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The chemical composition of the volatile oil of *Pavetta owariensis* P, Beauv. from Nigeria

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Abstract

The chemical composition of the volatile oil from the stem bark of Pavetta owariensis P. Beauv growing at the North Central of Nigeria was analyzed by Gas Chromatography-Mass Spectrometry (GC/MS). The hydro-distillation of the P.owariensis stem back was carried out using a Clevenger apparatus in order to obtain the volatile oil (0.26%). It showed the presence of seventeen (17) compounds. The major chemical composition of the volatile oil obtained are; dodecyl ester (25.97%), undecyl ester (12.27%), dodecanoic acid (12.24%), tetradecanoic acid (10.30%), tetradecyl ester (7.28%) and tetradecanoic acid (6.51%). The study established the chemical composition of the essential oil of the stem bark of the plant.

Keywords: *Pavetta owariensis*, Volatile oil, Fatty acid, GC - MS.

Introduction

The antiseptic, anti-microbacterial and anti-protozoa qualities of volatile oil from medicinal plants have been recognized for long, while attempts to characterize these properties in the laboratory dated back to the early 1900s[1,2]. Plant volatile oils are generally isolated from non woody plant material by distillation methods, steam or hydrodistillation, and the oil usually contain variable mixtures of chemical compounds that is principally terpenoids, specifically monoterpenes (C10) and sesquiterpenes (C15), although diterpenes (C20) may also be present, and a variety of low molecular weight aliphatic hydrocarbons (linear, ramified, saturated and unsaturated), acids, alcohols, aldehydes, acyclic esters or lactones. Terpenes are amongst the chemicals responsible for the medicinal, culinary and fragrant uses of aromatic and medicinal plants. The antimicrobial properties of plant volatile oils and their constituents from a wide variety of plants have been assessed and reviewed[3,4]. Plants leaves are major reservoirs of volatile oil as proven by many researches[5-11], even though essential oils have been extracted from plant stem barks[12]. Apart from woody plants, grasses[13] and shrubs[14] were known to contain essential oils. Most of these volatile oils have medicinal values that have been reported in the literature[8,14] and can be of insecticidal importance[5].

Pavetta Owariensis. P. Beauv is a perennial plant which belongs to the family Rubiaceae. It is used in North Central Nigeria folklore medicine for the management of malaria and other health challenges. The plant has also been reported to be used in Guinean traditional medicine as an anthelmetic[15]. Balde et al[16] reported the invivo activity of ethanolic extract of the plant on experimental *Schistosma mansoni* infection in mice. The extracts of the plant have been reported to have antimicrobial activities against the following organism: *Staphyloccucus aureus, Strep. Pneumonia* and *N.gonorrhoeae*[17-19]. Also the plant extract have shown some good activity against some strains of virus[20,21]. The frequent used of steam from the stem bark of the plant by the people of North central region of Nigeria to treat malaria and the used of its aroma for other health challenges prompted the search into the volatile oil of the plants.

Materials and methods

Sampling of plant material: The stem bark of *Pavetta Owariensis*. P.Beauv plant was freshly collected inside paper bags, at Jos wild life park Jos North Local government area of Plateau state. The plant was authenticated by Grace Ugabe of the herbarium unit, Department of Traditional Medicine Research and Medicinal Plant, National Institute for Pharmaceutical Research and Development Idu Industrial area, Abuja. The herbarium specimen is deposited in the same Institute.

Sample preparation: The stem bark (fresh) of the plant (30g) was sliced to small pieces and packed into a quick fit flask equipped with Clevenger apparatus for extraction.

Extraction and analysis of volatile oil: The plant sample was distilled over steam for 5 hours (22). The distillate was collected

and extracted with chloroform. The extract was dried over anhydrous sodium sulphate (23) before the chloroform was evaporated at room temperature living a yellow liquid that became solid at room temperature. The oily extract was analyzed by GC/MS using an Agilent 6890/5973 with HP-5MS capillary column (30 ×0.25mm: 0.25 µm film thickness). The carrier gas (helium) was maintained at a flow rate of 1.00ml/min and the split ration was 1:10. The column temperature was programmed within 60-260^{o}C at 4^{o}C/min. Mass was taken at 70 eV and Mass range of m/z 35-460 amu was programmed. The peaks of the eluded constituents were identified by matching their mass spectra with the system library and by comparison of their retention time indices with literature values[24].

Results and discussion

The hydrodistillation of the stem bark of *Pavetta owariensis* P. Beauv, gave a 0.26% (v/w) yield of a yellowish oil that solidified at room temperature. The result of the GC-MC from the GC peaks Figure-1, gave elution peaks for the chemical composition of the volatile oil as listed in Table-1. Seventeen compounds were identified as constituent of the volatile oil extracted. The oil was a mixture of four major families' of compounds namely:-ester of long chain hydrocarbons (58.82%), alcohols (23.55%), acids (11.78%) and aldehydes (5.88 %), that occur in varying percent concentrations (Table-2). The high percentage of the ester content of the volatile oil is responsible for the high aroma of the oil. Earlier, Prasad et al.[25] reported 24 compounds in the essential oils from leaves of *Pavetta indica* L. where the major oil components were β-pinene, β-endosmol, and tricyclene. In a another owariensis specie, Saini (11) identified 34 chemical compounds in the volatile oil extract of *Landolphia owariensis* P. beauv leaves and reported pentadecanal, 1-dodecaol, tetradecanol, hexadecatrienal, squalene, β and α- ionone, supraene, α-farnesene, carophyllene, and spathulenol as major components. Essentials oils have found applications in Phytotherapy, Aromatherapy, Nutrition, cosmetics and perfumery[26].

Table-1: Chemical composition of the volatile constituent of *Pavetta owariensis P, Beauv*.

Compounds	RT	Percentage
Undecanol	3.57	1.81
Dodecanal	4.03	1.88
1-Dodecanol	5.36	3.26
Undecyl acetate	6.17	1.85
1-Dodecanol	6.71	2.23
Isotridecanol	7.91	1.80
Dodecanoic acid	8.72	12.24
Dodecan-1-yl acetate	8.95	4.55
Tetradecanoic acid	14.40	6.51
Dodecanoic acid,tetrdecyl ester	31.44	2.34
Dodecanoic acid,undecyl ester	34.08	12.27
Dodecanoic acid, dodecyl ester	36.62	25.97
Tetradecanoic acid, tetradecyl ester	38.87	7.28
Tetradecanoic acid, dodecyl ester	41.18	10.30
Hexadecanoic, octadecyl ester	43.31	1.70
Hexadecanoic, dodecyl ester	45.47	2.03
n-Butylricinoleate	53.54	2.00
Total		**100**

Table-2: GC reading for Retention times and Area percentages of the chemical composition of volatile oil.

Area Percent Report

Data Path : C:\MSDChem\1\METHODS\FIXED OILS7.2.M\
Data File : JOHN.D
Acq On : 7 Dec 2011 18:44
Operator : Faruq
Sample : PUO
Misc : Dissolved in chloroform
ALS Vial : 1 Sample Multiplier: 1

Integration Parameters: rteint.p
Integrator: RTE
Smoothing : ON Filtering: 5
Sampling : 7 Min Area: 5 % of largest Peak
Start Thrs: 0.1 Max Peaks: 100
Stop Thrs : 0 Peak Location: TOP

If leading or trailing edge < 1 prefer < Tangent else baseline drop >
Peak separation: 0

Method : C:\MSDCHEM\1\METHODS\FARUQ4.M
Title :

Signal : TIC

peak #	R.T. min	first scan	max scan	last scan	PK TY	peak height	corr. area	corr. % max.	% of total
1	3.573	59	85	113	rBB	580172	1731947	6.97%	1.809%
2	4.025	149	164	211	rBB2	545704	1797733	7.23%	1.878%
3	5.358	344	397	449	rBV5	535091	3118390	12.54%	3.257%
4	6.165	512	538	582	rVB6	395465	1768268	7.11%	1.847%
5	6.709	603	633	660	rBB2	646941	2137074	8.60%	2.232%
6	7.910	785	843	855	rBV8	227869	1718772	6.91%	1.795%
7	8.723	862	985	995	rVB4	547758	11717968	47.13%	12.238%
8	8.952	995	1025	1079	rVB2	863787	4353999	17.51%	4.547%
9	14.399	1828	1977	2010	rBV10	382855	6237391	25.09%	6.514%
10	31.445	4929	4956	5025	rBB5	475336	2235631	8.99%	2.335%
11	34.083	5335	5417	5482	rBB	1776655	11745686	47.24%	12.267%
12	36.623	5790	5861	5921	rBB	2817435	24862010	100.00%	25.966%
13	38.872	6215	6254	6294	rBB4	1199170	6972821	28.05%	7.282%
14	41.178	6616	6657	6727	rBB4	1548855	9857652	39.65%	10.295%
15	43.307	7004	7029	7057	rBB7	304726	1630225	6.56%	1.703%
16	45.458	7372	7405	7435	rBB6	388179	1945143	7.82%	2.032%
17	53.543	8723	8818	8856	rVB8	118599	1917036	7.71%	2.002%

Sum of corrected areas: 95747746

ARUQ4.M Thu Dec 08 15:36:51 2011

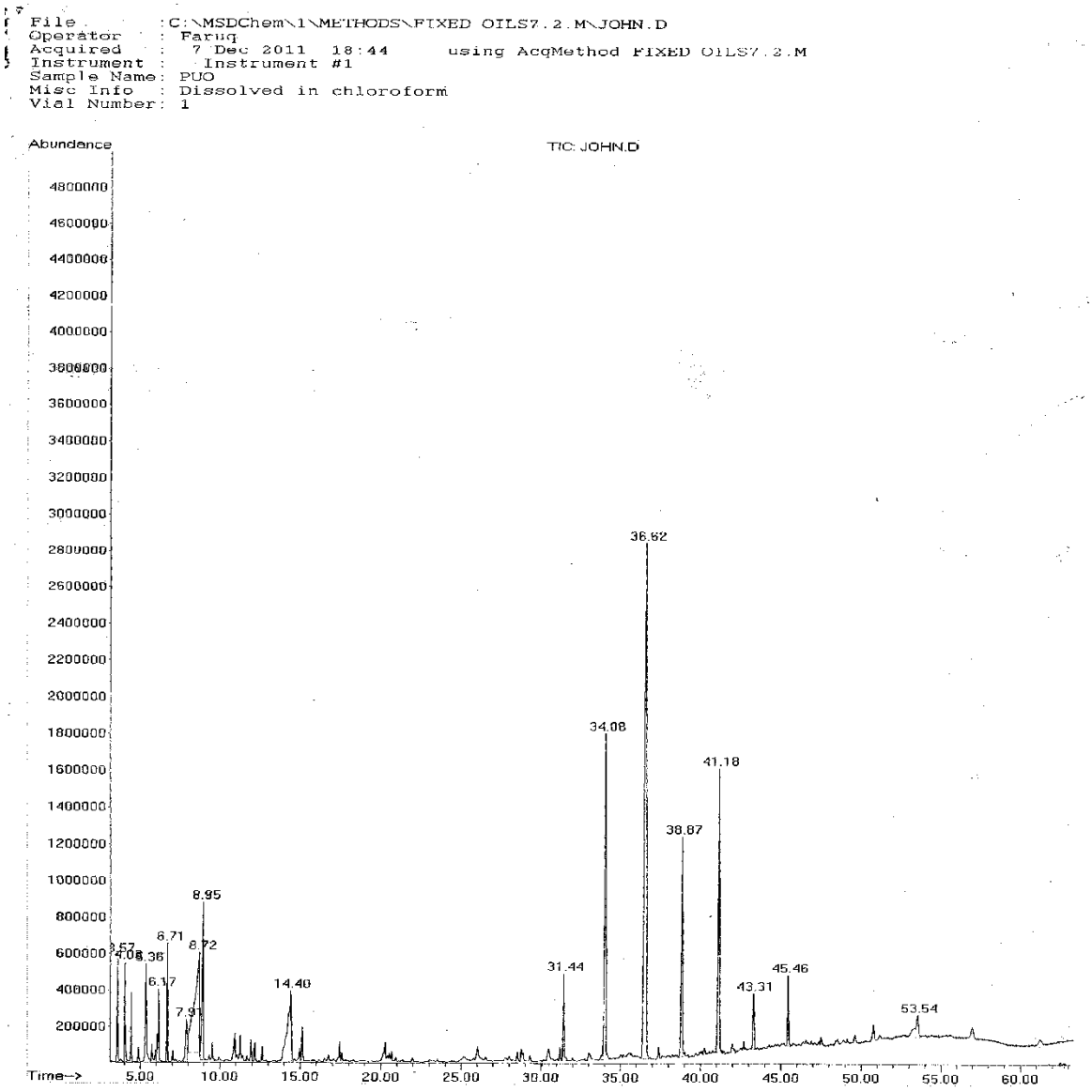

Figure-1: GC absorption peaks of essential oil components.

Conclusion

The stem bark of *Pavetta owariensis* P. Beauv, contains small amounts of essential oil that solidifies at room temperature. The oil was a mixture of four major families' of compounds of long chain hydrocarbons esters, alcohols, acids and aldehydes, with ester constituting the highest percentage.

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