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Chemical constituents of fruit essential oil of lantana camara L. grown in Nigeria

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ABSTRACT

Pulverized fruits (500g) of *Lantana camara* on hydrodistillation, afforded oil in the yield of 0.4% (v/w). Analysis of the oil using GC and GC-MS showed that the bulk of the oil is characterized by the abundance of sesquiterpenoids (91.9%). The percentage composition of monoterpenoids in the oil was 7.1%, while phenylpropernoids were detected in trace amounts. The principal constituents of the oil were; germacrene D (38.1%), germacrene-D-4-ol (19.6%), β-caryophyllene (17.7%) and germacrene B (16.5%). The abundance of germacrene D in the oil shows that the oil is of germacrene D chemotype.

Introduction

Lantana camara Linn (Verbenaceae) is a perennial shrub widely grown in tropical, sub-tropical and temperate region of the world. It is common in Nigeria where it is known as “Ewon agogo” by Yorubas’ [1]. The plant is used for the treatment of various ailments such as; chicken pox, measles, asthma, ulcers, swelling, eczema, tumor, high blood pressure, bilious fever, catarrhal infections, tetanus, rheumatism and malaria [2, 3]. Biological activities such as, antifungal, anti proliferative and antimicrobial activities of the plant justified its use in traditional medicine [4-7]. Insecticidal and nematicidal properties of the plant had also been reported [8-10].

Phytochemical investigations of the plant revealed the presence of terpenoids, steroids, alkaloids and glycosides [11-16]. However, sesquiterpenes which are mainly β-caryophyllene, zingiberene, δ-humulene, cucurmene, germacrene D and bisabolene were reported to be the principal constituents of the leave and flower essential oils of the plant growing in Cameroon, Medagascar and India [14, 18]. Earlier work on the stem essential oil of the plant from Northern plains of India revealed the predominance of palmitic and stearic acids. Meanwhile, analysis of fruit oil of the plant from the same location showed that the composition pattern of the oils were similar with respect to the abundance of the same types of fatty acid. However, germacrene D one of the abundant constituents of fruit oil was not found in the stem oil [19]. β-Caryophyllene, α-humullene, sabinene, germacrene D and cubenol were reported to be the principal constituents of leaf essential oil of Nigerian grown L. camara [20].

It has been established that composition pattern of essential oils obtained from different parts of a particular plant vary considerably [19, 21]. It is on the basis of this, that we investigate the fruit essential oil of Nigerian grown L. camara.

Experimental

Plant Materials: The fruit greenish- blue black varieties of *Lantana camara* were obtained in Ilorin, Kwara State, North central Nigeria. Identification was carried out at the herbarium of Forestry Research Institute of Nigeria, Ibadan, where voucher specimens were deposited. (FHI 107914)

Oil isolation: Pulverized fruit of greenish-blue black varieties of *Lantana camara* (500g) were hydro-distilled for 3 hours using Clevenger type apparatus according to the British pharmacopoeia specification [22]. The resulting oils were collected in a sealed glass tube and stored under refrigeration until analysis.

Gas Chromatography: GC analysis was performed on an Orion micromat 412 double focusing gas chromatography system fitted the two capillary column coated with CP – Sil 5 and CP – Sil 19 (fused silica, 25m x 0.25mm x 0.15 μm film thickness) and flame ionization detector (FID). The volume injected was 0.2 μL and the split ration was 1:30. Oven temperature was programmed from 50 – 230^{o}C at 50/min. using hydrogen gas as carrier gas. Injector and Detector temperature were maintained at 200 and 250^{o}C respectively. Qualitative data were obtained by electronic integration of FID area percents without the use of correction factors.

Gas Chromatography/Mass Spectrometry:

A Hewlett Packard 9HP 5890A) GC interfaced with a VG analytical 70 – 250S double focusing mass spectrometer was used. Helium was the carrier gas at 1.2ml/min. The MS operating conditions were; ionization voltage 70ev, ion source 230^{o}C. The GC was fitted with a 25m x 0.25mm, fused silica capillary column coated with CP – Sil 5. The film thickness was 0.15μm. The GC operating conditions were identical with those of GC analysis. The MS data were acquired and processed by on-line desktop computer equipped with disk memory. The

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percentage composition of the oil was computed in each case from GC peak areas. The identification of the component was based on the comparison of retention indices (determined relative to the retention time of series of n-alkanes) and mass spectra with those of authentic samples and with data from literature [23-25].

Results and discussion

Pulverized fruits of *Lantana camara* yielded 0.1% (v/w) of essential oil on hydrodistillation. The yield compared favourably well with the yield from the fruit of Indian grown *L. camara*[3].This implied that geographical and climatic conditions did not affect the oil yielded from the fruits.

Table 1 shows the retention indices, relative percentages and identities of the constituents of the oil. A total of 39 compounds that represent 99.0% of the oil were identified from their retention indices and mass spectra data.

Hydrocarbon monoterpenes were found in trace amounts except 1s-1-pinene (0.1%) that was found in significant quantity. On the other hand, oxygenated monoterpenes constituted 6.9% of the oil. Percentage composition of hydrocarbon sesquiterpenes in the oil was 72.3%. Quantitatively, terpen-4-ol (3.1%) and α-terpeneol (2.0%) were the predominant oxygenated monoterpenes in the oil, while nerol (0.1%) and geranial (0.5%) existed in appreciable quantities. The other carbonyl monoterpene in the oil was neral (1.3%) and was found in significant proportion.

The most abundant sesquiterpenes in the oil were germacrene D (38.1%), germacrene B (16.5%) and β-caryophellene (17.7%). Other sesquiterpenes: α-copaene, β-elemene, trans-α-bergamotene, β-bisabolene and β-sesquiphellandrene were found in trace amounts. Meanwhile, germacrene-D-4-ol (19.6%) was the most abundant sesquiterpenoid.

Significant variations were observed in the constituents of the oil and the oil obtained from the leaves of the plant grown in Nigeria [20]. Qualitatively, both oils were rich in germacrene D and β-caryophyllene but germacrene D is of greater abundant in the oil than the oil obtained from the leaves. However, the leave oil is richer in β-caryophyllene than the fruit oil. Meanwhile, germacrene-B and germacrene-D-4-ol that predominates the oil were not found in the leave oil. On the other hand, α-humulene, sabinene and cubenol that were found as principal constituents of the leave oil were not detected in the oil. Variations in c omposition patterns of the oils may be due to different roles of the oils in the leaves and the fruits.

Comparison of the composition pattern of the oil and the oil obtained from the fruit of Indian grown *Lantana camara L. ,also* showed significant variations [3]. For instance, germacrene D is of greater quantity in the oil than the oil obtained from the fruit of Indian grown *Lantana camara L.* Valecene which was found in higher quantity in the oil obtained from the fruit of *Lantana camara L.* grown in India was not detected in the oil. Also, palmitic and stearic acids that were found in significant proportions in the oil obtained from Indian grown *Lantana camara L.*were not detected in the oil. Thus, the oil is of germacrene D chemotype while that obtained from Indian grown plant is of palmitic acid chemotype.

The variations in the composition pattern of the oils may be attributed to geographical and climatic conditions.

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Table 1: Chemical Composition (%) of fruit essentialoil of *Lantana camara*

compound[a]	R1[b]	%Composition	Mass Spectra Data
Triclene	922	tr	136 121 105 93 77 67
□-thujene	926	tr	136 121 115 105 91 77
α-pinene	933	tr	136 121 105 93 79 67
Is-(1)--pinene	976	0.1	136 121 107 93 79 67
β-pinene	976	tr	136 121 107 93 79 67
myrcene	990	tr	136 121 115 105 91 77
car-2-ene	1001	tr	136 121 105 105 93 79 74
D-limonene	1027	tr	136 121 107 93 79 67
benzyl alcohol	1028	tr	108 91 89 77 51
1,8 – cineole	1029	tr	154 139 125 108 93 81
Allo-ocimene	1142	tr	136 121 105 105 93 79 74
γ-terpinene	1057	tr	136 121 105 105 93 77 65
fenchone	1058	tr	109 91 81 69 53 41
isoartemisia ketone	1062	tr	91 83 69 55 41
linalool	1098	tr	139 121 109 97 93 80
borneol	1162	tr	136 121 110 95 81 67
terpinen-4-ol	1175	tr	154 136 125 111 98 93
α-terpineol	1189	2.0	136 121 107 93 81 71
cinnamic aldehyde	1214	tr	131 115 103 91 87 78
nerol	1226	0.1	139 121 111 93 81 69
thymol nethyl ether	1235	tr	139 123 111 93 81 69
neral	1238	1.3	135 119 109 99 95 81
geraniol	1253	tr	139 123 111 93 81 69
linalyl acetate	1255	tr	135 121 105 93 80 67
geranial	1268	0.5	152 137 123 109 99 95
α-copeane	1375	tr	105 119 161 91 81 41
β-elemene	1391	tr	105 93 79 67 53 41
tran-α-bergamotene	1435	tr	119 93 79 69 55 41
ethyl cinnamate	1461	tr	176 158 147 131 115 103
germacrene D	1479	tr	204 161 147 133 119 105
bicyclic germacrene	1480	16.5	209 204 189 161 147 133
β-bisabolene	1509	tr	204 189 176 161 147 133]
β-sesquiphellandrene	1523	tr	204 161 147 133 120 105
acetyl eugenol	1523	tr	164 149 137 131 121 103
1, 6, 10-dodacatrien-3-ol, 3, 7, 11-trimethyl	1534	tr	161 105 91 69 41
Elemicin	1553	tr	208 193 177 165 150 133
Germacrene-D-4-ol	1573	19.6	204 189 161 147 133 123
β-caryophyllene	1654	17.7	202 189 175 161 147 133
Benzyl benzoate	1761	tr	212 194 167 152 105 91
TOTAL		99.0	

[a]Compound are listed in order of elution from silica capillary column coated on CP-Sil 5; [b]retention indices on fused silica capillary column coated with CP-Sil 5; t= trace (<0.1%).