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BEECH FORESTS OF KOSMAJ AS A NATURAL RESOURCE OF MEDICINAL PLANTS

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Abstract: This paper presents the results of research on wild-growing medicinal plants in the beech forests of the protected area of Kosmaj. Beech forests in this region are widely distributed and occur either as pure stands (*Helleboro odori*–*Fagetum moesiaceae* Soo & Borhidi 1960) or as mixed stands with sessile oak (*Quercus petraeae*–*Fagetum moesiaceae* Glišić 1971). The floristic composition of these forests was analyzed using 22 phytosociological relevés. Out of a total of 100 recorded plant taxa, 60 medicinal species belonging to 50 genera and 36 families were identified. The taxonomic analysis showed that the most represented medicinal plants belong to the families Rosaceae (15%) and Lamiaceae (13%), followed by Fagaceae (7%) and Liliaceae (5%). Species of the Central European distribution type were the most common (36%), while the analysis of life forms indicated a predominance of phanerophytes (48.4%) and hemicyptophytes (23.3%), with a notable share of geophytes (18%).

Keywords: beech forests, medicinal plants, taxonomic analysis, phytogeographical analysis, biological spectrum.

BUKOVE ŠUME KOSMAJA KAO PRIRODNI RESURS LEKOVITIH BILJAKA

Sažetak: U radu su prikazani rezultati istraživanja samoniklih lekovitih biljaka u bukovim šumama zaštićenog područja Kosmaja. Bukove šume na ovom području su široko rasprostranjene i javljaju se kao čiste (*Helleboro odori*–*Fagetum moesiaceae* Soo & Borhidi 1960.) ili mešovite sa kitnjakom (*Quercus petraeae*–*Fagetum moesiaceae* Glišić 1971.). Za analizu florističkog sastava bukovih šuma korišćeno je 22 fitocenološka snimka. Od ukupnog broja registrovanih biljaka (100) zabeleženo je 60 lekovitih vrsta iz 50 rodova i 36 familije. Taksonomska analiza pokazala je da su najzastupljenije lekovite biljke iz familije Rosaceae (15%) i Lamiaceae (13%), dok su nešto manje prisutne lekovite biljke iz familija Fagaceae sa 7% i Liliaceae sa 5%. Najzastupljenije su lekovite biljke srednjeevropskog areal tipa sa 36%, dok je analiza životnih formi pokazala da su najviše zastupljene fanerofita sa 48,4% i hemikriptofite (23,3%), uz visoko učešće geofita (18%).

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Ključne reči: Bukove šume, lekovite biljke, taksonomska analiza, fitogeografska analiza, biološki spektar.

1. INTRODUCTION

Medicinal plants and fungi have been used for centuries in folk and traditional medicine. However, global demand for these resources has threatened certain species, contributing to biodiversity loss and the depletion of natural resources essential for human health (Howes et al., 2020). Serbia is characterized by exceptional floristic diversity, which includes a substantial number of medicinal plant species. The highest alpha diversity is found in deciduous forests of the class *Quercio–Fagetea* which accounts for 52.49% of the total diversity of all analyzed ecosystem types (Lakušić, 2005). However, the natural potential of medicinal plants within forest ecosystems remains largely unexplored, often resulting in unsustainable use of this resource. Populations of medicinal plants are declining primarily due to overharvesting, habitat degradation, and the spread of invasive species (Chen et al., 2016). For this reason, it is essential to protect natural habitats containing valuable medicinal species. Identifying suitable areas and climatic parameters associated with the current distribution of medicinal plants can facilitate predictions of their future distribution and help estimate their level of endangerment.

According to data from the Second National Forest Inventory of the Republic of Serbia (2023), beech forests are the most widespread forest type in the country, covering an area of 733,042 ha, or 25.68% of the total forested land. In Serbia, beech forests thrive under a wide range of ecological conditions, occurring from the submontane to the subalpine belt. In addition to their broad climatic, beech forests also exhibit a wide edaphic amplitude. They occur on acidic silicate, basic, ultrabasic, and carbonate bedrocks. In Serbia, beech grows on ten different soil types (Knežević, 2003). The vascular plant species composition and richness of beech forests are highly variable among European regions and habitats; however, European beech forests are generally regarded as species-poor. Compared to Central European shady forests, beech forests in Serbia are more complex and more diverse (Karadžić, 2018).

Submontane beech forests in Serbia are largely shaped by orographic conditions. They typically occur at lower elevations within the climatic oak forest belt, on cold exposures or in sheltered, shaded valleys with specific microclimatic conditions (Tomić & Rakonjac, 2013). Floristically, submontane beech forests differ considerably from montane beech forests: they contain a larger share of mesophilous species characteristic of lower elevations, as well as admixed elements typical of adjacent oak forests. The present-day stands of submontane beech forests, which fall within the belt of oak-dominated vegetation, may be regarded as remnants of a once much broader range of this forest type, which existed before the onset of the current, more arid climate (Jovanović, 1980).

A large part of the study area on Mount Kosmaj is covered by forest vegetation belonging syntaxonomically to the deciduous oak and beech forests of the class *Quercio–Fagetea*. In this region, submontane beech forests are widely distributed, occurring either as pure stands (*Helleboro odori–Fagetum moesiaca* Soo & Borhidi 1960) or as mixed stands with sessile oak (*Quercu petraeae–Fagetum*

moesiaca Glišić 1971). The aim of this study was to determine the representation of medicinal plants within the flora of these beech forests, accompanied by a detailed taxonomic and phytogeographical assessment, as well as an analysis of their biological spectrum.

2. MATERIAL AND METHODS

Kosmaj is a low mountain massif (626 m) belonging to the Šumadija mountain system. Its terrain has a distinctive geological structure, which has resulted in considerable pedological diversity across the area. From a phytogeographical perspective, this region belongs to the Balkan floristic province within the Central European region.

To analyze the floristic composition, 22 phytosociological relevés were collected in beech forests within the study area. The floristic composition of the investigated stands was assessed using the Braun-Blanquet floristic–ecological method (Braun-Blanquet, 1964). Plant species were identified based on the following botanical literature: *Flora of Serbia* I–X (Josifović et al., 1972–1977; Sarić et al., 1986, 1992; Stevanović et al., 2012), and nomenclature was harmonized with the Euro+Med PlantBase database (Euro+Med, 2006 –). The identification of medicinal plants followed Sarić (1989). The spectra of floristic elements were prepared according to Gajić's (1980) classification of phytogeographical elements, while life-form spectra were derived following the method of Kojić et al. (1997).

3. RESULTS AND DISCUSSION

In the Kosmaj area, submontane beech forests are widely distributed, occurring either as pure stands (*Helleboro odori*–*Fagetum moesiaca* Soo & Borhidi 1960) or as mixed stands with sessile oak (*Quercus petraea*–*Fagetum moesiaca* Glišić 1971). They are mainly found at elevations between 370 and 580 m.a.s.l., on colder exposures (northern, northwestern, northeastern) and on slopes of 15–28° (Stajić et al., 2021).

The floristic structure of these beech forests comprises 46 families, 73 genera, and 100 plant species. Of the total 100 recorded taxa, as many as 60 medicinal plant species belonging to 36 families and 50 genera were identified (Table 1).

An essential prerequisite for the sustainable use of wild-growing medicinal plants is the preservation of forest or meadow ecosystems, as well as the key parameters such as abundance–cover and constancy (Obratov & Đukić, 2002). Species with the highest constancy (III–IV) in the investigated beech forests included *Lamium galeobdolon* (L.) Crantz, *Stachys silvatica* L., *Circaea lutetiana* L., *Helleborus odoratus* Willd., *Hedera helix* L., *Dioscorea communis* (L.) Caddick & Wilkin, *Geranium robertianum* L. Considering that the abundance and cover of medicinal plants (as well as plant species in general) depend on habitat type—and despite the overall species-poor character of beech forests—this study recorded a somewhat higher number of medicinal plants compared to certain oak forests in the area (Stajić et al., 2025).

Table 1. List of wild medicinal plants in the beech forests of Kosmaj

Species	Family	Floristic element	Life form
<i>Acer platanoides</i> L.	Aceraceae	Subse.	p
<i>Arum maculatum</i> L.	Araceae	Se.	g
<i>Hedera helix</i> L.	Araliaceae	Subatl-subm.	pl
<i>Asarum europaeum</i> L.	Aristolochiaceae	Evr.	g
<i>Ruscus aculeatus</i> L.	Asparagaceae	Subatl-subm.	np
<i>Ruscus hypoglossum</i> L.	Asparagaceae	Subm.	np
<i>Alliaria petiolata</i> (M.Bieb.) Cavara&Grande	Brassicaceae	Subse.	h
<i>Cardamine impatiens</i> L.	Brassicaceae	Evr.	th
<i>Campanula trachelium</i> L.	Campanulaceae	Subevr.	h
<i>Lonicera caprifolium</i> L.	Caprifoliaceae	Is.subm.	np
<i>Stellaria media</i> (L.) Vill.	Caryophyllaceae	Kosm.	th
<i>Euonymus europaeus</i> L.	Celastraceae	Subse.	np
<i>Cornus mas</i> L.	Cornaceae	Pont.subm.	np
<i>Corylus avellana</i> L.	Corylaceae	Subse.	p
<i>Dioscorea communis</i> (L.) Caddick & Wilkin	Dioscoreaceae	Subatl-subm.	g
<i>Euphorbia amygdaloides</i> L.	Euphorbiaceae	Subatl-subm.	zc
<i>Fagus sylvatica</i> L.	Fagaceae	Mez.	p
<i>Quercus cerris</i> L.	Fagaceae	Is.subm.	p
<i>Quercus frainetto</i> Ten.	Fagaceae	Is.subm.	p
<i>Quercus petraea</i> (Matt.) Liebl.	Fagaceae	Se.	p
<i>Geranium robertianum</i> L.	Geraniaceae	Subcirk.	th
<i>Juglans regia</i> L.	Juglandaceae	Subiran.-is.subm.	p
<i>Ajuga reptans</i> L.	Lamiaceae	Subse.	h
<i>Clinopodium vulgare</i> L.	Lamiaceae	Subm.	h
<i>Glechoma hirsuta</i> Waldst. & Kit.	Lamiaceae	Pont.-is.subm.	h
<i>Lamium galeobdolon</i> (L.) Crantz.	Lamiaceae	Subse.	zc
<i>Melittis melissophyllum</i> L.	Lamiaceae	Se.	g
<i>Scrophularia nodosa</i> L.	Lamiaceae	Evr.	h
<i>Stachys alpina</i> L.	Lamiaceae	Se.	g
<i>Stachys silvatica</i> L.	Lamiaceae	Subse.	g
<i>Allium ursinum</i> L.	Liliaceae	Se	g
<i>Lilium martagon</i> L.	Liliaceae	Evr.	g
<i>Polygonatum odoratum</i> (Mill.) Druce	Liliaceae	Subj.sib.	g
<i>Circaea lutetiana</i> L.	Oenotheraceae	Cirk.	g
<i>Fraxinus excelsior</i> L.	Oleaceae	Subse.	p
<i>Fraxinus ornus</i> L.	Oleaceae	Subm.	p
<i>Chelidonium majus</i> L.	Papaveraceae	Evr.	h
<i>Dryopteris filix-mas</i> (L.) Schott	Polypodiaceae	Kosm.	h
<i>Lysimachia nummularia</i> L.	Primulaceae	Subse.	zc
<i>Lysimachia vulgaris</i> L.	Primulaceae	Evr.	h
<i>Clematis vitalba</i> L.	Ranunculaceae	Subatl-subm.	p
<i>Helleborus odoratus</i> Willd.	Ranunculaceae	Srbalk.	h
<i>Crataegus monogyna</i> Jack.	Rosaceae	Subse.	p
<i>Crataegus nigra</i> Waldst. & Kit.	Rosaceae	Subpan.	p
<i>Fragaria vesca</i> L.	Rosaceae	Evr.	h
<i>Malus sylvestris</i> (L.) Mill.	Rosaceae	Evr.	p
<i>Prunus avium</i> L.	Rosaceae	Subse.	p
<i>Prunus spinosa</i> L.	Rosaceae	Subpont.	np
<i>Pyrus pyramidalis</i> (L.) Burgsd.	Rosaceae	Subse.	p
<i>Rosa canina</i> L.	Rosaceae	Subse.	np
<i>Rubus hirtus</i> Waldst. & Kit.	Rosaceae	Se.	np
<i>Galium odoratum</i> (L.) Scop.	Rubiaceae	Subevr.	g
<i>Populus tremula</i> L.	Salicaceae	Subevr.	p
<i>Sambucus nigra</i> L.	Sambucaceae	Subse.	np
<i>Atropa bella-donna</i> L.	Solanaceae	Subse.	h
<i>Tilia cordata</i> Mill.	Tiliaceae	Se.	p
<i>Tilia tomentosa</i> Moench	Tiliaceae	Subbalk.	p
<i>Ulmus minor</i> Mill.	Ulmaceae	Subm.	p
<i>Urtica dioica</i> L.	Urticaceae	Evr.	h

Species	Family	Floristic element	Life form
<i>Viola odorata</i> L.	<i>Violaceae</i>	Subatl-subm.	h

Legend: p-phanerophytes; np-nanophanerophytes; pl-phanerophytic lianas; zc-herbaceous chamaephytes; h-hemicryptophytes; g- geophytes; th-therophytes/chamaephytes.

The taxonomic analysis showed that the most represented medicinal plants belong to the families *Rosaceae* (15%) and *Lamiaceae* (13%), while medicinal species from *Fagaceae* (7%) and *Liliaceae* (5%) were less common. The two most species-rich families were also the richest in terms of genera: *Rosaceae* (*Crataegus*, *Rubus*, *Prunus*, *Rosa*, *Fragaria*, *Malus*) and *Lamiaceae* (*Calamintha*, *Scrophularia*, *Glechoma*, *Lamium*, *Ajuga*, *Melittis*, *Stachys*). The results of the taxonomic analysis of medicinal plants in the Nature Monument “Košutnjak Forests” likewise indicate a dominance of the families *Lamiaceae* and *Rosaceae* (Jokanović et al., 2021).



Figure 1. *Circaea lutetiana* L.



Figure 2. *Stachys silvatica* L.



Figure 3. *Atropa bella-donna* L.



Figure 4. *Helleborus odoratus* Willd.

A total of seven wild fruit tree species were also recorded in the floristic composition of these beech forests: *Prunus avium* L., *Prunus spinosa* L., *Pyrus pyraster* (L.) Burgsd., *Malus sylvestris* (L.) Mill., *Juglans regia* L., *Cornus mas* L., and *Rosa canina* L. In recent years, both in Europe and in Serbia, increasing attention has been devoted to forest fruit trees, as the collection of their seeds, the production of planting material, and their introduction into existing forests or into afforestation of bare areas contribute to the preservation of biological diversity.

In the spectrum of floristic elements, plants of the Central European range type were the most prevalent, accounting for 36.7% of the total (Table 2). Plant species of Eurasian range type had a somewhat smaller representation (21,7%), followed by plants of Sub-Mediterranean (11,7%), Sub-Atlantic (10%), Pontic (6,7%), and Balkan (5%) elements. Cosmopolitan and Circumpolar elements each represented 3.3% of the medicinal flora, while the desert floristic element was the least represented, with a share of 1.7%.

Overall, mesophilous plants were the most prevalent, accounting for as much as 46.7% of the flora. These included mainly Central European and Sub-Atlantic floristic elements, which are indicative of the mesophilous character of beech forests. They were followed by species with a broad ecological amplitude (25%), represented by Eurasian and Cosmopolitan range types, and xerothermophilous plants (23.3%), which included Pontic, Sub-Mediterranean, and Balkan elements. The somewhat higher proportion of Mediterranean and Pontic elements can be explained by the fact that beech in this area occurs at relatively low elevations, allowing a considerable number of thermophilous species from the oak forest zone to enter the community.

Table 2. *Spectrum of floristic elements*

Cumulative range types	Number	Share (%)	
Pontic	4	6.7	23.3
Sub-Mediterranean	7	11.7	
Balkan	3	5.0	
Central European	22	36.7	46.7
Subatlantic	6	10.0	
Desert	1	1.7	1.7
Eurasian	13	21.7	
Cosmopolitan	2	3.3	25.0
Circumpolar	2	3.3	3.3

The analysis of life-form spectra among medicinal plants revealed a dominance of phanerophytes, which accounted for 48.4%, followed by hemicryptophytes with 23.3% (Table 3). Geophytes were also well represented (18.3%), indicating favorable edaphic conditions (soil moisture, structure, and depth). This was to be expected, given that geophytes are typically associated with more mesophilous communities of a denser canopy structure.

Table 3. *Spectrum of life forms*

Life forms	Broj	Učešće (%)	
Phanerophytes	19	31.7	48.4
Nanophanerophytes	9	15.0	
Phanerophytic lianas	1	1.7	
Herbaceous chamaephytes	3	5.0	5.0
Hemicryptophytes	14	23.3	23.3
Geophytes	11	18.3	18.3
Therophytes /Chamaephytes	3	5.0	5.0

5. CONCLUSIONS

Of the total 100 plant species recorded in the beech forests of the Kosmaj area, as many as 60 medicinal plants were identified, belonging to 36 families and 50 genera. The most represented medicinal species belonged to the families *Rosaceae* (15%) and *Lamiaceae* (13%), while species from *Fagaceae* (7%) and *Liliaceae* (5%) were less common. Regarding the distribution of floristic elements, the Central European element was dominant, accounting for 36% of the occurring flora, followed by Eurasian (22%), Sub-Mediterranean (11%), and Sub-Atlantic (10%) elements. The analysis of life forms revealed a predominance of phanerophytes (48.4%), followed by hemicryptophytes (23.3%), with geophytes also well represented (18%).

The fact that approximately 60% of the entire flora of these beech forests consists of medicinal plants highlights the potential for harvesting this increasingly important natural resource. For this reason, future research should prioritize the assessment of the abundance and biotic potential of individual medicinal species. Identifying the areas and climatic parameters that currently determine the distribution of specific medicinal plants, as well as forest fruit trees, can contribute to predicting their future ranges and evaluating their level of threat, which is all fully aligned with the broader goal of preserving biodiversity in Serbia.

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REFERENCES

- Braun-Blanquet, J. (1964). *Pflanzensoziologie. Grundzüge Der Vegetationskunde* (3rd ed, 1-865). Springer Verlag, Vienna.
- Chen SL, Yu H, Luo HM, Wu Q, Li CF, Steinmetz A. (2016). Conservation and sustainable use of medicinal plants: problems, progress, and prospects. *Chin Med*. 11:37. DOI: 10.1186/s13020-016-0108-7.
- Howes M. J. R., Quave C. L., Collemare J., Tatsis E. C., Twilley D., Lulekal E., et al. (2020). Molecules from nature: Reconciling biodiversity conservation and global healthcare imperatives for sustainable use of medicinal plants and fungi. *Plants People Planet* 2, 463–481.
- Josifović, M. (ed.) (1970-1977): *Flora of Serbia II-IX*. Serbian Academy of Sciences and Arts, Department of Natural and Mathematical Sciences, Belgrade. [Josifović, M. (ed.) (1970-1977): *Flora Srbije II-IX*. Srpska akademija nauka i umetnosti, Odeljenje prirodno-matematičkih nauka, Beograd.]
- Jokanović, D., Petrović, J., Indić, P., Stanković, D., Trivan, G., Urošević, J., Marić, M. (2021). Pharmacodynamic properties of medicinal plants within eight departments of NM „Šuma Košutnjak“. *Ecologica* 101(28), 11-15. [Jokanović, D., Petrović, J., Indić, P., Stanković, D., Trivan, G., Urošević, J., Marić, M. (2021). Farmakodinamska svojstva lekovitih vrsta u okviru osam odeljenja SP "Šuma Košutnjak". *Ecologica* 101(28), 11-15.]

Jovanović, B. (1980). Forest phytocoenoses and habitats of mt. Suva planina. *Bulletin of the Faculty of Forestry, series A*, Belgrade. [Jovanović, B. (1980). Šumske fitocenoze i staništa Suve planine. *Glasnik Šumarskog fakulteta, serija A*, Beograd]

Karadžić, B. (2018). Beech forests (order *Fagetalia sylvaticae* Pawlowski 1928) in Serbia. *Botanica Serbica* 42 (1), 91-107.

Knežević M. (2003). Soils in beech forests of Serbia (in Serbian). *Forestry*, 1–2, pp. 97–106. [Knežević M. (2003). Zemljišta u bukovim šumama Srbije. *Šumarstvo* 1-2, Beograd, str. 97-106]

Kojić M., Popović R., Karadžić B. (1997). *Vascular plants of Serbia*. Institute for Agricultural Research "Serbia" and Institute for Biological Research "Sinisa Stanković", Belgrade.

Lakušić D. (2005). Relation between species and ecosystem diversity. In: V. Stevanović (ed.), *Biodiversity at the onset of the new millennium*. Serbian Academy of Science and Art, Belgrade, pp. 75–102. [Lakušić D. (2005). Odnos specijskog i ekosistemskog diverziteta. U: V. Stevanović (ed.), *Biodiverzitet na početku novog milenijuma*. Srpska akademija i nauka i umetnosti pp. 75–102.]

Obratov-Petković, D., Đukić, M. (2000). Possibilities of exploitation of medical plants in the aim of forest functions improvement. *Bulletin of the Faculty of Forestry* 82, pp. 127-135. [Obratov-Petković D., Đukić M. (2000). Mogućnosti korišćenja lekovitog bilja u cilju unapređenja stanja i funkcija šuma. *Glasnik Šumarskog fakulteta* 82, str. 127-135.]

Sarić, M, Diklić, N. (Eds) (1986). *Flora of Serbia X*. Serbian Academy of Sciences and Arts, Department of Natural and Mathematical Sciences, Belgrade. [Sarić M, Diklić, N. (eds) (1986). *Flora Srbije X*. Srpska akademija nauka i umetnosti, Odeljenje prirodno-matematičkih nauka, Beograd.]

Sarić M. (Ed.) (1989). *Medicinal plants of SR Serbia*. Serbian. Academy of Sciences and Arts, Belgrade. [Sarić M. (1989). *Lekovite biljke SR Srbije*. Srpska akademija nauka i umetnosti, Beograd]

Sarić, M. (Ed.) (1992). *Flora of Serbia I*. Serbian Academy of Sciences and Arts, Department of Natural and Mathematical Sciences, Belgrade. [Sarić M. (ed.) (1992): *Flora Srbije I*. Srpska akademija nauka i umetnosti, Odeljenje prirodno-matematičkih nauka, Beograd]

Stajić S., Cvjetičanin R., Čokeša V., Miletić Z., Novaković-Vuković M., Eremija S., Rakonjac Lj. (2021). Plant species richness and diversity in natural beech and oak-dominated forests of Kosmaj protected area (Serbia). *Applied Ecology and Environmental Research* 19(4), 2617-2628. DOI 10.15666/aeer/1904_26172628

Stajić S., Čokeša V., Rakonjac Lj., Eremija S. (2025). *Distribution of medicinal plants and forest fruit trees in oak-dominated forests in the area of Kosmaj (Serbia)*. Third conference on medicinal and wild-growing edible plants, Pirot, Serbia, June 26 – 28. 2025. Book of abstracts pp. 7–10. Research Association "Babin Nos", Temska, Pirot, Serbia; Institute of Forestry, Belgrade, Serbia

Stevanović, V. (Ed.) (2012). *Flora of Serbia II*. Serbian Academy of Sciences and Arts, Department of Natural and Mathematical Sciences, Belgrade. [Stevanović, V. (ed.) (2012): *Flora Srbije II*. Srpska akademija nauka i umetnosti, Odeljenje prirodno-matematičkih nauka, Beograd.]

Tomić, Z., Rakonjac, Lj. (2013). *Forest phytocoenoses of Serbia*, Institute of Forestry Belgrade, University Singidunum-Faculty for Applied Ecology Futura, Belgrade. [Tomić Z., Rakonjac Lj. (2013). *Šumske fitocenoze Srbije*. Institut za šumarstvo Beograd, Univerzitet Singidunum-Fakultet za primenjenu ekologiju Futura, Beograd]

Euro+Med (2006-): Euro+Med PlantBase – the information resource for Euro-Mediterranean plant diversity. Published at <https://www.europlusmed.org/> [accessed 21 Oct 2025].

*(2023). *The Results of the Second National Forest Inventory of the Republic of Serbia*. Ministry of Agriculture, Forestry, and Water Management – Directorate for Forests.

[(2023). *Rezultati Druge nacionalne inventure šuma Republike Srbije*. Ministarstvo poljoprivrede, šumarstva i vodoprivrede-Uprava za šume]

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Summary

The aim of this study was to determine the representation of medicinal plants within the flora of beech forests in the study area, accompanied by a detailed taxonomic, phytogeographical, and biological-spectrum analysis.

In the Kosmaj region, submontane beech forests are widely distributed, occurring either as pure stands (*Helleboro odori*–*Fagetum moesiaca* Soó & Borhidi 1960) or as mixed stands with sessile oak (*Quercus petraea*–*Fagetum moesiaca* Glišić 1971). These forests are generally found at elevations between 370 and 580 m, on colder exposures (northern, northwestern, northeastern) and slopes ranging from 15° to 28°. A total of 22 phytosociological relevés were used in the analysis of floristic composition.

Out of 100 recorded plant species, 60 medicinal species were identified, belonging to 36 families and 50 genera. The most represented families were *Rosaceae* (15%) and *Lamiaceae* (13%), followed by *Fagaceae* (7%) and *Liliaceae* (5%).

Within the spectrum of floristic elements, medicinal plants of the Central European range type were predominant (36.7%). They were followed by species of the Eurasian type (21.7%), sub-Mediterranean (11.7%), sub-Atlantic (10%), Pontic (6.7%), Balkan (5%), Circumpolar (3.3%), and Cosmopolitan types (3.3%), while species of the Desert range type were the least represented (1.7%).

The analysis of life forms revealed that phanerophytes were dominant (48.4%), followed by hemicryptophytes (23.3%).

The floristic composition of these beech forests also includes seven species of wild fruit trees: *Prunus avium* L., *Prunus spinosa* L., *Pyrus pyrastra* (L.) Burgsd., *Malus sylvestris* (L.) Mill., *Juglans regia* L., *Cornus mas* L., and *Rosa canina* L.

Identifying the current distribution areas of medicinal plant species provides a basis for predicting their future range of distribution and assessing their level of endangerment.

Therefore, future research in these forests should prioritize evaluating the abundance and biotic potential of some medicinal species.

BUKOVE ŠUME KOSMAJA KAO PRIRODNI RESURS LEKOVITIH BILJAKA

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Rezime

Cilj ovog rada bio je da se utvrdi zastupljenost lekovitih biljaka u flori bukovih šuma ovog područja, sa detaljnom taskonomskom i fitogeografskom, kao i analizom biološkog spektra.

Na području Kosmaja brdske bukove šume imaju široko rasprostranjenje, bilo da se javljaju kao čiste (*Helleboro odori-Fagetum moesiaca* Soo & Borhidi 1960.) ili mešovite sa kitnjakom (*Quercu petraeae-Fagetum moesiaca* Glišić 1971.). Prisutne su uglavnom na terenima 370 to 580 m nadmorske visine, hladnijim ekspozicijama (sever, severozapad, severoistok) i nagibima 15-28° U analizi florističkog sastava korišćeno je 22 fitocenološka snimka.

Od ukupnog broja biljnih vrsta (100), registrovano je 60 lekovitih vrsta biljaka iz 36 familije i 50 rodova. Najzastupljenije su lekovite biljke iz familije *Rosaceae* (15%) i *Lamiaceae* (13%), a nešto manje su prisutne lekovite biljke iz familija *Fagaceae* (7%) i *Liliaceae* (5%).

U spektru flornih elemenata, najzastupljenije su lekovite biljke srednjeevropskog areal tipa sa 36,7%. Nešto manju zastupljenost imaju biljne vrste evroazijskog areal tipa (21,7%), dok za njima slede biljke submediteranskog (11,7%), subatalanskog (10%), pontskog (6,7%), balkanskog (5%), cirkumpolarnog (3,3%), kosmopolitskog tipa (3,3%) i najmanje florni element pustinjaških predela (1,7%).

Analiza životnih formi lekovitih biljaka pokazuje da dominiraju fanerofite sa 48,4%, a zatim slede hemikriptofite sa 23,3%.

U florističkom sasatvu bukovih šuma ovog područja registrovano je i 7 vrsta divljih voćkarica: *Prunus avium* L., *Prunus spinosa* L., *Pyrus pyrastrer* (L.) Burgsd., *Malus sylvestris* (L.) Mill., *Juglans regia* L., *Cornus mas* L., *Rosa canina* L.

Identifikacija područja gde se danas nalaze pojedine lekovite biljke može pomoći u definisanju njihove buduće rasprostranjenosti i proceni nivoa ugroženosti, zbog čega bi u daljem istraživanju ovih šuma prioritet bio na utvrđivanju brojnosti i biotičkog potencijala pojedinih lekovitih vrsta.