

THE ALKANES FROM SOME PLANTS OF *SATUREJA* GENUS

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**Abstract.** Hydrocarbon fractions of pentane extracts of *Satureja montana* L. subsp. *montana*, *Satureja kitaibelii* Wierzb. ex Heuff. and *Satureja hortensis* L. were investigated. Non-branched, saturated, aliphatic hydrocarbons (C<sub>16</sub> to C<sub>35</sub>) were identified by GLC and GLC-MS and it was found that nonacosane, hentriacontane and tritriacontane were prevailing compounds. It was also observed that the relation between hydrocarbons with odd and even number of C-atoms was ~5.5:1.

## 1. Introduction

Natural products of the plant species of *Satureja* genus (*Labiatae* family) show an important physiological activity. That is why they were the subject of study for many authors. The intensive studies of these species resulted in a better understanding of accumulation, composition and biosynthesis of natural products, as well as chemotaxonomic distinctions between species [1-4].

The aim of this study was to enrich the chemotaxonomic data of the above mentioned species with those of hydrocarbon composition, because of their insufficiency in literature.

## 2. Experimental

**General.** Mps: uncorr. Mobile phase for TLC was C<sub>6</sub>H<sub>6</sub>-EtOAc (9:1) and the detector was 50% H<sub>2</sub>SO<sub>4</sub>.

**Plant material.** Plant material was collected in the blooming phase of vegetation. *S. montana* subsp. *montana* specimen was collected near Dečane, *S. kitaibelii* from Rtanj and *S. hortensis* from a garden (Sredska near Prizren) all in Serbia. Leaves, flowers and green parts of stems were air-dried for ten days at room temperature and kept at a cold and dark place till extracted.

**Extraction and isolation.** The plant material (600 g of *S. montana*, 300 g of *S. kitaibelii* and 150 g of *S. hortensis*) were extracted by pentane in a Soxhlet apparatus for 24 hours. The extracts were evaporated to a small volume and dried for 2 hours with dry MgSO<sub>4</sub>. After separation of

MgSO<sub>4</sub>, the extracts were evaporated on a vacuum pan till a constant weight. The extraction of *S. montana* gave 15.80 g (2.63%), *S. kitaibelii* 4.23 g (1.41%) and *S. hortensis* 10.02 g (6.68%) of residue. The extracts were separated on silica gel by CC (petrol, b.p. 40-70°C) into 8 fractions. The fractions 4-8 were combined (on the basis of TLC), precipitated (x2) in Et<sub>2</sub>O-Me<sub>2</sub>CO and dried. The yields were 463 mg (2.93%, *S. montana*), 105 mg (2.49%, *S. kitaibelii*) and 76 mg (0.76%, *S. hortensis*). Mps for all residues were in the interval 63-66°C.

IR. The spectra were obtained from KBr discs. IR bands  $\nu_{\max}$  cm<sup>-1</sup>: 2962, 2853, 1450, 750, 720.

<sup>1</sup>HNMR (60 MHz, CDCl<sub>3</sub>-TMS):  $\delta$  0.9 (m), 1.25 (m).

GLC. The hydrocarbon fractions of *S. montana* and *S. kitaibelii* were analyzed on a 4 m x 3 mm column packed with 3% SE-30, FID, carrier gas N<sub>2</sub> (30 cm<sup>3</sup>/min), temp. programmed 130-285°C at 4°/min, temps of injector and detector 310°C.

GLC-MS. The hydrocarbon fraction of *S. hortensis* was analyzed on 4 m x 3 mm column packed with 10% OV-101, FID, carrier gas N<sub>2</sub> (30 cm<sup>3</sup>/min), temp. programmed 150-300°C at 5°/min, temps of injector and detector 310°C. Identification of compounds was carried out by co-injection of authentic compounds (*S. montana* and *S. kitaibelii*) and by comparison of mass spectra with Wiley data base (*S. hortensis*). The obtained results are shown in Table I.

### 3. Results and discussion

Separated hydrocarbon fractions of pentane extracts of *S. montana* subsp. *montana*, *S. kitaibelii* and *S. hortensis* showed only one spot on TLC. IR bands  $\nu_{\max}$  cm<sup>-1</sup>: 1450 (CH<sub>2</sub>), 2853-2962 and 720-750 (-CH<sub>2</sub>-) pointed out a presence of a large number of methylene groups. The <sup>1</sup>HNMR data confirmed the presence of methyl ( $\delta$  0.9 ppm) and methylene ( $\delta$  1.25 ppm) protons. The melting interval (63-66°C) and GLC analyses indicated a mixture of alkanes.

The identification by GLC and GLC-MS gave the results shown in Table I. It can be seen that the relation between hydrocarbons with odd and even number of C-atoms was ~5.5:1. In addition, the main compounds were nonacosane, hentriacontane and tritriacontane which together reached about 65% of hydrocarbon fractions. Consequently, it seems that those compounds are the main chemotaxonomic characteristic of *S. montana* subsp. *montana*, *S. kitaibelii* and *S. hortensis*.

With an exception of hydrocarbons C<sub>27</sub> - C<sub>35</sub>, which had been identified before in petrol extract of *S. montana* [5], the other hydrocarbons of this plant identified in our study have not been identified up to now [6-12]. In addition, according to the available literature, hydrocarbon composition of *S. kitaibelii* and *S. hortensis* was studied for the first time.

Insufficient data about hydrocarbon composition of other species of *Satureja* genus do not allow us to make the definite conclusion, but it seems very likely that nonacosane, hentriacontane

and tritriacontane are, in fact, the main chemotaxonomic characteristic of the whole *Satureja* genus.

Table I. Saturated aliphatic alkanes in the pentane extracts of *S. montana* subsp. *montana*, *S. kitaibelii* and *S. hortensis*

Components, %	<i>S. montana</i>	<i>S. kitaibelii</i>	<i>S. hortensis</i>
Hexadecane	0.06	-	-
Heptadecane	0.02	0.02	0.67
Octadecane	0.12	0.05	-
Nonadecane	0.02	0.12	0.62
Eicosane	0.08	0.06	-
Heneicosane	0.03	0.07	0.35
Docosane	0.51	0.05	-
Tricosane	0.79	0.11	0.14
Tetracosane	0.66	0.10	0.10
Pentacosane	0.34	0.44	0.13
Hexacosane	0.23	0.35	-
Heptacosane	2.93	3.81	0.09
Octacosane	1.10	1.79	0.79
Nonacosane	21.31	30.40	10.20
Triacosane	4.14	4.70	4.02
Hentriacontane	30.12	27.51	32.68
Dotriacontane	3.14	2.81	5.05
Tritriacontane	13.33	8.24	18.60
Tettratriacontane	3.20	2.27	3.20
Pentatriacontane	1.30	1.07	7.34

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### ALKANI IZ NEKIH BILJAKA RODA *SATUREJA*

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Izvod. Ispitivane su ugljovodonične frakcije pentanskih ekstrakata *Satureja montana* L. subsp. *montana*, *Satureja kitaibelii* Wierzb. ex Heuff. i *Satureja hortensis* L. Gasnom hromatografijom (GLC) i GLC-MS-om identifikovani su normalni, zasićeni, alifatični ugljovodonici (C<sub>16</sub> do C<sub>35</sub>) i nađeno je da su nonakozan, hentriakontan i tritriakontan dominantna jedinjenja. Takođe je uočeno da je odnos ugljovodonika sa neparnim i parnim brojem C-atoma ~ 5,5:1.