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# CHEMICAL COMPOSITION OF VOLATILES OBTAINED FROM FRESH ROOT OF *PEUCEDANUM LONGIFOLIUM* WALDST. & KIT.

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For the first time, chemical composition of the essential oil (EO) and head space (HS) volatiles obtained from the fresh root of *P. longifolium* growing on silicate (S), and HS volatiles of the fresh root of P. longifolium growing on calcareous (C) bedrock was determined by GC-FID and GC-MS. α-Pinene was the most abundant compound in all three samples (60.3% EO S, 76.3% HS S and 62.6% HS C). The greatest differences are observed in the content of sabinene (20.9 % EO S, 8.1% HS S and 25.2% HS C). The difference in the prevalence of other constituents in all the investigated samples is less than 2%. *Acta Medica Medianae 2017;56(1):82-85.*

***Key words:*** *Peucedanum longifolium, essential oil composition, head space volatiles, α-pinene, sabinene*

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## Introduction

*Peucedanum longifolium* (Sect. *Peucedanum*) is one of the 14 *Peucedanum* L. species growing in the flora of Serbia (1). The species usually inhabits calcareous, dry grasslands and rocky slopes of medium altitudes in the C, S & E parts of the Balkan Peninsula, extending to the mountains of C Romania (1, 2). However, we have surprisingly found it growing over silicate bedrock. It seemed interesting to compare the chemical composition of the root volatile compounds of P. longifolium growing in unusual natural environments, i.e. on a siliceous substrate, and those from a calcareous geological substrate.

Some earlier phytochemical studies have made reference to the coumarins and flavonoids in the roots, steams, flowers and fruits of *P. Longifolium* (3). Furthermore, there have been several reports about the antioxidant and antimicrobial activity of essential oils (4, 5) and extracts (6) of the same species. Chemical composition of the essential oil obtained from air-dried aerial parts of flowering P. *longifolium* (4, 5, 7) and volatiles of the fresh above-ground parts in the initial stage of plant development (8) was also reported. The present study, for the first time, reports chemical composition of P. *longifolium* fresh root essential oil (EO) and head space (HS) volatiles obtained from the specimens growing on siliceous substrate and HS volatiles obtained from the plants growing on the calcareous substrate, in both cases in the vegetative stage of growth.

## Materials and Methods

Plant material

The roots of P. *longifolium* were collected from two different localities in the middle of vegetative season, in June 2015, from calcareous, steppe-like grasslands and rocks of Mt. Tupižnica (E Serbia, 43°43'50" N; 22°8'58" E), and similar habitats at siliceous slopes of Mt. Stara (Topli Do, E Serbia, 43°17'59" N; 22°36'42" E). The voucher specimens were deposited in the "*Herbarium Moesiacum* Niš" (HMN), Department of Biology and Ecology, Faculty of Science and Mathematics, University of Niš under the acquisition numbers 7225 and 11780 (respectively).

Isolation and Analysis of volatiles

Isolation and analysis of volatiles was done as previously described (8). The light yellow oil, which has a pleasant odor, was obtained in a yield of 0.09%.

## Results and Discussion

A total of 28 compounds were identified in all examined root samples: essential oil (EO) and

**Table 1.:** Chemical composition (%) of the essential oil (EO) and head space (HS) volatiles obtained from the fresh root of *P. longifolium* growing on silicate (S) and on calcareous (C) bedrock

| | RI* | AI** | Compound | EO*** S## | HS# S | HS C### |
|---|---|---|---|---|---|---|
| 1. | 802 | 801 | Hexanal | -++ | - | tr+ |
| 2. | 923 | 921 | Tricyclene | tr | tr | - |
| 3. | 928 | 924 | α-Thujene | 2.1 | 0.9 | 0.6 |
| 4. | 936 | 932 | α-Pinene | 60.3+++ | 76.3 | 62.6 |
| 5. | 948 | 945 | α-Fenchene | tr | tr | - |
| 6. | 949 | 946 | Camphene | 0.2 | 0.3 | tr |
| 7. | 957 | 953 | Thuja-2,4(10)-diene | tr | tr | tr |
| 8. | 966 | 961 | Verbenene | tr | tr | - |
| 9. | 976 | 969 | Sabinene | 20.9 | 8.1 | 25.2 |
| 10. | 979 | 974 | β-Pinene | 5.6 | 6.6 | 4.7 |
| 11. | 992 | 988 | Myrcene | 2.3 | 2.1 | 1.7 |
| 12. | 1006 | 1002 | α-Phellandrene | 0.1 | 0.1 | 0.1 |
| 13. | 1018 | 1014 | α-Terpinene | 0.5 | 0.2 | 0.1 |
| 14. | 1026 | 1020 | *p*-Cymene | 0.4 | 0.1 | 0.3 |
| 15. | 1031 | 1024 | Limonene | 0.7 | 0.6 | 1.3 |
| 16. | 1039 | 1032 | (*Z*)-β-Ocimene | 0.1 | - | 0.1 |
| 17. | 1049 | 1044 | (*E*)-β-Ocimene | 1.2 | 1.2 | 1.6 |
| 18. | 1060 | 1054 | γ-Terpinene | 1.1 | 0.5 | 0.6 |
| 19. | 1069 | 1065 | *cis*-Sabinene hydrate | 0.1 | - | tr |
| 20. | 1090 | 1086 | Terpinolene | 0.3 | 0.1 | 0.8 |
| 21. | 1180 | 1174 | Terpinen-4-ol | 0.7 | tr | tr |
| 22. | 1392 | 1388 | 1-Tetradecene | tr | tr | tr |
| 23. | 1397 | 1389 | β-Elemene | 0.1 | tr | - |
| 24. | 1426 | 1417 | (*E*)-Caryophyllene | 1.3 | 1.5 | 0.1 |
| 25. | 1460 | 1452 | α-Humulene | 0.1 | tr | - |
| 26. | 1502 | 1498 | α-Selinene | tr | - | - |
| 27. | 1512 | 1508 | Germacrene A | tr | - | - |
| 28. | 1591 | 1582 | Caryophyllene oxide | tr | - | - |
| | | | Total:<br>Monoterpenoids<br>Sesquiterpenoids<br>Other | 98.1<br>96.6<br>1.5<br>- | 98.6<br>97.1<br>1.5<br>tr | 99.8<br>99.7<br>0.1<br>tr |

*RI – experimental linear retention indices relative to $C_8$-$C_{40}$ alkanes on the HP-5MS
** AI- Adam's retention indices, *** EO – essential oil, ## S – silicate bedrock
# HS – head space volatiles, ### C – calcareous bedrock,
†† (-) - not detected, † tr– trace (< 0.05%)
††† The most represented components are in bold

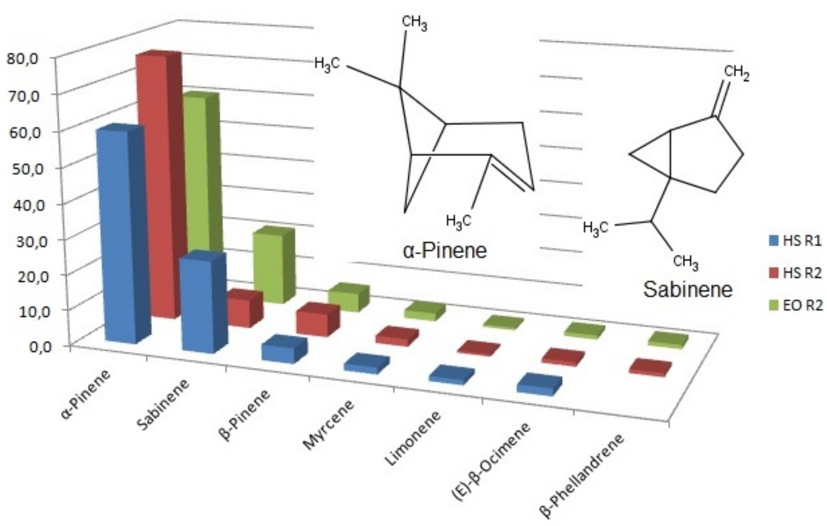


**Figure 1.:** The quantitative composition of examined *P. longifolium* volatiles and Chemical structures of dominant compounds

head space (HS) volatiles from siliceous (S) and HS volatiles from calcareous (C) rocky grounds (98.1% EO S, 98.6% HS S, 99.8% HS C) (Table 1). It should be mentioned here that the root quantity from calcareous substrate was suf-ficient only for analysis of HS volatiles and insuf-ficient for essential oil isolation.

Monoterpenes were predominant in all the samples (96.6% EO S, 97.1% HS S, 99.7% HS C). The presence of sesquiterpenes was negligible (1.5% EO S, 1.5% HS S, 0.1% HS C). α-Pinene was the most abundant component in all three samples, making nearly two-thirds of the total oil. The second most prevalent compound was sabinene. Nevertheless, its prevalence was several times lower than that of α-pinene. It was more interesting that there was a similarity in its abundance in EO S and HS C, while its abundance in HS S was roughly 2.5 times lower than that in EO S and HS C (Figure 1).

Comparing the composition of HS S and EO S, in addition to the above differences in sabinene content, there was an important difference in α-pinene content (76.3% HS S vs. 60.3% EO S). Other identified components were approximately equally present.

Regarding the composition of HS S and HS C, there was a noticeable difference in the prevalence of α-pinene, sabinene and (E)-caryophyllene (Figure 1).

β-elemene (24.9%) and (E)-β-ocimene (28.5%) are known in publications as the most prevalent components of EO and HS of the fresh above-ground part in the developing stage of P. *longifolium* harvested from the same location as HS C (8).

Contrary to that, in our HS C samples, β-elemene was not detected, while (E)-β-Ocimene was present at the level of only 1.6%.

## Conclusion

The results of this investigation present the differences in quantitative content of the examined P. *longifolium* volatiles (α-pinene, sabinene and (E)-caryophyllene). Whether the observed differences were caused by the type of substrate and/or some other environmental factors, we could not determine. Based on the results of this and a previous study (8), a firm conclusion may be drawn that P. *longifolium* has got different contents of the volatiles in its root and above-ground parts, obtained from the samples in the same vegetative phase and from the same location.


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# HEMIJSKI SASTAV ISPARLJIVIH KOMPONENTI DOBIJENIH IZ SVEŽEG KORENA *PEUCEDANUM LONGIFOLIUM* WALDST. & KIT.

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Hemijski sastav etarskog ulja (EO) i "head space" isparljivih komponenti (HS) dobijenih iz svežeg korena *Peucedanum longifolium* koji raste na silikatnom tlu (S) i hemijski sastav isparljivih komponenti svežeg korena P. *longifolium* koji raste na karbonatnom tlu (C) po prvi put su određeni pomoću GC-FID i GC-MS analiza. Dominantna komponenta prisutna u sva tri uzorka je α-pinen (60,3% EO S; 76,3% HS S; 62,6% HS C). Najveće razlike su manifestovane u sastavu sabinena (20,9 % EO S; 8,1% HS S; 25,2% HS C). Razlika u rasprostranjenosti drugih sastojaka u ispitivanim uzorcima je manja od 2%. *Acta Medica Medianae 2017;56(1):82-85.*

***Ključne reči:*** *Peucedanum longifolium, sastav eteričnog ulja, "head space" isparljive komponente, α-pinene, sabinene*