VOLATILE OIL COMPOSITION OF THE LEAVES OF EUCALYPTUS CITRIODORA HOOK.

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Received on:18/01/2011 Revised on:23/02/2011 Accepted on:04/03/2011

ABSTRACT
The leaves of Eucalyptus citriodora Hook. (Myrtaceae) of Delhi region yielded 0.22 % of the volatile oil which was analyzed by GC and GC-MS techniques. Fifteen components comprising 100 % of the total volatiles were identified which consisted of five monoterpenes (96.3 %) and ten aliphatic components (3.7 %). The major monoterpenes characterized included α-pinene (38.6 %), β-pinene (25.7 %), sabinene (19.6 %) and α-thujene (11.9 %). Among the aliphatic constituents, there were six hydrocarbons (2.3 %) and four aliphatic alcohols (1.4 %). Myrcene and all aliphatic constituents were present in trace amounts.

KEYWORDS: Eucalyptus citriodora, Myrtaceae, leaves, volatile oil composition.

INTRODUCTION
Eucalyptus citriodora Hook. (syn. Corymbia citriodora Hook.), family Myrtaceae, is a native to Queensland, Australia and is spread throughout the tropics and in several other regions of the world1. It is a tall, evergreen and graceful tree, commonly known as lemon-scented gum and grown for production of essential oil, fuel wood, timbers and as source of nectar in honey production. It grows fast, coppices heavily, tolerates stress and is not browsed by livestock. It produces a lot of biomass in a short time but consumes a lot of water, depletes the ground water and renders the soil unproductive in some areas. It has been introduced into India for reclamation of waste lands, timber, pulp, fuel and volatile oil2. The leaves are intensely aromatic releasing a number of volatile terpenes into the environment. The essential oil of the leaves is a powerful antiseptic and is used all over the world as a respiratory decongestant, for relieving colds, coughs, bronchitis, flu, pneumonia, headache and sore throats2,3. It has disinfectant action and is applied externally to cure cuts and skin infections. It is inhaled to open blocked nasal passages. It is useful as gargles for sore throats and is taken internally for a wide range of complaints. The Eucalyptus oils are the starting material for the manufacture of citronellal and derived products. E. citriodora oil showed analgesic, anti-inflammatory4, antiglandular5, acridical6, larvicidal7,10 and phytotoxic11,12 effects. The oil is mainly composed of citronellol, geranyl acetate, limonene and terpene-4-ol13. The present manuscript describes the isolation and analysis of the volatile oil of the leaves of E. citriodora of Delhi region.

MATERIALS AND METHODS
Plant material
The leaves of E. citriodora were collected form Pacchim Vihar, New Delhi. The plant material was authenticated by Prof. M.P.Sharma, Department of Botany, Faculty of Science, Jamia Hamdard. A voucher specimen No. PRL/JH/08/33 is retained in the herbarium of the Department of Pharmacognosy and Phytochemistry, Faculty of Pharmacy, Jamia Hamdard.

Isolation of oil
The plant material (1 kg) was hydro-distilled in a Clavenger apparatus to obtain a pale yellow oil (0.22 %). It was dried over anhydrous sodium sulphate and stored at 4°C in the absence of light prior to analysis.

GC analysis
Analytical GC was carried out by injection 0.1 µL of the leaf oil on a Varian 3300 gas chromatograph with FID detector fitted with silicone DB-I capillary column (30 m x 0.25 mm, film thickness 0.25 µm). GC operation condition split mode: carrier gas helium at a rate of 1.5 mL/min; temperature programme, 80 - 225°C (4°C
hydrocarbons in Cuban Eucalyptus eicosanje, n-dihydroxy alcohol (0.3 %). hydrocarbons (1.1%), four unsaturate
ten aliphatic components
α-monoterpenes were
contained five monoterpenes
1 capillary column. The oil
components are arranged in the
while oxygenated compounds and
leaves of E. citriodora, their retention indices and percentage are listed in Table 1. The constituents are arranged in the order of their elution on Ulbon HR-1 capillary column. Analysis of the oil by GC-MS led to identification of fifteen components comprising 100% of the total volatile oil. The oil contained five monoterpenes (96.3 %) and ten aliphatic components (3.7 %). The predominant monoterpenes were α-pinene (38.6 %), β-pinene (25.7%), sabinene (19.6%) and α-thujene (11.9%). All of them were the monoterpenic hydrocarbons. Among the aliphatic constituents, there were two saturated hydrocarbons (1.1%), four unsaturated hydrocarbons (1.2 %), three monohydroxy alcohols (1.1 %) and one dihydroxy alcohol (0.3 %). The oil components occurring in trace amounts included β-myrcene, n-eicosane, n-heneicos-3-ene, n-heneicos-10-ene, n-heneicos-8-ene, n-heneicosane, n-heneicosane-4-ene, n-octadecan-3,12-diol, n-eicos-14-en-2-ol, n-eicosan-5-ol and n-eicosan-6-ol. The volatile oil was devoid of any sesquiterpene and aromatic components. The chemical composition of the volatile oil of Delhi region was entirely different from the earlier reported oil constituents. Generally citronellal (52-88 %) along with geraniol, citronellol, cetonellyl acetate and isopulegol were the predominant components of the E. citriodora oil. However, oxygenated compounds and hydrocarbons in Cuban Eucalyptus leaf have been reported as the prominent constituents.

RESULTS AND DISCUSSION
The components of the volatile oil of the leaves of E. citriodora, and their retention indices and percentage are listed in Table 1. The constituents are arranged in the order of their elution on Ulbon HR-1 capillary column. Analysis of the oil by GC-MS led to identification of fifteen components comprising 100% of the total volatile oil. The oil contained five monoterpenes (96.3 %) and ten aliphatic components (3.7 %). The predominant monoterpenes were α-pinene (38.6 %), β-pinene (25.7%), sabinene (19.6%) and α-thujene (11.9%). All of them were the monoterpenic hydrocarbons. Among the aliphatic constituents, there were two saturated hydrocarbons (1.1%), four unsaturated hydrocarbons (1.2 %), three monohydroxy alcohols (1.1 %) and one dihydroxy alcohol (0.3 %). The oil components occurring in trace amounts included β-myrcene, n-eicosane, n-heneicos-3-ene, n-heneicos-10-ene, n-heneicos-8-ene, n-heneicosane, n-heneicosane-4-ene, n-octadecan-3,12-diol, n-eicos-14-en-2-ol, n-eicosan-5-ol and n-eicosan-6-ol. The volatile oil was devoid of any sesquiterpene and aromatic components. The chemical composition of the volatile oil of Delhi region was entirely different from the earlier reported oil constituents. Generally citronellal (52-88 %) along with geraniol, citronellol, cetonellyl acetate and isopulegol were the predominant components of the E. citriodora oil. However, oxygenated compounds and hydrocarbons in Cuban Eucalyptus leaf have been reported as the prominent constituents.

ACKNOWLEDGEMENT
The authors are thankful to the Head, SAIF, CDRI, Lucknow, for recording GC and CG-MS analysis of the volatile oil.

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Table 1: Chemical composition of the volatile oil of Eucalyptus citriodora leaves

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Components</th>
<th>KI</th>
<th>Percentage composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>α-Thujene</td>
<td>922</td>
<td>11.9</td>
</tr>
<tr>
<td>2</td>
<td>α-Pinene</td>
<td>925</td>
<td>18.3</td>
</tr>
<tr>
<td>3</td>
<td>Sabinene</td>
<td>960</td>
<td>19.6</td>
</tr>
<tr>
<td>4</td>
<td>β-Pinene</td>
<td>965</td>
<td>25.7</td>
</tr>
<tr>
<td>5</td>
<td>β-Myrcene</td>
<td>971</td>
<td>0.5</td>
</tr>
<tr>
<td>6</td>
<td>n-Eicosane</td>
<td>2003</td>
<td>0.8</td>
</tr>
<tr>
<td>7</td>
<td>n-Heneicos-10-ene</td>
<td>2011</td>
<td>0.2</td>
</tr>
<tr>
<td>8</td>
<td>n-Heneicos-3-ene</td>
<td>2018</td>
<td>0.3</td>
</tr>
<tr>
<td>9</td>
<td>n-Octadecan-3,12-diol</td>
<td>2027</td>
<td>0.3</td>
</tr>
<tr>
<td>10</td>
<td>n-Eicos-14-en-2-ol *</td>
<td>2045</td>
<td>0.3</td>
</tr>
<tr>
<td>11</td>
<td>n-Eicosan-5-ol *</td>
<td>2071</td>
<td>0.5</td>
</tr>
<tr>
<td>12</td>
<td>n-Heneicos-8-ene</td>
<td>2095</td>
<td>0.3</td>
</tr>
<tr>
<td>13</td>
<td>n-Heneicosane</td>
<td>2105</td>
<td>0.3</td>
</tr>
<tr>
<td>14</td>
<td>n-Heneicos-4-ene</td>
<td>2135</td>
<td>0.4</td>
</tr>
<tr>
<td>15</td>
<td>n-Eicosan-6-ol *</td>
<td>2112</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*Compounds reported for the first time in eucalyptus oil

Source of support: Nil, Conflict of interest: None Declared