Volatile Composition of Sage (*Salvia officinalis*) Honey from the North West Adriatic region of Croatia by SPME-GC-MS analysis

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INTRODUCTION

Sage (*Salvia officinalis*) honey is a traditional specialty of the North West Adriatic region of Croatia. The North West Adriatic region of Croatia is constituted by the islands of the Kvarner Bay and the part of the coast under the North Velebit mountain range. The volatile's composition is specific for each type of honey and closely related to the geographical region of production [1-4].

RESULTS and DISCUSSION

In the volatile fraction of sage honey 70 compounds were identified. The most abundant were benzeneacetaldehyde (mean 10.1% in 2007 - 15.6% in 2008) followed by benzaldehyde (mean 20.7% in 2007 - 53.8% in 2008). All the others compound's mean values range between 0.1 - 6.0% (Fig.1).

There is a variability in the volatile composition of the sage honey. The canonical discriminant function analysis-CDA, applied to volatile compositions, (Fig. 2) shows that the distance between the sage honey from 2007 and the one from 2008 is quite big, but the probability to correctly classify an unknown sample is 60% (crossvalidated).

From the compounds present in the volatile fraction of fresh sage flowers only limonene, gamma terpinene, N-ethyl benzenamine and borneol were also present in sage honey (Table 1).

Due to particular geographical characteristics and climate conditions of this region, the CDA was applied to volatile compositions of honeys from both years to distinguish sage honey from the islands and the one from the coast. Fig. 3 shows that the gap between the sage honey from the coast and the one from the islands is too small to distinguish them.

EXPERIMENTAL

Sample: 28 sage honey samples (year 2007 and 2008) from different locations of the NW Adriatic region; fresh sage flowers.

Extraction: 1g honey dissolved in 0.5ml water. SPME by using a fibre 50/30µm DVB/CAR/PDMS. The samples were thermostated on 50°C for 20min, absorption time 30min on 50°C, desorption time 10min.

GC analysis: GC-MS, HP 6890 coupled with a HP 5972 MSD and fitted with a fused silica capillary column 30m x 0.25mm i.d., coated with DB-5MS as stationary phase, df 0.25µm. GC was carried out applying the following experimental conditions: oven temperature from 40°C with 5°C/min to 230°C then with 20°C/min to 320°C, injection temperature 250°C, carrier gas (Helium) flow rate 1mL/min, split 2:1. GC-FID, Agilent 6890 fitted with a DB-5 narrow bore column (10m x 0.1mm i.d.; 0.1µm film thickness). The analytical conditions were: helium as carrier gas (average velocity 45cm/s), injector temperature 250°C, split ratio 5:1, temperature programme from 60°C with 8°C/min to 160°C then with 30°C/min to 280°C.

Identification: retention Indices (RI) of the compounds were determined on the basis of homologous n-alkane hydrocarbons under the same conditions. The compounds were identified by comparing their retention indices and the mass spectra to published data [5].

CDA: a canonical discriminant function analysis (CDA) performed with SPSS 15.0 was applied to volatile compositions.

Table 1: Volatile compounds with a mean value higher than 1%

COMPOUND	RI	FLOWER	HONEY
toluene	767	-	1.3%
n-octane	800	-	1.7%
alpha thujene	930	1.2%	-
alpha pinene	937	8.2%	-
benzaldehyde	965	-	10.1%
beta pinene	979	45.0%	-
1-octen-3-ol	981	-	1.6%
myrcene	991	2.9%	-
1,8-cineole	1031	12.8%	-
limonene	1032	3.4%	0.2%
benzeneacetaldehyde	1047	-	20.7%
gamma terpinene	1062	1.0%	1.3%
trans-linalool oxide	1074	-	2.3%
cis-linalool oxide	1088	-	1.1%
para-cymenene	1092	-	2.4%
linalool	1100	-	2.2%
alpha thujone	1102	11.3%	-
Ho-trienol+n-nonanal	1103	-	3.7%
phenyl ethyl alcohol	1113	-	1.3%
beta thujone	1114	4.2%	-
isophorone	1123	-	1.4%
benzenamine,N-ethyl	1130	0.5%	1.0%
lilac aldehyde A	1144	-	1.7%
ketoisophorone	1149	-	1.2%
lilac aldehyde B+C	1152	-	3.0%
lilac aldehyde D	1167	-	1.5%
1-nonanol	1173	-	1.8%
borneol	1176	1.4%	2.0%
n-decanal	1207	-	1.9%
carvone	1243	-	1.0%
beta-caryophyllene	1419	2.0%	-
alpha-humulene	1455	1.7%	-

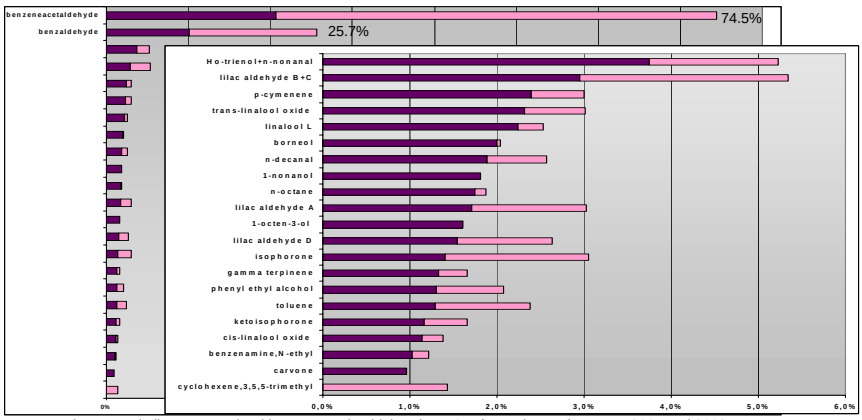


Figure 1 Volatile compounds with a mean value higher than 1% of sage honey from year 2007 and 2008

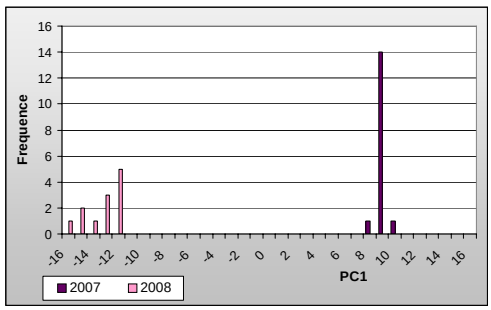


Figure 2 CDA between volatile composition of sage honey from year 2007 and one from year 2008

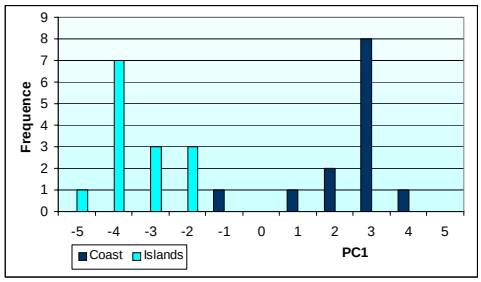
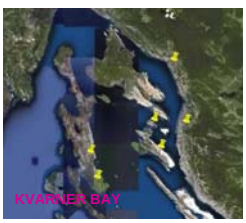


Figure 3 CDA between volatile composition of sage honey from coast and one from islands

NW Adriatic region of Croatia



Salvia officinalis in its natural habitat

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