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Secondary Metabolites in Essential Oil of *Achillea millefolium* (L.) Growing Wild in East Part of Kosova

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Abstract: Problem statement: Chemical composition of essential oil of *Achillea millefolium* (L.), originated from east part of Kosova, was investigated. **Approach:** The chemical profile of the essential oil was evaluated by GC and GC-MS. **Results:** Analysis of the oil resulted in the identification of 33 peaks, representing 81.4% of the oil. The main compounds of *Achillea millefolium* (L.) from east region of Kosova, were 1,8-cineole (22%), camphor (21%), borneol (7,6%) and β-pinene (5.3%). **Conclusion:** After comparison of our date with those reported in literature we can conclude that various chemotypes of *Achillea millefolium* (L.) occur in nature.

Key words: *Achillea millefolium* (L.), essential oil, east part of Kosova, 1,8-cineole, camphor, borneol, β-pinene

INTRODUCTION

Achillea millefolim (L.) is generally known as Yarrow (Benedek *et al*., 2008). The herb is very common during May and June and it grows in all parts of Kosova. *A. millefolium* (L.) is used in folk and official medicine (Benedek *et al*., 2008). It has traditionally used against skin inflammations, hepato-biliary disorder and gastrointestinal complaints. *A. millefolium* (L.) has been used internally as herbal tea and externally in lotions and herbal medications (Benedek *et al*., 2008; Smelcorevic *et al*., 2010; Baser *et al*., 2002).

The essential oil of *A. millefolium* (L.) is reported to posses disinfectant properties and has also been used as a haemostatic (Benedek *et al*., 2008; Smelcorevic *et al*., 2010; Baser *et al*., 2002). The chemical profiles of *A. millefolium* (L.) oil have been the subject of number publications over the years (Smelcorevic *et al*., 2010; Suleimenov *et al*., 2001; Hofmann *et al*., 1992). However, to our knowledge no detailed GC-MS analysis of *A. millefolim* (L.) essential oil from Kosova has been done out so far.

The aim of this study was to investigate the chemical profile of *A. milefolium* (L.) essential oil, from East part of Kosova and the results are compared to those reported in literature.

MATERIALS AND METHODS

The aerial part of *A. millefolium* (L.), growing wild in east part of Kosova, was collected in May 2008. Voucher specimens were deposited in the herbarium of the Department of Veterinary, University of Prishtina.

The plants were dried at room temperature. The essential oil of *A. millefolium* (L.) was extracted with steam distillation for 3h of 100g of air dried plants. The yield was 0.21% (v/w).

The analysis of essential oil was carried out by GC and GC-MS. The HP 5890 II chromatograph equipped with an FID detector and using fused silica capillary

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column (30 m×0.32 mm), coated with polydimethyl siloxane, was used for quantitative analysis. The GC oven temperature was set at 50°C for 3min, then programmed to 220°C at a rate of 5°C min^{-1} and then held isothermal at 220°C for 13 min. Nitrogen was the carrier gas. About 1 µL of diluted sample was injected manually. The percentage composition of the essential oil was computed from GC peak areas without correction factors.

Analysis by GC-MS was performed using a chromatograph HP 5890 II GC interfaced to a HP 5972 mass spectrometer (ionization voltage 70 eV) and equipped with capillary column HP-5MS (50 m×0.25 mm). The oven temperature was held at 100°C for 5 min and then programmed from 100-250°C at a rate of 5°C min^{-1}. He was as the carrier gas (1.0 mL min^{-1}).

Qualitative analysis was based on a comparison of retention times and indexes on both columns and mass spectra with corresponding data in the literature (Adams, 2001) and computer mass spectra libraries (Wiley and NBS 75 K).

RESULTS

Water-distilled essential oil from aerial part of *A. millefolium* (L.) was analysed by GC-MS. The identified compounds and their percentage are given in Table 1. The yield was 0.21% (v/w). Analysis of the oil resulted in the identification of 33 peaks, representing 81.4% of the oil. The main compounds of *A. millefolium* (L.) from east region of Kosova, were 1,8-cineole (22%), camphor (21%), borneol (7,6%) and β-pinene (5.3%).

DISCUSSION

The essential oil from aerial parts of *A. millefolium* (L.), obtained by hidro-distillation was analyzed by GC and GC-MS. The oil yield was 0.21% (v/w). When we compare this oil yield with those reported by other authors (Smelcorevic *et al*., 2010; Baser *et al*., 2002; Suleimenov *et al*., 2001; Hofmann *et al*., 1992), it was seen that we have obtained a very good yield.

Analysis of the oil resulted in the identification of 33 peaks, representing 81.4% of the oil. The main compounds of *A. millefolium* (L.) from east region of Kosova, were 1,8-cineole (22%), camphor (21%), borneol (7,6%) and β-pinene (5.3%).

1,8-Cineol (22%) and camphor (21%) in *A. millefolium* (L.) essential oil from Kosova is in higher quantity than in *A. millefolium* (L.) oil from Germany (Hofmann *et al*., 1992), but our oil is in agreement with essential oil of *A. millefolium* (L.) from Serbia (Smelcorevic *et al*., 2010) in the percentage composition of 1,8-cineol. Also, essential oil from Kosova contains more camphor than essential oil of *A. millefolium* (L.) from Serbia (11%) (Smelcorevic *et al*., 2010).

Borneol (7.6%) in *A. millefolium* (L.) oil from Kosova is in same quantity as in essential oil from Germany (8.1%) (Hofmann *et al*., 1992). β-Pinene (5.3%) from Kosova's *A. millefolium* (L.) essential oil, is in lower amount than in oil from Germany (11.5%) (Hofmann *et al*., 1992) but our oil matches to a great extent with essential oil from Serbia (Smelcorevic *et al*., 2010) in the percentage of β-pinene (5.4%).

The amounts of chemical components in *A. millefolium* (L.) essential oil from Kosova region are not in agreement with *A. millefolium* (L.) essential oil from other region. From here we can see the variation on the chemical composition of essential oil of *A. millefolium* (L.) Also, we have confirmed the conclusion of Hofmann *et al*. (1992) that various chemotypes of *A. millefolium* (L.) occur in nature.

Table 1: Chemical composition of *Achillea millefolium* (L.) essential oil

Components	RI	Percent
(Z)-3-hexanol	845	0.2
α-thyjene	924	0.2
α-pinene	937	1.3
camphene	949	0.6
sabinene	969	1.2
β-pinene	976	5.3
p-cymene	1015	1.6
1,8-cineol	1026	22.0
γ-terpinene	1050	0.9
trans-sabinene	1054	0.2
cis-sabinene	1090	0.7
α-thujone	1103	0.6
camphor	1127	21.0
menthone	1142	1.4
borneol	1157	7.6
terpinen-4-ol	1166	2.9
α-terpineol	1177	2.8
myrtenol	1184	1.2
trans-carveol	1202	0.1
bornyl acetate	1273	0.1
cis-jasmone	1379	0.2
β-caryophyllene	1417	2.6
cis-β-farnesene	1450	0.1
germacrene D	1479	1.9
α-murolene	1498	0.1
γ-cadinene	1527	0.1
α-cadinene	1536	0.1
β-caryophyllene oxide	1571	3.2
β-eudesmol	1638	0.2
α-eudesmol	1641	0.1
n-octadecane	1805	0.5
n-nonadecene	1906	0.3
(E, E)-fernasyl acetone	1921	0.1
Total		81.4

RI: Retention Indices

CONCLUSION

The present study presents the chemical profile of the essential oil of *Achillea millefolium* (L.) from east part of Kosova. 1,8-cineole (22%), camphor (21%), borneol (7,6%) and β-pinene (5.3%) were the major components. Comparing our results with *A. millefolium* (L.) oils from different parts of the Europe, it was evident that our oil is different from the others regions on chemical profiles.

After comparison of our date with those reported in literature (Baser *et al*., 2002; Suleimenov *et al*., 2001; Hofmann *et al*., 1992; Smelcorevic *et al*., 2010), we can conclude that genetic and environmental factors play role in chemical profiles of essential oil of *Achillea millefolium* (L.).

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