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Chemical Constituents of Essential Oil of *Lantana camara* Linn. Leaves

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Abstract: The determination of the chemical profile of essential oil of the leaves of *Lantana camara* Linn. was undertaken in this study. Essential oil was extracted from the dried leaf sample using hydro distillation method. Gas Chromatograph coupled with Mass Spectrometer (GC-MS) was used for chemical analysis of the extracted essential oil. Eighteen constituents were identified, representing 100% composition of the oil. The constituents were mainly monoterpenes and sesquiterpenes. The major constituents were found to be caryophllene oxide (21.75%), (-) -spathulenol (14.95%), D-nerolidol (10.39%) and (-) -β-caryophyllene (9.90%). The yield of essential oil obtained was 0.19%. Some of the identified constituents of the essential oil have proven pharmacological activities, uses in food, drink and cosmetic industries. The essential oil of *L. camara* leaves is worth exploiting for use by relevant industries.

Keywords: (-) -β-caryophyllene, (-) -spathulenol, caryophyllene oxide, chemical constituents, D-nerolidol, essential oil

INTRODUCTION

Lantana camara is a native of the American tropics. It has become naturalized in suitable habitats in tropical regions worldwide. *L. camara* is an erect or subs cadent aromatic branching shrub with prickles. It belongs to the Verbenaceae family. The stems are quadrangular, armed with hooked prickles. The leaves are simple, opposite and oval-shaped with serrated margins and green in color. The flowers are born in flat-topped clusters, small, tubular and white, yellows, orange, red or purple. The fruits are produced in clusters, green in color and turn black when ripe (Ivan, 2003).

L. camara Linn. has several uses, different parts of the plant are used for medicinal and non-medicinal purposes. It has been listed among the useful plants of West Tropical Africa by Burkill (2000). In Nigeria, the leaves have been used in folk medicine as antibiotic, febrifuge, for treatment of chest diseases and high blood pressure (NNMDA, 2006).

This study was undertaken to determine the chemical profile of the essential oil of the leaves of *L. camara* Linn.

MATERIALS AND METHODS

Plant material: The leaves of *L. camara* Linn. were collected in October-November 2009 from Mando/new Afaka area of Igabi Local Government Area of Kaduna, Kaduna State, Nigeria. Its identification was done by comparison with an authentic voucher of *Lantana camara* (voucher, No. 5) deposited in the herbarium of Department of Biological Sciences, Faculty of Science, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

Essential oil extraction: The collected leaves of the plant *L. camara* were air-dried at room temperature under shade for 28 days. The dried leaves were pounded to powdery form using local mortar and pestle. The powdery form was then subjected to hydro distillation. The extracted essential oil was dried over anhydrous sodium sulphate. The percentage yield was calculated based on the dry weight of the leaf.

Chemical analysis of essential oil: The chemical analysis of the oil was carried out on a GC-MS instrument (GCMS-QP 2010 Plus Shimadzu, Japan). The analysis was done under the following conditions: RTX-5 ms (30 m×0.25 mm; 0.25 μm film thickness) fused-silica capillary column; programmed column oven temperature 60°C (2 min), 180°C (3 min) and 280°C (5 min); injection temperature 250°C; carrier gas: helium; flow control mode: linear velocity of 36.2 cm/sec; injection mode; split; split ratio: 50.0; pressure: 56.2 pka; total flow: 53.2 mL/min; column flow: 0.99 mL/min; purge flow: 3.0 mL/min; Ion source temperature: 200°C; interface temperature: 25°C; solvent cut time: 2.50 min; detector gain mode: relative; detector gain: 0.00 kv; threshold: 2000. The quantitative data of the specific constituents of volatile

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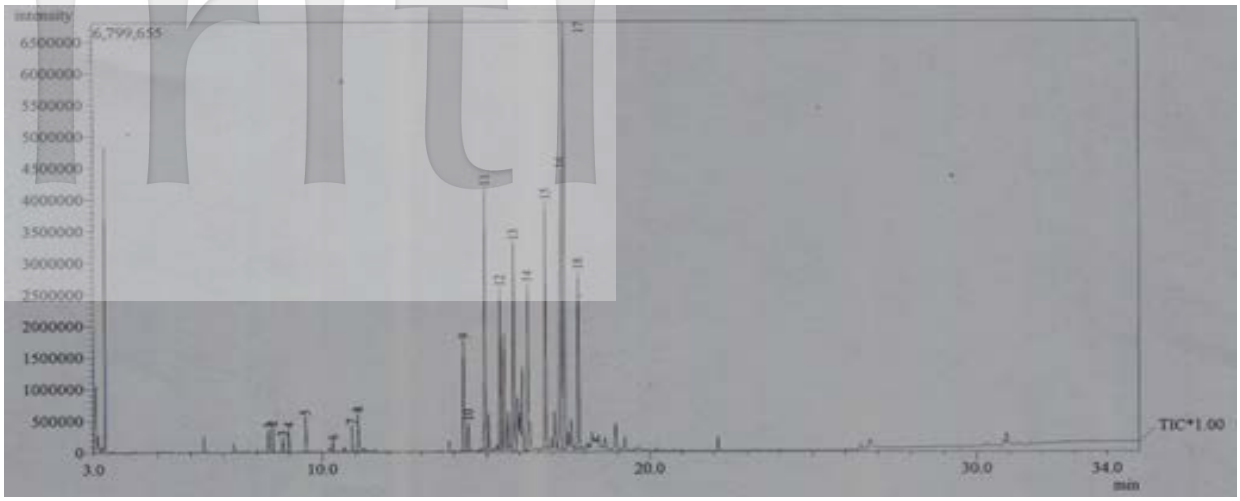

Fig. 1: Chromatogram of essential oil of the leaves of *Lantana camara* Linn.

Table 1: Chemical composition and retention indices of the essential oil of *Lantana camara* Linn. leaves

Peak number	Retention indices (min)	Constituents	Composition (%) of total oil
1	8.371	Eucalyptol	0.78
2	8.502	Lilac alcohol	0.82
3	8.811	Lilac alcohol formate A	0.51
4	8.986	Cis-β-terpineol	0.79
5	9.496	Linalyl alcohol	1.57
6	10.324	Cis-verbenol	0.37
7	10.897	4-terpineol	0.90
8	11.082	ρ-menth-1-ene-8-ol	1.42
9	14.288	Copaene	3.87
10	14.430	Germacrene	1.16
11	14.938	(-) -β-caryophyllene	9.90
12	15.408	α-caryophyllene	5.89
13	15.822	Davana ether	8.92
14	16.251	1-naphthalenol	6.94
15	16.799	D-nerolidol	10.39
16	17.267	(-) -spathulenol	14.95
17	17.375	Caryophyllene oxide	21.75
18	17.809	α-pinene epoxide	9.07

oil were obtained by peak area normalization using a GC/FID. The identification of specific components was done by comparison of both mass spectra and GC-retention data with authentic compounds previously analyzed and stored in the data system. Other identifications were carried out by comparison of the mass spectra with those existing in the data system libraries and cited in the literature (Adams, 2007; Mclafferty *et al*., 1974; NIST, 2005).

RESULTS

The chemical analysis of the essential oil extracted from the dried leaf sample of *Lantana camara* Linn. used in this study was done using gas chromatograph and mass spectrometer (GCMS-QP 2010 plus Shimadzu, Japan). The yield obtained was 0.19%. The essential oil was bright yellow in color and highly volatile. Eighteen compounds were identified representing 100% of the oil (Fig. 1). The major components are caryophyllene oxide (21.75%), (-) -spathulenol (14.95%), D-nerolidol (10.39%), (-) -β-caryophyllene (9.90%). Others are α-pinene epoxide (9.07%), davana ether (8.92%), 1-naphthalenol (6.94%), α-caryophyllene (5.89%) copaene (3.87%), linalyl alcohol (1.57%), ρ-meth-1-ene-8-ol (1.42%), germacrene (1.16%), 4-terpineol (0.90%), lilac alcohol (0.82%), cis-β-terpineol (0.79%), eucalyptol (0.78%), lilac alcohol formate A (0.51%) and cis-verbenol (0.37%) as shown in Table 1.

DISCUSSION AND CONCLUSION

The serrated leaves of *Lantana camara* are aromatic and result has shown that they contain highly volatile oil. This oil is responsible for its essence. The extracted essential oil was bright yellow in color. A yield of 0.19% was obtained.

The essential oil is composed of mainly monoterpenes and sesqiuterpenes. Eighteen compounds, representing 100% composition of oil were identified by GC-MS. The major components are oxygenated terpenoid; caryophllene oxide (21.75), (-) -spathulenol (14.95% 0), D-nerolidol (10.39%) and a bicyclic sesquiterpene; (-) -β-caryophyllene (9.90%).

Caryophllene oxide has been reported as having analgesic, anti-inflammatory activity and antifungal activity against dermatophytes (Yang *et al*., 1999; Chavan *et al*., 2010). It is also well known as a preservative in food, drugs and cosmetics (Yang *et al*., 1999).

Terpenes such as nerolidol, eucalyptol have been used as chemical enhancer to improve skin penetration for transdermal delivery of therapeutic drugs (Denise *et al*., 2005). D-nerolidol is also used as a food flavoring agent.

(-) -β-Caryophyllene, a natural bicyclic sesquiterpene that is a constituent of many essential oil especially clove oil, rosemary, hops, among others (Ghelardini *et al*., 2001; Glenn, 1993). (-) -β-caryophyllene has been demonstrated to have anti-inflammatory effects in mice (Gertsch *et al*., 2008). It is an FDA approved food additive and ingested daily with food. It is the first dietary cannabinoid.

Spathulenol has an earthly-aromatic odor and a bitter herbal flavor. It has been found in various types of Artemisia (Juell, 1976). Spathulenol is used as fragrance and flavoring agents for drinks.

α-Caryophyllene (α-humulene) is a naturally occurring monocyclic sesquiterpene found in essential oil of *Humulus lupulus* (hops) from which it derived its name (Glenn, 1993). The anti-inflammatory effects of α-humulene has been reported (Fernandes *et al*., 2007). α-Pinene oxide is used in fragrance industry. 1-Naphthalenol (1-Naphthol) is a precursor to a variety of insecticides including carbaryl and pharmaceuticals including nadolol (Meeker *et al*., 2006; Gerald, 2005). Nadolol is a non-selective beta blocker used in the treatment of high blood pressure, migraine headaches and chest pain.

Results from this study have shown that the essential oil of *L. camara* leaves contains compounds with proven pharmacological effects. The continued demand for preparation of synthetic flavorings and fragrances for use in pharmaceutical, food, drink and cosmetic industries makes the essential oil of *L .camara* worth exploiting for use by relevant industries.

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