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Comparative study of essential oil constituents of *Bupleurum* species from Mongolia

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ABSTRACT: Essential oils have been isolated from the Mongolian plant species *Bupleurum scorzonerifolium* Willd, *Bupleurum sibiricum* Vest and *Bupleurum multinerve* DC by a hydro distillation method. The compositions of the essentials oils were analyzed by GC and GC-MS methods. Indicating the following main constituents: limonene (15.21%), p-cymene (11.54%), (E)- β -ocimene (10.50%), myrcene (8.09%), sabinene (6.56%), α -pinene (6.33%), germacrene-D (4.08%), β -pinene (3.13%), δ -cadinene (2.73%), spathulenol (2.71%) and caryophyllene oxide (2.53%) for *B.scorzonerifolium*; caryophyllene oxide (16.97%), spathulenol (7.25%), pentadecane (6.33%), α -pinene (4.20%), limonene (3.30%), myrcene (3.09%), cis-carvylacetate (1.69%) and β -cubebene (1.43%) for *B.sibiricum*; germacrene-D (19.41%), (E)- β -ocimene (18.63%), myrcene (9.13%), limonene (7.81%), E-caryophyllene (4.60%), sabinene (2.80%), β -elemene (2.72%), bicyclogermacrene, β -pinene, γ -terpinene, (Z)- β -ocimene (2.00-2.10%), and caryophyllene oxide (1.11%) for *B.multinerve*.

Keywords: *Bupleurum scorzonerifolium*, *B.sibiricum*, *B.multinerve* (*Apiaceae*), essential oil composition

INTRODUCTION

The genus *Bupleurum* is a very common wild growing perennial and 150 species of those originate from Euro-Asia[1]. The roots are collected in the spring and autumn of those bitter herbs are used in herbal medicine that contain rutin, quercetin, organic acids (oleic, linolenic, palmetic, stearic et al), stigmasterol and bupleuomol, as well as calcium and potassium[2,3].

The *Bupleurum* root is considered an herbal anti-inflammatory and antibacterial agent that may be useful for treating rheumatoid arthritis as well as it is a popular plant in traditional medical systems in Europe and Asia with reputation in treatment of chronic enlarged liver or spleen which are caused by chemicals and other hepatic affects, liver stasis, liver congestion, depression and irregular menstruation[5].

In Mongolian traditional therapy, the aerial parts of *Bupleurum* species are used in some

cardiovascular diseases, in addition to infectious diseases⁴. A literature search is revealed many references of previous work those are on the essential oils of *Bupleurum* species[6-8].

Volatile components of *Bupleurum scorzonerifolium* and *Bupleurum sibiricum* from the Mongolian flora have been investigated[9,10] previously, while there is no report on the volatile constituents of the aerial parts of *Bupleurum multinerve*.

The aim of this paper was to investigate the chemical compositions of the essential oils of *B.scorzonerifolium*, *B.sibiricum* and *B.multinerve* from the Mongolian forest-steppe region.

EXPERIMENTAL

Plant material. The aerial parts of the *B.sibiricum* Vest were collected from Zuunharaa of the Selenge aimag, *B.multinerve* DC and *B. scorzonerifolium* Willd were collected from Terelj, Hentii mountains in Mongolia

during their flowering period in August-September, 2010. Voucher specimens were deposited in herbariums of the Botanical Institute of Mongolian Academy of Sciences, Ulaanbaatar, Mongolia.

Isolation of essential oil. The air-dried aerial parts of each plant species were hydro distilled in a Clevenger type apparatus[11] for 2h. The percentages of the essential oils were found to be 0.15% (w/w) from *B.scorzonerifolium*, 0.24% (w/w) from *B.sibiricum* and 0.35% (w/w) from *B.multinerve* respectively.

Gas chromatography analysis. About 15 mg of essential oils of these 3 plants, which were dried with anhydrous sodium sulfate, were dissolved in 1 ml of CH₃OH and subjected to gas chromatography (GC). Analysis was performed on a HP 6890 plus Gas Chromatography (GC) equipped with a FID and fitted with HP-5 column (L=25m. ID=0.25mm). The identification of constituents was established by comparison to retention times and MS spectra with those reported in the literature[12].

RESULTS AND DISCUSSION

The isolated essential oils from *B.scorzonerifolium*, *B.sibiricum* and *B.multinerve* were analyzed by gas chromatography and mass spectroscopy. The comparative study of chemical compositions of the essential oils of *B.scorzonerifolium*, *B.sibiricum* and *B.multinerve* from Mongolia are presented in Table I. As the results of monoterpenes and sesquiterpenes were revealed with a high amount in the essential oils of *B.multinerve* and *B.scorzonerifolium* as they grow in forest shadow and low lands. Furthermore, high amounts of the limonene (15.21%) and ocimene (10.5%) in the essential oil of *B.scorzonerifolium* make this essential oil more valuable than others. In contrast, the essential oil of *B.sibiricum* was rich in a high percentage of oxygenated sesquiterpenes. This fact might be explained that *B.sibiricum* usually grows in sunny places.

Table 1. Comparison of essential oil constituents of *Bupleurum* species from Mongolia

RT	Compounds	<i>Bupleurum</i>		
		<i>B.scorzonerifolium</i> Willd	<i>B.sibiricum</i> Vest	<i>B.multinerve</i> DC
800	Hexanal	0.65	1.12	-
807	ethyl acetate	-	1.46	-
867	n-hexanol	-	0.19	-
931	α -thujene	t	0.39	0.12
939	α -pinene	6.33	4.20	1.39
953	Camphene	0.54	0.10	0.10
969	n-heptanal	t	t	t
976	Sabinene	6.56	0.20	2.80
978	octen-3-ol(1)	-	t	-
980	β -pinene	3.13	0.64	2.10
991	Myrcene	8.09	3.09	9.13
993	octanol-3	0.1	0.33	t
1018	α -terpinene	0.33	0.10	0.10
1026	p-cymene	11.54	1.68	0.80
1031	Limonene	15.21	3.30	7.81
1040	(Z)- β -ocimene	1.00	0.27	2.00
1050	(E)- β -ocimene	10.50	1.10	18.63
1062	γ -terpinene	0.1	0.1	2.03
1088	Terpinolene	0.34	0.31	0.10
1095	α -pinene-oxid	t	-	-
1098	Linalool	0.1	1.63	0.1
1143	Camphor	-	-	0.1
1190	methyl salicylate	1.76	-	-
1194	Myrtenal	-	0.20	-
1204	Verbanone	-	0.20	-
1217	trans-carveol	0.21	0.66	0.1
1239	cumin-aldehyde	0.27	t	t
1240	Tridecane	-	0.57	-
1242	Carvone	0.49	0.35	0.1
1257	Myrtenol	t	t	t
1285	bornylacetate	0.36	0.57	0.21
1291	E,E-2.4-decadien	-	0.36	-
1351	α -cubebene	-	1.16	-
	Monoterpene hydrocarbons	66.01	15.48	47.11
	Oxygenated monoterpenoids	0.47	9.33	0.56
	Total (%)	66.48	24.81	47.67

RT	Compounds	<i>Bupleurum</i>		
		<i>B.scorzonerifolium</i> Willd	<i>B.sibiricum</i> Vest	<i>B.multinerve</i> DC
1362	cis-carvylacetate	0.47	1.69	0.11
1365	nerylacetate	-	-	0.13
1376	α -copaene	0.50	1.11	0.20
1383	geranylacetate	-	t	0.10
1390	β -cubebene	0.1	1.43	0.1
1391	β -elemene	0.27	0.1	0.1
1401	methyleugenol	0.1	-	-
1407	dodecanal	1.41	0.1	1.56
1418	caryophyllene	2.04	0.43	4.60
1457	α -humulene	0.77	0.1	1.40
1458	(E)- β -farnesene	0.1	0.1	0.31
1480	germacrene-D	4.08	0.1	19.41
1485	(E)-ionene	-	0.32	-
1493	eqi-cubebol	0.1	1.29	0.1
1494	bicyclogerman	0.1	0.1	2.10
1500	dentodecane	0.1	6.33	0.1
1508	E,E- α -farnesene	0.1	0.1	0.73
1514	cubebol	0.1	0.97	0.1
1524	δ -cadinene	2.73	1.29	0.53
1542	α -calocorene	-	t	-
1564	E-nerolidol	0.1	1.17	0.75
1566	spathulenol	2.72	7.25	0.77
1581	caryophyllene oxide	2.53	16.97	1.11
1611	tetradecanol	-	-	0.41
1627	epi-cubenol	-	0.64	-
1653	α -cadinol	0.1	0.1	0.78
1700	heptadecane	-	0.46	-
1762	benzylbenzoate	-	1.17	-
2100	heneicosane	-	0.56	-
2300	tricosane	-	0.49	-
	Sesquiterpene hydrocarbons	2.73	6.86	32.64
	Oxygenated sesquiterpenoids	8.21	37.11	5.38
	Total (%)	10.94	44.02	38.02

CONCLUSIONS

Our comparative study of the essential oils compositions of aerial parts of *B.scorzonerifolium*, *B.sibiricum* and *B.multinerve* shows that they differ by the contents of compositions which might be depended on plant species growing places and conditions. High percentage of limonene and

ocimene in the essential oils of *B.scorzonerifolium* made them more valuable for treatment of diseases caused by bacteria. Moreover, the essential oil of this plant species can be used as a raw material of perfumes and hygienic products.

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