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Review On Comparative Study Of Volatile Constituents Of *Bupleurum lanceolatum*, *Bupleurum falcatum* and *Bupleurum hemiltoniiBalak* From Kumaun Region Of Uttarakhand

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Abstract

The chemical composition of volatiles from the leaves of three different *Bupleurum* species have been studied. The fresh leaves of *Bupleurum lanceolatum* and flowering aerial part of *BupleurumhemiltoniiBalak and Bupleurum falcatum*Family Apiaceae (Umbellifereae) were steam distilled, extracted with n-hexane and dichloromethane and analyzed by GC and GC-MS.13 compounds were detected in the essential oil of *Bupleurum lanceolatum* representing 95.4% of the oil content, 27 compounds were identified in the oil of *BupleurumHemiltoniiBalak* representing 92.7% of total oil content and 14 compounds were detected in the oil of *Bupleurum falcatum* representing 85.6% of total. The oil was rich in sesquiterpene hydrocarbons, germacrene-D, β-caryophyllene, farnesene, humulene and ocimene.

Keywords: **Essential Oils, *Bupleurum lanceolatum*, *Bupleurum hemiltoniibalak*, *Bupleurum falcatum*, Apiaceae, Sesquiterpenes.**

Introduction

Essential oils and extracts of aromatic plants have been recognized for many years as a great source of pharmaceutical agents and food additives[1]. They have been employed for a long time in different industries, mainly in perfumes (fragrances and aftershaves), food (as flavorings and preservatives), pharmaceuticals (therapeutic action) and for centuries in traditional medicine[2]. Essential oils are obtained from different plant parts such as flower, buds, seed, leaves and fruits[3]. They are mainly composed of a mixture of volatile low molecular weight mono- and sesquiterpenes and other isoprenes.[4-6]

Previously, about 50 species from the genus Bupleurum have been studied chemically, resulting in the isolation of approximately 120 derivatives of saikosaponinslignans, coumarins, flavonoids, polyacetylenes, polysaccharides, sterols, phenylpropanoids and organic acids[7]. Moreover, some Bupleurum essential oils have been investigatedand more than 220 compounds have been identified in them [8-9].

Bupleurum belong to the family Apiaceae (Umbellifereae). It is cosmopolitan in distribution found mainly in northern temperate region[10-11]. *Bupleurum* is the genus of 190 species, distributed in temperate and alpine zone of kumaun region in Uttrakhand[12]. Most of the plants of alpine zone are medicinal, toxic or edible (Shah.1980, Shah and Joshi (1971) and Gupta (1960))[13-15]. The genus *Bupleurum* is annual or short-lived perennial herbs, about 30-150 cm high, lanceolate, mucronate, membranous, leaves entire, flowers yellow, fruit ovoid or oblong usually with prominent ribs, flowers and fruits, and propagated by seeds. Commonly found in grassy slopes and mossy rocks. The plants are poisonous to animals.[16-17]

Bupleurum lanceolatum are erect herbs; stem glabrous, furrowed, 0.5-1.5 m tall; leaves simple, basal leaves long petioled, lamina ovate, lanceolate, veins distinctly 7-9 venation parallel, converging towards apex, cauline leaves smaller and shortly petioled; involucral bracts absent; rays 5-10; involucel 4-5, veins 3; umbellets 10-12 flowered; flowers actinomorphic bisexual, yellow; calyx obsolete; petals 5, obovate, apex notched, inflexed; stamens 5, inflexed; stylopodium circular; fruit oblong-lanceolate, compressed, ridges distinct; Flowers.: July–August, Fruits.: August–September.

Bupleurum hamiltoniiBalak syn. *Bupleurum tenue* is an annual or short-lived perennial herb, one or more stem from the base, leaves entire, up to 8 cm long, flowers yellow, fruit ovoid or oblong usually with prominent ribs. In Uttarakhand found from an elevation of 1500–4000m. (Polunin & Stainton, 1984).[18]

Bupleurum has been used as a liver tonic, with spleen and stomach toning properties. The plant has also been used to promote perspiration and treat fever, flue, distending pain in the chest, and menstrual disorders.[18,19,20]. Radix bupleuri, a well-known traditional medicine, has been utilized to treat common cold with fever, influenza, hepatitis, malaria and menoxenia for more than 2000 years.[21]

The root parts of *Bupleurum falcatum* have been widely used in Chino – Japanese medicine for its anti- inflammatory action, sedative action and antipyretic action. In Indo – China its roots are prescribed in liver trouble and as diaphor in combination with other drugs. (Chopra, R.N., et. al, 1956)[18]. The roots of *Bupleurum falcatum* are well known for the presence of

bioactive saikosaponins, Fatty acids, phytosterols and Saikogenins stigmasterol. (Yamamoto, M., Kumagai, A., and Yamamura, Y.,1975)[19].

An essential oil in Bupleurum is responsible for its ability to relieve surface heat. This herb is anti-inflammatory, hepato-protective, mild sedative, antipyretic, analgesic, adaptogen, and anti-tussive (Yamamoto et al. 1975[20], Utrilla et al. 1991)[21]. The primary chemical constituents of Bupleurum root are: fatty acids, glycosides, oleic acid, palmitic acid, quercetin, and narcissin (Park et al. 2002)[22]. Bupleurum root is a primary component in dozens of classical formulations which serve a wide variety of harmonizing activities, all of which regulate body energy, help relieve blockages in the body, and discharges the toxins safely out of the system (Packer and Kliger 1984)[23].

The essential oil compositions of different species of *Bupleurum* have been previously reported. *Bupleurum fruticosum* was rich in pinene (15.3%) and -phellandrene (49.3%) (Giamperi, Ricci, Fraternale, Manunta, & Tabacchi, 1998)[24] while Liu, Lota, Casanova, and Tomi (2009)[25] have reported the preponderance of -phellandrene (67.7%), sabinene (9.3%) and limonene (5.6%). Chemical composition and antimicrobial activity of the essential oil of *Bupleurum montanum* and *Bupleurumplantagineum* have been reported from North Africa. Magastigma-4, 6-(E), 8(2)-triene (25.3%) was the major constituents of *B. montanum* oil. The major constituents of the oil of *B. plantagineum* were α-pinene (31.9%), cis-chrysanthenyl acetate (28.2%), myrcene (24.8%) and limonene (5.1%) (Laouer et al., 2009)[26]. There is one more report on the essential oil of B. tenue Buch. seed from Pakistan (Ahmad, Maqbool, Sabir, & Bhatty, 1987)[27.] The essential oil composition of Bupleurum candollii reported from Uttarakhand, India, contained caryophyllene (34.1%), caryophyllene oxide (20.7%), dehydro-aromadendrene (7.6%) and thymol methyl ether (7.2%) (Joshi & Pande, 2008).[28] "Essential oil composition of fresh leaves of bupleurum lanceolatum" a research paper was published (C. Kharkwal et al.)[29].

Result And Discussion

The components in the essential oil of fresh leaves of *Bupleurum lanceolatum,*and aerial part of *Bupleurum hemiltoniibalak*and *Bupleurum falcatum* were obtained by hydro distillation method through Clevenger's apparatus and analysed by GC and GC-MS analysis. The essential oil of *Bupleurum lanceolatum* collected from Nainital (Uttarakhand) showed the presence of 13 compounds which were identified, which represent 95.44% respectively of the total oil while *B. hamiltoniiBalak* syn *Bupleurum tenue* showed the presence of 39 compounds, of which 27 compounds representing 92.7% of the oil were identified and 14

compounds were detected in the essential oil of *Bupleurum falcatum* representing 85.6% of total.

The major constituents of the essential oil of B. hamiltonii were germacrene-D (17.83 %), (E)-β-farnesene (14.65 %), (E)-caryophyllene (13.10%) and bornyl acetate (5.63%). Other minor constituents present in the essential oil were limonene (4.03%), trans-ocimene (3.27%), γ-terpinene (4.22%), α-humulene (4.09), α-selinene (3.51%), (E, E)-α-farnesene (4.64%), sabinene (1.99%), βelemene (1.14%), γ-cadinene (1.69%), (Z)-α-trans-bergamotol (1.91%) and (Z)lanceol (1.01%). The major constituents B. falactum oil were germacrene D (26.81 %), (E)-caryophyllene (24.78 %), (E)-β-farnesene (14.34 %) and bornyl acetate (5.09%). Minor compounds present in amounts less the 5.0% were trans-ocimene (2.39%), α-humulene (2.62%), (E, E)-α-farnesene (2.81%) and α-zinziberene (1.66 %). The major constituents of the essential oils of B. lanceolatum were germacrene-D (40.72 %), (E)-β-farnesene (13.96 %), (E)caryophyllene (9.94 %) and bicyclogermacrene (6.35%). Other minor constituents present were bornyl acetate (4.54%), α-humulene (2.25%), trans-ocimene (1.71%), α-zinziberene (1.22 %). (E, E)-α-farnesene (1.89 %) and n-nonadecane (1.08 %). Bicyclo-germacrene was found as one of the major constituent of the B. lanceolatum was totally absent in B. hamiltonii and B. falactum. Minor constituents present in B. hamiltonii viz. sabinene, γ-terpinene, β-elemene γ-cadinene, limonene and (Z)-lanceol were absent in B. lanceolatum and B. falactum; α-zinziberene absent in B. hamiltonii while n-nonadecane was absent in both B. hamiltonii and B. falactum.

The essential oil consists of a high content of sesquiterpene hydrocarbons (61.94%, 74.63% and 77.67 % respectively) while aliphatic hydrocarbon present (1.08%) in B. lanceolatum

Table-1

Peak No.	Compounds		RI	Aerial part of B. hamiltonii	Aerial part of B. falcatum	Aerial part of B. lanceolatum
1	Camphene	MH	944	0.91	-	-
2	α-pinene	MH	945	0.60	-	-
3	Sabinene	MH	975	1.99	-	-
4	β-pinene	MH	979	0.69	0.16	-
5	β-myrcene	MH	990	t	-	-

6	p-cymene	MH	1024	0.87	0.16	-
7	Limonene	MH	1029	4.03	-	-
8	Cis-ocimene	MH	1032	-	-	-
9	Trans-ocimene	MH	1050	3.27	2.39	1.71
10	γ-terpinene	MH	1059	4.22	-	-
11	Linalool	OM	1096	0.61	-	-
12	Carvacrol methyl ether	OM	1244	-	0.53	-
13	Bornyl acetate	OM	1288	5.63	5.09	4.54
14	β-elemene	SH	1338	1.14	-	-
15	α-copaene	SH	1376	0.61	-	0.63
16	β-cubebene	SH	1387	-	-	-
17	β-bourbonene	SH	1388	0.40	-	0.71
18	(E)-Caryophyllene	SH	1419	13.10	24.78	9.94
19	α-humulene	SH	1454	4.09	2.62	2.25
20	(E)-β-farnesene	SH	1456	14.65	14.34	13.96
21	Germacrene-D	SH	1485	17.83	26.81	40.72
22	α-selinene	SH	1492	3.51	-	-
23	α-zinziberene	SH	1493	-	1.66	1.22
24	Bicyclogermacrene	SH	1505	-	0.97	6.35
25	(E, E)-α-farnesene	SH	1506	4.64	2.81	1.89
26	δ-amorphene	SH	1512	-	0.64	-
27	γ-cadinene	SH	1513	1.69	-	-
28	δ-candinene	SH	1523	0.28	-	-
29	(E)-norolidol	OS	1563	3.04	-	-

30	Spathulenol	OS	1578	0.60	-	-
31	Caryophyllene oxide	OS	1583	0.76	-	0.55
32	α-cadinol	OS	1654	-	-	0.29
33	(Z)-α-trans-bergamotol	OS	1690	1.91	0.80	-
34	Iso-longifolol	OS	1729	0.56	-	-
35	(Z)-lanceol	OS	1761	1.01	-	-
36	n-nonadecane	AH	1900	-	-	1.08
% Identified				92.7	85.6	95.44
Monoterpene hydrocarbons				16.58	2.71	1.71
Oxygenated monoterpenes				6.24	5.62	4.54
Sesquiterpene hydrocarbons				61.94	74.63	77.67
Oxygenated sesquiterpenes				7.88	0.80	0.84
Aliphatic hydrocarbons				-	-	1.08

Order of elution and percentages of individual components are given on an Equity-5 capillary column. Identification was made on the basis of their RI and MS (GC/MS). Bold type indicatedmajorcomponents.t=trace(<0.10%).

Conclusion

Comparative results of the volatile constituents of three different Bupleurum species showed quantitative and qualitative variations in their essential oils. To the best of our knowledge, the volatile constituents of flowering aerial parts of *Bupleurum hamiltonii, B. falactum* and *B.lanceolatum* have not been reported earlier. Interestingly, the common chemical markers of these three species were germacrene-D, (E)-β-farnesene, (E)-caryophyllene, and bornyl acetate.

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