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Essential Oil of *Juniperus squamata* D. Don var. *fargesii* Redh. and Wils. Leaves from China

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ABSTRACT: The leaf essential oil of *Juniperus squamata* var. *fargesii* from Gansu, China has been analyzed by GC/MS. Although the oil was found to contain more than 80 constituents, it was dominated by α-pinene (17.7-20.9%), sabinene (7.9-13.7%) and β-thujone. The oil is also compared to the oil of *J. squamata* from India.

KEY WORD INDEX: *Juniperus squamata* var. *fargesii*, Cupressaceae, essential oil composition, α-pinene, sabinene, β-thujone.

PLANT NAME: *Juniperus squamata* D. Don. var. *fargesii* Redh. & Wils. Common name: flaky juniper, Gaoshan-bai (alpine juniper), yanci-bai (rocky juniper),

SOURCE: Foliage was collected on Lian Hua Mountain (R. P. Adams, 6769-6771), Langmusi (R. P. Adams, 6778), and Duoer River (R. P. Adams, 6787), Gansu, China. Voucher specimens are deposited at BAYLU and the Herbarium, Northwest Normal University.

PLANT PART: Fresh leaves were steam distilled in a circulatory Clevenger-type apparatus (1) for 2 h to produce a light yellow oil with yields (g/g oven-dry leaves) ranging from 0.63% to 1.15%.

PREVIOUS WORK: Several papers report on the wood oil components (2-5) and two papers on the leaf oil of *J. squamata* D. Don var. *squamata* (6-7). There are no known reports on the leaf oil of *J. squamata* var. *fargesii* Redh.

PRESENT WORK: GC/MS was accomplished on a Finnigan Ion Trap 800 using a DB-5 column and the compounds identified by combined retention time and mass spectral data (8). Table I shows a comparison of the oils of *J. squamata* var. *fargesii*,

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Table I. Comparisons (percentage) of leaf essential oils of *Juniperus squamata* var. *fargesii* from China (composite) and an individual from Duoer River with *J. squamata* var. *squamata* from India [oil from Weyerstahl et al. (7)]

		China		
KI	Compound	Composite	Duoer	India
856	ethyl isovalerate	0.1	t	-
899	nonane	0.2	0.1	-
926	tricyclene	0.0	0.2	t
931	α-thujene	0.3	0.2	0.5
939	**α-pinene**	**17.7**	**20.9**	**6.9**
953	camphene	0.2	0.4	t
957	thuja-2,4(10)-diene	-	t	-
967	verbenene	-	0.6	-
976	**sabinene**	**13.7**	**7.9**	**9.8**
980	β-pinene	2.2	2.0	0.4
991	myrcene	2.1	2.6	1.9
1001	δ-2-carene	-	-	0.1
1005	α-phellandrene	t	t	0.2
1011	δ-3-carene	t	t	0.4
1018	α-terpinene	0.2	0.2	1.7
1026	p-cymene	0.3	0.4	1.6
1031	**limonene**	**3.0**	**8.9**	**20.7**
1031	β-phellandrene	0.5	0.2	-
1040	(Z)-β-ocimene	-	-	t
1062	γ-terpinene	0.5	0.4	2.6
1068	cis-sabinene hydrate (cis rel. to OH vs. IPP)	0.5	0.5	0.1
1088	terpinolene	0.4	0.6	1.3
1091	2-nonanone	0.2	2.7	-
1095	α-pinene oxide	-	0.4	-
1097	trans-sabinene hydrate (trans rel.to OH vs. IPP)	0.9	0.3	t
1098	linalool	1.0	0.5	0.1
1103	isopentyl isovalerate	-	0.1	t
1102	**cis-thujone (α-thujone)**	**3.0**	**-**	**t**
1114	**trans-thujone (β-thujone)**	**11.9**	**-**	**-**
1121	cis-pinene hydrate	t	0.2	0.1
1125	α-campholenal	t	0.3	-
1139	trans-pinocarveol	0.8	0.4	-
1140	cis-verbenol	t	t	-
1144	trans-verbenol	0.5	0.8	-
1148	camphene hydrate	0.3	0.4	-
1153	citronellal	0.4	-	-
1165	borneol	t	0.6	-
1177	terpinen-4-ol	1.3	1.4	2.8
1183	p-cymen-8-ol	-	-	t
1189	α-terpineol	0.1	0.2	0.4
1194	myrtenol	t	t	-
1204	verbenone	0.2	0.2	-
1217	trans-carveol	t	0.2	-
1228	citronellol	-	0.7	t
1235	myrtenyl acetate	-	t	0.1
1235	thymol, methyl ether	-	-	t
1244	carvacrol, methyl ether	-	t	-
1252	piperitone	t	0.7	-
1257	linalyl acetate	-	-	0.7
1261	methyl citronellate	1.0	-	0.1
1273	unknown	1.0	0.3	-
1285	bornyl acetate	0.4	8.4	0.3
1285	trans linalool oxide acetate (pyranoid)	t	-	-
1291	2-undecanone	-	t	-

Table I. (Cont.)

KI	Compound	China		India
		Composite	Duoer	
1323	methyl geranate	0.4	t	-
1350	α-terpinyl acetate	-	-	1.3
1351	α-cubebene	-	-	t
1376	α-copaene	-	-	0.3
1390	β-cubebene	-	t	t
1391	β-elemene	-	-	0.9
1409	α-cedrene	-	-	0.3
1418	(E)-caryophyllene (β-caryophyllene)	-	-	0.4
1429	**cis-thujopsene**	**4.0**	-	**t**
1446	cis-muurola-3,5-diene*	-	-	0.1
1449	unknown	0.7	0.2	-
1454	α-humulene	-	t	0.2
1462	sesquiterpene	0.3	0.3	0.7
1473	β-cadinene*	0.3	-	0.5
1475	β-chamigrene	0.8	-	-
1477	γ-muurolene	-	0.3	1.1
1480	germacrene D	-	t	0.6
1485	β-selinene	-	-	0.2
1490	sesquiterpene	-	0.3	0.7
1493	epi-cubebol	0.3	0.4	0.7
1499	α-muurolene	0.3	0.6	2.7
1509	β-bisabolene	-	-	0.4
1513	**γ-cadinene**	**0.3**	**1.3**	**3.6**
1514	cubebol	1.0	-	-
1524	**δ-cadinene**	**1.4**	**3.0**	**11.0**
1532	cadina-1,4-diene	-	-	0.2
1538	α-cadinene	-	0.3	0.8
1549	elemol	2.7	2.0	1.5
1556	germacrene B	-	t	0.7
1564	(E)-nerolidol	-	-	0.8
1574	germacrene D-4-ol	1.2	3.3	1.0
1581	caryophyllene oxide	-	-	t
1596	cedrol	0.4	-	2.7
1596	β-oplopenone	t	0.4	0.5
1614	1,10-di-epi-cubenol	-	-	0.2
1627	1-epi-cubenol	0.7	0.3	0.4
1630	γ-eudesmol	0.5	0.5	0.2
1640	epi-α-cadinol (=T-cadinol)	0.4	1.0	2.1
1641	epi-α-muurolol (=T-muurolol)	0.7	2.2	2.1
1645	α-muurolol (=torreyol)	t	0.6	0.7
1649	β-eudesmol	0.5	0.5	0.3
1652	α-eudesmol	0.3	t	t
1652	selin-1-en-4α-ol	-	-	t
1653	**α-cadinol**	**1.6**	**5.3**	**4.0**
1666	bulnesol	0.4	0.5	-
1686	epi-α-bisabolol	-	-	0.6
1733	oplopanone	0.4	1.0	t
1789	**8-α-acetoxyelemol**	**2.4**	**1.7**	**0.2**
1818	unknown	t	0.7	-
2054	**abietatriene**	**t**	**3.3**	**0.3**
2056	**manool**	**-**	**3.4**	**0.7**
2080	abietadiene	t	0.9	t
2288	4-epi-abietal	t	0.4	t
2300	tricosane	-	0.2	-
2303	trans-totarol	-	t	t
2325	trans-ferruginol	-	t	-

KI = Kovat's Index on DB-5 (=SE54) column; *tentatively identified;
t = trace (< 0.1%); unidentified components less than 0.5% are not reported

composite from Lian Hua Mtn. and Langmusi plants (6769-6771, 6778), an individual from the Duoer River (6787) and the oil from *J. squamata* from India [reported as *J. recurva* var. *squamata* (6)]. The oil of *J. squamata* var. *fargesii* was dominated by α-pinene and sabinene, with moderate amounts of limonene, cis- and trans-thujone, cis-thujopsene, and 8-α-acetoxyelemol. The oil of *J. squamata* var. *fargesii* differs considerably from *J. squamata* from India, which is dominated by limonene, with moderate amounts of sabinene, α-pinene, as well as δ- and γ-cadinenes. Mass spectra of the unknown compounds [ITMS, m/z (rel. int.)]: KI 1273, 41(37), 53(22), 67(13), 79(100), 91(55), 105(27), 119(8), 133(5), 147(13) monoterpene alcohol?; KI 1449, 43(66), 55(21), 67(12), 81(38), 91(58), 105(100), 119(58), 133(20), 147(27), 161(73), 175(3), 204(18) sesquiterpene; KI 1819, 43(100), 55(20), 67(17), 77(13), 93(28), 107(12), 119(20), 135(10), 145(12), 159(38), 177(4), 187(20), 202(8), 220(3) sesquiterpene alcohol.

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