ANNOTATION OF THE MATERIALS

under art. 65 of the Regulations for the Development of academic staff of PU "Paisii Hilendarski", including

EXTENDED HABILITATION REFERENCE

Chief Assist. Prof. Krasimir Tihomirov Todorov, PhD

for participation in a competition for the academic position "Associate Professor", announced in State Gazette, issue 96/11.11.2025

Field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.3 Biological sciences (Botany)

The materials submitted for participation in the competition for the academic position of Associate Professor include 19 scientific publications, one utility model registration certificate and one patent application, none of which were used for obtaining the educational and scientific degree PhD and the academic positions " Chief Assistant Professor ".

- All presented publications are referenced and indexed in the world-renowned scientific information databases Web of Science and Scopus
- Total number of IF for the articles participating in the competition: 33.74
- Total number of citations for the competition (only in Web of Science и Scopus): 46
- h-index according to Scopus: 5
- https://www.scopus.com/authid/detail.uri?authorId=56765637900
- h-index according to Web of Science: 5
- https://www.webofscience.com/wos/woscc/citation-report/03c78a52-1569-4b5e-bcef-804fbf366bf7-0187e1c1f9?page=1
- ORCID №: https://orcid.org/0000-0003-1344-624X
- Google scholar: https://scholar.google.com/citations?user=zlgk5gkAAAAJ&hl=bg
- Researchgate: https://www.researchgate.net/profile/Krasimir-Todorov?ev=hdr_xprf

For Criterion A.

SCIENTIFIC PUBLICATIONS ON THE BASIS OF WHICH THE DISSERTATION WORK IS DEFENDED:

1. **Todorov, K**., Ivanov, D., Dimitrova-Dyulgerova, I. (2014). Palynomorphological study of the Bulgarian representatives of genus *Carduus* (Asteraceae). *Phytologia Balcanica*, 20 (2–3): 233 – 245. Web of Science

   Abstract: A detailed palynomorphological study of the Bulgarian species of genus *Carduus* L. (*Asteraceae*) is carried out for the first time by light and electron microscopy. New data have been obtained on the endemic species *C. armatus, C. candicans* subsp. *globifer*, *C. kerneri* subsp. *austro-orientalis, C. rhodopaeus,* and *C. thracicus.* The grouping of the species is traced out and their similarity is assessed by means of statistical processing and cluster analysis. The assumption of the species'

belonging to one pollen type, the *Carduus crispus* type, has been confirmed. Within the framework of that type, two pollen groups have been distinguished: *Carduus nutans* and *Carduus crispus*. It has been established that the equatorial diameter, polar axis, height and width of the spikes are of the highest distinguishing value for the pollen grains.

2. **Todorov, K**., Stoyanov, P., Mladenova, Ts., Boyadzhiev, D., Dimitrova-Dyulgerova, I. (2017). Comparative anatomical leaf analyses of *Carduus nutans* L. and *Carduus thoermeri* Wienm. from Bulgaria. *Ecologia Balkanica*, 9 (2): 29-39. Web of Science, Scopus Q4 SJR 0.123

   Abstract: The present study provides a comparative anatomical leaf analysis of *Carduus nutans* L. and *C. thoermeri* Wienm., which belong to the Asteraceae family. Bifacial leaf structure, anomocytic and anisocytic types of stomatal apparatus and two types of trichomes (multicellular covering and glandular) were found on the leaves of both species. The quantitative anatomical characteristics varied considerably, however; basing on the statistical analyses, the most significant characteristics for distinguishing the two taxa are: the number of stomata in the abaxial epidermis, the number of capitated glandular trichomes and the number of multicellular covering trichomes in the upper (adaxial) and lower (abaxial) epidermis.

3. Denev, I., **Todorov, K**., Kirilova, I., Mladenov, R., Stoyanov, P., Dimitrova-Dyulgerova, I. (2018). Genetic diversity of Bulgarian representatives of genus *Carduus* L. (Asteraceae) as revealed by variability in sequences of internal transcribed spacers region. *Biotechnology & Biotechnological Equipment*, 32 (2): 387-396. Web of Science Q4 IF 1.097, Scopus Q3 SJR 0.394

   Abstract: The biodiversity of genus *Carduus* in Bulgaria is grossly under-studied with modern methods, which leads to unclear status of species and hampers the assessment of their habitats and conservation status. In this study, we used the variability of internal transcribed spacers (ITS) to investigate the biodiversity of *Carduus* species collected from different floristic regions of Bulgaria. Thirty-three samples were processed. Among the studied species, *C. acanthoides* exhibited the highest ITS variability (eight single nucleotide polymorphisms were found). High ITS variability was also found in *C. crispus* and *C. hamulosus*, demonstrating that some of the local *Carduus* species possesses unique genetic diversity, which can serve as source for future divergence of new forms and subspecies. For each species, unique nucleotides suitable as molecular taxonomy markers were identified. However, *C. nutans* and *C. thoermeri* displayed completely identical ITS sequences, which is in agreement with all ITS sequences of these species collected elsewhere in the world and deposited in the NCBI database. After careful analyses of both molecular and morphological data, we propose to restore *C. nutans* and *C. thoermeri* as one species with two subspecies. Namely, *Carduus nutans* subsp. *nutans* and *Carduus nutans* subsp. *thoermeri*. We recommend diameter of capitulum, length of peduncle, width of peduncle and width of bract as diagnostic features of taxonomic significance for distinguishing the two subspecies.

4. **Todorov, K.,** Cheshmedzhiev, I., Stoyanov, P., Mladenova, Ts., Dimitrova-Dyulgerova, I. (2018). Taxonomic structure of the genus *Carduus* L. in Bulgaria. *Ecologia Balkanica*, 10(2): 229-233. Web of Science, Scopus Q4 SJR 0.103

   Abstract: A key table for species determination of the Bulgarian representatives from the genus *Carduus* was modified, basing on the findings from the biosystematical study. Taxonomic classification of *C. nutans* and *C. thoermeri* was assumed, and new floristic regions of distribution were found for six species. The species *C. uncinatus* was not confirmed for the Bulgarian flora.

For Criterion B4.

HABILITATION WORK - SCIENTIFIC PUBLICATIONS IN PUBLICATIONS THAT ARE REFERENCED AND INDEXED IN SCIENTIFIC INFORMATION DATABASES OF WEB OF SCIENCE AND SCOPUS:

1. Mladenova, Ts., Stoyanov, P., Denev, P., Dimitrova, S., Katsarova, M., Teneva, D., **Todorov, K.,** Bivolarska, A. (2021). Phytochemical composition, antioxidant and antimicrobial activity of the Balkan endemic *Micromeria frivaldszkyana* (Degen) Velen. (Lamiaceae). *Plants*, 10(4): 710. Web of Science Q1 $_{IF\ 4.658}$, Scopus Q1 $_{SJR\ 0.765}$

   Abstract: The current study investigates the content of sugars, organic acids, phenolic acids and flavonoids, as well as antioxidant and antimicrobial activity of Balkan-endemic *Micromeria frivaldszkyana*. Glucose was the most abundant sugar in the plant (2.77%), followed by fructose (1.18%) and galactose (0.82%). Eight organic acids were detected with quinic acid being in the highest content—556.3 mg/100 g DW. From the individual phenolic acids, rosmarinic acid was found in the most significant amounts (2040.1 ± 1.97 mg/100 g) and hesperidin was the major representative of flavonoids with content 131.2 ± 5.6 mg/100 g DW. The antioxidant activity of the plant was studied by six methods: 2,2′-diphenylpicrylhydrazyl (DPPH)—286.4 ± 10.43 mM TE/g, 2,2′azinobis (3)-ethylbenzthiazoline-6-sulfonic acid (ABTS)—358.4 ± 10.4 mM TE/g, ferric reducing antioxidant power (FRAP)—388.0 ± 32.4 mM TE/g, cupric reducing antioxidant capacity (CUPRAC)—905.6 ± 19.2 mM TE/g, Oxygen Radical Absorbance Capacity (ORAC)—3250.5 ± 208.1 µmol TE/g and Hydroxyl Radical Averting Capacity (HORAC)—306.1 ± 23.5 µmol GAE/g. In vitro antimicrobial activity against nine microorganism was evaluated but the extract displayed antimicrobial activity only against *Listeria monocytogenes* ATCC 19111 with inhibition zone diameter 9 mm and minimal inhibitory concentration (MIC) 10 mg/mL.

2. Stavrakeva, K., Metodieva, K., Benina, M., Bivolarska, A., Dimov, I., Choneva, M., Kokova, V., Alseekh, S., Ivanova, V., Vatov, E., Gechev, Ts., Mladenova, Ts., Mladenov, R., **Todorov, K.,** Stoyanov, P., Gyuzeleva, D., Popova, M., Apostolova, E. (2024). Metabolic Composition of Methanolic Extract of the Balkan Endemic Species *Micromeria frivaldszkyana* (Degen) Velen and Its Anti-Inflammatory Effect on Male Wistar Rats. *International Journal of Molecular Sciences*, 25(10): 1-16, 5396. Web of Science Q1 $_{IF\ 4.9}$, Scopus Q1 $_{SJR\ 1.273}$

   Abstract: Extracts from medicinal plants are widely used in the treatment and prevention of different diseases. *Micromeria frivaldszkyana* is a Balkan endemic species with reported antioxidant and antimicrobial characteristics; however, its phytochemical composition is not well defined. Here, we examined the metabolome of *M. frivaldszkyana* by chromatography–mass spectrometry (GCMS), ultra-performance liquid chromatography–mass spectrometry (UPLC-MS-MS), and inductively coupled plasma mass spectrometry (ICP-MS). Amino acids, organic acids, sugars, and sugar alcohols were the primary metabolites with the highest levels in the plant extract. Detailed analysis of the sugar content identified high levels of sucrose, glucose, mannose, and fructose. Lipids are primary plant metabolites, and the analysis revealed triacylglycerols as the most abundant lipid group. Potassium (K), magnesium (Mg), zinc (Zn), and calcium (Ca) were the elements with the highest content. The results showed linarin, 3-caffeoil-quinic acid, and rosmarinic acid, as well as a number of polyphenols, as the most abundant secondary metabolites. Among the flavonoids and polyphenols with a high presence were eupatorin, kaempferol, and apigenin—compounds widely known for their bioactive properties. Further, the acute toxicity and potential anti-inflammatory activity of the methanolic extract were evaluated in Wistar rats. No toxic effects were registered after a single oral application of the extract in doses of between 200 and 5000 mg/kg bw. A fourteen-day pre-treatment with methanolic extract of M. frivaldszkyana in doses of 250, 400, and 500 mg/kg bw induced anti-inflammatory activity in the 1st, 2nd, and 3rd hours after carrageenan injection in a model of rat paw edema. This effect was also present in the 4th hour only in the group treated with a dose of 500 mg/kg. In conclusion, *M. frivaldszkyana* extract is particularly rich in linarin, rosmarinic acid, and flavonoids (eupatorin, kaempferol, and apigenin). Its methanolic extract induced no toxicity in male Wistar rats after oral application in doses of up to 5000 mg/kg bw. Additionally, treatment with the methanolic extract for 14 days revealed anti-inflammatory potential in a model of rat paw edema on the 1st, 2nd, and 3rd hours after the carrageenan injection. These results show the anti-inflammatory potential of the plant, which might be considered for further exploration and eventual application as a phytotherapeutic agent.

3. Gyuzeleva, D., Benina, M., Ivanova, V., Vatov, E., Alseekh, S., Mladenova, T., Mladenov, R., **Todorov, K.,** Bivolarska, A., Stoyanov, P. (2023). Metabolome Profiling of *Marrubium peregrinum* L. and *Marrubium friwaldskyanum* Boiss Reveals Their Potential as Sources of Plant-Based Pharmaceuticals. *International Journal of Molecular Sciences*, 24, 17035. Web of Science Q1 $_{IF\ 4.9}$, Scopus Q1 $_{SJR\ 1.179}$

Abstract: *Marrubium* species have been used since ancient times as food additives and curative treatments. Their phytochemical composition and various pharmacological activities were the focus of a number of scientific investigations but no comprehensive metabolome profiling to identify the numerous primary and secondary metabolites has been performed so far. This study aimed to generate a comprehensive picture of the total metabolite content of two *Marrubium* species—*M. peregrinum* and *M. friwaldskyanum*—to provide detailed information about the main primary and secondary metabolites. In addition, the elemental composition was also evaluated. For this purpose, non-targeted metabolomic analyses were conducted using GC-MS, UPLC-MS/MS and ICP-MS approaches. Nearly 500 compounds and 12 elements were detected and described. The results showed a strong presence of phenolic acids, flavonoids and their glucosides, which are generally of great interest due to their various pharmacological activities. Furthermore, tissue-specific analyses for *M. friwaldskyanum* stem, leaves and flowers were carried out in order to outline the sources of potentially important bioactive molecules. The results generated from this study depict the *Marrubium* metabolome and reveal its dual scientific importance—from one side, providing information about the metabolites that is fundamental and vital for the survival of these species, and from the other side, defining the large diversity of secondary substances that are a potential source of phytotherapeutic agents.

4. Gyuzeleva, D., Batsalova, Ts., Dzhambazov, B., Teneva, I., Mladenova, Ts., Mladenov, R., Stoyanov, P., **Todorov, K.,** Moten, D., Apostolova, D., Bivolarska, A. (2024). Assessment of the biological activity of *Marrubium friwaldskyanum* Boiss. (*Lamiaceae*). *Heliyon*, 10, e32599. Web of Science Q1 $_{IF\ 3.6}$, Scopus Q1 $_{SJR\ 0.644}$

Abstract: Present scientific evidences about the biological activity and potential medical application of extracts derived from *Marrubium friwaldskyanum* Boiss. are limited. Therefore, our study was undertaken to define several main characteristics in this regard – *in vitro* cytotoxicity and antitumor properties, antibacterial activity and immunomodulatory potential. Extracts were obtained from different aerial parts of *Marrubium friwaldskyanum* – stems, leaves and flowers. The *in vitro* cytotoxicity and antitumor activity of the samples were evaluated by tetrazolium salt reduction tests and Neutral red uptake assays using four human cell lines (a normal fibroblastic and three adenocarcinoma cell lines/A549, HeLa, HT-29/) and by experiments with HT-29 tumor spheroids. Antibacterial activity toward Gram-negative (*Escherichia coli*) and Gram-positive (*Bacillus cereus*) species was assessed based on estimation of minimal inhibitory and minimal bactericidal concentrations as well as longitudinal studies on bacterial viability. *Ex vivo* assays with normal leukocytes were performed to define potential immunomodulatory activity of the extracts. Our results demonstrated selective antitumor activity of the extracts directed against colon adenocarcinoma HT-29 cells and cervical adenocarcinoma HeLa cell line. Metabolic activity of A549 lung adenocarcinoma cells was affected only by the sample derived from flowers. *M. friwaldskyanum* leaf and flower extracts showed the highest activity, which included reduction of HT-29 tumor spheroid growth and viability. The studied samples exhibited antibacterial activity against both bacterial species tested. Treatment with *M. friwaldskyanum* extracts affected specific leukocyte populations (HLA+, CD19+, CD11b+, CD25+ cells). These results demonstrate for the first time complex biological effects of extracts derived from *M. friwaldskyanum* and their potential to serve as a source of valuable compounds for the pharmaceutical industry.

For Criterion G7.

SCIENTIFIC PUBLICATIONS IN JOURNALS THAT ARE REFERENCED AND INDEXED IN THE SCIENTIFIC INFORMATION DATABASES OF WEB OF SCIENCE AND SCOPUS, OUTSIDE OF THE HABILITATION THESIS

1. Dimitrova-Dyulgerova, I., Mollova, S., Mladenova, Ts., **Todorov, K.,** Stoyanov, P. (2017). Medicinal plants on the territory of the Municipality of Dospat. *Journal of BioScience and Biotechnology*, 6(1): 59-71. Web of Science

   Abstract: The study presents data on the species diversity of medicinal plants on the territory of the Municipality of Dospat (Western Rhodopes). 332 species were described, grouped in 75 families. The *Asteraceae, Lamiaceae* and *Rosaceae* families were represented by the largest species diversity, perennial herbaceous plants being predominant. There were 72 medicinal plant species of conservation significance, including endemic, rare and protected species.

2. Choneva, M., Bivolarska, A., Gyuzeleva, D., Turiyski, V., Stoyanov, P., Mladenova, Ts., **Todorov, K.,** Mladenov, R., Prissadova, N., Ardasheva, R., Yotov, V., Denev, P., Topalova-Shishmanova, A., Bivolarski, St., Dimov, I. (2025). Putting Ethnobotany into Practice: In Vitro Antioxidant Potential and Impact on Rat Gastric Smooth Muscle Reactivity of Aqueous Extracts of *Marrubium friwaldskyanum* Boiss. and *Marrubium peregrinum* L. *Life*, 15, 948. Web of Science Q1 IF 3.4 (2024), Scopus Q1 SJR 0.824 (2024)

   Abstract: The genus *Marrubium* (Lamiaceae) is widely used in traditional medicine. While some representatives of the genus have been well investigated, the biological activity of others remains largely unknown. The aim of the current study was to assess the in vitro antioxidant potential and the effect on the reactivity of isolated rat gastric smooth muscles (SM) of aqueous extracts of *Marrubium friwaldskyanum* inflorescences, stems and leaves, and *Marrubium peregrinum* as a whole herb. The antioxidant activity was analyzed through multiple spectrophotometric and fluorometric assays. The effect on SM reactivity was determined by the treatment of excised gastric muscles of 10 male Whistar rats with the plant extracts alone or successive to 1,1-dimethyl-4-diphenylacetoxypiperidinium iodide, ketanserin, verapamil, and acetylcholine. According to the obtained results, the *M. friwaldskyanum* leaf extract exhibited the greatest antioxidant potential, followed by the *M. peregrinum* one. The SM reactivity analysis revealed that the treatment with all four extracts induced a dose-dependent contractile response with predominant cholinergic character. However, activation of serotoninergic and/or dopaminergic pathways was also observed. Furthermore, when applied after verapamil, the extracts showed a SM relaxant effect. The discovered biological activity will serve as a basis for future analyses through which the therapeutic effect of the plants will be investigated.

3. Apostolova, E., Stavrakeva, K., Kokova, V., Dimov, I., Choneva, M., Delev, D., Kostadinov, I., Bivolarski, I., Koleva, M., Mladenova, Ts., **Todorov, K.,** Bivolarska, A. (2025). Subchronic Toxicity and Effect of the Methanolic Extract of *Micromeria frivaldszkyana* (*Degen*) Velen on Cognition in Male Wistar Rats. *Plants*, 14, 1837. Web of Science Q1 IF 4.1 (2024), Scopus Q1 SJR 0.888 (2024)

   Abstract: Recently, compounds of plant origin have been the focus of increased scientific interest. *Micromeria frivaldszkyana* is a rare species endemic to Bulgaria, whose biological activity remains unknown. This article aims to evaluate the subchronic toxicity of *Micromeria frivaldszkyana* methanolic extract and its effect on cognition in rats. Following 90 days of oral administration, a histopathological evaluation of brain, kidney, and liver tissues was conducted. Additionally, serum levels of total bilirubin (TB), conjugated bilirubin (CB), alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine (CR), uric acid (UA), and urea (U) were measured. Cognitive function was studied after 7 d of treatment using activity cage test, along with tests for active memory, passive memory, anxiety, spatial and working memory, and explorative activity. The experiments showed no toxic effects of the extract in subchronic application. No adverse effects on brain function were observed after 14 days of

treatment. While the extract increased the motor activity of the animals, it did not significantly improve the learning and memory processes. In conclusion, the methanolic extract of *Micromeria frivaldszkyana* in doses 250 and 500 mg/kg bw did not induce toxicity after 90-day treatment in rats. These doses did not significantly affect central nervous system (CNS) functions, although increased motor activity was observed after 14 days of treatment with the extract.

4. Mladenova, Ts., Stoyanov, P., **Todorov, K.,** Davcheva, D., Kirova, G., Deneva, T., Gyuzeleva, D., Mladenov, R., Bivolarska, A. (2021). Phytochemical and Biological Traits of Endemic *Betonica bulgarica* (Lamiaceae). *Separations*, 8(2): 11. Web of Science Q2 $_{IF\ 3.344}$, Scopus Q3 $_{SJR\ 0.418}$

   Abstract: *Betonica bulgarica* is an endemic species distributed in Bulgaria. The chemical composition of the essential oil analysed by GC–MS (Gas chromatography–mass spectrometry) and the content of trace elements analysed by ICP–MS (Inductively coupled plasma mass spectrometry) were determined. Additionally, a study on the types and distribution of trichomes was done using a microscope with a camera. The essential oil was characterized using a high concentration of sesquiterpene hydrocarbons, whose major compounds are β-caryophyllene (17.4%), germacrene D (9.9%), and β-bourbonene (6.7%). The contents of manganese (177.2 µg/g) and strontium (156.8 µg/g) were highest among the investigated micronutrients. Two types of trichomes were identified on the adaxial and abaxial epidermises of the leaves of *B. bulgarica*—covering and glandular. Peltate stacked glandular trichomes with a four-celled head of type B were observed on the leaf surface.

5. Teneva, O., Petkova, Z., Antova, G., Angelova-Romova, M., Stoyanov, P., **Todorov, K.,** Mladenova, T., Radoukova, T., Mladenov, R., Petkov, V., Bivolarska, A., Gyuzeleva, D. (2024). Chemical Composition and Lipid Bioactive Components of *Centaurea thracica* Dwelling in Bulgaria. *Molecules*, 29(14), 1-14, 3282. Web of Science Q2 $_{IF\ 4.6}$, Scopus Q1 $_{SJR\ 0.865}$

   Abstract: *Centaurea thracica (Janka) Hayek* is a plant common in southern Bulgaria. The inflorescences were collected during June and September 2021, while their seeds were obtained in September 2021. The chemical and lipid composition of the inflorescences during the vegetation process of the plant were established. A significant decrease in total proteins (from 8.7 to 7.4%), glyceride oils (2.0–1.7%), and ash (4.5–4.2%) content was observed, while the amount of carbohydrates (72.3–77.2%) and fibers (28.7–35.8%) increased. During the vegetation of the plant, the content of oleic and linoleic acids increased up to 2–3 times, while the level of palmitic acid decreased. The lipids from the seeds were rich in oleic (53.0%) and palmitic (36.2%) acids. The tocopherol content in the oils of the inflorescences during vegetation increased from 58 to 110 mg/kg, and the content in the oil from the seeds was 260 mg/kg. The phospholipid content decreased during vegetation, and differences were observed in the composition between the inflorescences and the seeds. The high content of oleic acid, linoleic acid, tocopherols, and phospholipids determine the nutritional and biological value of the oils isolated from *Centaurea thracica*, and contribute to their potential use in various directions.

6. Dimitrova-Dyulgerova, I., Merdzhanov, P., **Todorov**, **K.,** Seymenska, D., Stoyanov, P., Mladenov, R., Stoyanova, A. (2015). Essential oils composition of *Betonica officinalis* L. and *Stachys sylvatica* L. (Lamiaceae) from Bulgaria. *Comptes rendus de l'Acadėmie bulgare des Sciences*, 68(8), 991-998. Web of Science Q4 $_{IF\ 0.233}$, Scopus Q3 $_{SJR\ 0.205}$

   Abstract: Essential oils of *Betonica officinalis* and *Stachys sylvatica* obtained by hydrodistillation were analyzed by GC/MS. Sesquiterpene hydrocarbons were dominant in the oils of the studied plant species, growing wild in Bulgaria. The major components in the leaf oil of were: ϒ-muurolene (19.12%), β-caryophyllene (8.05%), benzaldehyde (7.08%), phytol (5.48%), allo-aroma-dendrene (5.06%), δ-cadinol (4.14%), β-bourbonene (3.35%), and in the ower oil ϒ-muurolene (16.68%), benzaldehyde (15.11%), phytol (12.12%), pimara- 7,15-dien-3-one (4.16%) and germacrene (3.02%). The major components of *S. sylvatica* leaf oil were: ϒ-muurolene (17.85%), phytol (9.82%), benzaldehyde (7.93%), β-caryophyllene (4.25%), heptadecane (3.84%), tau-cadinol (3.72%), germacrene (3.26%), α-farnesene

(3.02%) and in ower oil ϒ-muurolene (16.82%), benzaldehyde (14.36%), phytol (11.98%), pimara-7,15-dien-3-one (4.66%) and germacrene (3.16%).

7. Radoukova, Tz., Stoyanov, P., Mladenova, Ts., Mladenov, R., **Todorov, K.,** Rusinova-Videva, S. (2024). Analysis of Wild Edible Mushrooms in the Regions Strandzha and the Black Sea Coast in Bulgaria. *Ecologia Balkanica*, 16(1): 30-48. Web of Science, Scopus Q4 SJR 0.192

   Abstract: This article attempts to summarize the available data on wild edible macromycetes in the regions Strandzha and the Black Sea coast in connection with the clarification of ethnomycology. The total number of registered species of edible mushrooms for both areas is 105. The species *Boletus caucasicus* Singer ex Alessio; *Boletus luridiformis* Rostk. var. *luridiformis* and *Laccaria bicolor* (Maire) P.D. were noted only for the region of the Black Sea coast. The species composition, ecological-trophic structure and seasonality of edible mushrooms are briefly discussed. A list of 14 macroscopic edible fungi with conservation significance for the mycota of the two territories, assessed with the latest IUCN criteria, is given. Critically Endangered (CR) according to the Red List of fungi in Bulgaria and the Red Data Book of the Republic of Bulgaria was *Boletus caucasicus* Singer ex Alessio.

8. **Todorov, K.,** Stoyanov, P., Mladenov, R., Gyuzeleva, D., Radoukova, Tz., Selyami, Dzh., Zhelyazkova, S., Mladenova, Ts. (2025). Analysis of medicinal plants from the regions of the Strandzha mountain and southern Black Sea Coast, Bulgaria. *Ecologia Balkanica*, 17(1): 066-078. Web of Science, Scopus Q4 SJR 0.192 (2024)

   Abstract: This article presents summarized information about the medicinal plants distributed on the territory of Strandzha mountain and the southern Black Sea coast, Bulgaria. According to literature data, 252 medicinal taxa are found on the territory of the two floristic regions, 218 of which are included in the Medicinal Plants Act. All species included in the list are characterized by: biological type, life form, and floral element. 59 plants have conservation status, representing 23.4% of the established species composition. According to the Red List of Higher Plants in Bulgaria and the Red Book of the Republic of Bulgaria, the following species are critically endangered (CR): *Arbutus unedo* L. and *Sideritis syriaca* L. Four Balkan endemics have been identified - *Achillea clypeolata* Sm., *Opopanax chironius* (L.) W. D. J. Koch subsp. *bulgaricum* (Velen.) Andreev, *Sempervivum leucanthum* Pančič, and *Thymus longedentatus* (Deg. & Urum.) Ronn.

9. Stoyanov, P., **Todorov, K.,** Mladenov, R. (2016). Study of Plant Species Composition of Grasslands in Mugla Village Region (Western Rhodopes, South Bulgaria). *Ecologia Balkanica*, 8(1): 65-72. Web of Science, Scopus Q4 SJR 0.123

   Abstract: The study presents data on the diversity of grass species in the region of the village of Mugla (the Western Rhodopes). One hundred forty-one species of higher plants belonging to 40 families were registered: Apiaceae, Aspleniaceae, Asteraceae, Boraginaceae, Brassicaceae, Campanulaceae, Caryophyllaceae, Cistaceae, Cyperaceae, Dipsacaceae, Equisetaceae, Ericaceae, Euphorbiaceae, Fabaceae, Gentianaceae, Geraniaceae, Gesneriaceae, Hypericaceae, Juncaceae, Lamiaceae, Lemnaceae, Liliaceae, Linaceae, Menyanthaceae, Oleacea, Onagraceae, Orchidaceae, Parnassiaceae, Plantaginaceae, Plumbaginaceae, Poaceae, Polygalaceae, Primulaceae, Ranunculaceae, Rosaceae, Rubiaceae, Saxifragaceae, Scrophulariaceae, Valerianaceae and Violaceae. Their conservation status was presented, as well as medicinal plants.

10. Stoyanov, P., **Todorov, K.,** Teneva, I., Mladenova, Ts. (2018). Medicinal Plants on the Territory of the Waterfall Canyon Eco-trail (Soskovcheto Reserve, Western Rhodopes Mts., South Bulgaria). *Ecologia Balkanica*, 10(2): 1-6. Web of Science, Scopus Q4 SJR 0.103

    Abstract: The study presents data on the species diversity of medicinal plants on the territory of the Waterfall Canyon Eco-trail, part of the “Soskovcheto” Reserve (Western Rhodopes Mts. in South

Bulgaria). Ninety-six species were recorded, grouped in 42 families - Apiaceae, Aristolochiacea, Aspidiaceae, Aspleniaceae, Asteraceae, Athyriaceae, Balsaminaceae, Betulaceae, Boraginaceae, Brassicaceae, Campanulaceae, Caprifoliaceae, Caryophyllaceae, Crassulaceae, Cupressaceae, Ericaceae, Euphorbiaceae, Fabaceae, Fagaceae, Geraniaceae, Hypericaceae, Hypolepidaceae, Lamiaceae, Liliaceae, Orchidaceae, Oxalidaceae, Pinaceae, Plantaginaceae, Poaceae, Polygonaceae, Polypodiaceae, Primulaceaea, Pyrolaceae, Ranunculaceae, Rosaceae, Rubiaceae, Salicaceae, Saxifragaceae, Scrophulariaceae, Thymelaeaceae, Urticaceae, Violaceae. Eighteen medicinal plant species were with conservation significance, including endemic, rare and protected species**.**

11. Mladenova, Ts., Stoyanov, P., Michova-Nankova, I., Mladenov, R., Boyadzhiev, D., Bivolarska, A., **Todorov, K.** (2019). Comparative Leaf Epidermis Analyses of *Micromeria frivaldszkyana* (*Degen*) Velen. and *Clinopodium vulgare* L. (Lamiaceae) from Bulgarka Nature Park, Bulgaria. *Ecologia Balkanica*, 11(2): 133-140. Web of Science, Scopus Q4 SJR 0.134

    Abstract: The present work presents a comparative anatomical study of the leaf epidermis of the Bulgarian endemic *Micromeria frivaldszkyana* (Degen) Velen. and *Clinopodium vulgare* L., belonging to the family Lamiaceae. In both species they occur diacytic and anomocytic stomatal type, while the indumentum is presented by multicellular, linear covering trichomes and multicellular, stacked glandular trichomes. The results obtained from the statistical data processing contribute to the distinction between the two species with respect to the peculiarities of the leaf epidermis. Taxonomically significant anatomical features for their determination are: number, width and length of stomata on the abaxial epidermis; width of on the adaxial epidermis; number, width and length of basic epidermal cells along both epidermis and thickness of upper and lower cuticle.

12. Raycheva, Ts., Stoyanov, P., **Todorov, K.,** Raycheva T. (2021). Vascular flora of railway junctions in the Upper Tracian Lowland (Bulgaria). *Ecologia Balkanica*, 13(1): 45-53. Web of Science, Scopus Q4 SJR 0.137

    Abstract: Floristic studies have been carried out in the Upper Thracian Lowland in 14 railway stations: Dimitrovgrad, Knizhovnik, Malevo, Maslinovo, Most, Stara Zagora, Yabalkovo, Uzundzhovo, Harmanli, Skobelevo, Karadzhalovo, Stalevo, Plovdiv and Haskovo during the period 2017 to 2019. A total of 267 species, 174 genera and 53 families of higher vascular plants were identified. Alien and invasive species make up for a relatively high percentage of 9.4% in the railway flora. This indicates that the railway network plays an important role in the penetration and further dispersal of alien species in Bulgarian. The long-distance spread of railway areas is most common with passing trains and people moving. The largest number of alien species were found at stations with more intensive movement of passengers and cargo, where maneuvers are performed, stay of freight trains, such as Dimitrovgrad, Haskovo, Plovdiv, Stara Zagora. The alien species found at several of the studied railway stations were: *Convolvulus arvensis* L., *Erigeron canadensis* L., *Fallopia convolvulus* (L.) A. Love, *Amaranthus hybridus* L., *Amorpha fruticosa* L. Individual plants of strongly invasive *Ambrosia artemisifolia* L. have been identified in the railway station in the Haskovo City.

13. Gyuzeleva, D., Stoyanov, P., Bivolarska, A., Mladenov, R., Mladenova, Ts., Petkov, V., **Todorov, K.** (2022). Anatomical Investigation of *Marrubium friwaldskyanum* Boiss. and *Marrubium peregrinum* L. (Lamiaceae) from Bulgaria. *Ecologia Balkanica*, 14(1): 87-101. Web of Science, Scopus Q4 SJR 0.202

    Abstract: The present study presents data on the anatomical characteristics of the leaf and stem in *Marrubium friwaldskyanum* and *Marrubium peregrinum*. The leaves in both species are amphistomatic with diacytic and anomocytic stomata. The leaf lamina shows differentiation of palisade and spongy tissue, and collateral vascular bundles. Non-glandular and glandular trichomes have been found on the epidermis of the leaves and stem. The non-glandular trichomes are unicellular linear and multicellular branched. Glandular trichomes are peltate, with a single-celled or two-celled structure. There is a

difference between the two species in terms of the width of the epidermal cells of the stem, the thickness of the cortex, the thickness of the xylem and the phloem in the stem. The established differences in the anatomical features can be useful in future taxonomic studies within the genus *Marrubium*.

14. Stoyanov, P., Mladenov, R., Mileva, N., **Todorov, K.** (2022). Monitoring of Vascular Plant Species from the Southeastern Part of Strandzha Nature Park, Bulgaria. *Ecologia Balkanica*, SE 5: 7-15. Web of Science, Scopus Q4 SJR 0.202

    Abstract: The study presents data on some invasive and conservation-significant species in two protected areas of the Strandzha Nature Park – Protected Area "Marina Reka" and Protected Area "Silistar". There were monitored the protected species *Pancratium maritimum*, *Calluna vulgaris*, *Daphne pontica*, *Ilex colchica*, *Rhododendron ponticum*, *Mespilus germanica,* and *Taxus baccata*, as well as an invasive species – *Amorpha fruticosa*, whose population borders that of *Pancratium maritimum*. The projective coverage of species in the sample areas and the total projective coverage of the vegetation have been studied also measures for their protection have been indicated.

15. Mladenova, Ts., Naimov, S., Apostolova, E., Stoyanov, P., Mladenov, R., Bivolarska, A., Raycheva, Ts., Gyuzeleva, D., Pechanska, A., Balabanova, R., Kuzdova, D., **Todorov, K.** (2025). Comparative leaf epidermis and molecular analyses of *Micromeria dalmatica* Bentham and *Clinopodium vulgare* L. from Bulgaria. *Ecologia Balkanica*, 17(1): 037-046. Web of Science, Scopus Q4 SJR 0.192(2024)

    Abstract: The volume and number of taxa within the genus *Micromeria* have changed over the past decades based on several molecular genetic studies. In the Bulgarian flora, no revision has been conducted, and the boundaries of the genus remain unclear. Molecular studies have shown that members of the section *Pseudomelissa* within the genus *Micromeria* are more closely related to the genus *Clinopodium* than to the typical section *Micromeria*. In the present study, anatomical investigations of the leaf epidermis were carried out, and the molecular genetic structure of *Micromeria dalmatica* was determined. Its phylogenetic relationship with *Clinopodium vulgare* was established based on sequences in the ITS1 and tRNA-Leu regions.

For Criterion G9.

AN INVENTION, PATENT OR UTILITY MODEL FOR WHICH A PROTECTION DOCUMENT HAS BEEN DULY ISSUED

Bivolarska, A., Viraneva, A., Kokova, V., Gyuzeleva, D., Apostolova, E., Dimov, I., Bivolarski, I., **Todorov, K.,** Choneva, M., Marudova-Zhivanovich, M., Koleva, M., Esad, M., Popova, M., Stoyanov, P., Mladenov, R., Milenkova, S., Yovcheva, T., Mladenova, C. **Skin-wound healing patch, registered as Utility Model No. 4924 U1, with priority date 12 June 2024.**

Description: The wound-healing patch finds application in medicine. It comprises a polymeric blend of polyvinyl alcohol and chitosan, glycerol, and a methanolic extract of *Marrubium peregrinum*. The three components are present in the following weight ratios: 30–70 parts polymeric blend, 20–60 parts methanolic extract of *Marrubium peregrinum*, and 3–25 parts glycerol. Patches containing the methanolic extract of *Marrubium peregrinum* at a concentration of 4–8 mg/cm² exhibit excellent wound-healing activity, as evidenced by histological examinations of tissue samples from the wound surface of rats after euthanasia. Analysis of pro-inflammatory (TNF-α and IL-6) and anti-inflammatory (IL-10) cytokines in the tissue homogenate, as well as hydroxyproline levels, indicates increased cellular proliferation and collagen synthesis compared to control samples lacking the *Marrubium peregrinum* extract.

For Criterion G10.

PUBLISHED APPLICATION FOR A PATENT OR UTILITY MODEL

Wound-Healing Patch and Method for Its Preparation. **Patent Application No. 113914/12 June 2024.**

Plovdiv, 17.12.2025

Prepared by: .....
/Chief Assist. Prof. Krasimir Todorov, PhD/