 of them are mature according to IUCN definition. It grows in crevices of high, calcareous, sunny maritime cliffs and rocks with terra rossa, at an altitude of about 10 m a.s.l. According to IUCN *L. korakonisicum* fulfills Criterion D, mainly due to its very limited expansion/ restricted distribution (Extent of Occurrence less than 100 km2 and Area of Occupancy less than 10 km2), as well as its low number of mature individuals (less than 250). Thus, is here assessed as Endangered (EN). The hexaploid chromosome number (2n=6x=51), the karyotype and the self-incompatible pollen-stigma combination A (‘A’pollen and ‘Cob’ stigma), support that *L. korakonisicum* is an apomictic taxon originated through hybridization. Of great interest is that this new species is related to the polyploid apomictic *Limonium* species which are prevalent in the Aegean area and especially to the recently described

Cytherian endemic *L. spreitzenhoferi* Erben & Brullo. The morphological differences of *L. korakonisicum* from the above taxon as well as from the sexual diploid endemic *L.phitosianum* (2n=18) which coexists at the same locality are discussed.

Mon, 140

Some new occurrences of lichenicolous species from Balkan countries

Varga, Nóra (nora.varga@ymail.com), László Lőkös, Edit Farkas

The biota of lichenised and lichenicolous fungi of the Balkan and neighboring countries is still not sufficiently explored despite of the intensified investigation of diversity studies in the last few decades. Collections originate from mountainous and seashore areas of Albania, Greece, Montenegro and Serbia. During identification of mostly foliose and fruticose lichen species several lichenicolous fungi were detected. Some of them are new for at least one of the countries where our specimens were found, others represent new record for a smaller area or found on earlier unknown hosts. Even the detailed study of such common host lichen like *Xanthoria parietina* results numerous new records, or even *Xanthoriicola physciae* is most probably new for two of the studied countries (Albania and Serbia). This research was supported by the Hungarian Scientific Research Fund (OTKA K81232).

Mon, 143

Checklist of rust fungi (Pucciniales) in Croatia

Verčević, Nina (nina.vercevic@gmail.com), Tihomir Miličević

Rust fungi are the largest group of plant pathogenic fungi that belong in order Pucciniales (previously also known as Uredinales), class Pucciniomycetes (previously also known as Teliomycetes), phylum Basidiomycota. So far in the world were described over 7000 species of rust fungi from 168 genera classified into 15 families. The largest and best known family is Pucciniaceae with genus *Puccinia* which includes more than 4000 species. In Croatia rust fungi are, as well as other fungi, very poorly researched. Based on the review of the existing literature it was found that in Croatia about 180 species of rust fungi were described on different cultivated and wild plants, so far. Mostly these are studeis of foregin mycologists, from late 19th and early 20th century and for a long period we have no serious researches on the presence of these fungi in Croatia. Since the Croatian flora consists over 4400 species of plants, and most of plants can be hosts of this pathogen, number of undescribed species of rust fungi is certainly big. Therefore, one of the purpose of recently completed research project „Chorology of phytopathogenic fungi on plants of special importance in Croatian flora“ (2007-2014) was to investigate biodiversity of rust fungi. Within the project several species of rust fungi which have not been described in our contry (frst reports), were discovered, which contributed to better understanding of this group of plant pathogenic fungi in Croatia. Determination of rust species was based on the morphological characteristics of the spores (teliospore), and on the type of host plants, because rust are very specialized plant pathogens. The plant material with the findings of rust is in the herbarium, kept at the Department of Plant Pathology, Faculty of Agriculture, University of Zagreb.

Tue, 221

Micromorphology of seeds of *Prospero autumnale* (L.) Speta s.l. (Hyacinthaceae) from Serbia, Montenegro and FYR Macedonia

Vestek, Ana (ana.vestek@dbe.uns.ac.rs), Bojan Zlatković, Goran Anačkov

Micromorphological features of seeds of *Prospero autumnale* from Serbia, Montenegro and FYR Macedonia were investigated using binocular and scanning electron microscopy (SEM). Analysis was performed on a total of 105 specimens from eight populations. Three quantitative (length, width and seed length/width) and three qualitative characters (colour, shape and ornamentation) were studied. Statistical calculations were performed with Statistica for Windows ver. 12.0. The values of the length and width of seed derived from measurements differ from data in current literature. The dominant colour of seeds is black, with a few exceptions. The seeds are characterized by rugulose surface. On surface with less pronounced wrinkles are visible ovate or four-angled testa cells. Studied seeds could be divided into three types. Type I has crescent shape, which is the most frequent shape. Type II is characterised by intermediate shape between crescent and rounded and type III has oval shape. Results of the multivariant statistical methods (PCA and discriminant analysis) point to a clear differentiations between populations from Pannonian Plain and populations from mountainous parts of Serbia, Montenegro and FYR Macedonia.

Tue, 209

Floristic and habitat diversity of Ali Botush reserve (SW Bulgaria)

Vladimirov, Vladimir (vladimir_dv@abv.bg), Svetlana Bancheva, Malina Delcheva, Hristo Pedashenko, Kiril Vassilev

The study was aimed at inventorying the floristic and habitat diversity of Ali Botush reserve, identification of the species and habitats of conservation concern and their major threats, and proposing conservation measures. Ali Botush reserve is situated on the northern slopes of Mt. Slavyanka and covers 1638.12 ha. Field work was conducted in July – September 2014. Inventory of vascular plants was based on field trips on selected transects, phytosociological relevés, and on survey of already published data. Habitats diversity was assessed by field vegetation surveys using the Braun-Blanquet approach and the EUNIS habitat classification. The flora comprises more than 600 vascular plant species, many of which are of conservation concern. The taxonomic structure of the flora will be presented and the population state of the plants of conservation concern will be discussed. Altogether 14 EUNIS habitat types were recorded and mapped. Of these, 12 habitats are of conservation concern and cover 99% of the whole area. Major threats are natural vegetation succession, fire hazards, over-collecting of some medicinal plants and inappropriate regime of grazing. The floristic and habitats diversity is very high. Most species and habitats are in a good state and well preserved.

Tue, 219

Addition to the family Apiaceae from Carl Studniczka's Herbarium

Vladović, Dalibor (dalibor@prirodoslovni.hr), Božena Mitić, Nediljko Ževrnja

We analysed herbarium folder which contains herbarium sheets from the family Apiaceae, most of which were published in previous papers. According to the labels, the majority of herbarized material was collected in the area of Italy, France, Austria, Montenegro, Poland, Croatia, Romania, Slovenia, Czech Republic, Russia, Switzerland, Algeria, Hungary and Germany also have been registered. Most herbarium sheets belong to *Flora von Triest* collection. In reference to the part of Studniczka's herbarium which has already been there is one new collection: *Flora silesiach* which are mentioned for the first time; as well as the four botanists (collectors): Andrée, Felsmann, Oliver P. and Rach. Most herbarium sheets were collected by Studniczka himself (40). The oldest herbarium sheet dates from 1849 and the newest one is from 1903. Most herbarium sheets, 38 to be precise, were collected in the period from 1871 till 1880.

Thu, 343

Phenolic constituents and antioxidant activity of ethanolic extracts of endemic plant species *Centaurea ragusina* L. (Asteraceae)

Vujčić, Valerija (valerija.vujcic@biol.pmf.hr), Sandra Radić Brkanac, Marijana Radić Stojković, Mirko Ruščić, Branka Pevalek-Kozlina

Centaurea ragusina L. (Asteraceae) is a Croatian endemic perennial plant. Like some other species from *Centaurea* genus, *C. ragusina* is also interesting as a source of different bioactive substances with potential medicinal or pharmaceutical applications. The goal of this work was to determine the levels of total phenolics and phenolic groups as well as antioxidant activity in 80% ethanolic extracts of *C. ragusina* cultivated in vitro (½MS 2.9 μM GA3 + 0.5 μM BA and ½MS 2.5 μM IBA), acclimated from culture conditions (½MS 2.5 μM IBA) and collected at natural habitats (Sustipan and Katalinić brig). The correlation coefficients were also identified between the levels of total phenolics and phenolic groups and antioxidant activity. The highest level of total phenols, hydroxycinnamic acids, flavonols and proanthocyanidins was observed in ethanol extracts of leaves collected at Katalinić brig while the highest value of flavonoids was detected in calli ethanolic extracts cultivated in vitro (2.9 μM GA3 + 0.5 μM BA). Significant antioxidant activity measured by DPPH, ABTS, NO and FRAP methods was recorded in almost all ethanolic extracts. A positive correlation was found between the levels of total phenolics, as well as various groups of phenolic compounds and antioxidant activity of the extracts.

Mon, 118

In vitro development of the rare and endangered moss *Funaria muehlenbergii* Turn. (Funariaceae)

Vujičić, Milorad (milorad@bio.bg.ac.rs), Aneta Sabovljević, Marija Rajčić, Jelena Janković, Marko Sabovljević

The moss *Funaria muehlenbergii* Turn. is rare and threatened bryophyte species. Conservation aims to secure the long-term survival of habitats and species in nature. The aim of the study was to achieve the fully developed gametophyte and to propagate it for the purpose of conservation, reintroduction and introduction to potential habitats free from xenic contamination. Successfully achieved micropropagation of this threatened moss species enables better knowledge of its biology and is of great value for the further conservation and physiology research. The influence of exogenously added hormones, indole-3-butyric acid (IBA) and 6-benzyladenine (BA), on the morphogenesis of this species in vitro culture was examined. The plants were cultured under the long day regimen (16/8h photoperiod). The influence of plant growth regulators on the gametophyte multiplication, as well as protonemal diameter, was observed. The micropropagation of *F. muehlenbergii* was successfully applied on BCD medium supplemented with IBA and/or BA. According to the results, with the increase of IBA or BA concentration, there was a linear decrease of valve of the index of multiplication. Indices of multiplication as well as protonemal diameters were higher in plants grown on medium with added BA, than in plants grown on medium supplemented with IBA. When IBA and BA were applied together, the highest multiplication index was obtained on 0.3μM IBA and 3μM BA.

Tue, 211

***Cardamine fialae* Fritsch (Brassicaceae) a new species in Croatian flora**

Vukojević, Mara, Ivana Vitasović Kosić, Antun Alegro, Dmitar Lakušić, Sandro Bogdanović (sbogdanovic@agr.hr)

The Illyrian-Balkan species *Cardamine fialae* Fritsch was found for the first time in Croatia. It belongs to *C. maritima* complex, which includes seven endemic species with very restricted distribution. Six of them occur on the Balkan peninsula (*C. maritima* Port. ex DC., *C. adriatica* Jar. Kučera, Lihová & Marhold, *C. serbica* Pančić, *C. fialae* Fritsch, *C. montenegrina* Jar. Kučera, Lihová & Marhold and *C. rupestris* (O.E. Schulz) K. Malý), since one is distributed on the Apennine peninsula (*C. monteluccii* Brilli-Catt. & Gubellini). During a floristic survey of northern slopes of the Matokit Mt in surrounding of the town Vrgorac in inland of southern Dalmatia, a peculiar population of *Cardamine* has been found. Regarding its morphology, general habit, type of leaves and fruits, collected plants were determined as *C. fialae*. Herbarium vouchers of collected plants are digitalized and deposited in the herbarium ZAGR. Type specimens of *C. fialae* are deposited in herbarium GZU and they were consulted and confronted with specimens from Croatia. *C. fialae* was described in 1897 from surrounding of the settlement Klobuk in Bosnia and Herzegovina, which is eight kilometres air distance from the new locality on the Matokit Mt. Morphologically, *C. fialae* is similar to *C. serbica*, endemic in Serbia, with which it shares following characters: auricules at the base of lower cauline leaves, main stem and sepals hairy, stem and rosette leaves bipinnate, with serrate margin of leaflets. However, *C. fialae* differs by larger petals and

sepals and by 1-2 lateral stem branches. On the Matokit Mt, *C. fialae* grows on lower altitudes in rocky crevices within the zone of sub-Mediterranean vegetation of forest fringes.

Tue, 205

A contribution to the knowledge on the distribution of stenoendemic *Iris adriatica* Trinajstić ex Mitić (Iridaceae) in Croatia

Vuković, Nina (nina.vukovic@biol.pmf.hr), Slavko Brana, Sven D. Jelaska

First records of this dwarfed iris in Croatia date from the 19th century, when it was regarded as *Iris pumila*. After detailed taxonomical research in recent times, Croatian populations of *I. pumila* have gained a status of a separate species, named *Iris adriatica* Trinajstić ex Mitić. Most known findings of *I. adriatica* occur in the Northern and Middle Dalmatia, especially in the surroundings of Šibenik and on the islands of Šibenik archipelago. Until now, *I. adriatica* was generally considered a strictly Dalmatian species, with the northernmost locality on the island Vir. Fieldwork conducted during March 2014 resulted with the discovery of new populations. One new population was discovered in National Park Krka, which is the third known locality in the Park. Also, a new locality of *I. adriatica* was discovered on the island Cres, which is the northernmost known record, and the first record outside Dalmatia. The results of this study indicate that the areal of *I. adriatica* is wider than previously thought. It is possible that the species is sometimes overlooked in the field, due to relatively indistinctive appearance (very short plant with small, mostly pale yellow flowers) and early bloom (March and April).

Mon, 107

Epilithic and planktonic microalgae in two rivers of Albania

Xhulaj, Skerdilaid (xhulaj@yahoo.com)

The aim of the paper is to analyze the effect of the different river habitat on biological diversity of microalgae in order to reveal the status of algae indicators in the evaluation of river ecosystem health. The study is conducted to compare epilithic and planktonic algae in Semani river and Devolli river in autumn 2012. The trophic state is evaluated by saprobic system. There are 147 species belonging to 44 genera and 6 classes of planktonic algae and 52 species belonging to 14 genera and 3 classes of epilithic algae in the samples of Semani river. There are 115 species belonging to 33 genera and 6 classes of planktonic algae and 36 species belonging to 8 genera and 4 classes of epilithic algae in the samples of Devolli river. 13 genera orders 20 species of saprobic indicators are identified in the both rivers. The number of eutrophication indicators in Devolli river is lower than that in Semani river.

Mon, 119

Pollen and seed viability in three glacial relict plants of high conservation concern in Bulgaria

Yankova-Tsvetkova, Elina, Petka Yurukova-Grancharova, Vladimir Vladimirov (vladimir_dv@abv.bg), Georgi Baldjiev

Astragalus alopecurus, *Brassica jordanoffii* and *Potentilla fruticosa* are glacial relict plants of high conservation concern in the Bulgarian flora. *Astragalus alopecurus* is 'Critically Endangered' at national level, whereas the other two species are 'Vulnerable'. The three species are represented by single small populations in Bulgaria and are legally protected by the national Biodiversity Act. Two parameters of their reproductive biology were studied such as pollen and seed viability in order to assess the reproductive capacity of the species. The data obtained is as follows: *Astragalus alopecurus* has 85.04% pollen viability and 45.12% seed viability, *Brassica jordanoffii* – 71.97% pollen viability and 71.46 seed viability, and *Potentilla fruticosa* – 85.8% pollen viability and 57% seed viability. The results suggest that the rarity of the species in Bulgaria is not directly related to the pollen and seed viability that are relatively high in all the studied taxa.

Mon, 110

Some stoneworts (Charales) from coastal temporary ponds in Velipoja area (N Albania)

Zeneli, Vilza (m.vilza@hotmail.com), Lefter Kashta

Charophytes (stoneworts) constitute a group of macrophytes that occur mostly in fresh-water environments but can also be found in brackish waters. Knowledge about stoneworts in Albania is still scarce and incomplete. According to published data on charoflora of Albania, there are 23 species and four genera known from different freshwater habitats. The present work is based on plant material sampled from 5 slightly brackish-water temporary ponds in the coastal area of Velipoja (North Albania). During spring and summer 2013-2015, field surveys were carried out with the main purpose of filling knowledge gaps concerning brackish water charophytes. Altogether seven species were identified: four typical of brackish water habitat (*Chara baltica, C. canescens*, *C. galioides, C. connivens*) and three of broader tolerance (*C. aspera, C. vulgaris* and *Tolypella glomerata*). The first three species, which are considered as the rarest and most threatened on the Balkans, were found for the first time in Albania.

Tue, 203

Flora along the course of the Žrnovnica river (Dalmatia, Croatia)

Ževrnja, Nediljko (nediljko@prirodoslovni.hr), Dalibor Vladović, Dario Hruševar, Stjepan Mekinić, Gvido Piasevoli, Josip Boban, Sanja Barbarić, Ratko Cvitanić

Floristic research of the area along the course of the Žrnovnica river has been conducted during the year 2013 and 2014. River Žrnovnica is the short karst river, only 4.8 km in length. It rises on the southern slopes of the mountain Mosor, and flows into the Adriatic Sea near the

town of Stobreč. The study area includes both left and right banks of the watercourse, in the line weight of 10 m. The obtained floristic list contains 555 vascular plant taxa. From that number, 135 taxa were already noticed (according to the literature data) and 420 taxa were recorded for the first time. The paper contains analysis of floral elements and life forms of the investigated area.

Thu, 347

Analysis of forest vegetation types in Motovun forest (Istria)

Žiljak, Mirjana, Zrinka Mesić (zmesic@oikon.hr), Marina Škunca, Luka Škunca, Ana Đanić

Motovun forest located in the valley of the Mirna River and its tributary Butoniga is the last remainder of the Mediterranean floodplain forests settled along the Adriatic rivers valleys. Local hydrology of the area was changed by cutting off and abandonment of old Mirna river course which was passing through Motovun forest. Hydrologic conditions are one of the main factors which define the development and ecological conditions of floodplain forests which means their alteration can affect composition of forest vegetation. In order to preserve the Motovun forest, the revitalization project of old Mirna river course was planned. That is why in 2014 certain vegetation surveys were conducted in order to determine the ecological conditions of present forest habitats based on spatial distribution of bioindicator plant species. 104 relevés were made by using Braun-Blanquet method for assessing cover and abundance of herb, shrub and canopy layer. TWINSPAN method was used for floristic analysis of plots while the purpose of NMDS ordination method was analysis of vegetation changes along environmental gradients. For each plot, biodiversity indices were calculated and taking into account the coverage of certain plant species, the Ellenberg indicator values for moisture were determined. According to the mentioned analysis, six forest vegetation types were recognised. Their spatial distribution shows some spatial differences in floristic composition which partially depends on the level of humidity in different areas of Motovun forest.

Tue, 231

Morphological and anatomical differentiation of endemic *Hypericum rumeliacum* Boiss.: multivariate study

Zlatković, Bojan (bojanzlat@yahoo.com), Marina Jušković, Djordje Vukojević, Nataša Petrović

Possibility of infraspecific differentiation based on morphological and anatomical traits of endemic *Hypericum rumeliacum* from Balkan Peninsula was examined. Analysis included samples from 11 populations from Serbia, belonging to 3 described varieties (var. *blepharophyllum,* var. *rumeliacum* and var. *tenuifolium*). In total, 13 quantitative (morphometric) and 7 qualitative morphological characters of 165 specimens were analyzed. Additionally, 7 characters considering leaf micromorphology, 8 characters of leaf and 4 characters of steam anatomy were considered. We used various multivariate techniques (CA, PCA and CDA) in order to clarify the taxonomic status of identified taxa. According to morphological analyses, validity of two taxa (var. *rumeliacum* and var. *tenuifolium*) was confirmed. Furthermore, var. *blepharophyllum* showed great resemblance with var.

rumeliacum and therefore should be assigned to lower taxonomic rank. The results appointed to discrete level of differentiation, separating var. *tenuifolium* on the basis of petal length, as well as length and width of the middle cauline leafs. Additionally, analysis of qualitative traits separates this variety from the rest of the taxa even more. It was shown that leafs of this variety are lanceolate, rather than elliptic to narrowly elliptic in var. *rumeliacum* and var. *blepharophyllum*. Weak level of differentiation at anatomy level was recorded. As reported by literature sources var. *blepharophyllum* is separated into sole taxa based only on the presence of leaf marginal cilia. On one hand our research confirmed association of this trait with var. *blepharophyllum,* on the other hand the character was scarcely present in other studied taxa. However, we believe that there are more characteristics to be considered in order to clarify taxonomic rank of var. *blepharophyllum.*

Mon, 133

The dominant freshwater aquatic alien plants in Serbia

Živković, Milica (milica.zivkovic@dbe.uns.ac.rs), Ana Andjelković, Dušanka Cvijanović, Maja Novković, Dragana Marisavljević, Snežana Radulović

Aquatic freshwater ecosystems are especially prone to invasions by alien species, as they act as perfect corridors linking the neighboring habitats, and thus enabling the rapid dispersal of propagules of alien aquatic and semi-aquatic species. The strong anthropogenic influence highlights the role of human activities, which are a major source of the introduction and spread of aquatic invaders. This paper, dealing with aquatic alien plants species, combines the results of a detailed review of the available national sources, and the field surveys conducted during 2007-2014 period. Based on the data collected, six dominant alien aquatic plant species have been recorded in the freshwater ecosystems of Serbia. *Vallisneria spiralis* L. is the most abundant of the recorded species, with 88 records. The second most abundant is *Azzolla filiculoides* Lam. (69 records), closely followed by *Elodea nuttallii* (Planch.) H. St. John, with 54 records. *Elodea canadensis* Michx. with 46 records and *Azolla caroliniana* Willd. with 42 records follow them. *Cabomba caroliniana* A. Gray is the least numerous of the registered aliens, with only 4 records. In comparison with other countries of the region, Bulgaria and Macedonia which have 8 and 3 non-indigenous aquatic species respectfully and Croatia, which has 5, the figures are comparable. Nevertheless, as the neighboring country of Romania has 12 aquatic aliens and Hungary 25, it can be expected that the number of aliens in Serbia has a potential for increase.

Mon, 111

Siltation in Croatian rivers based on Diatom Siltation Index

Žižić Nakić, Antonija, Maja Miličić, Igor Stanković (igorstankovic1@gmail.com)

Diatom Siltation Index (DSI) calculated as percentage of motile diatoms (*Navicula* spp., *Nitzschia* spp., *Cylindrotheca* spp. and *Surirella* spp.) was tested on 338 samples from Croatian Water Diatom database. Samples were collected and analyzed in period between 2010 and 2015. Diatoms were collected on sampling sites designated by Croatian national monitoring program. Typology concept was used to distinguish different siltation rates

indicated by DSI. Values of DSI were analyzed on all sampling sites grouped according to ecoregion, catchment area, altitude, substrate type and weather they belong to spring area or lower river sections. DSI was low on all spring area sampling sites, no matter the ecoregion, catchment area, altitude or substrate type while it showed interesting differences in lower river sections with regards to grouping factor. Ecoregion concept showed that DSI was higher in Pannonian than in Dinaric Ecoregion. Differences in ecoregions also influenced on DSI values distribution grouped by catchment area. Results showed that DSI was higher in small, medium and very large rivers while it was unexpectedly lower in large rivers. That can be explained with the fact that 2/3 of sampling sites on large rivers are situated in Dinaric Ecoregion where siltation rate is generally low. DSI values grouped by substrate type and altitude showed that DSI was highest on silicate substrate and in lowland rivers, respectively. Results of this investigation indicate that DSI was proven as good tool for siltation overview in all types of rivers.

Mon, 155

Flora of steppe grassland (NATURA 2000 site) in Bilje (NE Croatia)

Žuna Pfeiffer, Tanja (tzuna@biologija.unios.hr), Dubravka Špoljarić Maronić, Vanda Zahirović, Filip Stević, Milorad Zjalić, Katarina Kajan, Valentina Šelja, Miran Koh, Antonija Zeko, Siniša Ozimec

Grassland area at the local cemetery in the village of Bilje (Baranja region, northeastern Croatia) is the last remnant of dry steppe grasslands of the alliance Festucion vallesiacae in Croatia. It is a site included in the national ecological network of Croatia (designated with code HR200078) which is part of the EU Natura 2000 network. Osijek-Baranja County proclaimed in 2001 protection of this steppe grassland in category of natural monument. The research of the grassland flora in the area of 0.63 ha was carried out during eight field surveys, from April to May, 2015. Total of 104 of vascular plants from 86 genera and 42 families were recorded. Among the identified taxa, the most belongs to Poaceae (11.0%), followed by Fabaceae (10.1%), Asteraceae (7.3%), Caryophyllaceae (6.4%), Brassicaceae (5.5%) and Lamiaceae (5.5%). Regarding the distribution of plant life forms, hemicryptophytes were dominant (62.4%), followed by therophytes (21.1%) and geophytes (12.8%). According to threatened status, given in Red Book of Vascular Flora of Croatia, three taxa are critically endangered (CR), one is vulnerable (VU) and three are nearly threatened (NT). High number of plant taxa recorded in this very small area suggests that steppe grasslands in Bilje is important for plant diversity.

List of participants and co-authors*

***as provided with abstracts, take care of the alphabetical order of letters not used in English alphabet!**

Accetto Marko
Trnovski pristan 18, SI-1000 Ljubljana, Slovenia

Aćić Svetlana
University of Belgrade, Faculty of Agriculture, Department of Agrobotany
Nemanjina 6, 11080 Zemun-Belgrade, Serbia
acic@agrif.bg.ac.rs

Akdağ Süleyman
Necmettin Erbakan University Department of Biology, Ahmet Keleşoğlu Faculty of Education, Necmettin Erbakan University
suleymandogu@gmail.com

Akdağ Turan
Necmettin Erbakan University Department of Animal and Plants Production, Seydişehir Vocational School, Necmettin Erbakan University, Konya, Turkey
turanakdag570@gmail.com

Aksoy Ahmet
Antalya University
Faculty of Arts and Science, Biology Department, Antalya
aksoy@akdeniz.edu.tr

Aksu Kalmuk Nursen
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, 61080 Trabzon, Turkey
nrsnaksu@hotmail.com

Akyol Ali Akın
Gazi University, Faculty of Fine Arts, Department of Conservation and Restoration of Cultural Properties, Material Research and Conservation Laboratory (MAKLAB)
TR-06830, Ankara / Turkey
aliakinakyol@gmail.com

Alegro Antun
Botanical Department, Division of Biology, Faculty of Science, University of Zagreb
Marulićev trg 20/II, Zagreb
antun.alegro@biol.pmf.hr

Aleksic Jelena
University of Belgrade, Institute of Molecular Genetics and Genetic Engineering (IMGGE)
VojvodeStepe 444a, PO box 23, 11010, Belgrade, Serbia
aleksic_jelena@yahoo.com.au

Alimpić Ana
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Takovska 43, 11000 Belgrade, Serbia
alimpic.ana@bio.bg.ac.rs

Anačkov Goran
University of Novi Sad Faculty of Sciences, Department of biology and ecology
Serbia, Novi Sad, 21000, 2 Trg Dositeja Obradovica
goran.anackov@dbe.uns.ac.rs

Anastasiu Paulina
Faculty of Biology and Botanical Garden "D. Brandza", University of Bucharest
Intr. Portocalelor 1-3, Bucharest, Romania
anastasiup@yahoo.com

Andjelkovic Ana
Institute for Plant Protection and Environment
Teodora Drajzera 9, 11040 Belgrade
ana.andjelkovic21@gmail.com

Andrić Andrijana
University of Novi Sad Faculty of Sciences, Department of biology and ecology
Serbia, Novi Sad, 21000, 2 Trg Dositeja Obradovica
andrijana.andric@dbe.uns.ac.rs

Anıl Sezin
Istanbul University, Faculty of Pharmacy,
Department of Pharmacognosy
sezin_kurtoglu@hotmail.com

Anđelković Ana
Institute for Plant Protection and Evironment
Teodora Drajzera 9, 11040 Beograd
ana.andjelkovic21@gmail.com

Anžlovar Sabina
Department of Biology, Biotehnical Faculty, University of Ljubljana
Večna pot 111, 1000 Ljubljana, Slovenia
sabina.anzlovar@bf.uni-lj.si

Arda Hayati
Trakya University, Science Faculty, Biology Department
Balkan Campus, Edirne, Turkey
harda@trakya.edu.tr

Arican Ercan
Istanbul University
Science Faculty, Molecular Biology and Genetics, Vezneciler
earican@istanbul.edu.tr

Arsenijević Jelena
University of Belgrade, Faculty of Pharmacy
Vojvode Stepe 450, 11221 Belgrade, Serbia
jelena.arsenijevic@gmail.com

Arsić Srdjan
Elementary School Radoje Domanović
Partizanski put 3, 17500 Vranje, Serbia
arsicsrdjan72@gmail.com

Arslan Gokhan
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, 61080 Trabzon, Turkey
gokhanarslan.2727@gmail.com

Artelari Rea
University of Patras

GR 265 00 Patras, Greece
artelari@uparas.gr

Asenov Asen
Privat participant from Sofia University "St Kliment Ohridtski"
Bulgaria; Sofia; blvd "Dragan Tsankov" 8; 164
asenasenov71@yahoo.com

Astashenkov Alexey
Central Siberian Botanical Garden of the Siberian Branch of the Russian Academy of Sciences
Russia, Novosibirsk, Zolotodolinskay st., 101
astal@bk.ru

Augustinović Zvijezdana
Križevci College of Agriculture
Milislava Demerca 1, 48260 Križevci, Croatia
zaugustinovic@vguk.hr

Aytaç Ayhan
Trakya University, Faculty of Economics & Administrative Sciences, Economy Department
Balkan Campus, Edirne, Turkey
ayhanaytac@yahoo.com

Bačič Tinka
Department of Biology, Biotechnical Faculty, University of Ljubljana
Večna pot 111, SI-1000 Ljubljana, Slovenia
martina.bacic@bf.uni-lj.si

Bağcı Yavuz
university of selcuk
science faculty, department of biology campus
Selcuklu/Konya
ybagci66@gmail.com

Balant Manica
University of Ljubljana, Biotechnical Faculty, Department of Biology
Vecna pot 111, Ljubljana, 1000 Slovenia
manicab@gmail.com

Baldjiev Georgi
Risk Assessment Center, Bulgarian Food Safetyz Agency
Tsar Boris III Blvd. №136, 1618 Sofia, Bulgaria
georgibaldjiev@gmail.com

Bancheva Svetlana
Institute of Biodiversisy and Ecosystem Research
Acad. G. Bonchev, bl. 23, 1113-Sofia, Bulgaria
sbancheva@yahoo.com

Barbarić Sanja
Natural History Museum and Zoo
Kolombatovićevo šetalište 2, 21000 Split
sbarbaric@prirodoslovni.hr

Barina Zoltán
Department of Botany, Hungarian Natural History Museum
1476 Budapest, P.O.Box 222, Hungary
barina@bot.nhmus.hu

Barudanović Senka
Faculty of Science, University of Sarajevo. Center for Ecology and Natural Resources - Academician Sulejman Redžić.
Zmaja od Bosne 33-35. 71000 Sarajevo.
sebarudanovic@gmail.com

Bašić Emina
Faculty of Science
Zmaja od Bosne 33-35
eminahadzic11@yahoo.com

Bekić Bojana
Institute of Agricultural Economics
Volgina 15, Belgrade, Serbia
bojana_b@iep.bg.ac.rs

Berta Alen
Oikon Ltd.
Trg senjskih uskoka 1-2, HR-10000 Zagreb
aberta@oikon.hr

Bertel Clara
Institut of Botany, University of Innsbruck
Sternwartestraße 15, A-6020 Innsbruck, Austria
clara.bertel@uibk.ac.at

Bertin Nadia
INRA, UR1115, Plantes et systèmes de culture horticoles
Site Agroparc Domaine St Paul, CS40509, 84914 Avignon Cedex 9, France
nadia.bertin@avignon.inra.fr

Biel Burkhard
Am Judengarten 3, D-97204 Höchberg, Germany
B.Biel@gmx.de

Bikić Milana
University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology
Trg D. Obradovića 2, 21000 Novi Sad, Serbia
milanabikic@hotmail.com

Bilir Nebi
SDU University, Faculty of Forestry, Department of Silviculture
Eastren Campus, Isparta-Turkey
nebibilir@hotmail.com

Bilovitz Peter Othmar
Institute of Plant Sciences, University of Graz
Holteigasse 6, A-8010 Graz, Austria
pe.bilovitz@uni-graz.at

Biruš Ivan
University of Zagreb, Faculty of Agriculture, Department of Seed Science and Technology
Svetošimunska cesta 25, 10000 Zagreb, Croatia
ivan.birus@gmail.com

Blagojević Ana
University of Belgrade, Faculty of Biology
Studentski trg 16, 11000 Belgrade
ekoanna@yahoo.com

Blinkova Martina
Institute of biology, Faculty of Natural Sciences and Mathematics, University of Sv. Kiril i Metodij
Skopje, Republic of Macedonia
mblinkova@yahoo.com

Boban Josip
Natural History Museum and Zoo
Kolombatovićevo šetalište 2, 21000 Split
josip@prirodoslovni.hr

Bogdan Saša
Faculty of Forestry, Department of Forest genetics, Dendrology and Botany

Svetošimunska 25, Zagreb
sbogdan@sumfak.hr

Bogdanović Sandro
Faculty of Agriculture, University of Zagreb
Svetošimunska 25, HR-10000 Zagreb, Croatia
sbogdanovic@agr.hr

Bogunić Faruk
University of Sarajevo, Faculty of Forestry
Zagrebačka 20, 71 000 Sarajevo, Bosnia and Herzegovina
faruk.bogunic@gmail.com

Bojović Srdjan
Institute for Biological Research "Siniša Stanković", University of Belgrade
Boulevard Despota Stefana 142, 11060 Belgrade, Serbia
bojovic@ibiss.bg.ac.rs

Bokić Bojana
University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology
Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia
bojana.bokic@dbe.uns.ac.rs

Borak Martan Valentina
Kamaufova ulica 10, 10000 Zagreb
valentina.borak@gmail.com

Bosak Sunčica
University of Zagreb, Faculty of Science
Roosevetov trg 6, 10000 Zagreb, Croatia
suncica.bosak@biol.pmf.hr

Bošnjak Ivana
University of Zagreb, Faculty of Science
Roosevetov trg 6, 10000 Zagreb, Croatia
ivana.bosnjak@biol.pmf.hr

Boža Pal
Prirodno-matematički fakultet, Univerzitet u Novom Sadu
Trg Dositeja Obradovića 2, 21000, Novi Sad
boza.pal@dbe.uns.ac.rs

Božin Biljana
University of Novi Sad, Faculty of Medicine
Hajduk Veljkova 3, 21000 Novi Sad, Serbia
bbozin2003@gmail.com

Brana Slavko
Istarsko botaničko društvo
Trgovačka 45, 52215 Vodnjan
slavko.brana@inet.hr

Branković Snežana
Faculty of Science
Radoja Domanovića 12, 34000 Kragujevac, Serbia
pavsnez@yahoo.co.uk

Braunovć Sonja
Institute of forestry
Kneza Višeslava 3, 11030 Belgrade, Serbia
sonjabraunovic@yahoo.com

Brečko Grubar Valentina
The Faculty of Humanities, University of Primorska
Titov trg 5, 6000 Koper, Slovenia
valentina.brecko.grubar@fhs.upr.si

Britski Dmitri
Komarov Botanical Institute RAS
197376, 2, prof. Popov str., St-Retersburg, RF
dmibri@binran.ru

Bulysheva Maria M.
Saint-Petersburg State University
7-9, Universitetskaya nab., St. Petersburg, Russia, 199034
massha_b@mail.ru

Buse-Dragomir Luminita
University of Craiova
Libertatii street, Craiova, 200583, Romania
luminita25dragomir@yahoo.com

Buzurović Uroš
Natural History Museum
Njegoševa 51, 11000 Belgrade, Serbia
uros.buzurovic@nhmbeo.rs

Caković Danka
University of Montenegro, Faculty of Natural Sciences and Mathematics, Department of Biology
G. Washington Street, 81 000 Podgorica, Montenegro
danka.petrovic@t-com.me

Candan Feyza
Department of Biology, Faculty of Arts and Sciences,
Manisa Celal Bayar University
Manisa, Turkey
feyzacandan2002@yahoo.com

Carpino Alberto
I.I.S. V. Emanuele II
via Cortese 1 - Catanzaro (ITALY)
albertocarpino@gmail.com

Caruso Giuseppe
I.I.S. V. Emanuele II
via Cortese 1 - Catanzaro (Italy)
caruso_g@libero.it

Celep Ferhat
Gazi University
Polatlı Faculty of Arts and Sciences, Biology Department, Polatlı-Ankara/TURKEY
ferhat_celep@hotmail.com

Çelik Bilge
Istanbul University
Institute of Science, Molecular Biology and Genetics, Vezneciler
bilgecelik1984>gmail.com

Cetinić Ivona
NASA Goddard Space Flight Center/USRA,Ocean Ecology Laboratory
Greenbelt, MD 20771, USA
icentinic@gmail.com

Cheniclet Catherine
University of Bordeaux, UMR 1332 Biologie du Fruit et Pathologie
F-33140 Villenave d'Ornon, France
catherine.cheniclet@bordeaux.inra.fr

Cieślak Elżbieta
Institute of Botany, Polish Academy of Sciences
Lubicz 46, PL-31-512 Krakow, Poland
e.cieslak@botany.pl

Çığır Yavuz
Erzincan University
Faculty of Arts and Science, Biology Department, Erzincan
yavuzcigir@gmail.com

Clementi Moreno
Department of Biology, University of Padova
via Ugo Bassi 58 B, 35131 Padova, Italy
moreno.clementi@bio.unipd.it

Colacino Carmine
University of Basilicata - SAFE
Via Ateneo Lucano 10 - 85100 Potenza, Italy
carmine.colacino@unibas.it

Çolak Adnan
Trakya University, Havsa Vocational School, Park and Garden Plants Department
Havsa, Edirne, Turkey
adnancolak@trakya.edu.tr

Constantinidis Theophanis
Faculty of Biology, Department of Ecology & Systematics, National & Kapodistrian University of Athens
Panepistimiopolis, 157 03 Athens, Greece
constgr@biol.uoa.gr

Coşkunçelebi Kamil
Karadeniz Technical University
Department of Biology, Faculty of Science, Karadeniz Technical University TR-61080 Trabzon, Turkey
kamil@ktu.edu.tr

Cvetić Antić Tijana
Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
tcvetic@bio.bg.ac.rs

Cvijanović Dušanka
Department of Biology and Ecology, Faculty of Science, University of Novi Sad
Trg Dositeja Obradovica 2, 21 000 Novi Sad
dusanka.cvijanovic@dbe.uns.ac.rs

Cvitanić Ratko
„Natura Illyrica“ Association for biodiversity conservation
Šišgorićeva 7, 21000 Split
ratko.cvitanic@gmail.com

Ćaćić Tatjana
University of Zagreb, Faculty of Agriculture, Department of Agricultural Botany
Svetošimunska 25, 10000 Zagreb, Croatia
tatjanacacic4@gmail.com

Čerenak Andreja
Slovenian Institute of Hop Research and Brewing
Cesta Žalskega tabora 2, 3310 Žalec, Slovenia
andreja.cerenak@ihps.si

Čorbo Adis
University of Sarajevo, Faculty of Natural Sciences and Mathematics, Department of Biology
Zmaja od Bosne 33-35, 71 000 Sarajevo, Bosnia and Herzegovina
adischoky@hotmail.com

Ćurković-Perica Mirna
University of Zagreb, Faculty of Science
Marulićev trg 9a, 10000 Zagreb, Croatia
mirna.curkovic-perica@biol.pmf.hr

Dahija Sabina
Faculty of Science
Zmaja od Bosne 33-35
sabina_dudevic@yahoo.com

Dajić Stevanović Zora
University of Belgrade, Faculty of Agriculture
Nemanjina 6, 11000 Belgrade, Serbia
zoradajic@agrif.bg.ac.rs

Damerval Catherine
CNRS
Le Moulon, 91190 Gif-sur-Yvette, France
damerval@moulon.inra.fr

Dane Feruzan
Trakya University Faculty of Sciences
Department of Biology, Faculty of Sciences, Trakya University, 22100 Edirne, Turkey
feruzandane@yahoo.com

Davidović Gnjatović Dunja
Central Institute for Conservation in Belgrade
Terazije 26, 11 000 Belgrade. Serbia
dunja.davidovic@cik.org.rs

Dayan Sergun
Trakya University, Faculty of Architecture, Landscape Architecture Department
Makedonya Campus, Edirne, Turkey
sergundayan@trakya.edu.tr

Delcheva, Malina
Department of Plant and Fungal Diversity and Resources, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
Acad. Georgi Bonchev St., bl. 23, 1113 Sofia, Bulgaria
malina.delcheva@gmail.com

Demir Goksel
Bahcesehir University
Bahcesehir University, Faculty of Engineering & Natural Sciences, Department of Environmental Engineering, Besiktas, 34353, Istanbul, Turkey
goksel.demir@eng.bahcesehir.edu.tr

Demiralay Mehmet
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, Trabzon, TURKEY
demiralay27@hotmail.com

Deroin Thierry
Museum National d'Histoire Naturelle
57 rue Cuvier CP39, 75005 Paris
deroin@mnhn.fr

Dimitrijević Dragoljub
Institute of Physics, University of Belgrade
Pregrevica 118, 11080 Belgrade, Serbia
dragoljub@ipb.ac.rs

Dinç Muhittin
Necmettin Erbakan University
Department of Biology, Ahmet Keleşoğlu Faculty of Education, Necmettin Erbakan University Konya/Turkey
muhdinc@yahoo.com

Di Pietro, Romeo
Department PDTA, Section Environment and landscape, Sapienza University of Rome
Via Flaminia, 72, 00196 Rome, Italy
romeo.dipietro@uniroma1.it

Dizdarević Aljoša
University of Sarajevo, Faculty of Natural Sciences and Mathematics, Department of

Biology
Zmaja od Bosne 33-35, 71 000 Sarajevo, Bosnia and Herzegovina
tanatos_87@yahoo.com

Djordjevic Vladan
Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
vlakiorhi@yahoo.co.uk

Dodoš Tanja
University of Belgrade - Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Studentski trg 16, 11000 Belgrade, Serbia
tanjadodos@bio.bg.ac.rs

Dodueva Irina
Saint-Petersburg State University
Universitetskaya emb.7/9, Saint-Petersburg, Russia
wildtype@yandex.ru

Doğan Hakan Mete
Gaziosmanpasa University Agricultural Faculty, Soil Science and Plant Nutrition Department, GIS/RS Division, Tasliciftlik Campus, Tokat/TURKEY
hmdogan@hotmail.com

Dogan Ilhan
Izmir Institute of Technology
Izmir Institute of Technology, Faculty of Science, Department of Molecular Biology & Genetics, Urla, 35430, Izmir, Turkey
ilhandogan@iyte.edu.tr

Doğan Musa
Middle East University
Faculty of Arts and Sciences, Biology Department, Ankara/TURKEY
doganm@metu.edu.tr

Doğu Süleyman
Necmettin Erbakan University
Department of Biology, Ahmet Keleşoğlu Faculty of Education, Necmettin Erbakan University Konya/TURKEY
suleymandogu@gmail.com

Dolenc Koce Jasna
Department of Biology, Biotehnical Faculty, University of Ljubljana
Večna pot 111, 1000 Ljubljana, Slovenia
jasna.dolenc.koce@bf.uni-lj.si

Dragićević Snežana
Natural History Museum of Montenegro
Trg Bećir-bega Osmanagića 16, Podgorica 374, Montenegro
sneza.dragicevic@t-com.me

Duletić Laušević Sonja
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Takovska 43, 11000 Belgrade, Serbia
sduletic@bio.bg.ac.rs

Duman Ozge
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, 61080 Trabzon, Turkey
ozgemduman@hotmail.com

Đanić Ana
Geonatura Ltd.
Trg senjskih uskoka 1-2
adanic@geonatura.hr

Đug Samir
University of Sarajevo, Faculty of Natural Sciences and Mathematics, Department of Biology
Zmaja od Bosne 33-35, 71 000 Sarajevo, Bosnia and Herzegovina
sdug@email.com

Đurović Sanja
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
sdjurovic@bio.bg.ac.rs

Ehrendorfer Friedrich
Department of Botany and Biodiversity Research, University of Vienna
Rennweg 14, A-1030 Vienna, Austria
friedrich.ehrendorfer@univie.ac.at

Ekici Nuran
Trakya University Faculty of Education
Department of Science Education
nuranekici@yahoo.com

Eleftheriadou Eleni
Aristotle University of Thessaloniki
Faculty of Forestry and Natural Environment, Aristotle University of Thessaloniki, University Campus, 54124 Thessaloniki Greece
eelefthe@for.auth.gr

Elmalı Nermin
university of selcuk
science faculty biology department campus
Selcuklu/KONYA
nerminelmalı@gmail.com

Erhatić Renata
Križevci College of Agriculture
Milislava Demerca 1, 48260 Križevci, Croatia
rerhatic@vguk.hr

Ersoy Huseyin
Trakya University
Faculty of Science, Department of Biology, 22030 Edirne, Turkey
hersoy20@hotmail.com

Eskin Bulent
Aksaray University
Aksaray University, Faculty of Economics and Administrative Sciences, Department of Public Administration, 68100 Aksaray, Turkey
b_eskin@hotmail.com

Espinosa Felipe
Museum National d'Histoire Naturelle
57 rue Cuvier CP39, 75005 Paris
felipeespinosam@gmail.com

Evangelista Enza
University of Basilicata - SAFE
Via Ateneo Lucano 10 - 85100 Potenza, Italy
enza.evangelista@alice.it

Fagaras Marius
Ovidius University of Constanta
1 Aleea Universitatii,

Constanţa
marius_fagaras@yahoo.com

Farkas Edit
Hungarian Academy of Sciences, MTA Centre for Ecological Research, Institute of Ecology and Botany
H-2163 Vácrátót, Alkotmány u. 2–4, Hungary
farkas.edit@okologia.mta.hu

Frajman Božo
University of Innsbruck, Institute of Botany
Sternwartestrasse 15, 6020 Innsbruck, Austria
bozo.frajman@uibk.ac.at

Franjić Jozo
Faculty of Forestry, Department of Forest genetics, Dendrology and Botany
Svetošimunska 25, Zagreb
jfranjic@sumfak.hr

Franković Maja
Central Institute for Conservation in Belgrade
Terazije 26, 11 000 Belgrade. Serbia
maja.frankovic@cik.org.rs

Gancheva Mariia
Saint-Petersburg State University
Universitetskaya emb.7/9, Saint-Petersburg, Russia
vaiagan@mail.ru

Ganeva Ana
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
Acad. Georgi Bonchev St., bl. 23, Sofia, 1113, Bulgaria
animoss@bio.bas.bg

Garnier-Géré Pauline
INRA, UMR 1202 Biogeco
69, Route d
pauline@pierroton.inra.fr

Gavarić Neda
University of Novi Sad, Faculty of Medicine
Hajduk Veljkova 3, 21000 Novi Sad, Serbia
nedalakic@gmail.com

Gavrilova Olga
Komarov Botanical Institute RAS
197376, 2, prof. Popov str., St-Retersburg, RF
gavrilova@binran.ru

Gavrilović Marjana
Botanical Society "Andreas Volni"
Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia
gavrilovicmarjana@gmail.com

Gavrilović Milan
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Takovska 43, Belgrade 11000, Republic of Serbia
mgavrilovic@bio.bg.ac.rs

Gjeta Ermelinda
Department of Biology, "Aleksander Xhuvani" University
Elbasan, Albania
ermelindagjeta@live.com

Glasnović Peter
Faculty of Mathematics, Natural Sciences and Information Technologies, University of Primorska
Glagoljaška 8, 6000 Koper, Slovenia
peter.glasnovic@zrs.upr.si

Glišić Radmila
Faculty of Science
Radoja Domanovića 12, 34000 Kragujevac,
rada@kg.ac.rs

Gornov Ganiil
SPbGUniversity
199034, 7-9, Universitetskaya nab., St-Retersburg, RF
gornov@gmail.com

Gozukirmizi Nermin
Istanbul University, Molecular Biology and Genetics Department
Istanbul University, Molecular Biology and Genetics Department, 34118, Vezneciler-Istanbul/Turkey
nermin@istanbul.edu.tr

Grašič Mateja
University of Ljubljana, Biotechnical Faculty, Department of Biology
Večna pot 111, SI-1000 Ljubljana, Slovenia
mgrasic@gmail.com

Grayer Renée J.
Jodrell Laboratory, Royal Botanic Gardens, Kew
Richmond, Surrey TW9 3AB, UK
r.gayer@kew.org

Grdiša Martina
University of Zagreb, Faculty of Agriculture
Svetošimunska 25, HR-10000 Zagreb, Croatia
mgrdisa@agr.hr

Gržetić Ivan
Faculty of Chemistry, University of Belgrade
Studentski trg 12-16, 11000 Belgrade, Serbia
grzetic@chem.bg.ac.rs

Güler Necmettin
Trakya University, Science Faculty, Biology Department
Balkan Campus, Edirne, Turkey
nguler@trakya.edu.tr

Gültepe Mutlu
Giresun University
Bulancak School of Applied Science, Giresun University, TR-28300 Giresun, Turkey
mutlugultepe61@gmail.com

Güneş Fatma
Trakya University
Faculty of Pharmacy, Department of Pharmaceutical Botany Edirne 22100, Turkey.
drgunes@gmail.com

Hafner Dubravka
Faculty of Science and Education, University of Mostar
Matice hrvatske bb, BiH - 88 000 Mostar, Bosnia and Herzegovina
dubhafner@gmail.com

Hajdari Avni
Institute of Biological and Environmental Research, University of Prishtina "Hasan Prishtina"
Mother Teresa, 1000 Prishtinë, Kosovo
avni.hajdari@uni-pr.edu

Hajrudinović-Bogunić Alma
University of Sarajevo, Faculty of Forestry
Zagrebačka 20, 71 000

Sarajevo, Bosnia and Herzegovina
alma.hajrudinovic@gmail.com

Hampe Arndt
INRA, UMR 1202 BIOGECO
69, Route d
arndt@pierroton.inra.fr

Harpke Dörte
Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)
D-06466 Gatersleben, Germany
doerte.harpke@gmx.de

Hayirlioglu-Ayaz Sema
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, 61080 Trabzon, Turkey
sha@ktu.edu.tr

Hlavati Širka Vesna
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11 000 Belgrade, Serbia
vesnahsirka@gmail.com

Horvatić Janja
Josip Juraj Strossmayer University of Osijek, Department of Biology
Cara Hadrijana 8A, 31000 Osijek
janja.horvatic@gmail.com

Hršak Vladimir
PMF - Division of Biology
Marulićev trg 20/II
vladimir.hrsak@biol.pmf.hr

Hruševar Dario
Universyty of Zagreb, Faculty of Science, Division of Botany
Marulićev trg 9a, 10000 Zagreb
dario.hrusevar@biol.pmf.hr

Hülber Karl
Department of Botany and Biodiversity Research, University of Vienna
Rennweg 14, A-1030 Vienna, Austria
karl.huelber@univie.ac.at

Humbatov Zaur
Azebaijan State Agricultural University
262 Ataturk av. AZ2000,Ganja, Azebaijan
zaurgumbatov@yandex.ru

Iamonico Duilio
Department PDTA, Section Environment and landscape, Sapienza University of Rome
Via Flaminia, 72, 00196 Rome, Italy
d.iamonico@yahoo.it

Idžojtić Marilena
University of Zagreb, Faculty of Forestry
Svetošimunska 25, 10000 Zagreb, Croatia
midzojtic@sumfak.hr

Igić Ružica
University of Novi Sad, Faculty of sciences, Department of biology and ecology
Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia
ruzica.igic@dbe.uns.ac.rs

İlhan Veli
Erzincan University
Faculty of Arts and Science, Biology Department, Erzincan
veliilhan@gmail.com

Ilić Miloš
University of Novi Sad, Faculty of sciences, Department of biology and ecology
Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia
milos.ilic@dbe.uns.ac.rs

Ilijević Konstantin
Inovation Centre of Faculty of Chemistry, Faculty of Chemistry, University of Belgrade
Studentski trg 12-16, 11000 Belgrade, Serbia
deepbllue@gmail.com

Imamoglu Kemal Vehbi
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, 61080 Trabzon, Turkey
kvimamoglu@ktu.edu.tr

Inceer Huseyin
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, 61080 Trabzon, Turkey
inceer@ktu.edu.tr

Ion Roxana
Institute of Biology Bucharest
Spl. Independentei 296, Bucharest, Romania
roxanaion85@gmail.com

Ivajnšič Danijel
Biology Department, Faculty of Natural Sciences and Mathematics, University of Maribor
Koroška c. 160, SI-2000 Maribor, Slovenia
dani.ivajnsic@um.si

Ivanković Mladen
Croatian Forest Research Institute
Cvjetno naselje 41, 10450 Jastrebarsko, Croatia
mladeni@sumins.hr

Jabbour Florian
Museum National d'Histoire Naturelle
57 rue Cuvier CP39, 75005 Paris
fjabbour@mnhn.fr

Jakovljević Ksenija
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
kjakovljevic@bio.bg.ac.rs

Jakovljević Olga
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden „Jevremovac"
Takovska 43, 11000 Belgrade, Serbia
olga.jakovljevic@bio.bg.ac.rs

Janaćković Pedja
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Takovska 43, Belgrade 11000,

Republic of Serbia
pjanackovic@bio.bg.ac.rs

Jančić Radiša
Department of Botany, Faculty of Pharmacy, University of Belgrade
Vojvode Stepe 450, 11000 Belgrade, Serbia
rjancic@pharmacy.bg.ac.rs

Janjić Đurđica
University of Novi Sad, Faculty of Science, Department of Biology and Ecology
Trg D. Obradovic 2, 21000 Novi Sad, Serbia
djurdjica.simin@dbe.uns.ac.rs

Janković Ivana
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
ijankovic@bio.bg.ac.rs

Janković Jelena
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
jelena.jankovic@bio.bg.ac.rs

Jelaska Sven D.
University of Zagreb, Faculty of Science, Division of Biology, Department of Botany
Marulićev trg 20/II, 10000 Zagreb
sven.jelaska@biol.pmf.hr

Jelic Ivana
Institute for nature conservation of Serbia
Dr Ivana Ribara 91, 11070 Belgrade, Serbia
ivana.jelic@zzps.rs

Jelikić Aleksa
Institute for the Protection of Cultural Monuments in Serbia
Radoslava Grujića 11, 11000 Belgrade, Serbia
aleksa.jelikic@yuheritage.com

Jenačković Dragana
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš
Visegradska 33, 18000 Niš, Serbia
draganaj@pmf.ni.ac.rs

Ježić Marin
University of Zagreb, Faculty of Science
Marulićev trg 9a, 10000 Zagreb, Croatia
marin.jezic@biol.pmf.hr

Jogan Nejc
Department of Biology, Biotechnical Faculty, University of Ljubljana
Večna pot 111, SI-1000 Ljubljana, Slovenia
nejc.jogan@bf.uni-lj.si

Jovanović Jelena
University of Belgrade, Faculty of Biology
Studentski trg 16, 11000 Belgrade
jelenajov88@gmail.com

Jovanović Lana
Department of Plant Ecology and Phytogeography, Faculty of Biology, University of Belgrade
Takovska 43, Belgrade, Serbia
lanajovanovic1@hotmail.com

Jovanović Milena
Central Institute for Conservation in Belgrade
Terazije 26, 11 000 Belgrade. Serbia
milena.jovanovic@cik.org.rs

Jovanović Slobodan
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11 000 Belgrade, Serbia
sjov@bio.bg.ac.rs

Jovanović Snežana
Department of Chemistry, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
coka.sslagalica@gmail.com

Jug-Dujaković Marija
Institute for Adriatic Crops and Karst Reclamation
Put Duilova 11, 21000 Split, Croatia
masa@krs.hr

Jušković Marina
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
marinaju@pmf.ni.ac.rs

Kabaš Eva
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
ekabas@bio.bg.ac.rs

Kabashi Edona
Institute for Biological and Environmental Research, Faculty of Mathematical and Natural Science, University of Prishtina "Hasan Prishtina".
Eqerem Qabej st. 10000 Prishtinë, Kosovo
k_dona_k@hotmail.com

Kadioglu Asım
Karadeniz Technical University, Faculty of Sciences, Department of Biology, Trabzon, TURKEY
asimkadioglu@gmail.com

Kahraman Ahmet
Usak University
Faculty of Arts and Sciences, Biology Department, Uşak/TURKEY
ahmet.kahraman@usak.edu.tr

Kajan Katarina
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia

Kaligarič Mitja
Biology Department, Faculty of Natural Sciences and Mathematics, University of Maribor
Koroška c. 160, SI-2000 Maribor, Slovenia
mitja.kaligaric@um.si

Kalpoutzakis Eleftherios
Faculty of Biology,

Department of Ecology & Systematics, National & Kapodistrian University of Athens
Panepistimiopolis, 157 03 Athens, Greece
elkalp@pharm.uoa.gr

Kamberović Jasmina
University in Tuzla, Faculty of Natural Sciences and Mathematics
Univerzitetska 4, 75 000 Tuzla
jasmina.kamberovic@untz.ba

Karadeniz Sedat
Marmara University
Marmara University, Faculty of Science and Arts, Department of Biology, 34722 Istanbul, Turkey
sedatkaradeniz.ktu@gmail.com

Karadžić Vesna
Institute of Public Health of Serbia „Dr Milan Jovanovic Batut“
Dr Subotića 6, 11000 Belgrade
vesna_karadzic@batut.org.rs

Karalija Erna
Faculty of Science
Zmaja od Bosne 33-35
erna.karalija@gmail.com

Karaman Maja
Faculty of Sciences, University of Novi Sad
Trg Dositeja Obradovića 3, Novi Sad 21000, Serbia
maja.karaman@dbe.uns.ac.rs

Karamian Roya
Bu-Ali Sina University
Department of Biology, College of Science, Bu-Ali Sina University, P. O. Box 65175/4161, Hamedan, Iran
R_karamian@basu.ac.ir

Karanović Dunja
Prirodno-matematički fakultet, Univerzitet u Novom Sadu
Trg Dositeja Obradovića 2, 21000, Novi Sad
dunja.karanovic@dbe.uns.ac.rs

Karlović Ksenija
3Faculty of Agriculture, University of Zagreb, Croatia
Svetošimunska 25, 10000 Zagreb, Croatia
karlovic@agr.hr

Kartal Ciler
Trakya University
Department of Biology Faculty of Science Trakya University Edirne TURKEY
cilermeric@yahoo.com

Kashta Lefter
FNS, University of Tirana
Bulevardi Zogu I
lefter.kashta@fshn.edu.al

Katanić Zorana
J. J. Strossmayer University, Department of Biology
Cara Hadrijana 8a, 31000 Osijek; Croatia
zorana.katanic@biologija.unios.hr

Kati Vasiliki
Department of Environmental and Natural Resources Management, University of Patras
Agrinio, Greece
vkati@upatras.gr

Katičić Bogdan Ida
Faculty of Forestry, Department of Forest genetics, Dendrology and Botany
Svetošimunska 25, Zagreb
ikaticic@sumfak.hr

Kaya Ayla
Department of Pharmaceutical Botany, Faculty of Pharmacy
Anadolu University, 26470 Eskisehir, Turkey
aykaya@anadolu.edu.tr

Kaya Zafer
Bartin Orman Fakultesi
74100 Bartin, Turkiye
zkaya23@hotmail.com

Keshavarzi Maryam
Associate professor, Department of plant sciences, faculty of Biological sciences, Alzahra University
Iran-Tehran-Vanak-Alzahra University
Neshat12000@yahoo.com

Keskin Mustafa
Marmara University
Marmara University, Faculty of Science and Arts, Department of Biology, 34722 Istanbul, Turkey
trifolium@hotmail.com

Khorsandyar Nastaran
Graduate student of Alzahra University
Iran-Tehran-Vanak-Alzahra University
nkhorsandyar92@gmail.com

Kiš Alen
Institute for Nature Conservation of Vojvodina Province, Radnička 20a, 21000 Novi Sad, Serbia
alen.kis@pzzp.rs

Kladar Nebojša
University of Novi Sad, Faculty of Medicine
Hajduk Veljkova 3, 21000 Novi Sad, Serbia
nebojsa.kladar@gmail.com

Kočić Aleksandra
Josip Juraj Strossmayer University of Osijek, Department of Biology
Cara Hadrijana 8A, 31000 Osijek
aleksandra_kocic@yahoo.com

Koh Miran
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia

Koletić Nikola
Institute for Research and Development of the Sustainable Ecosystems
Jagodno 100a, Velika Gorica
nikola.koletic@ires.hr

Koncani Uhač Ida
Arheološki muzej Istre
Carrarina ulica 3, HR-52100 Pula
ida.koncani-uhac@ami-pula.hr

Kosalec Ivan
Faculty of Pharmacy and Biochemistry, University of Zagreb
Schrottova 39, 10000 Zagreb, Croatia
ikosalec@pharma.hr

Köse Bedia
Trakya University Faculty of Sciences
Department of Biology, Faculty of Sciences, Trakya University, 22100 Edirne, Turkey
lokerbediha@yahoo.com

Košir Iztok
Slovenian Institute of Hop Research and Brewing
Cesta Žalskega tabora 2, 3310 Žalec, Slovenia
iztok.kosir@ihps.si

Koteyeva Nuria K.
Komarov Botanical Institute
2, Professor Popov str., St. Petersburg, Russia, 197022
knouria@mail.ru

Kougioumoutzis Konstantinos
Faculty of Biology, Department of Ecology & Systematics, National & Kapodistrian University of Athens
Panepistimiopolis, 157 03 Athens, Greece
kkougiou@biol.uoa.gr

Kralj Ines
Institute of Agriculture and Tourism
Karla Huguesa 8, 52440 Poreč, Croatia
ines@iptpo.hr

Kralj Borojević Koraljka
University of Zagreb, Faculty of Science
Rooseveltov trg 6, HR-10000 Zagreb, Croatia
kora.kralj@gmail.com

Kremer Dario
2Faculty of Pharmacy and Biochemistry, University of Zagreb, Croatia
Schrottova 39,10000 Zagreb, Croatia
dkremer@pharma.hr

Krivošej Zoran
University of Priština, Faculty of Natural Science
Lole Ribara Street, No. 29, 38220 Kosovska Mitrovica, Serbia
zoran.krivosej@gmail.com

Krizmanić Jelena
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden „Jevremovac“
Takovska 43, 11000 Belgrade, Serbia
kjelena@bio.bg.ac.rs

Krstin Ljiljana
J. J. Strossmayer University, Department of Biology
Cara Hadrijana 8a, 31000 Osijek; Croatia
ljiljana.krstin@biologija.unios.hr

Krstonošić Daniel
Faculty of Forestry, Department of Forest genetics, Dendrology and Botany
Svetošimunska 25, Zagreb
dkrstonosic@sumfak.hr

Kucukoduk Mustafa
Selcuk University
Selcuk University, Faculty of Science, Department of Biology, 42250, Selcuklu, Konya, Turkey
mkucukoduk@selcuk.edu.tr

Kucukonder Hande
Bartin University
Bartin University, Faculty of Economics and Administrative Sciences, Department of Business Administration, 74100 Bartin, Turkey
hkucukonder@gmail.com

Kultur Sukran
Istanbul University, Faculty of Pharmacy, Department of Pharmaceutical Botany
Istanbul, Turkey
s_kultur@istanbul.edu.tr

Kurmanbekova Gulbubu
Kyrgyzstan-Turkey Manas University
Kyrgyzstan-Turkey Manas University, Faculty of Science, Department of Biology, 72001, Bishkek, Kyrgyzstan
kurmanbekova59@gmail.com

Kuzmanović Nevena
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
nkuzmanovic@bio.bg.ac.rs

Küzmič Filip
University of Ljubljana, Biotechnical Faculty, Department of Biology
Večna pot 111, SI-1000 Ljubljana, Slovenia
filip.kuzmic.bio@gmail.com

Kvaternjak Ivka
Križevci College of Agriculture
Milislava Demerca 1, 48260 Križevci, Croatia
ikvaternjak@vguk.hr

Lakušić Branislava
Department of Botany, Faculty of Pharmacy, University of Belgrade
Vojvode Stepe 450, 11000 Belgrade, Serbia
blakusic@pharmacy.bg.ac.rs

Lakušić Dmitar
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
dlakusic@bio.bg.ac.rs

Lazarević Jelena
Prirodno-matematički fakultet, Univerzitet u Novom Sadu
Trg Dositeja Obradovića 2, 21000, Novi Sad
jelena.lazarevic@dbe.uns.ac.rs

Lazarević Maja
Department of Plant Ecology and Phytogeography, Faculty of Biology, University of Belgrade
Takovska 43, Belgrade, Serbia
majat@bio.bg.ac.rs

Lazarevic Predrag
Institute for Nature Conservation of Serbia
Dr Ivana Ribara 91, 11070 Belgrade, Serbia
predrag.lazarevic@zzps.rs

Leventer Sinem
Trakya University Faculty of Sciences
Department of Biology, Faculty of Sciences, Trakya University, 22100 Edirne, Turkey
si_lev@hotmail.com

Liber Zlatko
University of Zagreb, Faculty of Science, Division of Biology, Department of Botany and Botanical Garden
Marulićev trg 9A, 10000 Zagreb, Croatia
zlatko.liber@biol.pmf.hr

Likar Matevž
Department of Biology, Biotehnical Faculty, University of Ljubljana
Večna pot 111, 1000 Ljubljana, Slovenia
matevz.likar@bf.uni-lj.si

Likić Saša
Department of Biology, Faculty of Science, University of Zagreb
Rooseveltov trg 6, HR-10000 Zagreb, Croatia
saslikic@yahoo.com

Ljaljević Grbić Milica
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical garden "Jevremovac"
Takovska 43, 11 000 Belgrade, Serbia
jmilica@bio.bg.ac.rs

Ljubešić Nikola
Ruđer Bošković Institute
POB 1016, HR-10000 Zagreb, Croatia ljubesic@irb.hr

Ljubešić Zrinka
University of Zagreb, Faculty of Science
Roosevetov trg 6, 10000 Zagreb, Croatia
zrinka.ljubesic@biol.pmf.hr

Ljubičić Ivica
University of Zagreb, Faculty of Agriculture, Department of Agricultural Botany
Svetošimunska 25, 10000 Zagreb, Croatia
iljubicic@agr.hr

Lőkös László
Hungarian Natural History Museum, Department of Botany
H-1087 Budapest, Könyves Kálmán krt. 40., Hungary
lokos@bot.nhmus.hu

Lubarda Biljana
Faculty of Science, University of Banja Luka
Mladena Stojanovića 2
biljanadavidovic@yahoo,com

Łuczaj Łukasz
Dept of Botany, Institute of Applied Biotechnology and Basic Sciences, University of Rzeszów
Werynia 502, 36-100 Kolbuszowa, Poland
lukasz.luczaj@interia.pl

Luković Jadranka
Prirodno-matematički fakultet, Univerzitet u Novom Sadu
Trg Dositeja Obradovića 2, 21000, Novi Sad
jadranka.lukovic@dbe.uns.ac.rs

Lutova Ludmila
Saint-Petersburg State University
Universitetskaya emb.7/9, Saint-Petersburg, Russia
la.lutova@gmail.com

Mačukanović Jocić Marina
Department of Agrobotany, Faculty of Agriculture, University of Belgrade
Nemanjina 6, Belgrade, Serbia
marmajo@agrif.bg.ac.rs

Mahmutović Irma
University of Sarajevo, Faculty of Natural Sciences and Mathematics, Department of Biology
Zmaja od Bosne 33-35, 71 000 Sarajevo, Bosnia and Herzegovina
irma.contagium@gmail.com

Makbul Serdar
Recep Tayyip Erdoğan University
Department of Biology, Faculty of Sciences and Arts, Recep Tayyip Erdoğan University, TR-53100 Rize, Turkey
smakbul@hotmail.com

Maksimović Dušan
Central Institute for Conservation in Belgrade
Terazije 26, 11 000 Belgrade. Serbia
dusan.maksimovic@cik.org.rs

Mala Julia
M.G. Kholodny Institute of Botany
01004, 2, Tereshchenkivska st., Kyiv, Ukraine
mala.yulichka@gmail.com

Mala Xhavit
Directorate of Sharri National Park
Petrovë, Prizren 20000 Kosovo
xhavit.mala@hotmail.com

Malešević Nikola
Institute for Research and Development of Sustainable Ecosystems
Jagodno 100a, Velika Gorica, Croatia
nikola712@gmail.com

Manicacci Domenica
Univ. Paris Sud
Le Moulon, 91190 Gif-sur-Yvette, France
manicacci@moulon.inra.fr

Marakli Sevgi
Istanbul University, Molecular Biology and Genetics Department
Istanbul University, Molecular Biology and Genetics Department, 34118, Vezneciler-Istanbul/Turkey
sevgi.marakli@istanbul.edu.tr

Mareković Sara
University of Zagreb, Faculty of Science, Division of Biology
Marulićev trg 20/2, HR-10 000 Zagreb, Croatia
sara.marekovic@biol.pmf.hr

Marin Petar D.
University of Belgrade - Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Studentski trg 16, 11000 Belgrade, Serbia
pdmarin@bio.bg.ac.rs

Marisavljević Dragana
Institute for Plant Protection and Evironment
Teodora Drajzera 9, 11040 Beograd
marisavljevicd@yahoo.com

Marka Jani
Department of Biology, Faculty of Natural Sciences, Tirana University
Blvd. Zogu I, Tirana, Albania
jani.marka@fshn.edu.al

Marković Miroslav
Institute of Lowland Forestry and Environment
Antona Čehova 13, Novi Sad 21000, Serbia
miroslavm@uns.ac.rs

Mašić Ermin
Faculty of Science, University of Sarajevo. Center for Ecology

and Natural Resources - Academician Sulejman Redžić. Zmaja od Bosne 33-35. 71000 Sarajevo.
erminmasic@hotmail.com

Mayrhofer Helmut
Institute of Plant Sciences, University of Graz
Holteigasse 6, A-8010 Graz, Austria
helmut.mayrhofer@uni-graz.at

Mejdandžić Maja
Botanical Department, Division of Biology, Faculty of Science, University of Zagreb
Rooseveltov trg 6, Zagreb, Croatia
mmejdandzic@gmail.com

Mekinić Stjepan
Public Institution for the Protected Natural Values Management in the County of Split and Dalmatia
Prilaz braće Kaliterna 10, 21000 Split
smagata@yahoo.com

Meriç Çiler
Trakya University
Faculty of Sciences, Department of Biology, Edirne 22100, Turkey
cilermeric@gmail.com

Mesić Zrinka
Oikon Ltd.
Trg senjskih uskoka 1-2, HR-10000 Zagreb
zmesic@oikon.hr

Mihailović Nevena
Institute for the Application of Nuclear Energy – INEP, University of Belgrade
Banatska 31b, 11080 Belgrade, Serbia
nmihailovic@inep.co.rs

Mikac Iva
Ruđer Bošković Institute
Bijenička cesta 54, 10000 Zagreb, Croatia
iva.mikac@irb.hr

Milanović Đorđije
Faculty of Forestry, University of Banja Luka
Bulevar Vojvode Stepe Stepanovića 75a
djolebota@gmail.com

Milić Dubravka
University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology
Trg D. Obradovića 2, 21000 Novi Sad, Serbia
dubravka.milic@dbe.uns.ac.rs

Miličević Tihomir
Faculty of Agriculture, University of Zagreb
Svetošimunska cesta 25, 10000, Zagreb, Hrvatska
tmilicevic@agr.hr

Miličić Maja
Hrvatske vode, Central Water Management Laboratory
Ulica grada Vukovara 220, 10000 Zagreb, Croatia
mmilicic@voda.hr

Miljković Milica
Department of Ecology, Faculty of Biology, University of Belgrade
Takovska 33, 11000 Belgrade, Serbia
milica.zeka@yahoo.com

Milutinović Milica
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac
Takovska 43, Belgrade 11000, Republic of Serbia
milicamilutinovic4390@gmail.com

Mirgorodskaya Olga E.
Komarov Botanical Institute
2, Professor Popov str., St. Petersburg, Russia, 197022
mirgolga@yandex.ru

Mitić Božena
Botanički zavod, PMF Sveučilišta u Zagrebu
Marulićev trg 20/II, 10000 Zagreb
bozena@botanic.hr

Modrić Ines
Forest Administration Bjelovar, Forest Office Čazma, Croatian Forests Ltd.
Milana Novačića 48, 43240 Čazma, Croatia
ines.modric@hrsume.hr

Modrić Surina Željka
Natural History Museum Rijeka
Rijeka, Lorenzov prolaz 1
zeljka@prirodoslovni.com

Muggia Lucia
Department of Life Science, University of Trieste
Via Giorgieri 10, I-34127 Trieste, Italy
Lucia.muggia@uni-graz.at

Mullaj Alfred
Flora and Fauna Research Center, Faculty of Nature Science, University of Tirana, Tirana, Albania
alfredmullaj@gmail.com

Muratović Edina
University of Sarajevo, Faculty of Natural Sciences and Mathematics, Department of Biology, Laboratory for research and protection of endemic resources
Zmaja od Bosne 33-35, 71 000 Sarajevo, Bosnia and Herzegovina
edina1muratovic@yahoo.com

Mustafa Behxhet
Institute of Biological and Environmental Research, University of Prishtina "Hasan Prishtina"
Mother Teresa, 1000 Prishtinë, Kosovo
behxhet.mustafa@uni-pr.edu

Mutlu Salih
Erzincan University
Faculty of Arts and Science, Biology Department, Erzincan
salihmutlu@yahoo.com

Nadot Sophie
Univ. Paris Sud
Lab. ESE, 91405 Orsay, France
Sophie.Nadot@u-psud.fr

Najafian Ehteram
Alzahra University, Faculty of Biological sciences
Vanak, Tehran, Iran
ehteramnajafian@yahoo.com

Naqellari Peci
Department of Biology, "Aleksander Xhuvani" University
Elbasan, Albania
peci.naqellari@uniel.edu.al

Natcheva Rayna
Institute of Biodiversity and

Ecosystem Research, Bulgarian Academy of Sciences
Acad. Georgi Bonchev St., bl. 23, Sofia, 1113, Bulgaria
renimoss@bio.bas.bg

Naydenova Tsvetelina
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
Acad. Georgi Bonchev St., bl. 23, 1113 Sofia, Bulgaria
tsvety_n@yahoo.co.uk

Nedeljkovic Drgana
Institute for Nature Conservation of Serbia
Dr Ivana Ribara 91, 11070 Belgrade, Serbia
dragana.nedeljkovic@zzps.rs

Nedeljković Tatjana
Central Institute for Conservation in Belgrade
Terazije 26, 11 000 Belgrade. Serbia
tatjana.nedeljkovic@cik.org.rs

Nerić Vesna
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
vesna.neric@gmail.com

Niculescu Mariana
University of Craiova
19 Libertatii street, Craiova, 200583, Romania
mniculescum@yahoo.com

Niketić Marjan
Natural History Museum
Njegoševa 51, 11000 Belgrade, Serbia
mniketic@nhmbeo.rs

Nikolić Danijela
University of Niš, Faculty of Sciences and Mathematics, Department of Biology and Ecology
Višegradska 33, 18000 Niš, Serbia
danid@pmf.ni.ac.rs

Nikolic Nada
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
visinatavanu@yahoo.com

Nikolić Toni
Department of Botany and Botanical Garden, Division of Biology, Faculty of Science, University of Zagreb
Marulićev trg 9a, HR-10000 Zagreb, Croatia
toni.nikolic@biol.pmf.hr

Nikolov Zoran
Macedonian Museum of Natural History
Bulevar Ilinden 86, 1000 Skopje, Macedonia
znikolov61@yahoo.com

Novak Špela
Slovenian Museum of Natural History
Prešernova 20, 1001 Ljubljana, Slovenia
snovak@pms-lj.si

Novaković Jelica
University of Belgrade - Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Studentski trg 16, 11000 Belgrade, Serbia
jelica@bio.bg.ac.rs

Novkovic Maja
Department of Biology and Ecology, Faculty of Science, University of Novi Sad
Trg Dositeja Obradovica 2, 21 000 Novi Sad
malasupermocna@gmail.com

Nuskern Lucija
University of Zagreb, Faculty of Science
Marulićev trg 9a, 10000 Zagreb, Croatia
lucija.nuskern@biol.pmf.hr

Okur Seda
Recep Tayyip Erdoğan University
Pazar Vocational School, Recep Tayyip Erdoğan University, TR-53300 Pazar / Rize, Turkey
sedaokur_53@hotmail.com

Olanj Nayereh
Bu-Ali Sina University
Department of Biology, College of Science, Bu-Ali Sina University, P. O. Box 65175/4161, Hamedan, Iran
olanj.n@yahoo.com

Osma Etem
Erzincan University
Faculty of Arts and Science, Biology Department, Erzincan
eosma@erzincan.edu.tr

Özel Halil Barış
Bartın University, Faculty of Forestry, Department of Silviculture
Ağdacı Campus, 74100-Bartın/TURKEY
halilbarisozel@yahoo.com

Ozfidan-Konakci Ceyda
Necmettin Erbakan University
Necmettin Erbakan University, Faculty of Science, Department of Molecular Biology and Genetics, 42090, Meram, Konya, Turkey
cozfidan@konya.edu.tr

Ozimec Siniša
Josip Juraj Strossmayer University of Osijek, Faculty of Agriculture
Kralja Petra Svačića 1d, 31000 Osijek, Croatia
sinisaozimec@pfos.hr

Ozsoy Nurten
Istanbul University, Faculty of Pharmacy, Department of Biochemistry
Istanbul, Turkey
nozsoy@istanbul.edu.tr

Ozyigit Ibrahim Ilker
Marmara University
Marmara University, Faculty of Science & Arts, Department of Biology, Goztepe, 34722 Istanbul, Turkey
ilkozyigit@marmara.edu.tr

Panjković Biljana
Institute for Nature Conservation of Vojvodina Province, Radnička 20a, 21000 Novi Sad, Serbia
biljana.panjkovic@pzzp.rs

Papa Roberto
Università Politecnica delle Marche
via brecce bianche
r.papa@univpm.it

Papp Beata
Hungarian Natural History Museum, Botanical

Department
H-1476 Budapest Pf. 222,
Hungary
pappbea@nhmus.hu

Parić Adisa
Faculty of Science
Zmaja od Bosne 33-35
adisacausevic@hotmail.com

Paun Ovidiu
Department of Botany and Biodiversity Research, University of Vienna
Rennweg 14, A-1030 Vienna, Austria
ovidiu.paun@univie.ac.at

Paušič Igor
Biology Department, Faculty of Natural Sciences and Mathematics, University of Maribor
Koroška c. 160, SI-2000 Maribor, Slovenia
igor.pausic@um.si

Pavlović Danijela
Institute for Plant Protection and Evironment
Teodora Drajzera 9, 11040 Beograd
dulekaca@yahoo.com

Pećinar Ilinka
Faculty of Agriculture
Nemanjina 6, 11080 Belgrade-Zemun, Serbia
ilinka@agrif.bg.ac.rs

Pedashenko Hristo
Department of Plant and Fungal Diversity and Resources, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
Acad. Georgi Bonchev St., bl. 23, 1113 Sofia, Bulgaria
hristo_pedashenko@yahoo.com

Pekić Quarrie Sofija
Faculty of Agriculture
Nemanjina 6, 11080 Belgrade-Zemun, Serbia
pekic@agrif.bg.ac.rs

Peremin Volf Tomislava
Križevci College of Agriculture
Milislava Demerca 1, 48260 Križevci, Croatia
tperemin@vguk.hr

Perić Ranko
Provincial Institute of Nature Protection
Radnička 20a, Novi Sad, Serbia
ranko.peric@pzzp.rs

Perić Sonja
University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology
Trg D. Obradovića 2, 21000 Novi Sad, Serbia
peric.sonja.91@gmail.com

Peternel Hrvoje
Geonatura Ltd.
Trg senjskih uskoka 1-2
hpeternel@geonatura.hr

Petrović Milica
University of Belgrade, Faculty of Agriculture, Department of Agrobotany
Nemanjina 6, 11080 Zemun-Belgrade, Serbia
mpetrovic.azs@gmail.com

Petrović Nataša
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
petrovicnatasa@gmail.com

Pevalek-Kozlina Branka
Division of Botany, Department of Biology, Faculty of Science, University of Zagreb
Rooseveltov trg 6, HR-10000 Zagreb, Croatia
branka.pevalek-kozlina@biol.pmf.hr

Piasevoli Gvido
Public Institution for the Protected Natural Values Management in the County of Split and Dalmatia
Prilaz braće Kaliterna 10, 21000 Split
gvido.piasevoli@dalmatian-nature.hr

Pifkó Dániel
Department of Botany, Hungarian Natural History Museum
1476 Budapest, P.O.Box 222, Hungary
pifko@bot.nhmus.hu

Pilipović Andrej
University of Novi Sad, Institute of Lowland Forestry and Environment
Antona Čehova 13, 21000 Novi Sad, Serbia
andrej.pilipovic@gmail.com

Plenković Moraj Anđelka
University of Zagreb, Faculty of Science
Rooseveltov trg 6, HR-10000 Zagreb, Croatia
aplenk@biol.pmf.hr

Poljak Igor
University of Zagreb, Faculty of Forestry
Svetošimunska 25, 10000 Zagreb, Croatia
ipoljak@sumfak.hr

Poljuha, Danijela
Institute of Agriculture and Tourism
Karla Huguesa 8, 52440 Poreč, Croatia
danijela@iptpo.hr

Popović Maja
Croatian Forest Research Institute
Cvjetno naselje 41, 10450 Jastrebarsko, Croatia
majap@sumins.hr

Popović Slađana
University of Belgrade, Faculty of Biology
Studentski trg 16, 11000 Belgrade
spopovic.bio@gmail.com

Potočnik Tanja
Slovenian Institute of Hop Research and Brewing
Cesta Žalskega tabora 2, 3310 Žalec, Slovenia
tanja.potocnik@ihps.si

Predojević Dragana
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden „Jevremovac“
Takovska 43, 11000 Belgrade, Serbia
delfin0230@yahoo.com

Preljević Nusret
State University of Novi Pazar, Department of Biomedical sciences
Vuka Karadžića Street bb,

36300 Novi Pazar
nusret69@hotmail.rs

Prlić Dragan
Donji Meljani 92c, Slatina, Croatia
prlicdragan@gmail.com

Prodanović Danijela
University of Priština, Faculty of Agriculture Lešak
Kopaonička Street bb, 38219 Lešak, Serbia
danijela.prodanovic@gmail.com

Pršin Tjaša
Department of Biology, Biotehnical Faculty, University of Ljubljana
Večna pot 111, 1000 Ljubljana, Slovenia
tjasa.prsin@gmail.com

Pulaj Bledar
Institute of Biological and Environmental Research, University of Prishtina "Hasan Prishtina"
Mother Teresa, 1000 Prishtinë, Kosovo
bpulaj@hotmail.com

Pupuleku Blerina
Department of Biology, "Aleksander Xhuvani" University
Elbasan, Albania
blerina.pupuleku@hotmail.com

Radak Boris
University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology
Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia
boris.radak@dbe.uns.ac.rs

Radić Brkanac Sandra
Division of Botany, Department of Biology, Faculty of Science, University of Zagreb
Rooseveltov trg 6, HR-10000 Zagreb, Croatia
sandra.radic.brkanac@biol.pmf.hr

Radić Stojković Marijana
Division of Organic Chemistry and Biochemistry, Rudjer Boskovic Institute
Bijenička c. 54, HR-10000 Zagreb, Croatia
marijana.radic@irb.hr

Radosavljević Ivan
University of Zagreb, Faculty of Science, Division of Biology, Department of Botany and Botanical Garden
Marulićev trg 9A, 10000 Zagreb, Croatia
ivanrad@botanic.hr

Radovanović Sanja
University of Belgrade, Faculty of Biology
Takovska 43, 11000 Belgrade, Serbia
sanjaradovanovic90@gmail.com

Radulović Snežana
Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad
Trg Dositeja Obradovića 3, 21000 Novi Sad
snezana.radulovic@dbe.uns.ac.rs

Rajčević Nemanja
University of Belgrade - Faculty of Biology, Institute of Botany and Botanical Garden "Jevremovac"
Studentski trg 16, 11000 Belgrade, Serbia
nemanja@bio.bg.ac.rs

Rajčić Marija
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
rajcha.bgd@gmail.com

Rakaj Marash
Faculty of Natural Sciences, Universiteti i Shkodrës "Luigj Gurakuqi"
Sheshi 2 Prilli, Rruga Studenti 24, Shkodër, Albania
marash_rakaj@yahoo.com

Rakić Milana
Faculty of Sciences, University of Novi Sad
Trg Dositeja Obradovića 3, Novi Sad 21000, Serbia
milana.rakic@dbe.uns.ac.rs

Rakić Tamara
Department of Plant Ecology and Phytogeography, Faculty of Biology, University of Belgrade
Takovska 43, Belgrade, Serbia
tamaraz@bio.bg.ac.rs

Rakonjac Ljubinko
Institute of forestry
Kneza Višeslava 3, 11030 Belgrade, Serbia
ljrakonjac@yahoo.com

Rančić Dragana
Faculty of Agriculture
Nemanjina 6, 11080 Belgrade-Zemun, Serbia
rancicd@agrif.bg.ac.rs

Randić Marko
Public institution Priroda Rijeka, Grivica 4
marko.randic@ju-priroda.hr

Ranjbar Nika
Bu-Ali Sina University Department of Biology, College of Science, Bu-Ali Sina University, P. O. Box 65175/4161, Hamedan, Iran
nik.ranjbar@gmail.com

Ranđelović Vladimir
University of Niš, Faculty of Sciences and Mathematics, Department of Biology and Ecology
Višegradska 33, 18000 Niš, Serbia
vladar@pmf.ni.ac.rs

Rat Milica
University of Novi Sad Faculty of Sciences, Department of biology and ecology
Serbia, Novi Sad, 21000, 2 Trg Dositeja Obradovica
milica.rat@dbe.uns.ac.rs

Ratknić Mihailo
Institute of forestry
Kneza Višeslava 3, 11030 Belgrade, Serbia
mihailoratknic@yahoo.com

Ratknić Tatjana
Institute of forestry
Kneza Višeslava 3, 11030 Belgrade, Serbia
tatjanaratknic@yahoo.com

Rešetnik Ivana
Faculty of Science, University of Zagreb
Marulićev trg 20, HR-10000 Zagreb, Croatia
ivana.resetnik@biol.pmf.hr

Rilak Sara
Nature Conservation of Vojvodina Province
Radnicka 20a, 21000 Novi Sad,

Serbia
sararilak@yahoo.com

Ristić Mihailo
Institute for Medicinal Plant Research "Dr Josif Pančić"
Tadeuša Košćuška 1, 11000 Belgrade, Serbia
mristic@mocbilja.rs

Rohrer Alexander
Institute of Plant Sciences, University of Graz
Holteigasse 6, A-8010 Graz, Austria
alexander.rohrer@gmail.com

Rottensteiner Walter K.
Klosterwiesgasse 12, 8010 Graz
wk.rottensteiner@gmail.com

Rućando Marko
Faculty of Sciences, University of Novi Sad
Trg Dositeja Obradovića 3, Novi Sad 21000, Serbia
marko.rucando@dbe.uns.ac.rs

Ruščić Mirko
Department of Biology, Faculty of Science, University of Split
Teslina 12, HR-21000 Split
mirko.ruscic@pmfst.hr

Sabados Klara
Nature Conservation of Vojvodina Province
Radnicka 20a, 21000 Novi Sad, Serbia
klara.sabados@@pzzp.rs

Sabovljević Aneta
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
aneta@bio.bg.ac.rs

Sabovljević Marko
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
marko@bio.bg.ac.rs, sabmar@hotmail.com

Şafak Odabaşı Nevin
Namık Kemal University
Namık Kemal University, Faculty of Arts and Sciences, Biology Department, 59030 Tekirdağ
nsafak@gmail.com

Saglam Aykut
Karadeniz Technical University
Karadeniz Technical University, Faculty of Sciences, Department of Biology, Trabzon, Turkey
saglamay@gmail.com

Salik Vildan
Trakya University
Faculty of Science, Department of Biology, 22030 Edirne, Turkey
vildansalik@trakya.edu.tr

Savić Aleksandra
Natural History Museum Belgrade
Njegoseva 51, 11000 Belgrade, Serbia
aleksandra.savic@nhmbeo.rs

Savić Ana
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
anka@pmf.ni.ac.rs

Savković Željko
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical garden "Jevremovac"
Takovska 43, 11 000 Belgrade, Serbia
zexsavkovic@gmail.com

Schönswetter Peter
University of Innsbruck, Institute of Botany
Sternwartestrasse 15, 6020 Innsbruck, Austria
Peter.Schoenswetter@uibk.ac.at.

Sedlar Zorana
PMF - Division of Biology
Marulićev trg 20/II
zorana.sedlar@biol.pmf.hr

Sesal Nuzhet Cenk
Marmara University
Marmara University, Faculty of Science and Arts, Department of Biology, 34722 Istanbul, Turkey
csesal@marmara.edu.tr

Sever Krunoslav
Faculty of Forestry, Department of Forest genetics, Dendrology and Botany
Svetošimunska 25, Zagreb
ksever@sumfak.hr

Severoglu Zeki
Kyrgyzstan-Turkey Manas University
Kyrgyzstan-Turkey Manas University, Faculty of Science, Department of Biology, 72001, Bishkek, Kyrgyzstan
zseveroglu25@gmail.com

Siladi Petra
Agricultural High School Križevci
Milislava Demerca p.p.1, 48260 Križevci, Croatia
siladi.petra@gmail.com

Silajdžić Elma
University of Sarajevo, Faculty of Forestry
Zagrebačka 20, 71 000 Sarajevo, Bosnia and Herzegovina
silajdzic_elma@yahoo.com

Simi Zoran
Faculty of Science
Radoja DOmaanovića 12, 34 000 Kragujevac, Serbia
zsimic@kg.ac.rs

Sladonja Barbara
Institute of Agriculture and Tourism
Karla Huguesa 8, 52440 Poreč, Croatia
barbara@iptpo.hr

Slavkovska Violeta
Department of Botany, Faculty of Pharmacy, University of Belgrade
Vojvode Stepe 450, 11000 Belgrade, Serbia
violetas@pharmacy.bg.ac.rs

Soltani Narges
Bu-Ali Sina University
Department of Biology, College of Science, Bu-Ali Sina University, Hamedan, Iran
soltani@yahoo.com

Somogyi Gabriella
Department of Botany, Corvinus University of

Budapest
Ménesi str. 44., Hungary, 1118 Budapest
gabriella.somogyi@uni-corvinus.hu

Srečec Siniša
Križevci College of Agriculture
Milislava Demerca 1, 48260 Križevci, Croatia
ssrecec@vguk.hr

Stamenković Vanja
Botanical garden, Faculty of Science, University of Zagreb
Marulićev trg 9a, HR-10000 Zagreb,Croatia
vanja.stamenkovic@biol.pmf.hr

Stanković Igor
Hrvatske vode, Central Water Management Laboratory
Ulica grada Vukovara 220, 10000 Zagreb, Croatia
igorstankovic1@gmail.com

Stanković Vera
Institute of Criminological and Sociological Research
Gračanička 18, 11000 Belgrade, Serbia
vera.batanjski@gmail.com

Stanojević Dragan
Institute for the Protection of Cultural Monuments in Serbia
Radoslava Grujića 11, 11000 Belgrade, Serbia
dragan.stanojevic@yuheritage.com

Stefanović Saša
Department of Biology, University of Toronto Mississauga
3359 Mississauga Rd. N., Mississauga, Ontario L5L 1C6, Canada
sasa.stefanovic@utoronto.ca

Stešević Danijela
University of Montenegro, Faculty of Natural Sciences and Mathematics, Department of Biology
G. Washington Street, 81 000 Podgorica, Montenegro
danijela.denist@gmail.com

Stevanović Branka
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11000 Beograd, Serbia
bstev@bio.bg.ac.rs

Stevanović Vladimir
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
vstev@bio.bg.ac.rs

Stević Filip
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia

Stikić Radmila
Faculty of Agriculture
Nemanjina 6, 11080 Belgrade-Zemun, Serbia
rstikic@agrif.bg.ac.rs

Stojanović Gordana
Department of Chemistry, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
gocast@pmf.ni.ac.rs

Stojanović Danilo L,
University of Belgrade, Faculty of Pharmacy, Department of Botany
Vojvode Stepe 450, 11010 Belgrade, Serbia
dancho@pharmacy.bg.ac.rs

Stojanovic Verica
Institute for nature conservation of Serbia
Dr Ivana Ribara 91, 11070 Belgrade, Serbia
verica.stojanovic@zzps.rs

Stojšić Vida
Nature Conservation of Vojvodina Province
Radnicka 20a, 21000 Novi Sad, Serbia
vida.stojisic@pzzp.rs

Strgulc Krajšek, Simona
University of Ljubljana, Biotechnical Faculty, Department of Biology
Večna pot 111, SI-1000 Ljubljana, Slovenia
simona.strgulc@uni-lj.si

Strid Arne
Botanical Museum
Bakkevej 6, DK-5853 Oerbaek, Denmark
arne.strid@youmail.dk

Stupar Miloš
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical garden "Jevremovac"
Takovska 43, 11 000 Belgrade, Serbia
smilos@bio.bg.ac.rs

Stupar Vladimir
Faculty of Forestry, University of Banja Luka
Bulevar Vojvode Stepe Stepanovića 75a
stuparvladimir@gmail.com

Subakov Simić Gordana
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical garden "Jevremovac"
Takovska 43, 11 000 Belgrade, Serbia
gsubak@bio.bg.ac.rs

Surina Boštjan
Natural History Museum Rijeka, Lorenzov prolaz 1, HR-51000 Rijeka, Croatia
bostjan.surina@prirodoslovni.com

Sušnik Polona
University of Ljubljana, Biotechnical Faculty, Department of Biology
Večna pot 111, Ljubljana, SI-1000 Slovenia
polona.susnik@gmail.com

Szurdoki Erzsébet
Botanical Department, Hungarian Natural History Museum
H-1476, Budapest, Pf. 222., Hungary
szurdoki@bot.nhmus.hu

Šarac Zorica
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
saraczorica@gmail.com

Šatović Zlatko
University of Zagreb, Faculty

of Agriculture, Department of Seed Science and Technology
Svetošimunska cesta 25, 10000 Zagreb, Croatia
zsatovic@agr.hr

Šegota Vedran
Botanical Department, Division of Biology, Faculty of Science, University of Zagreb
Marulićev tr 20/II, Zagreb
vedran.segota@biol.pmf.hr

Šelja Valentina
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia

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

Šiljak-Yakovlev Sonja
Université Paris Sud, Laboratoire d'Ecologie, Systématique et Evolution
UMR8079 CNRS-UPS-AgroParis-Tech, Bât. 360, 91405 Orsay Cedex, France
sonia.yakovlev@u-psud.fr

Šinžar-Sekulić Jasmina
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
jsekulic@bio.bg.ac.rs

Škunca Luka
Geonatura Ltd.
Trg senjskih uskoka 1-2
lskunca@geonatura.hr, luka.skunca@udrugapopulus.hr

Škvorc Željko
Faculty of Forestry, Department of Forest genetics, Dendrology and Botany
Svetošimunska 25, Zagreb
zskvorc@sumfak.hr

Šoštarić Ivan
University of Belgrade, Faculty of Agriculture
Nemanjina 6, 11080 Zemun, Serbia
sostaric@agrif.bg.ac.rs

Šoštarić Renata
University of Zagreb, Faculty of Science, Division of Biology
Marulićev trg 20/2, HR-10 000 Zagreb, Croatia
rsostar@biol.pmf.hr

Šovran Sanja
University of Belgrade, Faculty of Biology
Takovska 43, 11000 Belgrade, Serbia
sanjaf@bio.bg.ac.rs

Špoljarić Maronić Dubravka
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia
dspoljaric@biologija.unios.hr

Šteko Višnja
Oikon Ltd.
Trg senjskih uskoka 1-2, HR-10000 Zagreb
vsteko@oikon.hr

Tabanli Fatih
Marmara University
Marmara University, Faculty of Science and Arts, Department of Biology, 34722 Istanbul, Turkey
fatihtabanli@gmail.com

Talovskaya Evgeniya
Russian Academy of Sciences, Siberian Branch, Central Siberian Botanical Garden
630090 Russua, Novosibirsk, Zolotodolinskaya str., 101
kolegova_e@mail.ru

Tan Kit
Institute of Biology, University of Copenhagen
Oester Farimagsgade 2D, DK-1353 Copenhagen K, Denmark
kitt@bio.ku.dk

Tekin Mehmet
Cumhuriyet University, Faculty of Pharmacy, Department of Pharmaceutical Botany
Sivas-Turkey
mtekin2280@gmail.com

Temunovic Martina
Faculty of Forestry, Department of Forest genetics, Dendrology and Botany
Svetošimunska 25, Zagreb
martina.temunovic@gmail.com

Theodoropoulos Konstantinos
Aristotle University of Thessaloniki
Faculty of Forestry and Natural Environment, Aristotle University of Thessaloniki, University Campus, 54124 Thessaloniki Greece
ktheodor@for.auth.gr

Tikhonova Olga
N. I. Vavilov Research Institute of Plant Industry
190000, 42-44, Bol. Morskaya str., St-Retersburg, RF
o.tikhonova@vir.nw.ru

Tkalec Mirta
Department of Biology, Faculty of Science, University of Zagreb
Rooseveltov trg 6, HR-10000 Zagreb, Croatia
mtkalec@zg.biol.pmf.hr

Tomov Rumen
University of Forestry
10 Kliment Ohridski St., 1756 Sofia, Bulgaria
rtomov@yahoo.com

Tomović Gordana
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
gtomovic@bio.bg.ac.rs

Trbojević Ivana
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden „Jevremovac"
Takovska 43, 11000 Belgrade, Serbia
ivanatrbojevic@yahoo.com

Trčak Branka
Centre for Cartography of Fauna and Flora
Antoličičeva 1, Miklavž na Dravskem polju, Slovenia
branka.trcak@ckff.si

Trichkova Teodora
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
1 Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria
trichkova@gmail.com

Trucchi Emiliano
Department of Botany and Biodiversity Research, University of Vienna
Rennweg 14, A-1030 Vienna, Austria
emiliano.trucchi@ibv.uio.no

Tsakiri Evdoxia
Laboratory of Systematic Botany & Phytogeography, Department of Botany, School of Biology, Aristotle University of Thessaloniki
Thessaloniki 54124, Greece
tsakiri@bio.auth.gr

Türkoğlu Koç Müge
Trakya University Faculty of Sciences
Department of Biology, Faculty of Sciences, Trakya University, 22100 Edirne, Turkey
mugeturkoglu@hotmail.com

Uhač Marko
Arheološki muzej Istre
Carrarina ulica 3, HR-52100 Pula
uhacmarko@yahoo.com

Uludag Ahmet
Düzce University
Düzce, Turkey
ahuludag@yahoo.com

Unković Nikola
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical garden "Jevremovac"
Takovska 43, 11 000 Belgrade, Serbia
nidzobio@gmail.com

Uras Mehmet Emin
Marmara University
Marmara University, Faculty of Science and Arts, Department of Biology, 34722 Istanbul, Turkey
memin3335@gmail.com

Valli Anna-Thalassini
Agricultural University of Athens
Iera Odos 75,11855 Athens, Greece
thalassinivalli@yahoo.gr

Varga Nóra
Szent István University, Institute of Botany and Plant Ecophysiology
H-2100 Gödöllő, Páter K. u. 1., Hungary
nora.varga@ymail.com

Vasiljević Perica
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
perica@pmf.ni.ac.rs

Vassilev Kiril
Department of Plant and Fungal Diversity and Resources, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
Acad. Georgi Bonchev St., bl. 23, 1113 Sofia, Bulgaria
kiril5914@abv.bg

Vatansever Recep
Marmara University
Marmara University, Faculty of Science and Arts, Department of Biology, 34722 Istanbul, Turkey
recep_vatansever@hotmail.com

Veljković Bojana
State University of Novi Pazar, Department of Biomedical sciences
Vuka Karadžića Street bb, 36300 Novi Pazar
bojana.radulovic@yahoo.com

Verčević Nina
Faculty of science, University of Zagreb
Horvatovac 102A, 10000 Zagreb, Hrvatska
nina.vercevic@gmail.com

Veselaj Zeqir
Faculty of Education
University of Prishtina "Hasan Prishtina"
Mother Teresa, 1000 Prishtinë, Kosovo
zeqir.veselaj@uni-pr.edu

Vestek Ana
University of Novi Sad, Faculty of Science, Department of biology and ecology
Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia
ana.vestek@dbe.uns.ac.rs

Vidaković Danijela
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical Garden „Jevremovac"
Takovska 43, 11000 Belgrade, Serbia
daca.vidakovic@yahoo.com

Vitasović Kosić Ivana
University of Zagreb, Faculty of Agriculture, Department of Agricultural Botany
Svetošimunska cesta 25, 10000 Zagreb, Croatia
ivitasovic@agr.hr

Vladimirov Vladimir
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences
15 Noemvri Str.,1040 Sofia, Bulgaria
vladimir_dv@abv.bg

Vladović Dalibor
Prirodoslovni muzej i zoološki vrt
Kolombatovićevo šet. 2, 21000 Split
dalibor@prirodoslovni.hr

Vucić Anita
Health Ecology Service, Public Health Institute Zadar
Kolovare 2, 23000 Zadar, Croatia
avucic@zjz-zadar.hr

Vujasinović Aleksandra
Public company „Vojvodinašume"
Preradovićeva 2, 21131 Petrovaradin, Serbia

Vujčić Valerija
Division of Botany, Department of Biology, Faculty of Science, University of Zagreb
Rooseveltov trg 6, HR-10000 Zagreb, Croatia
valerija.vujcic@biol.pmf.hr

Vujičić Milorad
Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
milorad@bio.bg.ac.rs

Vukasovic Zivko
Institute for Nature Conservation of Serbia
Dr Ivana Ribara 91, 11070 Belgrade, Serbia
zivko.vukasovic@zzps.rs

Vukojević Djordje
Department of Biology and Ecology, Faculty of Sciences and Mathematics, University of Niš
Višegradska 33, 18000 Niš, Serbia
synezis@yahoo.com

Vukojević Jelena
University of Belgrade, Faculty of Biology, Institute of Botany and Botanical garden "Jevremovac"
Takovska 43, 11 000 Belgrade, Serbia
vjelena@bio.bg.ac.rs

Vukojević Mara
Croatian Botanical Society
Marulićev trg 9, 10000 Zagreb, Croatia
mvukojev1@gmail.com

Vukojičić Snežana
Institute of Botany and Botanical Garden "Jevremovac", Faculty of Biology, University of Belgrade
Takovska 43, 11000 Belgrade, Serbia
sneza@bio.bg.ac.rs

Vukov Dragana
University of Novi Sad, Faculty of sciences, Department of biology and ecology
Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia
dragana.vukov@dbe.uns.ac.rs

Vuković Nina
University of Zagreb, Faculty of Science, Division of Biology, Department of Botany
Marulićev trg 20/II, 10000 Zagreb
nina.vukovic@biol.pmf.hr

Vuković Rosemary
J. J. Strossmayer University, Department of Biology
Cara Hadrijana 8a, 31000 Osijek; Croatia
rosemary.vukovic@biologija.unios.hr

Xhulaj Skerdilaid
Faculty of Natural Sciences, University of Tirana
Bulevardi "Zogu I", Nr. 25/1, Tirana, Albania
xhulaj@yahoo.com

Yalcin Ibrahim Ertugrul
Bahcesehir University
Bahcesehir University, Faculty of Engineering & Natural Sciences, Department of Environmental Engineering, Besiktas, 34353, Istanbul, Turkey
ibrahimertugrul.yalcin@eng.bahcesehir.edu.tr

Yaman Barbaros
Bartin University, Faculty of Forestry, Wood Anatomy and Dendrochronology Laboratory
TR-74100 Bartin / Turkey
yamanbar@gmail.com

Yankova-Tsvetkova Elina
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Department of Plant and Fungal Diversity and Resources
Acad. Georgi Bonchev Str., bl. 23, 1113 Sofia, Bulgaria
e_jankova@abv.bg

Yasar Ulkuhan
Bartin University
Bartin University, Faculty of Engineering, Department of Environmental Engineering, 74100 Bartin, Turkey
ulkuhanyasar@hotmail.com

Yildiztugay Evren
Selcuk University
Selcuk University, Faculty of Science, Department of Biology, 42250, Selcuklu, KONYA, TURKEY
eytugay@selcuk.edu.tr

Yilmaz Sibel
Istanbul University, Molecular Biology and Genetics Department
Istanbul University, Molecular Biology and Genetics Department, 34118, Vezneciler-Istanbul/Turkey
sibelyilmaz22@hotmail.com

Yurukova-Grancharova Petka
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Department of Plant and Fungal Diversity and Resources
Acad. Georgi Bonchev Str., bl. 23, 1113 Sofia, Bulgaria
y_grancharova@abv.bg

Yuzbasioglu Gozde
Istanbul University, Molecular Biology and Genetics Department
Istanbul University, Molecular Biology and Genetics Department, 34118, Vezneciler-Istanbul/Turkey
yuzbasoglugozde@gmail.com

Zahirović Vanda
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia

Zebec Marko
University of Zagreb, Faculty of Forestry, Department of Forest Genetics, Dendrology and Botany
Svetošimunska cesta 25, 10000 Zagreb, Croatia
mzebec@sumfak.hr

Zebec Vladimir
Croatian Natural History Museum
Demetrova 1, 10000 Zagreb, Croatia
vladimir.zebec@hpm.hr

Zeko Antonija
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia

Zeneli Vilza
FNS, University of Tirana
Bulevardi Zogu I
m.vilza@hotmail.com

Zjalić Milorad
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia

Zlatković Bojan
Prirodno-matematički fakultet, Univerzitet u Nišu
Višegradska 33, 18000 Niš,

Serbia
bojanzlat@yahoo.com

Zlatković Ivana
College of Agriculture and Food Technology
Ćirila i Metodija 1, 18400 Prokuplje, Serbia
gajevicivana@yahoo.com

Zoldoš Vlatka
University of Zagreb, Faculty of Science, Divison of Biology, Department of Molecular Biology
Horvatovac 102a, 10000 Zagreb, Croatia
vzoldos@biol.pmf.hr

Zorić Lana
Prirodno-matematički fakultet, Univerzitet u Novom Sadu
Trg Dositeja Obradovića 2, 21000, Novi Sad
lana.zoric@dbe.uns.ac.rs

Zubin Ferri, Tea
METRIS - Material Research Centre
Zagrebačka 30, 52100 Pula, Croatia
tea.zubin@centarmetris.hr

Ževrnja Nediljko
Prirodoslovni muzej i zoološki vrt
Kolombatovićevo šet. 2, 21000 Split
nediljko@prirodoslovni.hr

Žiljak Mirjana
Geonatura d.o.o.
Trg senjskih uskoka 1-2, 10020 Zagreb
mziljak@geonatura.hr

Živković Milica
Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad
Trg Dositeja Obradovića 3, 21000 Novi Sad
milica.zivkovic@dbe.uns.ac.rs

Žižić Nakić Antonija
Hrvatske vode, Central Water Management Laboratory
Ulica grada Vukovara 220, 10000 Zagreb, Croatia
azizic@voda.hr

Žuna Pfeiffer Tanja
Josip Juraj Strossmayer University of Osijek
Cara Hadrijana 8/A, 31000 Osijek, Croatia
tzuna@biologija.unios.hr

Index of authors

Notes

Notes

Notes

Notes

Notes

Notes

PRIRODOSLOVNI MUZEJ RIJEKA
NATURAL HISTORY MUSEUM RIJEKA
PRIMORSKO-GORANSKA ŽUPANIJA • COUNTY OF PRIMORJE AND GORSKI KOTAR

Croatian
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University
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