

Leaf Essential Oil of *Juniperus indica* Bertol. from Nepal

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ABSTRACT: The leaf oils of *Juniperus indica* Bertol. of Nepalese origin have been analyzed by GC/MS. The oils were dominated by sabinene (19.4-31.3%), β -thujone (4.5-25.8%), terpinen-4-ol (3.7-13.0%) and trans-sabinyl acetate (7.6-24.3%).

KEYWORD INDEX: *Juniperus indica*, Cupressaceae, essential oil composition, sabinene, β -thujone, trans-sabinyl acetate, terpinen-4-ol.

PLANT NAME: *Juniperus indica* Bertol., Indian juniper.

SOURCE: Specimens were collected at 4000 m near the Langtang glacier, Nepal. Voucher specimens (Adams 7625, 7626, 7627) are deposited at BAYLU herbarium.

PLANT PART: The fresh leaves (200 g fresh wt) were steam distilled for 2 h using a circulatory Clevenger apparatus (1) for 2 h. Oil yields were 0.48%, 0.70% and 0.27% (oven dry wt basis). The oil samples were concentrated (ether trap removed) with nitrogen and the samples stored at -20°C until analyzed.

PREVIOUS WORK: A review of the literature reveals one report on the biflavones from *Juniperus indica* (2), but no reports on the essential oils.

PRESENT WORK: The oil was analyzed on a Finnigan Ion Trap (ITD) mass spectrometer, model 800, directly coupled to a Varian 6500 gas chromatograph, using a J & W DB-5, 0.26 mm x 30 m, 0.25 μm coating thickness, fused silica capillary column (see reference 3 for operating details). Identifications were made by library searches of our volatile oil library, LIBR(TP) (3), using the Finnigan library search routines based on fit and purity, coupled with retention time data of reference compounds. The leaf oil compositions for three individuals is given in Table I. The oil is dominated by sabinene, β -thujone, terpinen-4-ol and trans-sabinyl acetate.

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Table I. Comparative percentage composition of three leaf oils of *Juniperus indica* from Nepal

| KI | Compound | Plant accession numbers | | |
|-------------|---|-------------------------|-------------|-------------|
| | | 7625 | 7626 | 7627 |
| 800 | hexanal | 0.1 | 0.1 | 0.1 |
| 854 | (E)-2-hexenal | 0.1 | 0.3 | 0.4 |
| 926 | tricyclene | t | t | t |
| 931 | α -thujene | 1.4 | 0.9 | 1.5 |
| 939 | α -pinene | 2.4 | 1.0 | 3.8 |
| 953 | camphene | t | t | t |
| 976 | sabinene | 24.6 | 19.4 | 31.3 |
| 978 | 1-octen-3-ol | t | t | t |
| 980 | β -pinene | 0.1 | 0.2 | - |
| 991 | myrcene | 2.6 | 2.5 | 3.3 |
| 1001 | δ -2-carene | 0.1 | - | - |
| 1005 | α -phellandrene | 0.1 | 0.1 | 0.2 |
| 1011 | δ -3-carene | t | t | t |
| 1018 | α -terpinene | 1.8 | 0.8 | 2.3 |
| 1026 | p-cymene | 0.2 | 0.3 | 0.2 |
| 1031 | limonene | 0.5 | 0.5 | 0.5 |
| 1031 | β -phellandrene | 1.1 | 0.8 | 2.7 |
| 1033 | 1,8-cineole | 1.2 | 0.2 | 2.1 |
| 1062 | γ -terpinene | 2.8 | 1.2 | 3.4 |
| 1068 | cis-sabinene hydrate | 2.0 | 0.8 | 2.0 |
| 1088 | terpinolene | 1.1 | 0.6 | 1.2 |
| 1097 | trans-sabinene hydrate | 1.4 | 0.5 | 1.3 |
| 1102 | cis-thujone (= α -thujone) | 2.6 | 4.1 | 0.5 |
| 1114 | trans-thujone (= β-thujone) | 14.5 | 25.8 | 4.5 |
| 1121 | cis-p-menth-2-en-1-ol | 0.7 | 0.3 | 0.8 |
| 1140 | trans-p-menth-2-en-1-ol | - | - | 0.6 |
| 1140 | trans-sabinol | 3.7 | 2.3 | 0.5 |
| 1149 | neo-3-thujanol | 0.2 | 0.2 | t |
| 1156 | sabina ketone | t | - | t |
| 1171 | umbellulone | 0.2 | 0.1 | 0.2 |
| 1177 | terpinen-4-ol | 9.7 | 3.7 | 13.0 |
| 1189 | α -terpineol | 0.4 | 0.1 | 0.3 |
| 1228 | citronellol | 0.1 | 0.1 | 0.1 |
| 1244 | methyl carvacrol | t | t | t |
| 1252 | piperitone | 0.3 | - | - |
| 1261 | methyl citronellate | 0.1 | t | 0.2 |
| 1285 | bornyl acetate | 0.2 | t | 0.2 |
| 1291 | trans-sabinyil acetate | 14.1 | 24.3 | 7.6 |
| 1351 | α -cubebene | t | t | 0.1 |
| 1376 | α -copaene | t | t | t |
| 1390 | β -cubebene | t | t | 0.1 |
| 1418 | β -caryophyllene | t | t | 0.1 |
| 1423 | 2,5-dimethoxy-p-cymene | 0.1 | - | 0.2 |
| 1446 | cis-muurolo-3,5-diene | 0.2 | t | 1.2 |
| 1454 | α -humulene | t | - | 0.1 |
| 1460 | cis-muurolo-4(14),5-diene | - | 0.1 | - |
| 1473 | β -cadinene* | 0.1 | t | 0.8 |
| 1476 | γ -himachalene | - | 0.1 | - |

Table I. (Cont.)

| KI | Compound | Plant accession numbers | | |
|------|---------------------------------------|-------------------------|------|------|
| | | 7625 | 7626 | 7627 |
| 1477 | γ -muurolene | t | - | t |
| 1480 | germacrene D | - | t | - |
| 1491 | sesquiterpene | 0.5 | 0.1 | 2.1 |
| 1499 | α -muurolene | 0.1 | 0.2 | 0.1 |
| 1513 | γ -cadinene | 0.4 | 0.6 | 1.4 |
| 1524 | δ -cadinene | 0.4 | 1.3 | 1.0 |
| 1524 | sesquiterpene | t | - | 0.5 |
| 1532 | cadina-1,4-diene | - | - | 0.1 |
| 1538 | α -cadinene | - | 0.1 | - |
| 1549 | elemol | 1.2 | 1.2 | 0.7 |
| 1576 | sesquiterpene | 0.3 | 1.0 | 0.1 |
| 1627 | 1-epi-cubenol | 0.3 | - | 1.0 |
| 1630 | γ -eudesmol | 0.2 | 0.1 | t |
| 1640 | epi- α -cadinol (=T-cadinol) | 0.1 | 0.3 | 0.1 |
| 1641 | epi- α -muurolol (=T-muurolol) | 0.1 | 0.3 | - |
| 1642 | cubenol | t | 0.1 | 0.2 |
| 1645 | α -muurolol (=torreyol) | t | 0.1 | t |
| 1649 | β -eudesmol | 0.2 | 0.2 | 0.2 |
| 1652 | α -eudesmol | 0.3 | 0.2 | 0.2 |
| 1653 | α -cadinol | 0.2 | 0.7 | 0.2 |
| 1666 | bulnesol | 0.3 | 0.2 | 0.1 |
| 1908 | diterpene | 0.1 | 0.1 | 0.7 |
| 1930 | ent-rosadiene | 0.1 | - | t |
| 1941 | pimaradiene | t | - | t |
| 1961 | 13-epi-manool | 0.5 | 0.1 | 0.8 |
| 2054 | abietatriene | t | t | t |
| 2054 | manool | 1.7 | 1.1 | 0.5 |
| 2080 | abietadiene | 0.9 | 0.3 | 0.2 |
| 2288 | 4-epi-abietal | t | t | t |
| 2303 | trans-totarol | t | t | t |

KI = Kovats Index on DB-5 (=SE54) column; *tentatively identified;
t = trace (0.1%), Unidentified components less than 0.5% are not reported;
Components larger than 5% are highlighted in boldface

Mass spectra for unidentified constituents: [ITMS, m/z (rel. int.): KI 1491, 41(66), 55(12), 67(11), 81(21), 91(45), 105(49), 119(32), 133(16), 147(4), 161(100), M⁺204 (23), sesquiterpene; KI 1526, 41(81), 55(20), 67(15), 81(62), 91(46), 105(60), 119(53), 133(25), 147(15), 161(92), 189(23), M⁺204(49), sesquiterpene; KI 1576, 41(100), 55(29), 65(18), 79(39), 91(52), 105(73), 119(53), 133(26), 148(5), 161(100), 175(2), 189(10), M⁺204(25), sesquiterpene; KI 1908, 41(100), 55(40), 67(34), 81(32), 91(43), 105(50), 119(20), 133(22), 145(12), 161(25), 175(18), 187(20), 201(8), 215(10), 230(9), 243(2), 257(60), M⁺272(13), diterpene.

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