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ANALYSIS OF PHYTOCOMPONENTS IN THE *N*-HEXANE EXTRACT FROM THE STEM BARK OF *Parinari polyandra* (BENTH) USING FTIR AND GC-MS

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ABSTRACT
Parinari polyandra belongs to the family chrysobalanaceae which is made up of 115 genera and with about 3200 species distributed all over the world. Parinari polyandra also known as Maranthes is a savannah tree with very conspicuous whitish or pinkish flowers in dense and flattened panicles at the end of the branches. Parinari polyandra is about 8m high with a gnarled and twisted bore. Leaves are 6-13cm long by 3-8cm broad; usually round at both ends and sometimes with a very short pointed tip, leathery dark green and glossy on its top. This present study is aimed at investigating the phytochemicals present in n-hexane extract of the stem bark using FTIR and GCMS spectroscopy. The phytochemical analysis reveals the presence of alkaloids, cardiac glycosides, flavonoids, terpenoid, steroids, tannins and saponins. The Fourier transform infrared (FT-IR) result reveals the presence of aldehydes, ketones, alcohols, amines, phenols, alkenes, anhydride, aliphatic and aromatic compounds. The Gas Chromatography- Mass spectrometry (GC-MS) chromatogram indicated that the n-hexane extracts contain 20 compounds as indicated that could be associated with their pharmacological properties. This study justifies the ethno medicinal uses of the plants stem bark for the treatment of various ailment due to the presence of some phytochemical constituents that found uses in pharmacology.

INTRODUCTION

Ever since ancient times, in search for rescue for their disease, the people looked for drugs in nature. The beginnings of the medicinal plants' use were instinctive, as is the case with animals (Stojanoski, 1999). In view of the fact that at the time there was not sufficient information either concerning the reasons for the illnesses or concerning which plant and how it could be utilized as a cure, everything was based on experience. In time, the reasons for the usage of specific medicinal plants for treatment of certain diseases were being discovered; thus, the medicinal plants' usage gradually abandoned the empiric framework and became founded on explicatory facts. Until the advent of iatrochemistry (Chemical Medicine) in 16th century, plants had been the source of treatment and prophylaxis (Kelly, 2009).

In recent years, with considerable research, it has been found that many plants do indeed have medicinal values. This involves the use of medicinal plants not only for the treatment of diseases but also as potential material for maintaining good health (Oladeji, 2016). The medicinal value of this plant lies in the bioactive phytochemical constituents that produce certain physiological action on the human body (Akinmoladun *et al*., 2007). Medicinal plants contain some organic compounds which provide definite physiological action on the human body and these bioactive substances includes tannins, alkaloids, carbohydrates, triterpenoids, steroids and flavonoids (Edogo *et al*., 2005).

Due to the minor side effects as well as the synergistic action of the combination of compounds, the world health organization (WHO) has endorsed and promote the addition of herbal drugs in national health care programs because they are easily accessible at a price within the reach of a common man and are time tested and thus considered to be safer than the modern synthetic drugs (WHO, 2002).

The bioactive compounds present in plants such as alkaloids, flavonoids, saponnins, terpenoids, glycosides, tannins and phenolic compounds were considered to be of pharmacological important. Plants have provided a source of inspiration for novel drugs, as plant derived medicines have made large contributions to

human health and well-being (Okenwa *et al.*, 2015). There has been renewed interest in herbal product partly due to high cost involved in the development synthetic drugs. Haven this at the back of our mind, it is of interest that we go into analyzing the constituent of the plant for possible identification of bioactive component in the plant

MATERIAL AND METHODS

Sample Collection and Preparation

The stem barks of *Parinari polyandra* Benth plant were collected from Kogi State polytechnic, Lokoja, Kogi state. The stem bark was cut into pieces and air dried at room temperature in chemistry laboratory of the Federal University Lokoja Kogi State for about two months and pulverized using wooden mortar and pestle. The powdered samples were stored in a suitable container until ready for use.

Extraction Procedure

The powdered stem bark (200 g) was soaked in analytical grade n-hexane (800 mL) in an amber bottle with occasional shaking for five days and filtered with Whatman no1 filter paper. The filtrate was concentrated by evaporation to obtain n-hexane extract and the residue was discarded. The crude extracts obtained were taken for further analysis.

Phytochemical screening of *Parinari polyandra* n-Hexane stem crude extract:

The n-hexane extract was screened for certain secondary metabolites, namely: flavonoids, saponins, glycosides, alkaloids, tannins, steroids, terpenoids, carbohydrates and phenols using standard methods as described by Harborne (1973), Trease and Evans (2009),

Fourier Transform Infrared Spectroscopy (FTIR)

n-Hexane extracts of *Parinari polyandra* was scanned for the presence of functional groups using Agilent Technologies, Happ-Genzel FT-IR spectrophotometer. The molecular functional vibration of chemical groups present in the sample was recorded with Happ-Genzel FT-IR spectrophotometer, ranging from 4000-650cm^{-1}

Gas Chromatography-Mass Spectrometry (GC-MS)

GC-MS analysis of *Parinari polyandra* stem bark extract was carried out using GC-MSQP2010 PLUS SHIMADZU, Japan machine. Helium was used as a carrier gas at a flow rate of 1.5mL/min and at 250 injector temperature. Ion source temperature was maintained at 230 with purge flow of 3.0mL/min. The oven temperature was programmed initially at 80 for 1min, then programmed to increase to 200 at a rate of 10℃/min ending with a 5min isothermal of 280. The extract was analyzed and data evaluated using Total Ion Count (TIC) for compound identification.

RESULTS AND DISCUSSION

The powdered stem bark of *Parinari Polyandra* was extracted with n-hexane to yield 0.5g. **P**reliminary phytochemical analyses of the n-hexane stem bark extracts showed the presence of flavonoids, steroids, tannins, alkaloids, terpenoid and cardiac glycosides (Table1).

Table1: Phytochemical results of the hexane stem bark extracts of *Parinari polyandra*

S/No	Test	n-Hexane extract
1	Phenol	**-**
2	Tannins	**+**
3	Terpenoids	**+**
4	Alkaloids	**+**
5	Steroids	**+**
6	Saponins	**-**
7	Flavonoids	**+**
8	Cardiac glycosides	**+**
9	Carbohydrates	**-**

Note: + indicates positive result – indicates negative result

The FT-IR spectrum of the n-hexane extract of *Parinari polyandra* stem bark extract is as shown in table 2 and fig1. The following functional groups were found present in the n-hexane extract; alkane (C-H stretch) at frequency of 2922.2cm^{-1}, aldehyde(C-H) at 2855.1cm^{-1}, ketone (C=O) at 1710.8cm^{-1}, alkyl (C-H bend of CH_3, CH_2) at 1379.1 and 1461.1, carboxylic acid, alcohol, ester, ether and anhydride (C-O) at (1244.9, 1166.7, 1114,5, 1043.7). The presence of these functional group in the extract has implicated the presence of the compound identified from the GC-MS analysis such as oleic acid (35.18%), 1, 2, 3 propanetriol (glycerine) (11.60%), Heptane, 3-ethyl-5-methyl (9.38%). Other compounds observed are n-octadecanoic acids (5.20%), 9- octadecenamide (Z}), octane, 1-propoxy

Table 2: FTIR Analysis of the plant extract (n-Hexane extract)

S/N	Frequency	Bond	Compound
1	2922.2	C-H stretch	Alkyl groups of CH_3, CH_2, CH
2	2855.1	C-H stretch	Alkyl groups of CH_3, CH_2, CH
3	1710.8	C=O stretch	Ketones $R_2C=O$
4	1379.1	C-H bend of CH_3	Methyl
5	1461.1	C-H bend of CH_2	
6	1244.9,1166.7,1114.5,1043.7	C-O	Alcohols,esters,ethers carboxylic acid, anhydrides

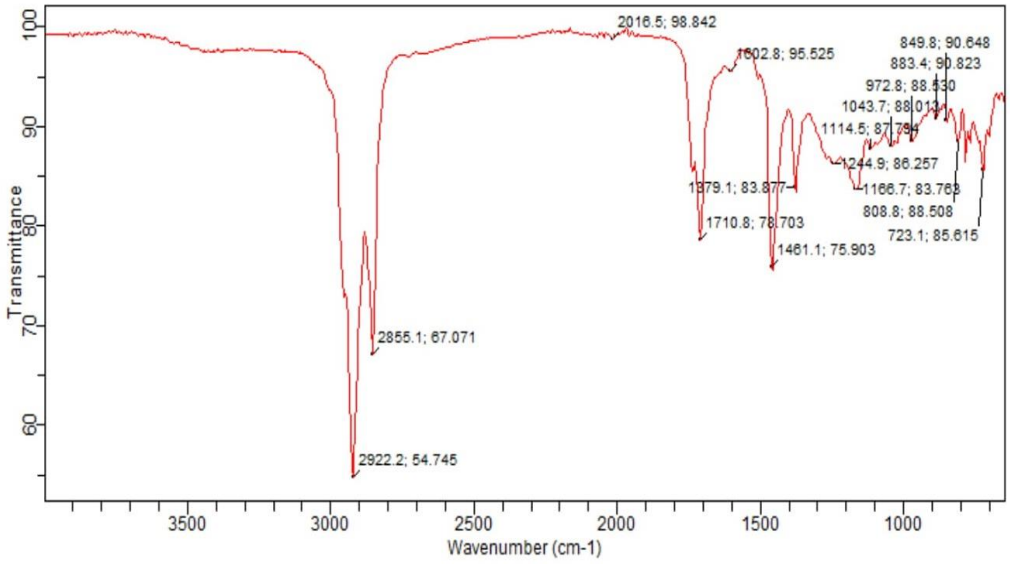

Figure 1: FT-IR spectrum showing the functional groups present in n-hexane stem bark extract.

The GC-MS analysis of the crude n-hexane extract reveal the presence of twenty (20) compounds at different retention time and base peak. The most abundant compounds are oleic acid (35.18%), 1, 2, 3 propanetriol (glycerine) (11.60%), Heptane, 3-ethyl-5-methyl (9.38%). Other compounds observed are n-octadecanoic acids (5.20%), 9- octadecenamide (Z}), octane,1-propoxy, nonanoic acid, (E)-13-docosenoic acid (The tables 3 and figures 2). The results shows the presence of long chain carboxylic acids (saturated and unsaturated) and their derivatives and esters.

Oleic acid is an unsaturated fatty acid present in several plants and being unsaturated is considered as a healthy source of fat in the diet. Many fatty acids are known to have antibacterial and antifungal properties (Russel, 1991). It has also been reported that oleic acid content is responsible for the hypotensive effects of olive oil (Terés *et. al.*, 2008). Hexadecanoic acid and octadecanoic acid are among fatty acids known to have antibacterial and antifungal activities. (McGraw, *et. al*, 2004; Seidel and Taylor, 2004). The structure and kinetics studies of n-Hexanedecanoic acid showed that it is an inhibitor of phospholipase, and hence it is an anti-inflammatory compound (Kumar et al., 2010; Aparna et al., 2012).

Table 3: GCMS Analysis of n-Hexane Extract of *Parinari Polyandra* Stem Bark

S/N	Compound	Peak (area %)	Molecular weight g/mol	Retention time	Retention index
1	1,2,3-Propanetriol(Glycerol)	11.60	92	5.342	967
2	Octane, 1-propoxy	0.14	172	12.075	1191
3	Trans-trans-octa-,4-dienyl acetate	0.09	168	13.15	1199
4	Tetradecanoic acid	0.14	228	14.483	1769
5	Pentadecanoic acid, 14-methyl, methyl ester	1.15	270	16.992	1814
6	n-Hexadecanoic acid	10.10	256	18.342	1968
7	Nonanoic acid,-2-propyl ester/Allylnonanoate	0.29	198	19.700	1371
8	9,12-octadecanoic acid, methyl ester	1.25	294	20.000	2093
9	11-octadecanoic acid, methyl ester	1.49	296	20.092	2085
10	Octadecanoic acid, methyl ester	*0.52*	*298*	*20.442*	*2077*
11	Oleic acid	35.18	282	21.208	2175
12	n-Octadecanoic acid,	5.20	284	21.392	2167
13	Hexadecanoic acid,2,3 propylester	2.96	330	22.075	2482
14	Oxirane,(tetradecyloxy) methyl	4.16	270	22.583	1877
15	9-Octadecenamide(Z}	3.29	281	23.442	2228
16	9,12,-Octadecadenoyl chloride	3.87	298	23.908	2139
17	Oxalic acid, hexadecyl ester	1.74	398	24.175	2741
18	9-Octadecenal	3.77	266	24.383	2007
19	Heptane,3-ethyl-5-methyl	9.87	142	25.050	887
20	Oxycyclotetradecane-2,11dione, 13 methyl	3.18	240	26.642	2137

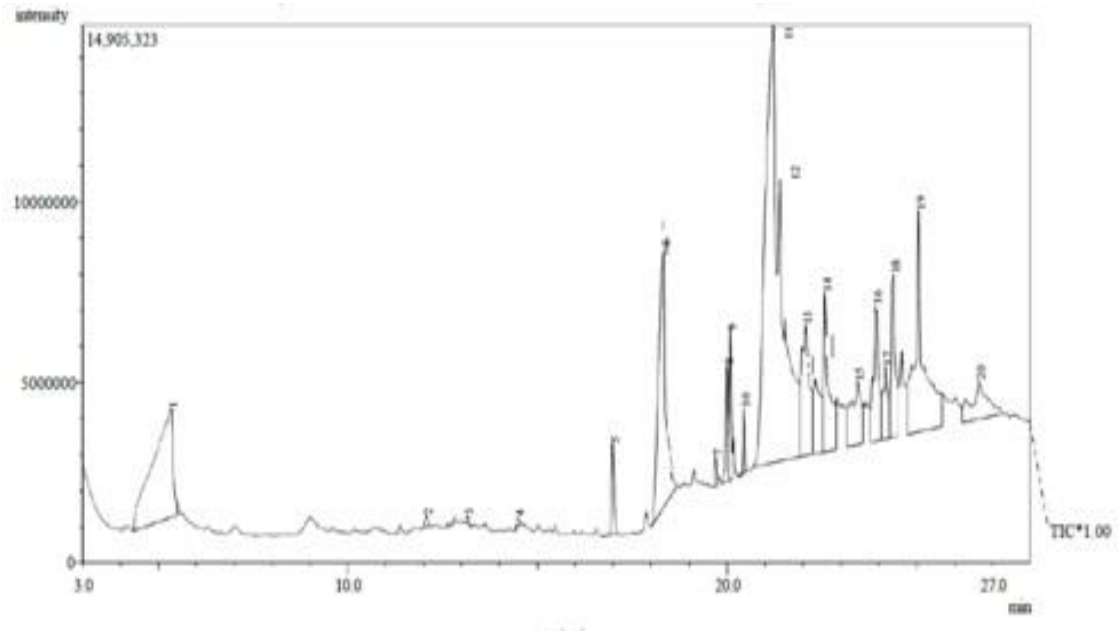

Figure 2: GC Chromatograph of n-Hexane extract of *Parinari polyandra* stem bark

CONCLUSION

The n-hexane stem bark extract of *Parinari polyandra* was found to have phytochemicals which are responsible for its therapeutic or medicinal applications in ethno medicine. Therefore no doubt that this plant can serve as reservoir for potential chemical compounds for new drug formulation. Based on the above finding further research need to be carried out on it antimicrobial properties in order to assess the mechanism of action that could be responsible for its activity if found positive. Also isolation and characterization of the isolated compound is recommended. Other solvents should be explore for further extraction and analysis.

Conflict of interest: There is no conflict of interest between the authors.

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