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Short communication

Comparative study of the chemical composition of essential oils isolated from *Juniperus excelsa* and *Juniperus communis* from Macedonian flora

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Introduction

Species of the genus *Juniperus* (Cupressaceae) are aromatic plants rich in essential oils with important biological and pharmaceutical properties. Their essential oils exhibit diuretic, antiseptic, antimicrobial, antioxidant and anti-inflammatory activities and are widely used in traditional medicine and the pharmaceutical industry (Adams, 2014). In addition, Juniper oils have applications in the food, cosmetic and pharmaceutical industries. Among them, *Juniperus excelsa* and *Juniperus communis* are particularly important due to their characteristic chemical profiles. However, essential oil composition may vary depending on species and geographical origin (Maksimović et al., 2008; Sela et al., 2012; Adams, 2014).

Therefore, this study aimed to compare the chemical composition of essential oils from these two *Juniperus* species collected from different localities in Macedonia.

Materials and methods

Distillation of the essential oils

The plant material of *J. communis* was collected from Šar Mountain, while *J. excelsa* was collected from Čalakli, Valandovo, North Macedonia.

Essential oils were isolated from the pseudofructus of *Juniperus communis* and *Juniperus excelsa* by hydrodistillation using a Clevenger-type apparatus, according to the requirements of the European Pharmacopoeia. For each extraction, 50 g of dried plant material was used. After distillation, the isolated oils were collected and stored under appropriate conditions until further analysis.

GC/FID/MS analyses

The chemical composition of the obtained essential oils was analyzed by gas chromatography coupled with flame ionization detection and mass spectrometry (GC/FID/MS). This method enabled the separation and identification of volatile constituents present in the samples. Chromatograms obtained from the analysis were used for qualitative and quantitative comparison of the essential oil composition of *Juniperus communis* and *Juniperus excels* (Sela et al., 2012).

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Results and discussion

The essential oil obtained from *Juniperus excelsa* was characterized by a markedly high proportion of *α*-pinene (73.14%), followed by cedrol (4.84%), limonene (4.69%), myrcene (2.84%), germacrene D (1.80%), and *β*-pinene (1.72%). Overall, monoterpene hydrocarbons constituted the dominant fraction of the oil, indicating a clear *α*-pinene–rich chemotype typical for this species. A total of 97.60% of the oil constituents were successfully identified, indicating a detailed characterization of the essential oil composition. In contrast, the essential oil of *Juniperus communis* showed lower α-pinene content (45.18%) and a higher proportion of monoterpenes and sesquiterpenes, including myrcene (12.35%), germacrene B (5.64%), γ-elemene (4.76%), δ-cadinene (3.84%) and germacrene D (3.33%), with 91.46% of constituents identified, indicating a well-characterized volatile profile.

Previously reported studies on Macedonian populations of *J. communis* have identified *α*-pinene as the predominant constituent (15.59–43.19%), while myrcene, sabinene, limonene and germacrene D were reported as the major secondary components (Sela et al., 2012). In the present study, *α*-pinene reached 45.18%, slightly exceeding the upper value reported by Sela et al., whereas myrcene (12.35%) and germacrene D (3.33%) remained within the previously reported ranges. These findings indicate a generally similar chemical profile and further confirm *α*-pinene as the characteristic dominant constituent of Macedonian *J. communis* essential oils. The *α*-pinene content in *J. communis* was slightly higher than previously reported Macedonian populations, suggesting possible ecological or geographical influence (Adams, 2014). Variations in *J. communis* essential oil profiles reported across Europe, including the Balkans, show that *α*-pinene is commonly accompanied by myrcene, sabinene and limonene, with fluctuations depending on environmental conditions. The higher proportion of myrcene and sesquiterpene hydrocarbons observed in this study is consistent with reported chemotypic variability (Maksimović et al., 2008). The chemical profile of *J. excelsa* agrees with literature data, confirming *α*-pinene as the dominant constituent. Its significantly higher *α*-pinene content compared to *J. communis* indicates clear interspecific differences in terpene biosynthesis and chemotype expression (Moein et al., 2010; Sela et al., 2015). Overall, both species exhibit *α*-pinene–dominant essential oils, with *J. excelsa* showing a more stable *α*-pinene chemotype, consistent with previous Balkan and Mediterranean studies.

Conclusion

The obtained results are consistent with existing literature and confirm *α*-pinene as the major constituent in both studied species, while also highlighting clear interspecific differences in the relative distribution of secondary terpene constituents. These findings emphasize that *Juniperus excelsa* exhibits a more stable *α*-pinene–rich chemotype, whereas *Juniperus communis* shows greater chemical variability and a more complex volatile profile influenced by ecological and geographical factors.

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