Essential Oil of *Juniperus formosana* Hayata Leaves from China

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ABSTRACT: The leaf oil of *Juniperus formosana* of Chinese origin was analyzed by GC/MS. It was found to contain more than 70 components, although most of them were present in amounts of less than 2%. The oil is dominated by α-pinene (47.7%), with lesser amounts of myrcene (7.2%), limonene (4.0%), β-pinene (2.9%), γ-cadinene (2.4%) and germacrene D (2.3%).

KEY WORD INDEX: *Juniperus formosana*, Cupressaceae, essential oil composition, α-pinene.

PLANT NAME: *Juniperus formosana* Hayata, common name: Ci-bai, Taiwan juniper.

SOURCE: Foliage was collected near Jone, Gansu (R. P. Adams, 6772-6774) and Lazikou (R. P. Adams, 6792). 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 clear oil with yields (g/g oven dry leaves) ranging from 0.94% to 1.33%.

PREVIOUS WORK: Several papers report on wood oil components (2-5). There are no known reports on the leaf oil of *J. formosana* from China.

PRESENT WORK: GC/MS was accomplished on a Finnigan Ion Trap 800 using a DB-5 column and the compounds identified by combined retention times and mass spectral data (6). Table I shows the composition of the oil of *J. formosana*. The oil is dominated by α-pinene (47.7%), with lesser amounts of myrcene, limonene,

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Table I. Composition of the leaf essential oil of *Juniperus formosana* from China

KI	Compound	Percentage	KI	Compound	Percentage
854	(E)-2-hexenal	0.2	1217	trans-carveol	0.1
926	tricyclene	0.1	1220	endo-fenchyl acetate	0.2
931	α-thujene	t	1228	citronellol	0.4
939	**α-pinene**	**47.7**	1235	myrtenyl acetate	0.3
953	camphene	0.6	1252	piperitone	0.6
957	thuja-2,4(10)-diene	0.1	1255	geraniol	0.2
967	verbenene	1.5	1262	unknown	1.2
976	sabinene	0.2	1285	bornyl acetate	1.6
980	**β-pinene**	**2.9**	1292	unknown (isomer of 1262)	1.4
991	**myrcene**	**7.2**	1350	α-terpinyl acetate	0.2
1001	δ-2-carene	0.8	1376	α-copaene	0.2
1005	α-phellandrene	1.2	1383	geranyl acetate	0.2
1018	α-terpinene	t	1418	(E)-caryophyllene	1.0
1026	p-cymene	0.9	1454	α-humulene	0.6
1031	**limonene**	**4.0**	1458	(E)-β-farnesene	0.2
1031	β-phellandrene	1.4	1477	γ-muurolene	t
1057	pentyl isobutyrate	0.2	**1480**	**germacrene D**	**2.3**
1062	γ-terpinene	0.1	1493	epi-cubebol	t
1065	3-methyl-2-buten-1-yl, acetate*	0.6	1495	(E)-methyl isoeugenol	0.2
			1499	α-muurolene	0.2
1088	terpinolene	1.0	1507	sesquiterpene	0.5
1091	2-nonanone	0.1	**1513**	**γ-cadinene**	**2.4**
1095	α-pinene oxide	1.4	1517	sesquiterpene	0.5
1097	ipsenol	0.7	1524	δ-cadinene	0.9
1112	endo-fenchol	0.5	1529	citronellyl butyrate	0.1
1121	cis-p-menth-2-en-1-ol	0.2	1538	α-cadinene	0.1
1125	α-campholenal	0.3	1562	geranyl butyrate	0.5
1139	trans-pinocarveol	0.3	1564	(E)-nerolidol	0.3
1140	cis-verbenol	0.1	1574	germacrene-D-4-ol	0.9
1144	trans-verbenol	0.5	1581	caryophyllene oxide	0.3
1148	camphene hydrate	0.3	1606	humulene epoxide II	0.2
1160	trans-pinocarveol	t	1627	1-epi-cubenol	t
1162	pinocarvone	t	1640	epi-α-cadinol (=T-cadinol)	1.6
1165	borneol	0.4	1645	α-muurolol (=torreyol)	0.2
1173	cis-pinocamphone	t	1652	α-eudesmol	t
1177	terpinen-4-ol	0.5	1653	α-cadinol	1.1
1183	p-cymen-8-ol	0.1	1722	(E,E)-farnesol	0.7
1189	α-terpineol	0.6	1989	manoyl oxide	t
1194	myrtenol	0.2	2054	abietatriene	t
1204	verbenone	0.1	2080	abietadiene	t

KI = Kovats Index on DB-5(=SE54) column; *tentatively identified; t = trace (compositional values less than 0.1%); unidentified components less than 0.5% are not reported

β-pinene, γ-cadinene and germacrene D. Mass spectra of the unknown compounds: [ITMS, m/z (rel. int.)]: KI 1262, 41(77), 43(64), 53(12), 68(100), 71(23), 99(20); KI 1292, 41(100), 43(64), 53(14), 69(72), 71(32), 99(24); KI 1507, 41(70), 53(10), 65(11), 79(21), 91(100), 105(16), 119(49), 134(8), 161(4), sesquiterpene; KI 1517, 41(80), 55(14), 71(20), 79(25), 93(100), 108(76), 121(83), 136(27), 161(10), 204(3), sesquiterpene.

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