
Истраживачко друштво „Бабин нос“, Темска, Пирот

Институт за шумарство, Београд 

Штампарија „Свен“, Ниш

ETHNOBOTANY

ЕТНОБОТАНИКА

Third conference about medicinal and wild-growing
edible plants

Треће саветовање о лековитом и самониклом
јестивом биљу

Book of abstracts

Зборник резимеа

Pirot, Serbia, June 26 - 28. 2025.

Пирот, Србија, 26 - 28. јун 2025.

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Preface

The Research Association "Babin nos" from the village Temska near Pirot, and Institute of Forestry from Belgrade organizing for the third time in Serbia the scientific conference dedicated to the use of plants. The organization of this conference is financially supported by the City of Pirot. We would like to express our sincere gratitude to the mayor, mr Vladan Vasić, and his associates for their support.

Pirot city, as the place where this conference is organized, has exceptionally clean and unpolluted nature in its surroundings. It is home to a whole range of medicinal and wild edible plants, the diversity of which is great, and whose preventive use can be beneficial in preserving health and the normal functioning of the human body, as well as in the prevention and treatment of many diseases. After the official part of the conference with lectures, presentations and discussion in the amphitheater of the "Sveti Sava" Primary School in Pirot, the conference continues in the nature surrounding Pirot on Stara planina Mt in the area of the village of Dojkinci at the localities "Arbinje" and the "Tri Kladenca" waterfall.

The goal of this conference is to influence the preservation, prosperity, protection and improvement of the health of the social community, as well as everyone, based on the results of scientific research. The goal of the conference is also to develop awareness among the local population about the great wealth of medicinal and wild edible plant resources, as well as the great need to preserve populations of rare and endangered plant species. The organization of the Third conference about medicinal and wild-growing edible plants in Pirot city and its surroundings should contribute to the development of science, the intensification of cooperation within the country, as well as the beginning of international cooperation in the areas of the conference's topic.

We are grateful to Marjan Rančić, director of the "Sveti Sava" Primary School in Pirot, for approving the use of the school amphitheater for the official part of the conference. We express our gratitude for donations to the sponsor: 1) Bogdan Jovanović from a craft workshop "Prirodno", Belgrade, which produces healthy food, 2) "Small Tree", tea shop, Belgrade, 3) A.D. Planinka Kuršumljija, and 4) Zemljoradnička zadruga "Meli", Knjaževac.

We owe great gratitude to all collaborators in the joint successful implementation of the project entitled "Third conference about medicinal and wild-growing edible plants", the result of which is the publication of Book of Abstracts.

In Pirot, June 2025.

Organizing, Program and Scientific Committee of the Conference

Предговор

Истраживачко друштво „Бабин нос“ из села Темске код Пирота и Институт за шумарство из Београда организују по трећи пут у Србији научни скуп који је посвећен темама употребе биљака. Организовање овог скупа финансијски је подржано од Града Пирота. Најсрдачније се захваљујемо градоначелнику мр Владану Васићу и његовим сарадницима на подршци.

Град Пирот, као место организовања овог скупа, поседује у својој околини изузетно чисту и незагађену природу. У њој расте читав низ лековитих и самониклих јестивих биљака, чија је разноврсност велика, а чија превентивна примена може да буде благотворна у очувању здравља и нормалног функционисања људског организма, као и у сузбијању и лечењу многих болести. Након званичног дела скупа са предавањима, излагањима и дискусијом у амфитеатру Основне школе „Свети Сава“ у Пироту, скуп се наставља у природи околине Пирота на Старој планини у атару села Дојкинци на локалитетима „Арбиње“ и водопада „Три кладенца“.

Циљ овог скупа је да на бази резултата научних истраживања утиче на очување, просперитет, заштиту и унапређење здравља друштвене заједнице, као и сваког појединца. Циљ саветовања је и развој свести код домаћег становништва о великом богатству ресурса лековитог и самониклог јестивог биља, као и о великој потреби очувања популација ретких и угрожених врста биљака. Организација Трећег саветовања о лековитом и самониклом јестивом биљу у Пироту и околини требало би да допринесе развоју науке, интензивирању сарадње у оквиру земље, као и почетку међународне сарадње у областима тематике скупа.

Захвалност дугујемо Марјану Ранчићу, директору Основне школе „Свети Сава“ у Пироту, на одобрењу коришћења амфитеатра школе за одржавање званичног дела скупа. Захвалност за донације изражавамо следећем спонзорима: 1) Богдан Јовановић из занатске радионице „Природно“, Београд, која се бави производњом здраве хране, 2) продавница чајева "Small Tree", Београд, 3) А.Д. „Планинка“, Куршумлија, 4) Земљорадничка задруга „Мели“, Књажевац.

Свим сарадницима дугујемо велику захвалност у заједничкој успешној реализацији пројекта под називом „Треће саветовање о лековитом и самониклом јестивом биљу“, чији је резултат публикавање Зборника резимеа.

У Пироту, јуна 2025.

Организациони, Програмски и Научни одбор саветовања

CONFERENCE PROGRAM

Third conference about medicinal and wild-growing edible plants

Pirot, June 26-28. 2025

First day: June 26. 2025.

Participant registration in the hotel "Dijana" 10.00 – 13.00

Opening of the conference 13.00 – 14.30:

Marija S. Marković, Ph.D, president of Organizing committee

Vesna P. Stankov Jovanović, Ph.D, president of Program committee

Ljubinko B. Rakonjac, Ph.D, president of Scientific committee

Welcome cocktail

Second day: June 27. 2025.

Plenary lectures in the amphitheater of the Elementary School "Sveti Sava", Pirot

Lunch break

Oral presentations, poster presentations and discussion in the amphitheater of the Elementary School "Sveti Sava", Pirot

Introductory speech and opening of the conference session:

Vesna P. Stankov Jovanović, Ph.D, Marija S. Marković, Ph.D, moderators

Ljubinko B. Rakonjac, Ph.D, president of Scientific committee

PLENARY LECTURES:

1. Lyuben Zagorchev, Ph.D, Associate Professor, Faculty of Biology, Sofia University "St. Kliment Ohridski", Sofia, in cooperation with Denitsa Teofanova, Ph.D,

- 9.00 – 9.20 Plenary lecture with title **Biologically active compounds and antioxidant activity of parasitic plants from the genus *Cuscuta* in Bulgaria;**

2. Biljana B. Arsić, Ph.D, Senior Research Associate, Faculty of Science and Mathematics, University of Niš, in cooperation with Danijela A. Kostić, Ph.D, Dragoljub Miladinović, Ph.D, Aleksandra N. Pavlović, Ph.D, Gordana S. Stojanović, Ph.D,

- 9.30 – 9.50 Plenary lecture with title **Application of chemometrics in the analysis of wild plant species;**

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- 3. Snežana A. Stajić, Ph.D**, Senior Research Associate, Institute of Forestry, Belgrade, in cooperation with Vlado M. Čokeša, Ph.D, Ljubinko B. Rakonjac, Ph.D, Saša M. Eremija, Ph.D,
- 10.00 – 10.20 Plenary lecture with title **Medicinal plants and forest fruit trees in oak dominated forests in the area of Kosmaj (Serbia)**;
- 4. Suzana Ž. Mitrović, Ph.D**, Senior Research Associate, Institute of Forestry, Belgrade,
- 10.30 – 10.50 Plenary lecture with title **Unmanaged forest complex that belonged to the former Avala film in Belgrade – potential risk for users**;
- 5. Marija S. Marković, Ph.D**, Senior Research Associate, Institute of Forestry, Belgrade, in cooperation with Dejan S. Pljevljakušić, Ph.D, Biljana M. Nikolić, Ph.D, Ljubinko B. Rakonjac, Ph.D, Bojan K. Zlatković, Ph.D, Branko N. Jotić, Vesna P. Stankov Jovanović, Ph.D,
- 11.00 – 11.20 Plenary lecture with title **Traditional medicinal use of *Juniperus communis* in the Pirot District (Serbia)**;
- 6. Ina Aneva, Ph.D**, Associate Professor, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Sofia,
- 11.30 – 11.50 Plenary lecture with title **Taxonomic and Phytochemical Challenges in the Genus *Thymus* in Bulgaria: From Scientific Research to Sustainable Cultivation and Innovative Applications**;
- 7. Marija Jug-Dujaković, Ph.D**, Research Associate, Institute for Adriatic Crops and Karst Reclamation, Split, in cooperation with Łukasz Łuczaj, Ph.D,
- 12.00 – 12.20 Plenary lecture with title **Traditional wild food plants used on Island Hvar (Croatia)**;
- 8. Andela V. Dragičević, Ph.D student**, University of Niš, Faculty of Medicine, Department of Pharmacy, in cooperation with Jelena S. Matejić, Ph.D, Ana M. Džamić, Ph.D, Tijana J. Ivanović, Ph.D, Dragana R. Pavlović, Ph.D,
- 12.30 – 12.50 Plenary lecture with title **Ethnobotanical findings on the traditional use of medicinal plants in the urban ecosystem of the city of Niš (southeastern Serbia)**;
- 9. Govind P. Rao, Ph.D**, ICAR-Emeritus Scientist (Crop Protection), Division of Plant Pathology, Indian Agricultural Research Institute, Pusa Campus, New Delhi,
- 13.00 – 13.20 Plenary lecture with title **Medicinal Plants and Spices of Wonders for Health Benefit from Indian Origin**.

Break: 13.20 – 14.00

ORAL PRESENTATIONS:

1. Biljana Bauer, Ph.D, Full Professor, Institute of Pharmacognosy, Faculty of Pharmacy, Ss. Cyril and Methodius University, Skopje, in cooperation with Sanja Kostadinović Veličkovska, Ph.D,
- 14.00 – 14.15 Oral presentation with title **The usage of medicinal plants thought history;**

2. Radica Zurovac, political scientist/project manager, World Music Association Serbia, Jagodina, in cooperation with Saša Srećković,
- 14.20 – 14.35 Oral presentation with title **Establishment of a regional inventory of good practices on intangible cultural heritage (ICH) / REGISTER, related to natural resources along the Danube;**

3. Ekaterina Kozuharova, Ph.D, Full Professor, Department of Pharmacognosy, Faculty of Pharmacy, Medical University, Sofia, in cooperation with Christina Stoycheva, Ph.D, Daniela Batovska, Ph.D, Giuseppe Antonio Malfa, Ph.D, Rosaria Acquaviva, Ph.D,
- 14.40 – 14.55 Oral presentation with title **Sustainable use of peonies in - Is it possible to substitute the rare medicinal *P. peregrina* with the ornamental *P. lactiflora*?**

4. Katarina Husnjak Malovec, Ph.D, student, Expert Associate, University of Zagreb, Faculty of Science, Botanical Garden, Zagreb,
- 15.00 – 15.15 Oral presentation with title **Traditional knowledge on wild edible and medicinal plants – contemporary vs. past use in NW Croatia;**

5. Ana Paravinja, Ph.D, student, University of Belgrade, Institute for Multidisciplinary Research, Belgrade, in cooperation with Miloš Stanojević, Nina Nikolić, and Miroslav Nikolić,
- 15.20 – 15.35 Oral presentation with title **Potential of Medicinal Plants in Controlling Iron Deficiency in Humans.**

DISCUSSION

15.40 – 16.00

POSTER PRESENTATIONS:

16.00 – 17.00

1. Ana Dragumilo, Ph.D, Research Associate, Institute for Medicinal Plants Research "Dr. Josif Pančić", Belgrade, in cooperation with Tatjana Marković, Ph.D, Sara Mikić, Stefan Gordanić, Ph.D, Željana Prijić, Ph.D, Sava Vrbničanin, Ph.D, Miloš Rajković, Ph.D, Dragana Božić, Ph.D,

- Poster presentation **Weed Flora of Medicinal Plant Crops in Southern Banat;**

2. Alen Gačić, JPŠ Šume Republike Srpske, Banja Luka, in cooperation with Marijana Kapović Solomun, Ph.D, and Ilija Čigoja, Ph.D student,

- Poster presentation **The influence of the physico-chemical properties of the ranker of the "Usorsko-Ukrinsko" forestry management area on the possibility of forest fruit trees planting;**

3. Stefan Gordanić, Ph.D, Research Associate, Institute for Medicinal Plants Research "Dr. Josif Pančić", Belgrade, in cooperation with Ana Dragumilo, Ph.D, Tatjana Marković, Ph.D, Miloš Rajković, Ph.D, Sara Mikić, Snežana Mrđan, and Željana Prijić, Ph.D,

- Poster presentation **The effect of aging on germination and seed viability of *Arnica montana* L.;**

4. Filip A. Jovanović, Ph.D, Senior Research Associate, Institute of Forestry, Belgrade, in cooperation with Jovana Z. Cvetković and Sonja Z. Braunović, Ph.D,

- Poster presentation **Ethnobotanical use of the genus *Galanthus* L.;**

5. Sanja Kostadinović Veličkovska, Ph.D, Full Professor, Faculty of Agriculture, University "Goce Delčev", Štip, in cooperation with Daniela Todevska, Ph.D, Fidanka Ilieva, Ph.D, Maja Čočevska, Ph.D, Elizabeta Jančovska Seničeva, Ph.D, and Biljana Bauer, Ph.D,

- Poster presentation **Wild raspberries from Republic of North Macedonia as a valuable source for healing vinegars;**

6. Biljana Kovacevik, Ph.D, Associate Professor, Faculty of Agriculture, University "Goce Delčev", Štip, in cooperation with Sasa Mitrev, Ph.D, Sanja Kostadinović Veličkovska, Ph.D, and Emilija Arsov, Ph.D,

- Poster presentation **The potential of essential oils from medicinal plants as "new age pesticides" in agriculture;**

7. Jovan B. Lazarević, Ph.D student, Research Associate, Tamiš Research and Development Institute, Pančevo, in cooperation with Isidora S. Knežević, Ph.D, Mirela Matković Stojšin, Ph.D, Jelena M. Damjanović, Ph.D, Sava P. Vrbničanin, Ph.D, Svetlana M. Roljević Nikolić, Ph.D,

- Poster presentation **"In vitro" allelopathic effect of angelica hydrolate (*Angelica archangelica* L.) on soybean seed germination (*Glycine hispida*);**

8. Bojana Maksimović, Ph.D student, Junior Research Assistant, Faculty of Science and Mathematics, University of Niš, in cooperation with Aleksandra G. Petrović, Ph.D, Višnja Madić, Ph.D, Marina Jušković, Ph.D, Ljubiša Đorđević, Ph.D, and Perica Vasiljević, Ph.D,

- Poster presentation **Hemolytic activity and effect on lipid peroxidation of decoctions of the plant species *Linum usitatissimum* L. under *in vitro* conditions;**

9. Biljana Nikolić, Ph.D, Principal Research Fellow, Institute of Forestry, Belgrade in cooperation with Ljubinko B. Rakonjac, Ph.D, Sonja Z. Braunović, Ph.D, Filip A. Jovanović, Ph.D, Dejan S. Pljevljakušić, Ph.D, Marija S. Marković, Ph.D, and Vesna P. Stankov-Jovanović, Ph.D,

- Poster presentation **Ethnopharmacological use of plants from the genus *Crataegus* in the Pirot District (southeastern Serbia);**

10. Biljana Nikolić, Ph.D, Principal Research Fellow, Institute of Forestry, Belgrade in cooperation with Saša M. Eremija, Ph.D, Goran D. Češljar, Ph.D, Aleksandar Ž. Lučić, Ph.D, Marija S. Marković, Ph.D, Snežana R. Konatar, Tatjana T. Ćirković-Mitrović, Ph.D,

- Poster presentation **Traditional consumption modes of fruits from the genus *Crataegus* in the Pirot District (southeastern Serbia);**

11. Aleksandra Petrović, Ph.D, Research Associate, Faculty of Science and Mathematics, University of Niš, in cooperation with Bojana Maksimović, Višnja Madić, Ph.D, Nerma Mladenović, Jovan Zdravković, Bojan K. Zlatković, Ph.D, Marina Jušković, Ph.D, Perica Vasiljević, Ph.D, Ljubiša Đorđević, Ph.D,

- Poster presentation **Evaluation of cytotoxic and genotoxic effects of chicory (*Cichorium intybus* L.) decoct;**

12. Željana Prijić, Ph.D, Research Associate, Institute for Medicinal Plants Research "Dr. Josif Pančić", Belgrade, in cooperation with Sara Mikić, Ana Dragumilo, Ph.D, Snežana Mrđan, Petar Batinić, Ph.D, Natalija Čutović, Ph.D, Nikola Đukić, Ph.D, Tatjana Marković, Ph.D,

- Poster presentation **The influence of a hot and dry year on the seed development of herbaceous peonies (*Paeonia* spp.) native to Serbia;**

13. Ljubinko B. Rakonjac, Ph.D, Principal Research Fellow, Institute of Forestry, Belgrade in cooperation with Biljana M. Nikolić, Ph.D, Marija S. Marković, Ph.D,

Sabahudin H. Hadrović, Ph.D, Natalija R. Momirović, Jelena D. Urošević, Saša M. Eremija, Ph.D,

- Poster presentation **Forest fruit trees in the Pirot surroundings (Serbia), ecological importance and economic potential;**

14. Ljubinko B. Rakonjac, Ph.D, Principal Research Fellow, Institute of Forestry, Belgrade in cooperation with Marija S. Marković, Ph.D, Biljana M. Nikolić, Ph.D, Dejan S. Pljevljakušić, Ph.D, Sonja Z. Braunović, Ph.D, Filip A. Jovanović, Ph.D, Vesna P. Stankov-Jovanović, Ph.D,

- Poster presentation **Ethnobotanical use of silver birch in the Pirot District (Serbia);**

15. Milica N. Simić, Ph.D student, Faculty of Science and Mathematics, University of Niš, in cooperation with Nataša M. Joković, Ph.D, Jelena S. Matejić, Ph.D, Bojan K. Zlatković, Ph.D, Łukasz Łuczaj, Ph.D, Marija S. Marković, Ph.D,

- Poster presentation **Gastronomic potential of wild edible plants at Rujan Mt (Serbia);**

16. Milica N. Simić, Ph.D student, Faculty of Science and Mathematics, University of Niš, in cooperation with Nataša M. Joković, Ph.D, Bojan K. Zlatković, Ph.D, Jelena S. Matejić, Ph.D, Saša S. Stanković, Ph.D, Marija S. Marković, Ph.D,

- Poster presentation **Traditional agricultural use of wild plants in as a green fertilizer of cultivated crops and for insect and rodent control on Rujan Mt (Serbia);**

17. Mirjana Smiljić, Ph.D student, Faculty of Science and Mathematics, University of Priština in Kosovska Mitrovica, in cooperation with Tatjana Jakšić, Ph.D, Predrag Vasić, Ph.D, Marija S. Marković, Ph.D, Gorica Đelić, Ph.D,

- Poster presentation **Ethnopharmacological use of sage in northern part of Kosovo and Metohija (southern Serbia);**

18. Ivana Vitasović Kosić, Ph.D, Associate Professor, Faculty of Agriculture, University of Zagreb, in cooperation with Jelena Blagec, Ph.D student,

- Poster presentation **Folk medicine in the Hrvatsko Zagorje region (NW Croatia);**

19. Milica S. Luković, Ph.D, Associate Professor, Faculty of Hotel Management and Tourism in Vrnjačka Banja, University of Kragujevac, in cooperation with Danijela V. Pantović, Ph.D, and Jelena S. Davidović, Ph.D,

- Poster presentation **Ethnobotanical knowledge and practices in the context of regenerative tourism**;

20. Biljana Karovska, Petel Paun Design Arts and Crafts, Ripanj, Belgrade, in cooperation with Ivana Kruljević,

- Poster presentation **The Art and Science of Natural Dyeing - Reappearance of plant colors**;

21. Radomir B. Ljupković, Ph.D, Research Associate, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Slobodan A. Ćirić, Ph.D, Katarina D. Stepić, Jovana D. Ickovski, Ph.D, Aleksandra S. Đorđević, Ph.D, Marija S. Marković, Ph.D, Vesna P. Stankov Jovanović, Ph.D,

- Poster presentation **Traditional use of wild garlic (*Allium ursinum*) in southeastern Serbia: an ethnobotanical survey from the Niš District**;

22. Radomir B. Ljupković, Ph.D, Research Associate, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Slobodan A. Ćirić, Ph.D, Jovana D. Ickovski, Ph.D, Katarina D. Stepić, Aleksandra S. Đorđević, Ph.D, Marija S. Marković, Ph.D, Vesna P. Stankov Jovanović, Ph.D,

- Poster presentation **Ethnobotanical insights into the use of the plants from genus *Thymus* in the Niš District of southeastern Serbia**;

23. Jovana D. Ickovski, Ph.D, Research Associate, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Slobodan A. Ćirić, Ph.D, Radomir B. Ljupković, Ph.D, Katarina D. Stepić, Aleksandra S. Đorđević, Ph.D, Marija S. Marković, Ph.D, Vesna P. Stankov Jovanović, Ph.D,

- Poster presentation **The scent of tradition: an ethnobotanical Story of chamomile in the Niš District**;

24. Jovana D. Ickovski, Ph.D, Research Associate, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Slobodan A. Ćirić, Ph.D, Katarina D. Stepić, Radomir B. Ljupković, Ph.D, Aleksandra S. Đorđević, Ph.D, Marija S. Marković, Ph.D, Vesna P. Stankov Jovanović, Ph.D,

- Poster presentation ***Mentha piperita* L. in the context of urban ethnobotany: a case study from the Niš District**;

25. Slobodan A. Ćirić, Ph.D, Research Associate, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Jovana D. Ickovski, Ph.D, Katarina D. Stepić, Radomir B. Ljupković, Ph.D, Aleksandra S. Đorđević, Ph.D, Marija S. Marković, Ph.D, Vesna P. Stankov Jovanović, Ph.D,

- Poster presentation **Traditional use of wild aromatic herbs as spices in southeastern Serbia;**

26. Slobodan A. Ćirić, Ph.D, Research Associate, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Jovana D. Ickovski, Ph.D, Katarina D. Stepić, Radomir B. Ljupković, Ph.D, Aleksandra S. Đorđević, Ph.D, Marija S. Marković, Ph.D, Vesna P. Stankov Jovanović, Ph.D,

- Poster presentation **Wild fruits as a culinary and medicinal resource: Ethnobotanical research for Niš District;**

27. Svetlana M. Tošić, Ph.D, Associate Professor, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Jovana B. Nikolić, Martina V. Kuzmanović, Milica M. Pavlović,

- Poster presentation **Allelopathic effect of *Equisetum arvense* L. on germination *Solanum lycopersicum* var. *cerasiforme* and *Lycopersicum esculentum*;**

28. Ahmed Snoussi, Ph.D, Assistant Professor, Higher School of Food Industries of Tunis, Tunisia, in cooperation with Hayet Ben Haj Koubaier, Ph.D, Saoussen Bouacida, Ph.D, Nabih Bouzouita, Ph.D,

- Poster presentation **Unlocking the potential of wild myrtle (*Myrtus communis* L.) in the agri-food sector for enhanced food security;**

29. Łukasz Łuczaj, Ph.D, Full Professor, Faculty of Biology and Nature Conservation, University of Rzeszów, Poland,

- Poster presentation **The alimentary use of water caltrop (*Trapa natans*) in Europe;**

30. Stefan Lj. Marković, Faculty of sport and physical education, University of Niš, in cooperation with Slavoljub Uzunović, Ph.D, Anđela S. Pančić, Marija S. Marković, Ph.D, Olivera Papović, Ph.D, and Vesna P. Stankov Jovanović, Ph.D,

- Poster presentation **Nutrition and traditional use of forest fruit trees as integral parts of diabetes treatment in the Pirot District (Serbia);**

31. Vesna P. Stankov Jovanović, Ph.D, Full Professor, Faculty of Sciences and Mathematics, University of Niš, in cooperation with Marija Ilić, Ph.D, Violeta Mitić, Ph.D, Jelena Nikolić, Ph.D, Marija Dimitrijević, Ph.D, Slobodan Ćirić, Ph.D, Marija S. Marković, Ph.D,

- Poster presentation **Assessment of the antioxidant properties of methanolic extracts of the plant species *Geranium macrorrhizum* from the post-fire area.**

Third day: June 28, 2025.

7.30 – 17.30 Excursion on Stara planina Mt in the area of the village of Dojkinci at the localities "Arbinje" and the "Tri Kladenca" waterfall.

Abstract

The potential of essential oils from medicinal plants as "new age pesticides" in agriculture

Biljana Kovacevik^{1*}, Sasa Mitrev¹, Sanja Kostadinović Veličkovska¹, Emilija Arsov¹

Aromatic plants naturally produce essential oils (EOs) as secondary metabolites in the secretory glands of specific plant organs. These oils provide both direct and indirect defenses against herbivores and pathogenic microorganisms. EOs are composed of complex mixtures of terpenes, terpenoids, and phenylpropanoids as their primary components. Known for their antioxidant, antimicrobial, and anti-inflammatory properties, EOs derived from medicinal plants have broad applications in cosmetics, the food industry, and traditional medicine. By the end of the twentieth century, the antimicrobial properties of EOs had attracted significant scientific interest, highlighting their potential as alternatives to synthetic pesticides in agriculture. Among the most studied and widely used EOs for their bioactive effects on plant pathogens, pests, and weeds are those derived from citronella, lavender, rosemary, lemongrass, thyme, peppermint, cinnamon, clove, eucalyptus, sage, tea tree, oregano, and citrus. Although the literature contains extensive data on the effectiveness of EOs against plant pathogens, pests, and weeds, their practical application in agriculture remains surprisingly limited. The main limitations for their commercial use in agriculture include manufacturing constraints, their lipophilic and highly volatile nature, production costs, and variability in their composition. Emerging innovations, such as nanoencapsulation, offer promising solutions to overcome some of these challenges. This review compiles and discusses the latest scientific literature on the biological activities of EOs from medicinal plants against plant pathogens, pests, and weeds, their chemical composition, and modes of action. Additionally, the

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review explains both the benefits and limitations of using EOs as alternatives to synthetic pesticides, as well as the regulatory and approval processes involved.

Keywords: biopesticides, terpens, terpenoides, phenylpropanoids, mode of action, regulations, agriculture

Сажетак

Потенцијалот на есенцијални масла од лековити растенија како „нова генерација на пестициди“ во земјоделието

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Етеричните масла (ЕМ) природно ги произведуваат ароматичните растенија, во нивните секреторни жлезди кои се наоѓаат во одредени органи, како секундарни метаболити чија што главна улога е да обезбедат директна и индиректна одбрана на растенијата од нападот на некои хербивори и патогени микроорганизми. Составени се од сложени мешавини од терпени, терпеноиди и фенилпропаноиди како главни компоненти. Познати по своите антиоксидантни, антимикробни и антиинфламаторни својства, ЕМ од лековити растенија наоѓаат широка примена во козметиката, прехранбената индустрија и традиционалната медицина. До крајот на дваесеттиот век, антимикробните својства на ЕМ привлекоа значителен научен интерес како потенцијални алтернативи на синтетичките пестициди во земјоделството. Најпознати и најшироко користени ЕМ во однос на нивните биоактивни својства кон растителните патогени, штетници и плевели се маслата од citronella, лаванда, рузмарин, маточина, мајчина душица, пеперминт, цимет, каранфилче, еукалиптус, жалфија, чајно дрво, оригано и цитрус. Иако литературата содржи обемни податоци за ефикасноста на есенцијалните масла против патогените организми на растенијата, штетниците и плевелите, нивната практична примена во земјоделството останува изненадувачки ограничена. Производствените ограничувања, нивната липофилна и испарлива природа, трошоците за производство и варијабилноста на составот се препознаваат како најважни ограничувања за нивната комерцијална употреба во земјоделството. Новите иновации како што е нанокapsулацијата ветуваат решенија за надминување на некои од овие предизвици. Овој преглед има за цел да даде преглед и увид во најновата научна литература за биолошките активности на ЕМ од лековити растенија против патогените организми на растенијата, штетниците и плевелите, нивниот хемиски состав и начинот на дејствување. Дополнително, ќе биде

даден увид во придобивките и ограничувањата од користењето на ЕМ како замена за синтетичките пестициди, заедно со законските регулативи и процеси на одобрување.

Клучни зборови: биопестициди, терпени, терпеноиди, фенилпропаноиди, начин на делување, законски регулативи, земјоделе