IJBPAS, October, 2019, 8(10): 1851-1858

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

GAS CHROMATOGRAPHY-MASS SPECTROMETRY ANALYSIS OF BIOACTIVE CHEMICAL COMPOUNDS OF ETHYL ACETATE FRACTION OF *Lantana camara* LEAF: A POTENTIAL FOLKLORE MEDICINAL PLANT

UGOCHI O. NJOKU[1] AND MARTINS O. OGUGOFOR[1*]

[1]Pharmacology and Toxicology Unit, Department of Biochemistry, University of Nigeria Nsukka

***Corresponding author: Martins O. Ogugofor: E mail: obinna.ogugofor.pg76810@unn.edu.ng**

Phone number: +2348105504783; ORCID: https://orcid.org/0000-0002-9491-7498

Received 20th Feb. 2019; Revised 11th March. 2019; Accepted 5th April 2019; Available online 1st Oct. 2019

https://doi.org/10.31032/IJBPAS/2019/8.10.4819

ABSTRACT

Lantana camara is one of the medicinal plants of verbenacea family, used extensively in herbal medicine to treat several diseases. The present study was carried out to determine the possible phytochemical components present in ethyl acetate fraction of *Lantana camara* leaves and evaluate the bioactive compounds using Gas Chromatograph-Mass spectrometry. Gas chromatography-mass spectroscopy was used to carry out analysis. Mass spectra of the unknown compounds found in the fraction were matched with standard mass spectra of known components stored in National Institute of Standards and Technology (NIST) library. Result: GC MS analysis produced 19 peaks, corresponding to constituent compounds present in the sample. The eight major phytoconstituents identified were 2,2,4-trimethyl-3-(3,8,12,16-tetramethyl-heptadeca-3,7,11,15-tetraenyl)-cyclohexanol, 9,12,15 octadecatrienoic acid, 2, 3-dihydroxypropyl ester, phytol, aromadendrene oxide(-2) and its isomer, spathulenol, 3,7,11,15-tetramethyl-2-hexadecen-1-ol, 6- epi-shyobunol, hexadecanoic acid, and 1-(hydroxymethyl)-1,2-ethanediyl ester. These major compounds add up to 80.15 % of total constituents. Minor constituents identified were caryophyllene, ledene oxide-(II), cycloheptasiloxane tetradecamethyl, propanoic acid,2-[3-acetoxy-4,4,14-trimethylandrost-8-en-17yl], 1,6,10-dodecatrien-3-ol,3,7,11-trimethyl-[s-(z)], humulene, 13-heptadecyn-1-ol, α- acorenol, ergosta-

5,22-dien-3-ol, acetate, [3β, 22E] and 1-heptatriacotanol, all summing up to 19.84 % of total constituents. The presence of various bioactive compounds identified in ethyl acetate fraction of *Lantana camara* leaves, justifies the use of the plant for diverse ailments by traditional practitioners and can be proposed as a plant of phyto-pharmaceutical relevance.

Keywords: Bioactive compounds, GC MS, *Lantana camara,* medicinal properties

INTRODUCTION

Presently, nearly 80 % of the world populations depend on the use of herbal drugs for their health care need. The special importance on the use of plant based drugs is not only due to their therapeutic values and accessibility, but they are cheap and lack side effects [1]. Plants are rich sources of bioactive substances with variety of structural arrangements that contain therapeutic values [2].

In recent times, interest in the pharmacological evaluation and scientifically authentication of various plants used in different folklore system of medicine, have been on tremendous increase. In last few decades, ethnopharmacology has been extensively studied by advanced scientific techniques and emerging reports on the various medicinal properties of plants have become inexhaustible.

Recently, GC MS is one of the increasingly advanced, analytic technique of interest among researchers for identification and determination of bioactive compounds [3-5].

Lantana camara Linn is a flowering ornamental plant belonging to family Verbenaceae. It is also known as West Indian lantana, wild sage, and Surinam Tea Plant. In herbal medicine, *Lantana camara* is a prominent medicinal plant with several therapeutic properties and scientific studies have accentuated the possible use of *L. camara* in modern medicine [6].

Pharmacological properties of the different parts of the plant have been reported, which include: wound healing, antiulcerogenic, antihyperglycemic, anti-inflammatory, antioxidant, anticancer and antiproliferative activities [7-12]. These studies established the therapeutic potential of *Lantana camara* in modern medicines and its advanced prospects for the development of effective therapeutic compounds.

Conversely, perusal of literature discloses that GC-MS analysis of *Lantana camara* is entirely missing and hence the present investigation was undertaken. The main objective of the study is to analyze the

various phytochemical constituents found in *Lantana camara* leaves.

2.0 MATERIALS AND METHODS

2.1 Drugs and Chemicals

All chemicals used in this study were of analytical grade.

2.2 Collection and Extraction of Plant Material

The fresh *Lantana camara* leaves were harvested from Ogbodu-Aba in Udenu L.G.A Enugu State of Nigeria and identified by Mr. A. Ozioko of the International Center for Ethnomedicine and Drug Development, Enugu State. The leaves were air dried under room temperature, pulverized to powder using a miller, and macerated in 6L of methanol with vigorous shaking at regular intervals. It was allowed to stand for 72 hours at room temperature. The mixture was filtered using Whatman no.1 filter paper and subsequently concentrated at 45 °C using rotary evaporator under reduced pressure. Methanol extract of *Lantana camara leaves* was further fractionated successively with n-hexane, ethyl acetate and methanol. The solvents were recovered under pressure and the ethyl acetate part was filtered through whatman – 1filter paper, distilled, concentrated and kept in a refrigerator until further use.

2.3 Gas Chromatography-Mass Spectrometry (GC-MS) Analysis

GC-MS analysis of ethyl acetate fraction of *Lantana camara* leaves was carried out in a combined 7890A gas chromatograph system (Agilent 19091-433HP, USA) and mass spectrophotometer, fitted with a HP-5 MS fused silica column (5% phenyl methyl siloxane 30.0 m × 250 µm, film thickness 0.25 µm), interfaced with 5675C Inert MSD with triple-Axis detector. Helium gas was used as carrier gas and was adjusted to column velocity flow of 1.0 ml/min-1.

Other GC-MS conditions are Ion-source temperature: 250 ^{o}C, interface temperature: 300 ^{o}C, pressure: 16.2 psia, out time, 1.8mm, 1µl injector in split mode with split ratio 1:50 with injection temperature of 300 ^{o}C. The column temperature started at 36 ^{o}C for 5mins and changed to 150 V at the rate of 4 ^{o}C/min. The temperature was raised to 250 ^{o}C at the rate of 20 ^{o}C/min and held for 5 mins. The total elution was 47.5 mins. The relative % amount of each component was calculated by comparing its average peak area to total areas. MS solution software provided by supplier was used to control the system and to acquire the data.

2.4 Identification of Compounds

Identification of components was achieved based on their retention indices and

interpretation of mass spectrum was conducted using the database of National Institute of Standards and Technology (NSIT). The database consists of more than 62,000 patterns of known compounds. The spectra of the unknown components of *Lantana camara* fraction obtained were compared with the standard mass spectra of known components stored in NIST library (NISTII).

3.0 RESULT

The bioactive components present in ethyl acetate fraction of *Lantana camara* leaves were identified by GC-MS analysis. The GC-MS chromatogram of 19 peaks corresponding to the constituent compounds present in the fraction is shown in Figure 1. The active principle with their retention time (RT), concentration (%), molecular weight (MW), molecular formula (MF), structure and bioactivity are presented in Table 1. GC-MS chromatogram analysis of the ethyl acetate fraction of *Lantana camara* leaves showed the presence of eight major compounds identified as follows; 2,2,4-trimethyl-3-(3,8,12,16-tetramethylheptadeca-3,7,11,15-tetraenyl)-cyclohexanol (RT 43.532, 22.55 %), 9,12,15-octadecatrienoic acid, 2,3-dihydroxypropyl ester,(Z,Z,Z) (RT 38.834, 15.11 %), phytol (RT 38.509, 10.99 %), aromadendrene oxide-(2) and its isomer (RT 32.054 and 30.152, 8.86 %), (-)-spathulenol (RT 29.314, 8.81 %) and 3,7,11,15-tetramethyl-2-hexadecen-1-ol (RT 36.232, 5.00 %) which is an isomer of phytol, 6- epi-shyobunol (RT 30.665, 4.81 %), and hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester (RT 37.715, 4.02 %). These major compounds add up to 80.15 % of total constituents. The minor constituents are caryophyllene (RT 24.497, 3.17 %), ledene oxide-(II) (RT 31.365, 2.91 %), an isomer of spathulenol and aromadendrene oxide-(2), Cycloheptasiloxane, tetradecamethyl (RT 27.475, 2.80 %), propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandrost-8-en-17-yl (RT 32.235, 2.66 %), 1,6,10- dodecatrien-3-ol, 3,7,11-trimethyl-[S-(Z)] (RT 29.157, 2.19 %), humulene (RT 25.548, 2.00 %), 13-heptadecyn-1-ol (RT 36.726, 1.60 %), α-acorenol (RT 26.899, 0.89 %), an isomer of 6- epi-shyobunol and 1,6,10- dodecatrien-3-ol, 3,7,11-trimethyl-[S-(Z)], ergosta-5,22-dien-3-ol, acetate,(3β, 22E) (RT 35.275, 0.83 %) and 1-heptatriacotanol (RT 36.539, 0.79 %) all summing up to 19.84 % of total constituents.

4.0 DISCUSSION

The Phytochemical constituents of a medicinal plant have been interrelated with its pharmacological activity. Amongst the

identified phytochemicals, 2,2,4-Trimethyl-3-(3,8,12,16-tetramethyl-heptadeca-3,7,11,15-tetraenyl)-cyclohexanol has been reported to inhibit inflammation and may be employed as anti-inflammatory agent and utilized as such [13-14].

Phytol a diterpene compound, as well as its terpene alcohol isomer, 3,7,11,15-Tetramethyl-2-hexadecen-1-ol detected in the ethyl acetate fraction of *Lantana camara* leaves, have been found to decrease autoimmune responses and ameliorate different phases of arthritis. The results show that phytol and its isomer, reactive oxygen species-promoting substances, constitute a promising novel class of pharmaceuticals for treatment of rheumatoid arthritis and possibly, other chronic inflammatory diseases [15]. In addition, phytol has also been reported to exert insecticidal, antihelmintic or antiseptic, antimicrobial, anticancer and diuretic activities and hence, may be employed as such [16-17].

Previously, researchers have reported the diverse antimicrobial potential of *Lantana camara* and antioxidant properties of the ethyl acetate extract of *Lantana camara* leaves; hence, our reports support these findings [18-20].

Amongst the compound detected, Aromadendrene oxide – (2), an oxygenated sesquiterpenes naturally found as a chemical component of essential oils has been demonstrated to exhibit potent anticancer activity. Aromadendrene oxide – (2) inhibits the growth and colony formation ability of A431 human epidermoid cancer and precancerous HaCaT cells and induces cell cycle arrest at G0/G1 phase and apoptosis through intracellular ROS accumulation. Furthermore, it also has the property of anti HIV5, 6, antifungal and antimicrobial activities [13].

Spathulenol also identified in *Lantana camara* leaves, is a tricyclic sesquiterpene alcohol with potent antimicrobial, immunomodulatory and anti-tumor properties and may be employed as such [21].

6 –epi-shyobunol, an oxygenated sesquiterpene has been reported to exert anti-inflammatory, antinociceptive and antipyretic properties and can be utilized as such agents [13]. On the other hand, propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandrost-8-en-17-yl has demonstrated potential as an inhibitor of a protein tyrosine phosphatase 1B (PTP 1B), a negative regulator of the insulin-signalling pathway, considered a promising potential therapeutic target in particular, for the treatment of type-2 diabetes [22-23].

Conversely, anti-hyperglycemic, hypo-lipidemic, antimicrobial and anti-tumor activities of Propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandrost-8-en-17-yl detected, have also been established [23-24].

Consequently, propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandrost-8-en-17-yl may be useful for various herbal formulation as an antihyperglycemic, hypolipidemic, antimicrobial and anti-tumor agents and employed as an approach in developing novel PTP 1B inhibitor for the management of diabetes and obesity.

CONCLUSION

The presence of various bioactive compounds detected after GC-MS analysis of ethylacetate fraction of *Lantana camara* leaves justifies the use of the plant for treatment of various diseases. However, isolation and evaluation of the biological activities of the compounds identified in this study is in progress.

ACKNOWLEDGEMENT

We are thankful to **Mr. Alfred Ozioko** of Bioresources Development and Conservative Programme Research Center, Enugu State, Nigeria, for authentification of plant sample and **Dr. Nnaemeka Asogwa** of Central Research lab, Ilorin, Kwara State, Nigeria, for all his technical assistance.

REFERENCES

[1] Shil S, Dutta CM, Das S, Indigenous knowledge of medicinal plants used by the Reang tribe of Tripura State of India. J Ethnopharmacol, 152, 2014, 135-41.

[2] Kalaisezhiyan P, Sasikumar V, GC MS evaluation of chemical constituents from methanolic leaf extract of *Kedrostis foetidissima* (Jacq). Cogn. Asian J Pharm Clin Res, 5(4), 2012, 77-81.

[3] Florence AR, Jeeva S, FTIR and GC MS spectral analysis of *Gmelina asiatica* L. leaves. Sci Res Repot, 5(2), 2015, 125-136.

[4] Edy HJ, Wahyuono MS, Nugroho AE, Characterization and evaluation of bioactive compounds of extract ethanol *Tagetes crecta* L. by GC MS. Int J Chem Tech Res, 10(2), 2017, 172-175.

[5] Gogoi D, Bora G, Borgohain R, Handique JG, Antioxidant capacity and GC MS analysis of hexane, ethylacetate and methanol extracts of *Ficus bhotanica* – A potential folklore medicinal plant. Int J Pharmacogn Phytochem Res, 10(5), 2018, 201-212.

[6] Kalita S, Kumar G, Karthik L, Rao KVB. A review on medicinal

properties of *Lantana camara* Linn. Res J Pharm Tech, 5(6), 2012, 711-715.

[7] Abdulla MA, Hassandarvish P, Ali HM, Noor SM, Mahmoud FH, Bashah NA, et al. Acceleration of wound healing potential by *Lantana camara* leaf extract in experimental rats. Res J Med Sci, 3(2), 2009, 75-79.

[8] Thamotharan G, Sekar G, Thangavel G, Saikat S, Chakraborty R, Kumar NS, Antiulcerogenic effects of *Lantana camara* Linn leaves on *in vivo* test models in rats. Asian J Pharm Clin Res, 3(3), 2010, 57-60.

[9] Ganesh T, Sen S, Thilagam E, Thamotharan G, Chakraborty R, Pharmacognostic and anti-hyperglycemic evaluation of *Lantana camara* (L) var. aculeate leaves in alloxan-induced hyperglycemic rats. Int J Res Pharm Sci, 1(3), 2010, 247-252

[10] Gidwani BK, Bhargava S, Rao SP, Majoomdar A, Pawar DP, Alaspure RN, Analgesic, anti-inflammatory and anti-hemorrhoidal activity of aqueous extract of *Lantana camara* Linn. Res J Pharm Tech, 2(2), 2009, 378-381.

[11] Mayee R, Thosar A, Evaluation of *Lantana camara* Linn (*Verbenacea)* for antiurolithiatic and antioxidant activities in rats. Int J Pharm Clin Res, 3(1), 2011, 10-14.

[12] Pour BM, Latha LY, Sasidharan S, Cytotoxicity and oral acute toxicity studies of *Lantana camara* leaf extract. Molecules, 16(5), 2011, 3663-3674.

[13] Shareef HK, Muhammed HJ, Hussein HM, Hameed IH, Antibacterial effect of ginger (*Zingiber officinale*) roscoe and bioactive chemical analysis using Gas chromatography mass spectrum. Orient J Chem, 32(2), 2016, 817-837.

[14] Srivastava R, Mukerjee A, Verma A, GC-MS analysis of phytocomponents in,pet ether fraction of *Wrightia tinctoria* seed. Pharmacogn J, 7(4), 2015, 249-253.

[15] Ogunlesi M, Okiei W, Ofor E, Osibote AE, Analysis of the essential oil from the dried leaves of *Euphorbia hirta* Linn (Euphorbiaceae), a potential medication for asthma. Afr J Biotechnol, 8(24), 2009, 7042-7050.

[16] Rajalakshmi K, Mohan VR, GC-MS Analysis of Bioactive Components of *Myxopyrum serratulum* A.W. Hill (Oleaceae) Int. J. Pharm. Sci. Rev. Res, 38(1), 2016, 30-35.

[17] Sudha T, Chidambarampillai S, Mohan V.R, GC-MS analysis of bioactive components of aerial parts of *Fluggea leucopyrus* willd. (Euphorbiaceae). J Appl Pharm Sci, 3(05), 2013, 126-130.

[18] Saraf A, Quereshi S, Sharma K, Khan NA, Antimicrobial activity of *Lantana camara* L. J. Exp. Sci, 2(10), 2011, 50-54.

[19] Ganjewala D, Sam S, Hayat KK, Biochemical compositions and antibacterial activities of *Lantana camara* plants with yellow, lavender, red and white flowers. Eurasia J Biosci, 3(10), 2009, 69-77.

[20] Swamy MK, Sinniah UR, AKhtar MS, In vitro pharmacological activities and GC-MS analysis of different solvent extracts of *Lantana camara* leaves collected from Tropical region of Malaysia. Evid Based Complement Alternat Med, 2015, 2015:506413.

[21] Rajeshwari N, Ramlakshmi S, Muthuchelian K. GC - MS analysis of bioactive components from the ethanolic leaf extract of Conthium dicoccum, J. Chem. Pharm Res, 3(3), 2011, 792-798.

[22] Parimalakrishnan S, Akalanka Dey, Rajeswari J, Ravikumar K, Extraction and characterization of phytoconstituents of *Cleome chelidonii* by GC/MS. Int J Chem Pharm Sci, 6(1), 2015, 63-69.

[23] Venkatachalam M, Singaravelu G, Govindaraju K, Ahn JS, PTP 1B inhibitory action of a phytochemical propanoic acid, 2-(3-acetoxy-4,4,14-trimethylandrost-8-en-17-yl). Curr Sci, 105(6), 2013, 827-832.

[24] Zhang S, Zhang ZY, Drug discovery today, 12, 2007, 373-381.