



**African Journal of  
Biochemistry Research**

**Volume 11 Number 3, March 2017**

**ISSN 1996-0778**



*Academic  
Journals*

## ABOUT AJBR

The African Journal of Biochemistry Research (AJBR) (ISSN1996-0778) is published Monthly (one volume per year) by Academic Journals.

**African Journal of Biochemistry Research (AJBR)** provides rapid publication (monthly) of articles in all areas of Biochemistry such as Nutritional biochemistry, Analytical biochemistry, Clinical Biochemistry, Human and Plant Genetics, Molecular and Cell Biology, Enzymology, Toxicology, Plant Biochemistry, Biochemistry Education etc. The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles are peer-reviewed.

### Contact Us

**Editorial Office:** [ajbr@academicjournals.org](mailto:ajbr@academicjournals.org)

**Help Desk:** [helpdesk@academicjournals.org](mailto:helpdesk@academicjournals.org)

**Website:** <http://www.academicjournals.org/journal/AJBR>

**Submit manuscript online** <http://ms.academicjournals.me/>

## **Editor**

**Prof. Johnson Lin**

*School of Biochemistry, Genetics, Microbiology  
and Plant Pathology  
University of KwaZulu-Natal (Westville)  
Private Bag X 54001, Durban  
Republic of South Africa*

## **Associate Editors**

**Gregory Lloyd Blatch**

*Dept Biochemistry Microbiology & Biotechnology  
Rhodes University Grahamstown 6140  
South Africa*

**Dr. Serap Yalin**

*Mersin University,  
Faculty of Pharmacy,  
Department of Biochemistry,  
Yenisehir Kampusu,  
Mezitli 33161  
Mersin/Turkey*

**Dr. Om Prakash Gupta**

*Directorate of Wheat Research (ICAR)  
Post Box-158, A  
grasain Marg, Karnal-132001, Haryana, India*

## Editorial Board

**Dr. Desouky A.M. Abd-El-Haleem**  
Biological Sciences Department,  
College of Arts and Sciences,  
Qatar University, Doha,  
Qatar

**Dr. S.K. Trigun**  
Biochemistry and Molecular Biology Section,  
Banaras Hindu University  
Varanasi-221005,  
India

**Dr. ImedGallouzi**  
McGill University,  
Biochemistry Department,  
3655 Promenade Sir William OslerMontreal,  
Quebec, H3G 1Y6,  
Canada

**Dr. Ashraf A Khalil**  
Protein Technology Lab, Mubarak City for Science, New  
Borg Elarab,  
Alexandria,  
Egypt.

**Dr. Stanley Mukanganyama**  
Department of Biochemistry,  
University of Zimbabwe, Box MP 167,  
Mount Pleasant, Harare,  
Zimbabwe

**Prof. Salah A. Sheweita**  
Taibah University, Faculty of Medicine, Department of  
Biochemistry, PO Box 30001, Madinah,  
Saudi Arabia

**Dr Oluwafemi O Oguntibeju**  
Department of Clinical Biochemistry,  
School of Medicine,  
Spartan Health Sciences University,  
P.O. Box 324, Vieux Fort, St Lucia,  
West Indies

**Dr. Robert L. Brown**  
USDA ARS,  
Southern Regional Research Center  
1100 Robert E. Lee Blvd.,  
New Orleans, LA 70124

**Dr. Edward Eteshola**  
Biomedical Engineering Center  
Davis Heart and Lung Research Institute  
Ohio State University  
473 W. 12th Avenue  
Columbus, OH 43210

**G. Suresh Kumar**  
Senior Scientist and Head  
Biophysical Chemistry Laboratory  
Indian Institute of Chemical Biology  
Council of Scientific and Industrial Research  
Jadavpur,  
Kolkata 700 032,  
India

**Xu Lu**  
Department of Biochemistry and Molecular Biology  
Colorado State University  
Fort Collins,  
CO 80523-1870  
USA

**Mohammed A.A Sarhan**  
Dept. Biological Sciences  
Faculty of Science  
King Khalid University  
Saudi Arabia

**MehrdadBehmanesh**  
Department Of Genetics  
School Of Science  
P.O.Box 114-175 Tehran Iran  
Iran

**Hans Verhagen**  
P.o Box 1 3720 Ba Bilthoven  
The Netherlands  
Netherlands

**P.K.Sumodan**  
Post Graduate Department Of Zoology  
Government College Madappally India  
India

**BalesengMoseki**  
University Of Botswana  
Botswana

**Bhaskar C. Behera**

*Agharkar Research Institute  
Plant Science Division India  
India*

**Luiz Claudio Miletti**

*Universidade Do Estado De Santa Catarina  
Brasil*

**Oladipo Gabriel Sunday**

*University Of Port Harcourt  
Port Harcourt-Nigeria  
Nigeria*

**Basiouny Ahmed El-Gamal**

*Biochemistry Department  
Faculty Of Science  
Alexandria University  
Egypt*

**AminigoEbiokpo Rebecca**

*University Of Port Harcourt  
Portharcourt-Nigeria  
Nigeria*

**JiaZeng**

*Department Of Bioengineering  
Central South University  
Changsha Hunan 410083 P.R.China  
China*

**Adenike Kuku**

*ObafemiAwolowo University  
Department Of Biochemistry  
Nigeria*

**Elsayed Hafez**

*Genetic Engineering and Biotechnology Research Institute  
Egypt*

**Gabriella Castoria**

*Via L. De Crecchio 7 -80138 Naples  
Department Of General Pathology  
Italy*

**SalwaSeddik Abdel-Latif**

*21 Elbatal Ahmed Abdel Aziz  
Elmohandesien Giza  
Egypt*

**Erasto Vitus Mbugi**

*Muhimbili University  
Biochemistry Department  
School Of Medicine  
India*

**Mohamed Rholam**

*Université Paris7 - Denis-Diderot  
France*

**Hooi Ling Foo**

*Universiti Putra Malaysia  
Malaysia*

**JayanthRao**

*Biochemistry And Nutrition  
Cftri Mysore  
India*

**Maznah Ismail**

*Universiti Putra  
Malaysia*

**Svetlana Lutsenko**

*Oregon Health & Science University  
USA*

**Gabriel Ugwem**

*Rivers State University Of Science And Technology  
P.M.B. 5080 Port Harcourt  
Nigeria*

**HariChhatpar**

*Dept. Of Microbiology & Biotechnology Centre  
Faculty Of Science  
M.S.University Of Baroda  
Vadodara 390 002  
Baroda India*

**MahiuddinAlamgir**

*The University Of New South Wales  
Sydney Nsw-2052  
Australia*

**Sheeja Samuel Edwin**

*B.R Nahata College of Pharmacy & Research Centre  
India*

**William Cho**

*Room 1305 13/F Block R Department of Clinical Oncology  
Queen Elizabeth Hospital  
30 Gascoigne Road Kowloon  
Hong Kong*

**Dr. SurainiAbd-Aziz**  
*Universiti Putra Malaysia  
Malaysia*

**Dr. Mustafa NumanBucak**  
*Lalahan Livestock Central Research Institute Lalahan  
Ankara Turkey*

**Alparslan Kadir Devrim**  
*Department Of Biochemistry  
Faculty of Veterinary Medicine  
Kafkas University 36040 Kars  
Turkey*

**Vasudev R. Thakkar**  
*Sardar Patel University  
Brd School of Biosciences  
Sardar Patel University  
Nagar*

**Prof. Emmanuel Anosike**  
*Department Of Biochemistry  
University Of Port Harcourt  
Nigeria*

**Dr. Usama Beshay**  
*New Bourg El-Arab City, Research Area  
Alexandria 21934  
Egypt*

**Dr. Ramar Perumal Samy**  
*Department of Anatomy  
Yong Loo Lin School of Medicine  
National University of Singapore  
Singapore*

**Dr. Shin-ichi ONO**  
*Laboratory of Clinical Pharmacy  
College of Pharmacy, Nihon University  
Japan*

**Prof. Lawal Bilbis**  
*Biochemistry Department  
UsmanuDanfodiyo University Sokoto  
Nigeria*

**Dr. Adriana G. Chicco**  
*Department of Biochemistry  
University of Litoral, Santa Fe  
Argentina*

**Prof. Zia-Ur Rahman**  
*Department Of Physiology and Pharmacology  
University Of Agriculture  
Faisalabad  
Pakistan*

**Dr. Oluwole Ariyo**  
*Allen University  
USA*

**Prof. Francisco Torrens**  
*Institut Universitari de Ciència Molecular  
Universitat de València  
Spain*

**Prof. Belkhodja Moulay**  
*University of Senia Oran  
Algeria*

**Dr. Hossam M Ashour**  
*Department of Microbiology and Immunology  
Faculty of Pharmacy, Cairo University  
Egypt*

**Dr. Fidelis Ocloo**  
*Biotechnology and Nuclear Agriculture Research  
Institute/GAEC  
Ghana*

**Ass. Prof. Alfonso Baldi**  
*Dept. Biochemistry, Sect. Pathology  
Second University of Naples,  
Italy*

**Dr. Anandh Babu Pon Velayutham**  
*Department of Human Nutrition  
Foods and Exercise 253 Wallace Hall Virginia Tech  
Blacksburg VA 24061  
USA*

**Dr. Tapan K. Chaudhuri**  
*Department of Biochemical Engineering and Biotechnology  
Indian Institute of Technology Delhi, HauzKhas  
New Delhi-110016, India.*

**Dr. Rong Zhang**  
*Shenyang Pharmaceutical University  
China*

**Ass. Prof. Tzong-Jih Cheng**  
*Department of Bio-Industrial Mechatronics*  
*National Taiwan University*  
*Taiwan*

**Dr. Zuyong Xia**  
*Department of Radiology,*  
*1201 Welch Rd, Room P089, Stanford, CA 94301*  
*USA*

**Dr. Pratap Kumar Das**  
*Indian Institute of Chemical Biology*  
*India*

**Dr. Vasudeo Pandharinath Zambare**  
*Advanced Enzyme Technologies Ltd*  
*India*

**Dr. A M Mujumdar**  
*Agharkar Research Institute*  
*India*

**Prof. Christine Clayton**  
*ZMBH*  
*ImNeuenheimer Feld 282*  
*69120 Heidelberg*  
*Germany*

**Prof. Rekik Boul baba**  
*ESA Mateur*  
*Département des sciences et techniques de productions*  
*animales*  
*Tanzania*

**Dr. Farhad Mirzaei**  
*National Dairy Research Institute, NDRI*  
*Karnal*  
*India*

**Dr. ROUABHI Rachid**  
*Biology Department*  
*Tebessa University.*  
*Algeria*

**Prof. Vaclav Vetvicka**  
*University of Louisville*  
*USA*

**Dr. Ramesh Putheti, Ph.D**  
*Research scientist*  
*Actavis Pharmaceuticals*  
*10065 red run blvd,owings mills Blvd,Maryland.U.S.A.21030*  
*USA*

**Prof. Dr. Mustafa NAZIROGLU**  
*Head of Department of Biophysics*  
*Medical (TIP) Faculty, SuleymanDemirel University*  
*Cunur, TR-32260 Isparta*  
*TURKEY*

**Dr. José Luis Arias Mediano**  
*GrupoInvestigaciónFarmaciaPráctica (CTS-205)*  
*Dept. Farmacia y TecnologíaFarmacéutica*  
*Facultad de Farmacia*  
*Campus Universitario de Cartuja, s/n Universidad de*  
*Granada*  
*18071 Granada.*

**Ahmed Malki, PhD**  
*Lecturer of Biochemistry and Molecular Biology*  
*Biochemistry Department*  
*Faculty Of Science*  
*Alexandria University*  
*Alexandria,*  
*Egypt*

**Dr. Alireza Seidavi (PhD)**  
*Assistant Professor of Animal and Poultry Nutrition,*  
*Department of Animal Science,*  
*College of Agriculture,*  
*Islamic Azad University, Rasht Branch,*  
*Rasht, Iran*

**Amani S. Awaad**  
*Professor of pharmacognosy, Chemistry Department*  
*Faculty of Sciences, King Saud University .*  
*Riyadh. KSA. P.O. Box 22452, Riyadh 11495.*  
*Saudi Arabia*

**Dr. Abdel-TawabMossa**  
*Environmental Toxicology Research Unit (ETRU),*  
*Pesticide Chemistry Department,*  
*National Research Centre,*  
*Dokki,*  
*Egypt*

**Dr. Amal A. Mohamed**

*Plant Biochemistry Department,  
Agriculture Division - National Research Center,  
31-El-Tahrir St.,  
Dokki,  
Cairo – Egypt*

**Dr. Anabella Gaspar**

*Department of Biochemistry,  
University of Pretoria,  
South Africa*

**Dr. Anna Janecka**

*Department of Biomolecular Chemistry,  
Medical University of Lodz,  
Mazowiecka 6/8,  
92-215 Lodz,  
Poland*

**Dr. Caser Abdel**

*Horticulture Department,  
Dohuk University,  
Iraq*

**Dr. David Sheehan**

*Dept Biochemistry,  
University College Cork,  
Ireland*

**Dr. Dayananda Chandrappa**

*Center for Bioenergy,  
Department of Life and Physical  
Sciences,  
Cooperative Research,  
Lincoln University,  
Jefferson City,  
USA*

**Dr. Elsayed Abdelaal**

*Special Graduate Faculty,  
University of Guelph,  
Onatio,  
Canada*

**Dr. Etienne Marbaix**

*CELL Unit,  
de Duve Institute,  
UCL-75.41, 75 avenue  
Hippocrate,  
B-1200 Bruxelles,  
Belgium*

**Dr. Gary L. Firestone**

*Department of Molecular and Cell Biology,  
University of California,  
Berkeley,  
CA, 94720,  
USA*

**Dr. Henryk Zielinski**

*Institute of Animal Reproduction and Food Research,  
Polish Academy of Sciences,  
Poland*

**Dr. Irshad A. Nawchoo**

*Department of Botany,  
University of Kashmir,  
India*

**Dr. Luchai Butkhup**

*Department of Biotechnology,  
Faculty of Technology,  
Mahasarakham University,  
Mahasarakham 44000,  
Thailand*

**Dr. Luminita Vladescu**

*Department of Analytical Chemistry,  
Faculty of Chemistry,  
University of Bucharest,  
Romania*

**Dr. Mira Debnath**

*School of Biochemical Engineering,  
Institute of Technology - Banaras Hindu University,  
Varanasi,  
India*

**Dr. Nilesh S. Panchal**

*Department of Biosciences,  
Saurashtra University,  
Rajkot-360005,  
Gujarat.  
India*

**Dr. Rayappa A. Balikai**

*University of Agricultural Sciences,  
Dharwad,  
Karnataka- 580 005,  
India*



**Dr. SaadTayyab**

*Institute of Biological Sciences,  
University of Malaya,  
50603 Kuala Lumpur,  
Malaysia*

**Dr. Shijun Fu**

*Institute of Health Sciences,  
Shanghai Institutes for Biological Sciences,  
Chinese Academy of Sciences and Shanghai Jiao Tong  
University School of Medicine, Shanghai,  
P. R. China*

**Dr. Shiming Zhang**

*Weis Center for Research,  
Geisinger Clinic,  
Danville, Pennsylvania,  
USA*

**Dr. Thomas Efferth**

*Department of Pharmaceutical Biology,  
Institute of Pharmacy and Biochemistry,  
University of Mainz, Heidelberg,  
55128 Mainz,  
Germany*

**ARTICLE**

<b>GC-MS/FT-IR screening of <i>Xylopi</i>a <i>aethi</i>opica (Dunal) A. Rich Fruit</b>	<b>12</b>
Okereke S. C., Arunsi U. O. and Nosiri C. I.	

## Full Length Research Paper

# GC-MS/FT-IR screening of *Xylopiya aethiopica* (Dunal) A. Rich Fruit

Okereke S. C.<sup>1\*</sup>, Arunsi U. O.<sup>1</sup> and Nosiri C. I.<sup>1</sup>

Department of Biochemistry, Abia State University, Uturu, Nigeria.

Received 17 November, 2016; Accepted 18 January, 2017

The present study was aimed at identifying the functional groups and phyto-constituents present in *Xylopiya aethiopica* (Dunal) A Rich fruit using Fourier Transform Infrared Spectrometry (FTIR) and Gas chromatography-mass spectroscopy (GC-MS), spectroscopy. FTIR method was performed using Perkin Elmer Spectrophotometer and the characteristic peaks were detected. The phytochemical constituents were screened by GC-MS method and the compound detection employed the NIST Ver. 2.0 year 2005 library. The results of the GC-MS analysis showed different peaks determining the presence of 15 phytochemical compounds in the fruit extract of *A. aethiopica*. The phyto-constituents with their percentage areas include  $\beta$ -Ylangene(2.85%), 1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylene)-, [s-(E,E)]- (1.71%); (-)-Spathulenol (1.23%); Trans-Z- $\alpha$ -Bisabolene epoxide (1.68%); n-Hexadecanoic acid (2.90%); Manoyl oxide (2.51%); Linoleic acid (8.14%); Oleic acid (3.13%); Cis-Z- $\alpha$ -Bisabolene (1.34%); Pimara-7,15-diene-3-one (8.86%); 1-Heptatricotanol (2.07%); Kaur-1 $\beta$ -ene (6.59%);  $\beta$ -Pimaric acid (36.39%); Doconexent (1.66%) and Androstan-17-one, 3-ethyl-3-hydroxyl-, (5 $\alpha$ )- (17.48%). The result of the FTIR spectroscopic studies revealed the presence of arenes, alcohols, phenols, carboxylic acids, ethers, aromatics, aryl ketone, alkenes, saturated aldehyde and phenols. The findings of the study revealed that the GC-MS and FTIR spectral analyses of *Xylopiya aethiopica* (Dunal) A. Rich fruit extract composed of various bioactive compounds which have are used in ethnomedicine to treat and cure infections and diseases.

**Key words:** Fourier Transform Infrared Spectrometry (FTIR), Gas chromatography-mass spectroscopy (GC-MS), phytochemical, *Xylopiya aethiopica*.

## INTRODUCTION

Over the years, man has been in constant combat with agents that cause diseases and infections and attempt to avert their associated consequences with conventional medicines have proved abortive. Recently, the tribes in developing countries, particularly Nigeria, rely primarily on herbal medicines to overcome health problems (Anand and Gokulakrishnan, 2012). Okwu and Josiah

(2006) observed that medicinal plants have been variously employed by, traditional practitioners to treat diseases, heal wounds and infections. A large proportion of these plants are trees, shrubs and weeds (Ikeyi and Omeh, 2014), and they are consumed as foods (Faleye and Ogundaini, 2012). The efficacies of these medicinal plants in the treatment of diseases have been attributed

\*Corresponding author. E-mail: okerekestan@gmail.com.

to the presence of bioactive compounds, which have diverse physiological and pharmacological responses (Ekanem and Udo, 2009).

Phytochemicals are bioactive substances derived from plants and are associated with the protection of human health against chronic degenerative diseases (Florence et al., 2015) which do not act alone but most time, in a combination of complexes (Cowan, 1999). Determination of phytoconstituents is largely performed by relatively expensive and often laborious techniques such as Gas Chromatography (GC) combined with specific detections schemes (Uzer et al., 2005). The specific detection schemes can be Mass Spectrometry (MS) or Fourier Transform Infrared Spectrometry (FTIR). Gas chromatography combined with mass spectroscopy (GC-MS) can identify pure compounds present at less than 1ng biological specimen and quantification purpose (Florence and Jeeva, 2015). The unknown organic compounds in a complex mixture can be determined by the interpretation and also by matching the spectra with reference spectra (Hites, 1997). FT-IR Spectroscopy has demonstrated to be a reliable and sensitive method for finding out the functional groups, present in plant samples using IR region in the range of 400 to 4000  $\text{cm}^{-1}$ . For most common plant compounds, the spectrum of an unknown compound can be identified by comparison to library of known compounds (Griffiths and Haseth, 1986).

The plant, *Xylopi aethiopia* (Dunal) A. Rich belonging to the family Annonaceae is widely distributed in the West African forest from Senegal to Sudan in Eastern Africa, and down to Angola in Southern Africa (Burkhill, 1985). The plant is described by different tribes of Nigeria as Uda (Igbo), Sesdo (Yoruba), Kimba (Hausa) and Aghako (Edo) (Nnodim et al., 2013). *X. aethiopia* is a perennial woody and evergreen aromatic tree or shrub with main trunk and branches, growing up to 20 m high (Enemchukwu et al., 2014). The fruits are green when matured and black with pungent aromatic scent when dried (Ikeyi and Omeh, 2014).

Burkhill (1985) reported that, seeds of *X. aethiopia* have both nutritional and medicinal values. In South Eastern Nigeria, the fruits are used as spices and aqueous decoction is used especially after birth, probably for its antiseptic properties, to arrest bleedings (Nnodim et al., 2013). Several parts of the plant (leaves, seeds and roots) are employed in folk medicine for managing various ailments such as skin infections, cough and fever (Mishana et al., 2000). The fruits are used as a postpartum tonics and remedy for many ailments like bronchitis, asthma, rheumatism, neuralgia and amenorrhea in women (Burkhill, 1985). The seeds extract of *X. aethiopia* has been identified by many researchers to possess anti-hypertensive, diuretic, antimicrobial, antioxidant and cytotoxic effects on a wide range of cancer cell lines (Somova et al., 2001; Asekun and Adeniyi, 2004; Ju et al., 2004).

Considering the relevance of the plant in folk medicine

for the treatment of various ailments, the need to identify the bioactive compounds responsible for its therapeutic potentials is quint essential. The thrust of this study was aimed at evaluating the phyto-constituents of *X. aethiopia* (Dunal) A. Rich using the technique of GC-MS/FTIR.

## MATERIALS AND METHODS

### Collection, Identification and processing of plant material

The fruits of *Xylopi aethiopia* were purchased from Eke Okigwe Market, Okigwe Local Government Area of Delta State. Eke Okigwe lies between latitude 5°50'0.9"N and 5°49'55"N and longitude 7°21'32.6"E and 7°23'17"E. The plants were identified in the department of Plant Science and Biotechnology of the Abia State University, Uturu (ABSUU). The fruits were properly sorted to remove dust and decayed materials and then washed with sterile distilled water. The fruits were cut, shade dried, ground into fine powder and stored in air tight polythene bags until use.

### Plant sample extraction

2 g of air dried powder of fruit sample was extracted with 50 ml of methanol, with gentle stirring for 72 h. The sample was kept in dark for 72 h with intermittent shaking. After incubation, the solution was filtered through Whatmann No. 1 filter paper and the filtrate was collected (crude extracts). It was then transferred to glass vials and kept at 4°C before use.

### Gas Chromatography-Mass Spectrometry analysis (GC-MS)

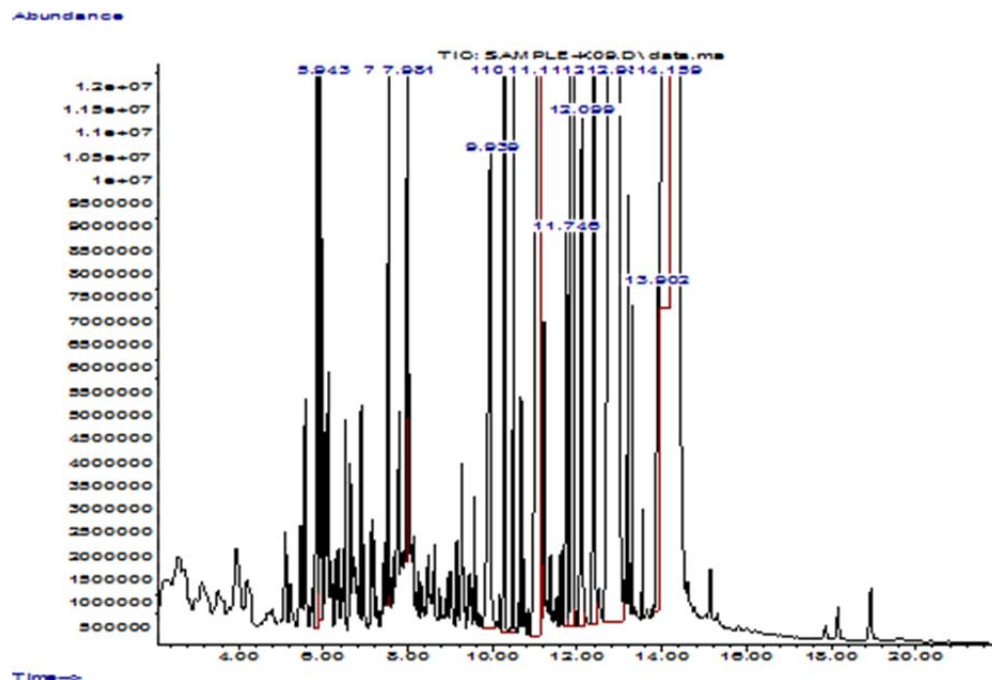
10 g of powdered fruit sample was soaked with 30 ml ethanol overnight and filtered through ash less filter paper with anhydrous sodium sulphate (2 g), to remove residual water from the sample before soxhlet extraction. The extract is concentrated to 1 ml by bubbling nitrogen into the solution. The extract contained both polar and non-polar phyto-components. 2  $\mu\text{l}$  of the methanolic extract of *X. aethiopia* fruit was employed for GC-MS analysis.

The Clarus 500 GC used in the analysis, employed a fused silica column packed with Elite-1 (100% dimethyl poly siloxane, 30 nm  $\times$  0.25 mm ID  $\times$  1  $\mu\text{m}$  df) and the components were separated using Helium as carrier gas at a constant flow of 1ml/min.

The 2  $\mu\text{l}$  sample extract injected into the instrument was detected by, the turbo gold mass detector (Perkin Elmer) with the aid of the turbo mass 5.1 software. During the 36th min GC extraction process, the oven was maintained at a temperature of 110°C with 2 min holding. The injector temperature was set at 250°C (mass analyser). The different parameters involved in the operation of the Clarus 500 MS, were also standardized (Inlet line temperature: 200°C; Source temperature: 200°C). Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 45 to 450 Da. The MS detection was completed in 36 min.

### Fourier Transform Infrared spectroscopic analysis (FT-IR)

Oven-dried fruit samples (60°C) were ground into fine powder, using a mortar and pestle. Two milligrams of the sample was mixed with 100 mg KBr (FT-IR grade) and then compressed to prepare a salt-disc (3 mm diameter). The disc was immediately kept in the



**Figure 1.** Mass chromatogram of methanolic fruit extract of *Xylopia aethiopica*.

sample holder and FT-IR spectra were recorded in the absorption range between 400 and 4000  $\text{cm}^{-1}$ . All investigations were carried out with a Shimadzu FT-IR spectrometer.

#### Identification of components

Interpretation of mass spectrum obtained from GC-MS was conducted using the database of National Institute Standard and Technology (NIST) having more than 82,000 patterns. The spectrum of the unknown component was compared with the spectra of the known components stored in the NIST library. The name, molecular weight, molecular formula and structure of the components of the test materials were ascertained.

#### Identification of functional groups

The FTIR spectrum was used to identify the functional groups of the active components, present in plant sample, based on the peaks values in the region of IR radiation. When the plant extract was passed into FTIR, the functional groups of the components were separated based on its peaks ratio.

### RESULTS AND DISCUSSION

Gas Chromatography-Mass Spectrometry analysis (GC-MS) is one of the best methods to identify the bioactive compounds of, nonpolar components and volatile essential oil, fatty acids and lipids. Fifteen compounds were identified from the methanolic extract of *X. aethiopica* fruit. The identification of the phytochemical compounds was confirmed based on the peak area

retention time and molecular formula was presented in Figure 1 and Table 1. The GC-MS analysis of *X. aethiopican* fruit extract revealed that, the presence of phytochemicals represented  $\beta$ -Ylangene (2.85%), 1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylene)-, [s-(E,E)]-(1.71%); (-)-Spathulenol (1.23%); Trans-Z- $\alpha$ -Bisabolene epoxide (1.68%); n-Hexadecanoic acid (2.90%); Manoyl oxide (2.51%); Linoleic acid (8.14%); Oleic acid (3.13%); Cis-Z- $\alpha$ -Bisabolene (1.34%); Pimara-7,15-diene-3-one (8.86%); 1-Heptatricotanol (2.07%); Kaur-1 $\beta$ -ene (6.59%);  $\beta$ -Pimaric acid (36.39%); Doconexent (1.66%) and Androstan-17-one, 3-ethyl-3-hydroxyl-, (5 $\alpha$ )-(17.48%).

According to Duke's ethnobotanical and phytochemistry database (Duke's, 1998) the identified compounds possess many biological properties. Among the identified bioactive compounds,  $\beta$ -Ylangene is suggested to be a sesquiterpenoid and may be employed in folk medicine as cytotoxic and anti-inflammatory agents (Yun-Jie et al., 2013). The compound 1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylene)-, [s-(E,E)]-, otherwise known as Germacrene D is a class of volatile organic hydrocarbons, which plays a role as a precursor of various sesquiterpenes such as cadinenes and selinenes (Telascrea et al., 2007). Plant terpenes according to Langenheim (1994) have anti-herbivore defenses.

Several researches on the bioactivity of phytochemicals found in natural products have revealed that, germacrene D has deterrent effects against herbivores and it has

**Table 1.** List of compounds identified at various retention times from methanolic extract of fruits of *Xylopia aethiopica* by GCMS.

S/N	RT	Compound name	MW	Formula	Area (%)
1	5.847	$\beta$ -Ylangene	204	C <sub>15</sub> H <sub>24</sub>	2.85
2	5.943	1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylene)-, [s-(E,E)]-	204	C <sub>15</sub> H <sub>24</sub>	1.71
3	7.542	(-)-Spathulenol	220	C <sub>15</sub> H <sub>24</sub> O	1.23
4	7.981	Trans-Z- $\alpha$ -Bisabolene epoxide	220	C <sub>15</sub> H <sub>24</sub> O	1.68
5	9.939	n-Hexadecanoic acid	256	C <sub>16</sub> H <sub>32</sub> O <sub>2</sub>	2.90
6	10.276	Manoyl oxide	290	C <sub>20</sub> H <sub>34</sub> O	2.51
7	11.105	Linoleic acid	280	C <sub>18</sub> H <sub>32</sub> O <sub>2</sub>	8.14
8.	11.131	Oleic acid	282	C <sub>18</sub> H <sub>34</sub> O <sub>2</sub>	3.13
9.	11.746	Cis-Z- $\alpha$ -Bisabolene	220	C <sub>15</sub> H <sub>24</sub> O	1.34
10.	11.886	Pimara-7,15-diene-3-one	286	C <sub>20</sub> H <sub>30</sub>	8.86
11.	12.099	1-Heptatricotanol	536	C <sub>37</sub> H <sub>76</sub> O	2.07
12.	12.410	Kaur-16-ene	272	C <sub>20</sub> H <sub>32</sub>	6.59
13.	12.982	$\beta$ -Pimaric acid	302	C <sub>20</sub> H <sub>30</sub> O <sub>2</sub>	36.39
14.	13.902	Doconexent	328	C <sub>22</sub> H <sub>32</sub> O <sub>2</sub>	1.66
15.	14.159	Androstan-17-one, 3-ethyl-3-hydroxyl-, (5 $\alpha$ )-	318	C <sub>21</sub> H <sub>34</sub> O <sub>2</sub>	17.48

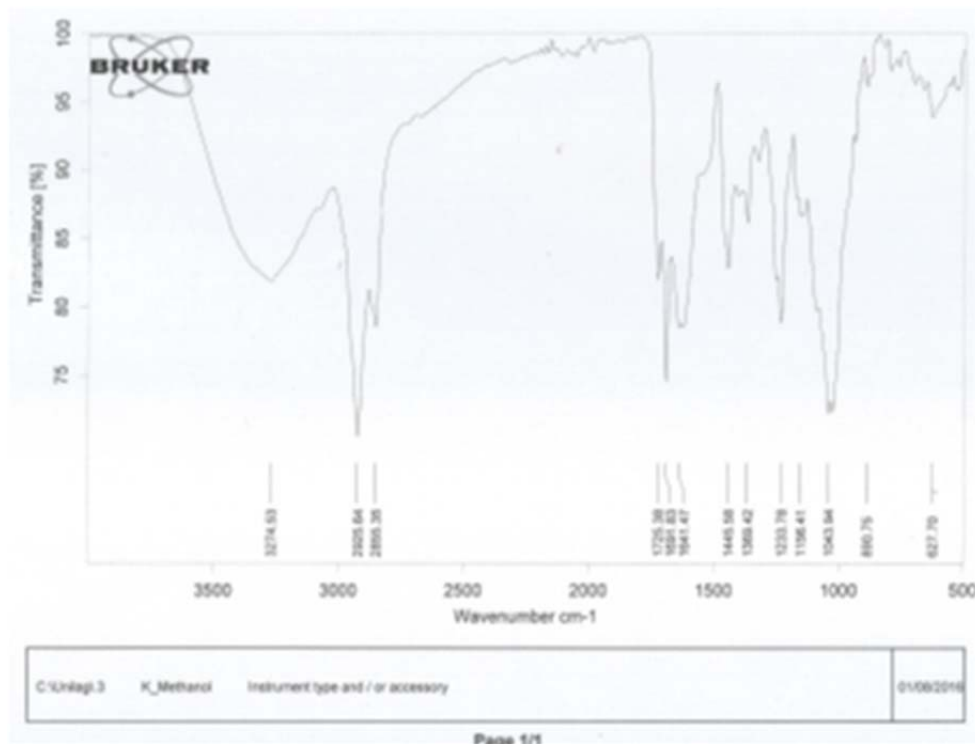
been reported to have insecticidal activity against mosquitoes (Kiran and Devi, 2007), antibacterial activity against gram negative and positive bacteria (Hamadan et al., 2013), as well as repellent activity against aphids (Bruce et al., 2005) and ticks (Birkett et al., 2008). Spathulenol is an oxygenated sesquiterpene and has been reported to have immunomodulatory effects, mosquito repellent activity, antimicrobial and anti-inflammatory activities (Prakasias and Nair, 2015).

Trans-Z- $\alpha$ -Bisabolene epoxide is an oxygenated sesquiterpene and has been observed to have antitumor and anti-inflammatory properties (Srinivasan et al., 2014). Manoyloxide is a diterpene and have been reported to have antimicrobial effects against *Borrelia burgdorferi* sensu stricto (Bbss) *in vitro* (Hutschenreuther et al., 2010). Doconexent otherwise known as Cis-4,7,10,13,16,19-Docosahexanoic acid has been reported to have anticardiovascular, antitumor and neuroprotective effects (Guesnet and Alessandri, 2011). Kalaivani et al., (2012) reported that Androstan-17-one, 3-ethyl-3-hydroxy-(5 $\alpha$ ) has neuroactive, analgesic and anesthetic effects. n-Hexadecanoic acid (palmitic acid) and 9,12-Octadecadienoic acid (Z,Z)- (linoelic acid) are fatty acids and have been reported to possess antioxidant, hypocholesterolemic, hemolytic 5-Alpha reductase inhibitor, anti-androgenic, lubricant, anti-histaminic, insectifuge, anti-eczemic and antiacne activities (Kalaivani et al., 2012). Oleic acid is a monounsaturated fatty acid and has been reported by Devi et al. (2014) to possess anti-inflammatory, anti-androgenic, cancer preventive, antimicrobial, dermatitogenic, hypocholesterolemic, anemiagenic, flavor, 5-alpha reductase inhibitor, insectifuge and larvicidal activities.

The results of FT-IR spectroscopic analysis of

methanolic fruit extract revealed the presence of arenes, alcohols, phenols, carboxylic acids, ethers, aromatics, aryl ketone, saturated aldehyde and phenols and alkenes (Figure 2 and Table 2). The absorption at 3274.53 cm<sup>-1</sup> is due to C=C group that is present in the extract. The band at 2925.64 cm<sup>-1</sup> is due to C-H<sub>3</sub>, C-H<sub>2</sub> and C-H; the band at 1725.38 cm<sup>-1</sup> showed saturated aldehyde and ketones; the band at 1691.83 cm<sup>-1</sup> showed aryl ketone bend; the band at 1641.47 cm<sup>-1</sup> showed Aromatic C=C bend; the band at 1445.58 cm<sup>-1</sup> showed Alcohol and Phenol O-H in-plane bend, the band at 1369.42 cm<sup>-1</sup> showed CH<sub>3</sub> deformation, the band at 1233.78 cm<sup>-1</sup> showed ether C-O bend; the band at 1156.41 cm<sup>-1</sup> showed tertiary alcohol C-O bend, the band at 1043.94 cm<sup>-1</sup> showed carboxylic acid O-C bend; the band at 890.75 cm<sup>-1</sup> showed Alcohol and phenol O-H stretch; and 627.70 cm<sup>-1</sup> showed Arenes C-H bend. Fourier Transform Infrared Spectroscopy (FT-IR) is a reliable and sensitive technique, employed for the detection of bimolecular composition (Kumar and Prasad, 2011). The results of the present study further revealed that, the FT-IR analysis of the methanolic extract of *X. aethiopica* fruit separated the functional groups of the component, based on its peak ratio which identified the chemical compounds. The presence of arenes, alcohols, phenols, carboxylic acids, ethers, aromatics, aryl ketone, alkenes, saturated aldehyde and phenols might be responsible for various medicinal properties of the plant.

This is the first report on the chemical composition of phyto-constituents fruit of *X. aethiopica* (Dunal) A. Rich. The result reveals that the GC-MS and FTIR spectral analysis of *X. aethiopica* (Dunal) A. Rich methanolic fruit extract is composed of, various functional groups and variety of fatty acids which are responsible for many biological activities. It is strongly recommended that, this



**Figure 2.** FTIR spectrum of methanolic extract fruit leaves of *Xylopiya aethiopica*.

**Table 2.** FTIR analysis of methanolic extract of fruits of *Xylopiya aethiopica*

S/N	Wave number (cm <sup>-1</sup> )	Functional group
1	627.70	C-H (Arenes)
2	890.75	O-H (Alcohols and phenols)
3	1043.94	O-C (Carboxylic acids/derivatives)
4	1156.41	C-O (Tertiary alcohols)
5	1233.78	C-O (Ethers)
6	1369.42	CH <sub>3</sub> deformations (Alkanes)
7	1445.58	O-H in plane bending (Alcohols and phenols)
8	1641.47	C=C (Aromatics)
9	1691.83	Aryl ketone
10	1725.38	C=O (Saturated aldehyde and ketones)
11	2925.64	CH <sub>3</sub> , CH <sub>2</sub> and CH (Alkanes)
12	3274.53	C=C (Alkenes, aromatics)

medicinal plant needs further research in many-sided field of natural products to isolate, typify and explicate the structure of bioactive molecules, which ensure the clinical trials and develop an effectual plant-based natural drug for various ailments in the point of health security.

#### CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

#### REFERENCES

- Anand T, Gokulakrishnan K (2012). Phytochemical analysis of *Hybanthus enneaspermus* using UV, FTIR and GC- MS. IOSR J. Pharm. 2(3):520-524.
- Asekun OT, Adeniyi BA (2004). Antioxidant and Cytotoxic Activities of the Fruit Essential Oils of *Xylopiya aethiopica* from Nigeria. Fitoterapia 75:368-370.
- Birkett MA, Al Abassi S, Krober T, Chamberlain K, Hooper AM, Guerin PM, Pettersson J, Pickett JA, Slade R, Wadhams LJ (2008). Antiectoparasitic activity of the gum resin, gum hagggar, from the East Africa plant, *Commiphora holtziana*. Phytochemical 69:1710-1715.

- Bruce TJA, Birkett MA, Blande J, Hooper AM, Martin JL, Khambay B, Prosser I, Smart LE, Wadhams LJ (2005). Response of economically important aphids to components of *Hemizygia petiolata* essential oil. *Pest Manage. Sci.* 61:1115-1121.
- Burkhill HM (1985). The useful plants of West Africa. 2<sup>nd</sup> Edn. Royal Botanic Gardens, 1 (A-D). pp. 130-132.
- Devi I, Amutha J, Muthu AK (2014). Gas chromatography-mass spectrometry analysis of bioactive constituents in the ethanolic extract of *Saccharum spontaneum* Linn. *Int. J. Pharm. Pharm. Sci.* 6(2):755-759.
- Duke J (1998). Duke's phytochemical and ethnobotanical databases. Available at: [www.ars-grin.gov/duke/](http://www.ars-grin.gov/duke/). Accessed 12/09/2016.
- Ekanem AP, Udo FV (2009). African natural plant products: New discoveries and challenges in chemistry and quality. ACS publications. pp. 135-147.
- Enemchukwu BN, Erimujor SO, Ubaaji KI (2014). Phytochemical screening and biochemical effects of aqueous seed extract of *Xylopiya aethiopic* (Uda) on selected haematological indices in male wistar albino rats. *The Bioscientist* 2(1):103-109.
- Faleye FJ, Ogundaini OA (2012). Evaluation of anti-oxidant and antimicrobial activities of two isolates from *Aspilia Africana*. *Int. Res. J. Pharm.* 3(7):135-138.
- Florence AR, Jeeva S (2015). FTIR and GC-MS spectral analysis of *Gmelina asiatica* L. leaves. *Sci. Res. Rep.* 5(2):125-136.
- Griffiths PR, Haseth JA (1986). Fourier Transform Infrared Spectroscopy. New York, Wiley.
- Guesnet P, Alessandri JM (2011). Docosahexanoic acid (DHA) and the developing central nervous system (CNS) – Implication for dietary recommendation. *Biochimie* 93(1):7-12.
- Hamadan DI, Abdulla RH, Mohamed ME, El-Shazly AM (2013). Chemical composition and biological activity of essential oils of Cleopatra mandarin (*Citrus reshni*) cultivated in Egypt. *J. Pharmacogn. Phytother.* 5(5):83-9.
- Hites AR (1997). Gas Chromatography Mass Spectroscopy: Handbook of Instrumental Techniques for Analytical Chemistry. pp. 609-611.
- Hutschenreuther A, Birkemeyer C, Grotzinger K, Straubinger RK, Rauwald HW (2010). Growth inhibiting activity of volatile oil from *Cistus creticus* L. against *Borrelia burgdorferi* s.s *in vitro*. *Pharmazie* 65(4):290-295.
- Ikeyi PA, Omeh NY (2014). A review of the Ethnotherapeutics of medicinal plants used in traditional/alternative medicinal practice in Eastern Nigeria. *Int. J. Curr. Microbiol. Appl. Sci.* 3(1):675-683.
- Ju EM, SE Lee, HJ Hwang, JH Kim (2004). Antioxidant and anticancer activity of extract from *Betula platyphylla* var. Japonica. *Life Sci.* 74(8):1013-1026.
- Kalaivani CS, Sathish SS, Janakiraman N, Johnson M (2012). GC-MS medicinally important plant. *Int. J. Med. Aromat. Plants* 2(1):69-74.
- Kiran SR, Devi PS (2007). Evaluation of mosquitocidal activity of essential oil and sesquiterpenes from leaves of *Chloroxylon swietenia* DC. *Parasitol. Res.* 101:413-418.
- Kumar KJ, Prasad DAG (2011). Identification and comparison of biomolecules in medicinal plants of *Tephrosiatinctoria* and *Atylosia albicans* by using FTIR. *Rom. J. Biophys.* 21(1):63-71.
- Langenheim JH (1994). Higher plant terpenoids: A phyto-centric overview of their ecological roles. *J. Chem. Ecol.* 20:1223-1280.
- Mishana NR, Abbiw DK, Addae-Mensah I, Adjanouhoun E, Ahyi MRA, Ekpere JA, Enow-Orock EG, Gbile ZO, Noamesi GK, Odei MA, Odunlami H, Oteng-Yeboah AA, Sarpong K, Sofowora A, Tackie AN (2000). Traditional Medicine and Pharmacopoeia, Contribution to the revision of ethnobotanical and Floristic Studies in Ghana. OAU/STRC Tech. Rep. P 67.
- Mishra D, Joshi S, Sah SP, Dev A, Genga B (2011). Chemical composition and antimicrobial activity of the essential oils of *Senecioru finervis* DC. (Asteraceae). *Indian J. Nat. Prod. Resour.* 2(1):44-47.
- Nnodim JK, Nwanjo HU, Okolie NJ, Opara AU, Nwosu DC, OKoroiwu I, Dike J, Okorie H, Nwadike CN, Uduji HI (2013). Effects of *Xylopiya Aethiopic* fruits on reproductive hormonal level in rats. *Glob. J. Med. Plant Res.* 1(1):29-31.
- Okwu DE, Jossiah C (2006). Evaluation of the chemical composition of two Nigerian medicinal plants. *Afr. J. Biotechnol.* 5(4):357-361.
- Prakasia PP, Nair AS (2015). Chemical fingerprint of essential oil components from fresh leaves of *Glycosmis pentaphylla* (Retz.) Correa. *Pharma Innov. J.* 3(12):50-56.
- Somova LI, FO Shode, K Moodley, Y Govender (2001). Cardiovascular and Diuretic activity of Kaurene Derivatives of *Xylopiya aethiopic* and *Alepidea amatymbica*. *J. Ethnopharmacol.* 77:165-174.
- Srinivasan K, Sivasubramanian S, Kumaravel S (2014). Phytochemical profiling and GCMS study of *Adhatodavasicaleaves*. *Int. J. Pharma Bio Sci.* 5(4):714-720.
- Telascrea M, de Araújo CC, Marques MOM, Facanali R, de Moraes PLR, Cavalheiro AJ (2007). Essential oil leaves of *Cryptocaryam andioccana* Meisner (Lauraceae): Composition and intraspecific chemical variability. *Biochem. System. Ecol.* 35:222-232.
- Uzer, A., Ercag, E. and Apak, R. (2005). Selective spectrophotometric determination of TNT in soil and water with dicyclohexylamine extraction. *Anal. Chim. Acta*, 534:307-317.
- Yun-Jie, X., Jui-Hsin, S., Bo-Wei, C., Yen-Ju, T., Yang-Chang, W. and Jyh-Horng, S. (2013). Oxygenated ylangene-derived sesquiterpenoids from the soft coral *Lemnalia philippinensis*. *Marine Drugs* 11: 3735-3741.





# African Journal of Biochemistry Research

Related Journals Published by Academic Journals

- *International Journal of Plant Physiology and Biochemistry*
- *African Journal of Biotechnology*
- *Journal of Developmental Biology and Tissue Engineering*

**academic**Journals