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Chemical Constituents of the Essential Oil of *Laggera pterodonta* (DC.) Sch. Bip. From North-Central Nigeria

Egharevba Henry Omoregie, Kunle Folashade Oluyemisi, Okwute Simon Koma and Okogun Joseph Ibumeh

Egharevba Henry Omoregie, Kunle Folashade Oluyemisi, Okogun Joseph Ibumeh
Department of Medicinal Plant Research and Traditional Medicine National Institute for Pharmaceutical Research & Development (NIPRD), Idu Industrial Layout, Idu, P.M.B. 21 Garki, Abuja, Nigeria.

Okwute Simon Koma
Department of Chemistry, University of Abuja, Gwagwalada, FCT, Nigeria

For Correspondence
Egharevba Henry Omoregie
Department of Medicinal Plant Research and Traditional Medicine National Institute for Pharmaceutical Research & Development (NIPRD), Idu Industrial Layout, Idu, P.M.B. 21 Garki, Abuja, Nigeria.
Tel: +234-805-155-9005

ABSTRACT

The aerial part of *Laggera pterodonta* plant found in North-Central part of Nigeria was hydrodistilled and the volatile oil subjected to GCMS analysis. 23 components were identified in the essential oil of which n-Triacontane was the major constituent (~43%). Other major volatile constituents include, Dimethoxydurene (~9%), Caryophyllene oxide (~7%), Linoleoyl chloride (~7%), oleic acid (~4%), gamma-Eudesmol (~4%), 2,6,10-trimethylundeca-1,3,diene (~3%) and n-Dotriacontane (~3%). This is the first time that n-triacontane is being found as the major constituent of an essential oil, and also the first time the composition of the essential oil of *Laggera pterodonta* from North-central Nigeria is being reported.

Keywords: *Laggera pterodonta*, essential oil, chemical composition, n-triacontane, 2,6,10-trimethylundeca-1,3,diene, 7-methyl-1-undecene, gamma-Eudesmol.

INTRODUCTION

Laggera pterodonta is annual shrub found growing as common weed in Nigeria. It belongs to the family Asteraceae (Compositae) and the genus consists of about 20 species. The plant is spread throughout the sub-Saharan Africa and the tropical countries of Asia, especially Southeast Asia, in open waste spaces and partially shaded galleried forest. It grows in Senegal, Sierra Leone, Nigeria and West Cameroons, and probably occurring elsewhere in the region (Burkill, 1985; Wu *et al.*, 2011). Reports of chemical constituents of the volatile oil from the species in Benin and Cameroon as well as other regions showed variation in composition (Egharevba *et al.*, 2010; Asfaw *et al.*, 2001; Asfaw *et al.*, 1999). The essential oil from the plant had been reported for use as an insecticide in Cameroon (Njan Nlôga *et al.*, 2007; Ngamo *et al.*, 2007). Despite the huge potential of the plant and its essential oil, it remained highly under-studied in Nigeria. The aim of this study was to examine the chemical constituents of the essential oil of the Nigerian species of the plant from North-central part of Nigeria with a view to establish the chemotype and usefulness.

MATERIALS AND METHODS

All the solvents and reagents used in the study were of Analar grade and, unless otherwise stated, were sourced from Zayo-Sigma, Abuja, Nigeria.

Collection and Extraction of Plant Material

The plant (aerial part) was collected on the 15 November, 2009 from Chaza village, Suleja, Niger State, North-central zone of Nigeria, and authenticated by the Taxonomist in the Department of Medicinal Plant Research and Traditional Medicine of the National Institute for Pharmaceutical Research and Development (NIPRD) Abuja, Nigeria. The plant was assigned a voucher specimen number NIPRD/H/6403. The roots were removed and the fresh aerial parts were rinsed in distilled water and immediately used for the study.

Hydrodistillation

500g of fresh material was chopped to size with a clean kitchen knife and hydrodistilled over 5hrs using Clevenger apparatus. The oil/water mixture was collected into a glass sample bottle. The mixture was salted with 3g of sodium chloride salt and then extracted with hexane. The moisture in the hexane extract was removed with 2g of anhydrous sodium sulphate and filtered. The hexane filtrate was collected in a glass bottle and subjected to GCMS analysis.

GCMS Analysis

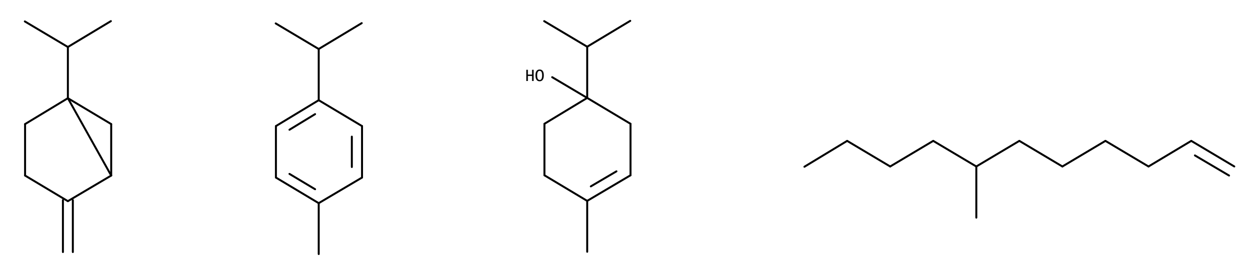
The oil was analysed on a Shimadzu GCMS-QP2010 Plus (Japan) at the National Research Institute for Chemical Technology (NARICT) Zaria, Nigeria. The column length, diameter and thickness were 30m, 0.25mm and 0.25µm respectively, and the stationary phase was 100% dimethylpolysiloxane. The conditions for analysis were set as follows; column oven temperature was programmed from 60-280°C (temperature at 60°C was held for 5min, raised to 140°C at 5°C/min and then finally to 280°C at 15°C/min and held for 10min); injection mode, Split (1.0); injection temperature, 250°C; flow control mode, linear velocity (46.3cm/sec); pressure, 100.2 kPa; carrier gas, helium; total flow rate, 6.2mL/min; column flow rate, 1.61 mL/min; ion source temperature, 200°C; interface temperature, 250°C; solvent cut time, 2.50 min; start time 3.00 min; end time, 35.00 min; start m/z, 40 and end m/z, 400.

RESULTS AND DISCUSSION

Table 1 shows the GCMS data and the identified constituents of the hydrodistilled essential oil. The identification of the constituents was based on comparison of their mass spectra data with those available in the data bank of NIST library. The oil extraction yield was 0.001% v/w.

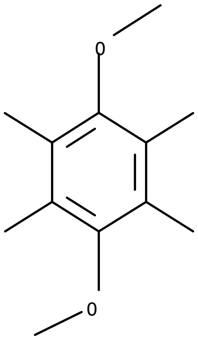
The major component of the essential oil was n-triacontane which constituted 43.18% of the identified components. n- Dotriacontane has been previously reported from *Laggera aurita*, while other volatiles like sabinene, p-cymene, gamma-eudesmol were previously reported from the Cameroonian species of the plant (Ngassoum *et al.*, 2000). 2,5-dimethoxy-p-cymene (30.5%) and gamma-eudesmol (24.6%) have been reported in the oil from the plant species in Benin Republic, while 2,5-dimethoxy-p-cymene (44.2%) and sabinene (15%) has been reported in *L. alata* (*L. aurita*) from Nigeria (Asfaw *et al.*, 1999; Ekundayo *et al.*, 1989). Previously reported compounds like thymol, Juniper camphor, δ-cadinene, α-cadinol, dimethoxy-p-cymene isomers, laggerol, chrysanthenone isomers, isogeranic acid, isointennedeol, filifolone were not detected. Triacontane (Fig. 1) is a high molecular weight alkane with a melting point of 65-67°C, boiling point of 449-451°C at 760 mmHg and a flash point of 302.22°C. The presence of volatile components like sabinene, cymene and terpineol (Fig. 1) suggests that the oil may be useful in aromatherapy and in the pharmaceutical and confectionary industries as fragrance or additives (Evans, 2002). Cymene has been reported to exhibit antibacterial properties, while caryophellene has been reported to exhibit antibacterial, antitumor, anti-inflammatory and antifungal properties (Sulochana and Bakiyalakshmi, 2011). Other components like diisooctyl adipate and linoleoyl chloride (Fig. 1) are used in the synthesis of a number of organic polymers (Evans, 2002).

CHEMICAL STRUCTURES OF IDENTIFIED COMPOUNDS

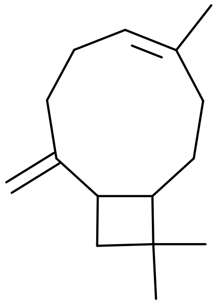


Sabinene p-Cymene 4-Terpineol 7-Methyl-1-undecene

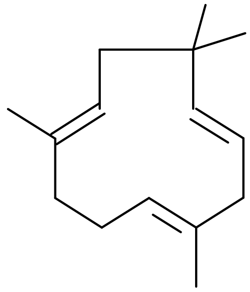
Fig. 1: Continued….



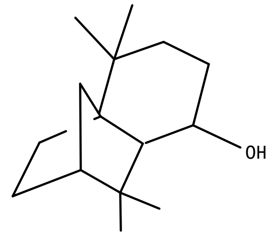
Dimethoxydurene



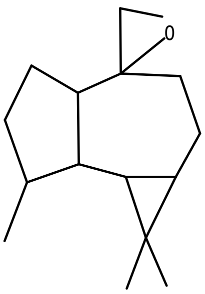
Caryophyllene



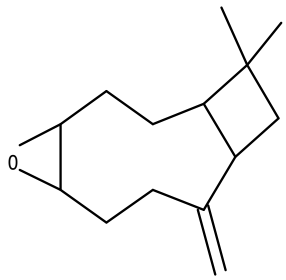
Humulene



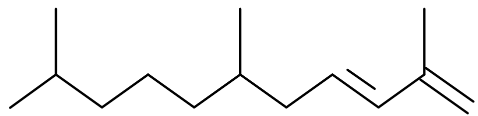
Isolongifolan-8-ol



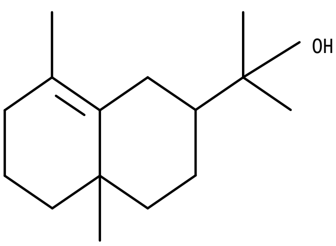
Alloaromadendrene oxide



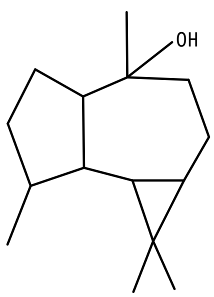
Caryophyllene oxide



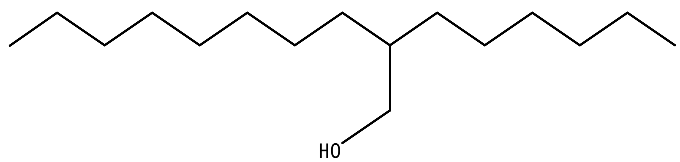
2,6,10-trimethylundeca-1,3,diene



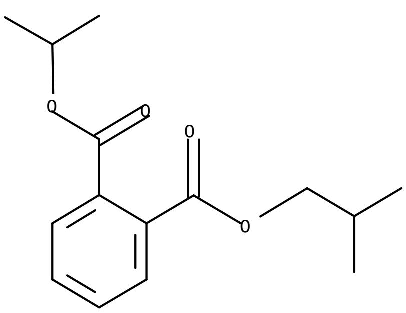
gamma-Eudesmol



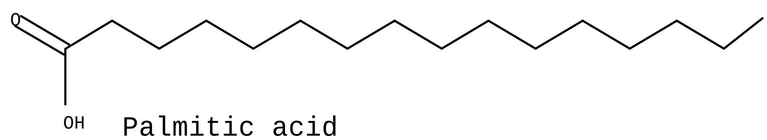
Viridiflorol



2-Hexyl-1-decanol



Diisobutyl phthalate



Palmitic acid

Fig. 1: Continued….

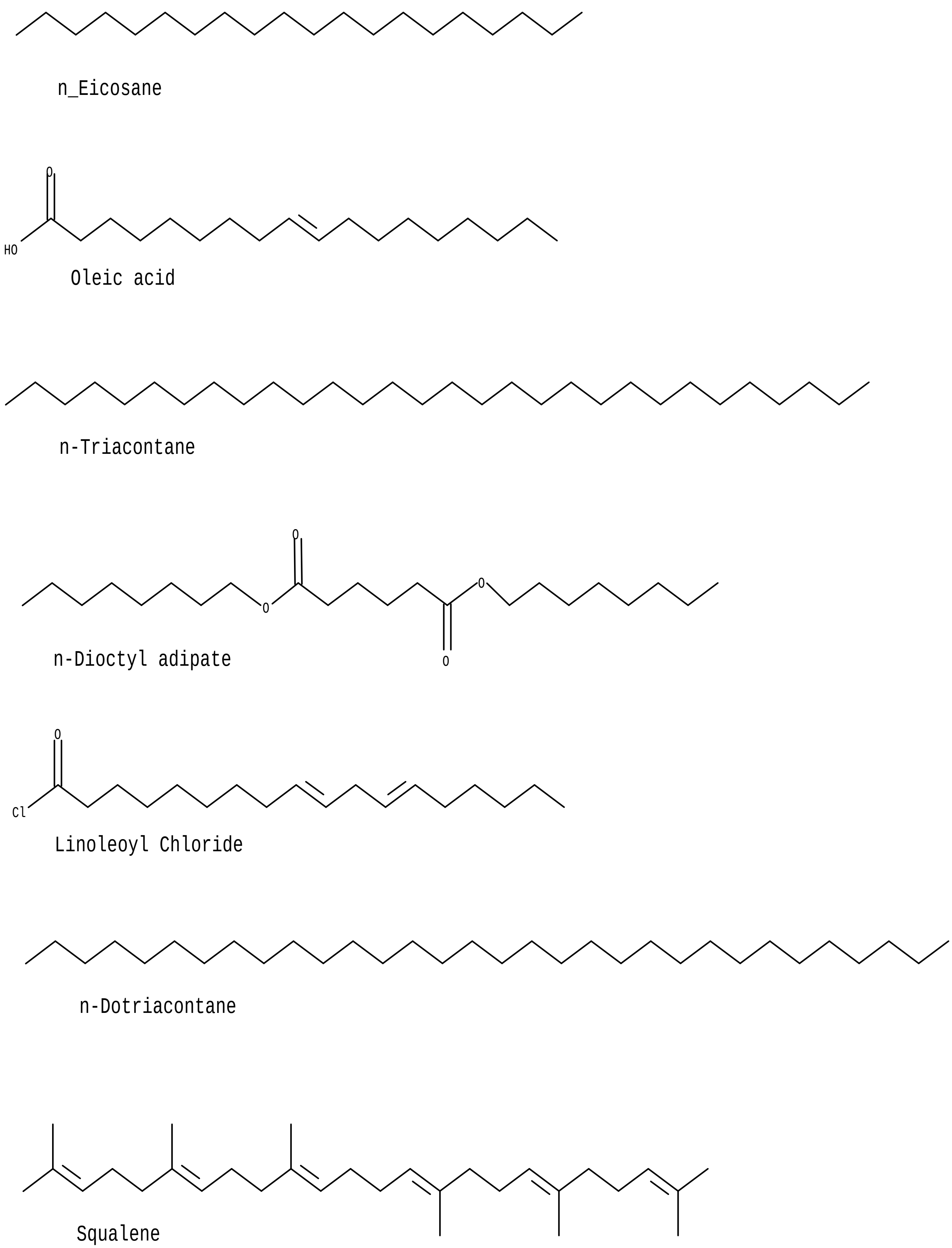


Fig. 1: Chemical structures of identified compounds.

Table. 1: Gcms Analysis of Essential oil of Laggera Pterodonta.

Retention time (min)	Base Peak	Molecular weight/Formula	%	Compound
8.942	93.10	136 $C_{10}H_{16}$	0.34	Sabinene
10.51	119.10	134 $C_{10}H_{14}$	0.62	p-Cymene
15.4	71	154 $C_{10}H_{18}O$	0.79	4-Terpineol
19.7	69	168 $C_{12}H_{24}$	0.39	7-methyl-1-Undecene
22.1	179.05	194 $C_{12}H_{18}O_2$	9.39	Dimethoxydurene
22.3	93.10	204 $C_{15}H_{24}$	1.38	Caryophyllene
22.9	93.10	204 $C_{15}H_{24}$	1.15	Humulene
23.6	207.10	222 $C_{15}H_{26}O$	1.93	Isolongifolan-8-ol
24.2	82.05	220 $C_{15}H_{24}O$	1.76	Alloaromadendrene oxide
24.6	79.10	220 $C_{15}H_{24}O$	7.12	Caryophyllene oxide
24.9	43	194 $C_{14}H_{26}$	3.25	2,6,10-Trimethylundeca-1,3,-diene
25.083	189.10	222 $C_{15}H_{26}O$	3.96	γ-Eudesmol
25.475	57.05	222 $C_{15}H_{26}O$	0.99	Viridiflorol
26.358	69.10	242 $C_{16}H_{34}O$	1.37	2-hexa-1-decanol
27.1	57.05	278 $C_{16}H_{22}O_4$	2.08	Diisobutyl phthalate
27.9	73.05	256 $C_{16}H_{32}O_2$	1.02	Palmitic acid
28.117	71.10	282 $C_{20}H_{42}$	2.38	n-Eicosane
29.058	55.05	282 $C_{18}H_{34}O_2$	4.27	Oleic acid
30.217	57.05	422 $C_{30}H_{62}$	43.18	n-Triacontane
30.533	57.05	370 $C_{22}H_{42}O_4$	2.36	Diisooctyl adipate
30.983	55.05	298 $C_{18}H_{31}ClO$	6.59	Linoleoyl Chloride
33.217	57.05	450 $C_{32}H_{66}$	3.13	n-Dotriacontane
33.817	69.05	410 $C_{30}H_{50}$	0.55	Squalene

CONCLUSION

The major essential oil chemotype for *L. Pterodonta* in the African region include oxygenated sesquiterpenoid-rich oil like those rich in p-cymene (30.5, 44.2%), and hydrocarbon-rich oil such as n-triacontane-rich as found in this study (43.18%). This is the first time the composition of essential oil has been found to contain this high level of n-triacontane. It is also the first time n-triacontane, 7-methyl-1-undecene, dimethoxydurene, isolongifolan -8-ol, 2,6,10-trimethylundeca-1,3,diene, viridiflorol, 2-hexyl-1-decanol, diisobutyl phthalate, alloaromadendrene oxide, caryophellene oxide, palmitic acid, oleic acid, n-eicosane, dioctyl adipate, linoleoyl chloride and squalene were being reported from the volatile oil of Laggera species especially *L. pterodonta*. The marked difference in chemical composition of the essential oil of *L. pterodonta* in this study from those previously reported by other workers may be due to variation in geo-ecological factors such as soil type, vegetation and humidity, as well as genetic factors (Owolabi *et al.*, 2009).

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