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GC-MS Analysis of *Pteleopsis suberosa* Stem Bark Methanol-Chloroform Extract

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Abstract: The investigation was carried out to determine the possible bioactive components of the stem bark of *Pteleopsis suberosa* using GC-MS analysis. The chemical compositions of the methanol-chloroform (2:1 v/v) extract of the plants stem bark was investigated using GC-MS QP2010 PLUS, while the mass spectra of the compounds found in the extract was matched with the National Institute of Standard and Technology (NIST) library. Twelve compounds were identified; Friedelan-3-ol (23.47%) was found to be major component followed by Di-n-octyl phthalate (17.23%), 9-Octadecenoic acid (Z)- (17.80%), Diethyl Hexadecanedioate (10.55%), Glycerol-1,2-dipalmitate (8.50%), 9,12-Octadecadienoic acid (Z,Z)- (7.08%), n-Hexadecanoic acid (6.85%).

Keywords: GC-MS, *Pteleopsis suberosa*, Ethnomedicine, Phytochemical

1. Introduction

According to the World Health Organization (WHO) in 2008, more than 80% of the world's population relies on traditional medicine for their primary healthcare needs [1], most of which make use of plants. The use of plants as medicine to cure or prevent illness and to lubricate the wheels of social interaction at the interpersonal and group level is a behaviour that predates civilization, and in today's civilization, it is found in every society irrespective of its level of development and sophistication [2]. Also, medicinal plants have been used by humans since ages in traditional medicine due to their therapeutic potential and the search on medicinal plants have led to the discovery of novel drug candidates used against diverse diseases [3, 4], just as reports available on green plants show effective chemotherapeutants, which are non-phytotoxic, more systemic and easily biodegradable [5, 6, 7]. Hedberg [8] stated that about 80% of the western pharmaceuticals have their origin in plants. Soladoye *et al.,* [9] opined that the Nigeria flora has already and will continue to make a great contribution to the health care of Nigerians, as the indigenous medicinal plants form an important component of the natural wealth of Nigeria. This knowledge of the chemical constituents of plant is helpful in the discovery of therapeutic agent as well as new sources of economic materials like oil and gums [10].

Pteleopsis suberosa is a shrub or tree plant from the family of *Combretaceae* and towers to a height of over 10 meters. It is found in the open and wooded savanna of Senegal to Nigeria [11]. It is generally used in Agri-horticulture as a land conservator, while in Ivory Coast, while the different plant parts of *Pteleopsis suberosa* are widely medicinally used throughout West Africa.

Extracts obtained from its chopped up roots and smaller shoots are taken as a cough-medicine and for other naso-pharyngeal infections. A decoction of the fresh roots is drunk or applied as enema as a poison antidote and purgative and to treat stomach-ache, gastric ulcers and dysentery. It is externally applied to treat dermatitis. The roasted pulverised root is rubbed on the head to treat a headache. The pulverised root bark, with bulbs of *Allium cepa* L., is put in hot water and the infusion taken to ease a difficult childbirth [12]. A bark or leafy twig infusion is taken to treat amoebic dysentery, jaundice, toothache, coughs, sore throat and general weakness, and externally applied to treat haemorrhoids, itchy skin caused by

filariasis, dermatitis, wounds, conjunctivitis, trachoma and cataract. A leaf decoction is taken to treat kwashiorkor, meningitis and epilepsy [13]. Commercial usage of the leaves yielded a yellow dye for dying fabrics. The straight stems are used for the production of pickets and poles, as well as small framework structures. The wood is used as firewood. From the bark cordage is made which is used for tying roof grasses. Young branches are used to make baskets, and are used as chew sticks. In Senegal *Pteleopsis suberosa* is left in the field to protect crops and to ensure fertility of the soil [13, 14]. The objective of this study therefore is to identify the bioactive constituents of *Pteleopsis suberosa* stem bark with the aid of GC-MS technique.

2. Materials and Method

2.1. Collection of Plant Material

The stem bark of *Pteleopsis suberosa* were bought from *Oja Oba* Herbs market beside the Kings' Palace in Akure and they were identified and authenticated at the Department of Crop Science, Federal University of Technology Akure, Ondo State Nigeria.

2.2. Preparation of Powder and Extract

Shade dried stem bark of *Pteleopsis suberosa*, were powdered and was extracted by the modified Bligh and Dyer procedure [15]. 5 g of powdered sample were shaken with 18 ml methanol–chloroform (2:1, v/v), for 2 minutes. The homogenate was filtered and the filtered residue was shaken with 18 ml of methanol–chloroform (2:1, v/v) and 2 ml of H_20. Followed by another round of filtration and the filtered residue was washed with 3 ml of methanol–chloroform (2:1; v/v), to the combined filtrates in a separatory funnel, 5 ml of chloroform and 6 ml of water was added and the phases were allowed to separate. The chloroform layer was withdrawn, diluted with benzene and concentrated in vacuo. The residual lipids were immediately dissolved in 0.1 ml chloroform–methanol (1:1) for analysis.

2.3. GC-MS Analysis and Identification of Components

The GC-MS analysis of *Pteleopsis suberosa* powder stem-bark extract was performed using a GC-MS QP2010 PLUS Shimadzu, Japan. Interpretation on mass spectrum of GC-MS was done using the database of National Institute Standard and Technology (NIST), having more than 62,000 patterns. The mass spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library. The name, molecular weight and structure of the components of the test materials were ascertained.

3. Results

GC-MS is one of the best techniques to identify the constituents of volatile matter, long chain, branched chain hydrocarbons, alcohols acids, esters etc. The GC-MS analysis of *P. suberosa* stem bark revealed the presence of twelve compounds (phytochemical constituents) that could contribute to the medicinal quality of the plant. The identification of the phytochemical compounds was confirmed based on the peak area, retention time and molecular formula. The active principles with their Retention time (RT), Molecular formula, Molecular weight (MW) and peak area in percentage are presented in Table 1. The first compound identified with less retention time (10.89min) was Sulfurous acid, nonyl pentyl ester, whereas Friedelan-3-ol was the last compound which took longest retention time (22.01min) to identify. The phytochemicals identified through GC-MS analysis showed many biological activities relevant to this study are listed in Table 2. The biological activities listed are based on Dr. Duke's Phytochemical and Ethnobotanical Databases created by Dr. Jim Duke of the Agricultural Research Service (USDA).

Table 1. *Components detected in the stem bark of methanol-chloroform extract of Pteleopsis suberosa.*

No.	RT	Name of the compound	Molecular Formula	Molecular Weight	Peak Area %
1.	10.89	Sulfurous acid, nonyl pentyl ester	$C_{14}H_{30}O_3S$	278	0.60
2.	15.83	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	6.85
3.	17.07	Methyloctadec-9-enoate	$C_{19}H_{36}O_2$	296	1.15
4.	17.48	9-Octadecenoic acid	$C_{18}H_{34}O_2$	282	17.80
5.	17.70	Octylundec-10-enoate	$C_{19}H_{36}O_2$	296	2.29
6.	18.39	2-Isopentyl-5-propyltetrahydrofuran	$C_{12}H_{24}O$	184	1.42
7.	18.73	Glyceryl-2-monostearate	$C_{21}H_{42}O_4$	358	3.05
8.	20.19	9,12-Octadecadienoic acid	$C_{18}H_{32}O_2$	280	7.08
9.	20.41	Glycerol-1,2-dipalmitate	$C_{35}H_{68}O_5$	568	8.50
10.	20.72	Di-n-octylphthalate	$C_{24}H_{38}O_4$	390	17.23
11.	21.41	Diethylhexadecanedioate	$C_{20}H_{38}O_4$	342	10.55
12.	22.01	Friedelan-3-ol	$C_{30}H_{50}O$	426	23.47
					100.00

Table 2. *Bio-activity of phyto-components identified in the methanol-chloroform extracts of the stem bark of Pteleopsis suberosa.*

RT	Peak Area %	Name of the compound	Molecular Formula	Molecular Weight	Compound Nature	**Activity
15.83	6.85	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Lubricant, Antiandrogenic, Flavor, Hemolytic 5-Alpha reductase inhibitor.
17.07	1.15	9-Octadecenoic acid (Z)-, methyl ester	$C_{19}H_{36}O_2$	296	Fatty acid ester compound	Antiinflammatory, Hypocholesterolemic, Cancer preventive, Hepatoprotective, Nematicide, Insectifuge Antihistaminic, Antiarthritic, Anticoronary, Antieczemic Antiacne, 5-Alpha reductase inhibitor, Antiandrogenic.
17.48	17.80	9-Octadecenoic acid (Z)-	$C_{18}H_{34}O_2$	282	Oleic acid	Hypocholesterolemic, 5-Alpha reductase inhibitor, Anemiagenic Insectifuge, Flavor
20.19	7.08	9,12-Octadecadienoic acid (Z,Z)-	$C_{18}H_{32}O_2$	280	Linoleic acid	Antiinflammatory, Nematicide, Insectifuge, Hypocholesterolemic, Cancer preventive, Hepatoprotective, Antihistaminic, Antiacne, Antiarthritic, Antieczemic, 5-Alpha reductase inhibitor, Antiandrogenic, Anticoronary.
20.72	17.23	Di-n-octylphthalate	$C_{24}H_{38}O_4$	390	Plasticizer	Antimicrobial, Antifouling
22.01	23.47	Friedelan-3-ol	$C_{30}H_{50}O$	426	Triterpenes	Antibacterial, antiulcer, Anti-plasmodial, cholinesterase inhibiting activities.
	100.00					

* Activity source: Dr. Duke's Phytochemical and Ethnobotanical databases

4. Discussion

The compounds identified possess many biological properties for instance, 9,12-Octadecadienoic acid (Z,Z) – Linolenic acid (R/T 20.19) and 9-Octadecenoic acid (Z)-,methyl ester, a fatty acid ester (R/T 17.07) both possess Antiinflammatory, Nematicide, Insectifuge, Hypocholesterolemic, Cancer preventive, Hepatoprotective, Antihistaminic, Antiacne, Antiarthritic, Antieczemic, 5-Alpha reductase inhibitor, Antiandrogenic, Anticoronary properties. n-Hexadecanoic acid – palmitic acid (R/T 15.83) can be an Antioxidant, Hypocholesterolemic, Nematicide, Pesticide, Lubricant, Antiandrogenic, Flavor, Hemolytic, 5-Alpha reductase inhibitors. Hexadenoic acid has earlier been reported as a component in alcohol extract of the leaves of *Kigelia pinnata* [16] and *Melissa officinalis* [17]. Parasuraman *et al*., [18] identified 17 compounds with n-Hexadecanoic acid and Octadecanoic acid as the major compounds in the leaves of *Cleistanthus collinus.* Friedelan-3-ol, a triterpene (R/T 22.01) possess Antibacterial, antiulcer, Anti-plasmodial, cholinesterase inhibiting activities. Other compounds as identified by GC-MS in methanol-chloroform extract possess various pharmaceutical applications.

The bark and leaves of *Pteleopsis suberosa* are particularly rich in tannins and saponins and from stem bark a number of oleanane saponins were isolated [19]. This was also confirmed by this study, as a rich quantity of 9-Octadecenoic acid an oleanane with 17.8% abundance was observed. The oleanane saponins were also tested against *Helicobacter pylori* standard and several clinical virulence genotypes, and arunglucoside I, and it showed a significant activity against three metronidazole-resistant strains [20]. Baba-Moussa *et al.,* [21] in his work observed that an aqueous extracts of the stem bark and leaves showed significant antifungal activity in vitro against a range of pathogenic fungi, while a methanolic stem bark extract and a decoction showed moderate antibacterial activity against *Staphylococcus aureus* in vitro.

5. Conclusion

Unique qualitative and quantitative patterns from a GC analysis will often help identify the source of many plants (herbs and species), as well as their bioactive components. The present study, which reveals the presence of components in *Pteleopsis suberosa,* however suggests that the identified phyto-components in their individual or synergistic actions would be responsible for the various qualities that have been attributed to this plant part as recorded from several literatures. Hence, further studies in isolating these bioactives to assess their individual medicinal effects may be necessary in order to develop safe drugs of interest.

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