

## Composition of *Helichrysum thianschanicum* Regel essential oil from Pamir (Tajikistan)

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*Helichrysum thianschanicum* Regel was collected from Khorugh town of Kuhistoni Badakhshon Autonomous Province of Tajikistan. The essential oil was obtained by hydrodistillation and analyzed by gas chromatography – mass spectrometry. A total of 67 compounds were identified representing 88.4% of the total essential oil composition. The major components of *H. thianschanicum* essential oil were (*E*)-1-(6,10-dimethylundec-5-en-2-yl)-4-methylbenzene (pentylicurcumene) (21.6%),  $\beta$ -selinene (6.4%),  $\delta$ -selinene (3.8%), (*2E,6E*)-farnesol (3.3%), nerol (4.1%) and neryl decanoate (4.2%). To our best knowledge, no previous studies have been reported on the chemical composition of the essential oil of *H. thianschanicum*.

**Keywords:** pentylicurcumene, selinene, *Helichrysum thianschanicum* Regel, essential oil composition.

*Helichrysum thianschanicum* Regel (Asteraceae) is a member of the genus *Helichrysum* Mill., includes about 500 species, widespread throughout the Old World [1a]. The plant has several synonyms: *H. arenarium* var. *kokanicum* Regel & Schmalh.; *He. kokanicum* (Regel & Schmalh.) Krasch & Gontsch.; *H. thianschanicum* var. *aureum* O. Fedtsch. & B. Fedtsch [1b] and *Xerochrysum bracteatum* (Vent.) Tzvelev [1c]. *H. thianschanicum*, locally named “guli ghozi” or “ghozichoy”, is a perennial herb growing up to 40 cm. [1d]. As a traditional medicine, herbal tea from *H. thianschanicum* flowers are used to treat liver diseases, gall bladder disorders, jaundice, tuberculosis, for removing the kidney stones, as a diuretic and as an anthelmintic [1e]. To our knowledge, no previous studies have been reported on the phytochemistry of *H. thianschanicum*. In this report, we present the essential oil (EO) composition of *H. thianschanicum* collected from Tajikistan.

*H. thianschanicum*, in the flowering phase, was collected from the town of Khorugh, Kuhistoni Badakhshon Autonomous Province, Tajikistan, and the yellow EO was obtained in 0.2% yield by hydrodistillation. The chemical compositions of the EO was determined by GC-MS (see Table 1). A total of 67 compounds were identified representing 88.4% of the EO composition. The major components of *H. thianschanicum* EO were pentylicurcumene (21.6%),  $\beta$ -selinene (6.4%),  $\delta$ -selinene (3.8%), (*2E,6E*)-farnesol (3.3%), nerol (4.1%) and neryl decanoate (4.2%). A number of studies have been carried out on chemical compositions of EOs of different species of *Helichrysum* [2]. The floral EO of *H. italicum* is an article of commerce and is reputed to be beneficial for skin care as well as anti-inflammatory and immunomodulatory effects [3]. The *H. italicum* EOs are generally rich in neryl acetate, neryl propionate, and  $\gamma$ -curcumene, but may also contain significant quantities of  $\alpha$ -pinene or limonene [4]. The results from this current

study are in agreement with previously reported *Helichrysum* EO compositions. *Helichrysum* EOs are generally dominated by monoterpenoids and sesquiterpenoids with the predominant metabolites  $\alpha$ -pinene, linalool, *p*-cymene,  $\beta$ -selinene,  $\gamma$ -curcumene,  $\beta$ -caryophyllene, caryophyllene oxide, caryophyllenol, neryl acetate, eudesmen-7(11)-en-4-ol, and neryl propionate. In contrast, however, the aromatic hydrocarbon pentylicurcumene [(*E*)-1-(6,10-dimethylundec-5-en-2-yl)-4-methylbenzene] was found as the major component in the EO of *H. thianschanicum*. Recently, pentylicurcumene was found in the EOs of *Geophila repens* [5a] and *Zingiber officinalis* [5b].

### Experimental

**Plant Material:** Aerial parts of *H. thianschanicum* were collected from Khorugh town of Kuhistoni Badakhshon Autonomous Province of Tajikistan on 9 September 2016. The plant was identified by comparison the voucher specimen (K000978204), deposited in the herbarium of the Royal Botanic Gardens, Kew (Richmond TW9 3AB, UK) [6]. The air-dried sample was crushed and hydrodistilled for 3 h to give the EO.

**Gas Chromatographic-Mass Spectral Analysis:** GC-MS analysis was performed on the EO of *H. thianschanicum* using an Agilent 6890 GC with Agilent 5973 MSD and HP-5ms capillary column as described previously [7]. Identification of the EO components was based on retention indices (RI) and mass spectral fragmentation patterns with those reported in the literature [8], and our own in-house database.

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**Table 1:** Essential oil composition of *Helichrysum thianschanicum* from Tajikistan.

RI <sup>a</sup>	Compound	%	RI <sup>a</sup>	Compound	%	RI	Compound	%
941	$\alpha$ -Pinenes	2.2	1365	Neryl acetate	0.2	1640	$\tau$ -Cadinol	0.3
952	$\alpha$ -Fenchene	0.2	1367	Decanoic acid	0.2	1654	Selin-11-en-4 $\alpha$ -ol	1.9
992	Myrcene	0.1	1384	( <i>E</i> )- $\beta$ -Damascenone	0.2	1657	Valerianol	0.4
1024	<i>p</i> -Cymene	0.1	1388	Unidentified sesquiterpene C <sub>15</sub> H <sub>22</sub> <sup>b</sup>	1.5	1670	Unidentified neryl or geranyl ester <sup>f</sup>	2.2
1027	Limonene	0.2	1401	$\gamma$ ,4-Dimethylbenzenebutanal	0.6	1683	<i>epi</i> - $\alpha$ -Bisabolol	1.4
1036	Santolina alcohol	0.1	1409	$\alpha$ -Gurjunene	0.2	1685	$\alpha$ -Bisabolol	0.3
1058	$\gamma$ -Terpinene	0.3	1435	Neryl acetone	0.5	1695	Neryl isohexanoate	0.6
1071	<i>n</i> -Octanol	0.2	1438	Aromadendrene	0.7	1707	Pentadecanal	0.3
1072	<i>cis</i> -Linalool oxide (furanoid)	0.2	1447	Unidentified sesquiterpenoid (C <sub>15</sub> H <sub>26</sub> O) <sup>c</sup>	1.5	1730	Neryl hexanoate	0.8
1087	Terpinolene	0.2	1454	Geranyl acetone	0.2	1743	( <i>2E,6E</i> )-Farnesol	3.3
1100	Linalool	3.1	1475	$\beta$ -Chamigrene	1.1	1764	Myristic acid (= Tetradecanoic acid)	0.3
1104	<i>cis</i> -Thujone (= $\alpha$ -Thujone)	0.6	1481	$\gamma$ -Curcumene	1.1	1789	Neryl isohexanoate	0.6
1112	<i>endo</i> -Fenchol	0.5	1486	$\beta$ -Selinene	6.4	1829	Neryl heptanoate	1.0
1115	<i>trans</i> -Thujone (= $\beta$ -Thujone)	0.5	1492	Neryl isobutanoate	0.3	1873	Unidentified diterpene (C <sub>20</sub> H <sub>32</sub> ) <sup>g</sup>	2.3
1120	<i>exo</i> -Fenchol	0.6	1495	$\delta$ -Selinene	3.8	1896	Unidentified diterpene (C <sub>20</sub> H <sub>32</sub> ) <sup>h</sup>	1.4
1125	$\alpha$ -Campholenal	0.2	1511	Tridecanal	0.7	1913	Pentylcurcumene	21.6
1137	<i>trans</i> -Pinoarveol	0.2	1524	$\delta$ -Cadinene	0.2	1919	Neryl octanoate	2.7
1163	Borneol	1.6	1539	2-Phenylethyl angelate	0.2	2124	Neryl decanoate	4.2
1175	Terpinen-4-ol	2.3	1564	( <i>E</i> )-Nerolidol	1.2		Total identified	88.4
1189	$\alpha$ -Terpineol	3.0	1579	Pacificogiol	2.6		Monoterpene hydrocarbons	3.3
1205	<i>n</i> -Decanal	0.1	1583	Globulol	1.5		Oxygenated monoterpene hydrocarbons	32.0
1226	Nerol	4.1	1591	Viridiflorol	0.2		Sesquiterpene hydrocarbons	13.5
1235	Pulegone	0.3	1594	Cubeban-11-ol	0.1		Oxygenated Sesquiterpene	14.1
1253	<i>cis</i> -Piperitone epoxide	1.0	1599	Fokienol	0.2		Aromatic hydrocarbons	22.3
1269	Nonanoic acid	0.1	1609	Unidentified sesquiterpenoid (C <sub>15</sub> H <sub>26</sub> O) <sup>d</sup>	1.0		Phenols	1.7
1291	Thymol	0.9	1618	Unidentified sesquiterpenoid (C <sub>15</sub> H <sub>26</sub> O) <sup>e</sup>	3.9		Others	1.4
1300	Carvacrol	0.8	1627	1- <i>epi</i> -Cubanol	0.4			

<sup>a</sup> RI = "Retention Index", determined in reference to a homologous series of *n*-alkanes on an HP-5ms column. <sup>b</sup> MS, m/z: 192(3), 174(6), 160(13), 159(100), 147(22), 131(23), 119(55), 107(42), 105(57), 93(32), 91(60), 79(26), 77(23), 55(17). <sup>c</sup> MS, m/z: 222(35), 207(30), 166(9), 151(79), 124(28), 111(34), 110(30), 98(72), 83(100), 69(20), 55(30). <sup>d</sup> MS, m/z: 207(52), 204(51), 189(48), 161(31), 147(30), 135(58), 123(40), 109(50), 95(68), 93(43), 82(60), 81(100), 71(67), 69(52), 67(61), 57(60), 55(77). <sup>e</sup> MS, m/z: 222(5), 204(12), 189(8), 161(13), 148(17), 140(40), 139(79), 123(30), 111(38), 109(33), 95(30), 83(57), 82(100), 72(39), 69(48), 67(40), 57(32), 55(47). <sup>f</sup> MS, m/z: 204(2), 189(3), 161(5), 136(5), 121(11), 109(15), 107(13), 95(18), 93(32), 81(50), 69(100), 67(18), 55(17), 53(11). <sup>g</sup> MS, m/z: 272(6), 187(39), 161(15), 159(30), 145(18), 134(30), 132(68), 121(59), 119(100), 107(25), 105(46), 93(38), 91(30), 81(23), 69(76), 55(24). <sup>h</sup> MS, m/z: 272(7), 187(33), 161(16), 159(27), 145(19), 134(32), 132(64), 121(62), 119(100), 107(25), 105(48), 93(38), 91(33), 81(27), 69(83), 55(25).

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