GC-MS Analysis of Some Phytochemical Constituents in Stem Bark of *Khaya Senegalensis* (Desr.) A. Juss

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Abstract: **The phytochemical constituents of crude ethanolic stem bark extracts of *khaya senegalensis* were isolated and analyzed using gas chromatography-mass spectrometry (GC-MS). A shade dried stem bark of *khaya senegalensis* was extracted using ethanol solvent. The crude extract was subjected to preliminary phytochemical analysis in order to confirm the various classes of secondary metabolites present using standard procedure, and this indicated the presence of alkanoid, flavonoids, tannins, terpenoids, steroids, saponins, and carbohydrate. The GC-MS analysis of crude ethanolic extract of the sample using coupled Agilent 7890B gas chromatography and Agilent 5977A mass spectrometer confirmed the presence of: Methylamine, N, N-dimethyl-; N, N-Dimethylotylamine; 1-Hexene, 3,4- dimethyl; 1-nonanol; Benzaldehyde, 3-benzyloxy-2-fluoro-4-methoxy; 7-Tetradecene; Bicyclo [2.1.1] hexane-2-ol, 2-ethenyl; 4-chloro-3-n-hexyltetrahydropyran; 5-ethyl-5-methyl-2-phenyl-2-oxazoline; Cis 5, 8, 11, 14, 17-Eicosapentaenoic acid; 2, 4′-Dihydroxydiphenylsulphone; Phenylphosphonous acid; 3-Hydroxy-2,5,5,8a-tetramethyl-3,4,4a,5,6,7,8,8a-octahdronaphthalene-1-carboxylic acid, methyl ester; Extran-3-one,17-hydroxy-(5α,17β); i-propyl 9-hexadecanoate; Octahydro-benzo[b]furan, 2-cyclohexylimino 7a-methyl; Germacrene A, 9-(methylthio)-; 3-hydroxy-2,5,5,8a-tetrametyl-3,4,4a,5,6,8,8a-octahydronaphthalene-1-carboxylic acid, methyl ester; 5-[(2,4-Dinitrophenyl)-hydrazonomethyl]-dihydrofuran-2-one. for minor peaks. The molecular weight of these compounds ranged from low to high with carbon skeleton of between C_3 and C_{20} that are both aromatic and aliphatic.**

Keywords**: khaya-senegalensis, GC-MS, estradiol, stem-bark, chromatogram.**

I. INTRODUCTION

Plants as well as shrubs are believed to contain substances of high medicinal values, Secondary metabolites from plants have been harnessed and believed for curative purposes by man, dates to antiquity. [1].

Khaya senegalensis A. Juss (*Meliaceae*) is a popular medicinal plant among the Nupes and Yorubas in Nigeria, the *Meliaceae* (Mahogany family) is a flowering plant which are characterized by alternate, usually pinnate leaves without stipules, and by syncarpous, apparently bisexual (but actually mostly cryptically unisexual) flowers borne in panicles, cymes, spikes, or clusters [2].The crude aqueous stem bark extract is traditionally use in the treatment of malaria, jaundice, edema and headache [2] while the Hausa and Fulani tribes in Northern Nigeria use it as a remedy for several human and animal ailments [3]. It is use to calm cough and to treat laryngitis and treacheries as well as so many bacterial diseases [4]. The plant extracts have greater potential as antimicrobial compounds against microorganisms and they can be use in the treatment of pathogens caused infectious diseases [5]

II. METHODOLOGY

Collection of Sample and Preparation

Khaya senegalensis stem bark was collected from Potiskum Local Government area of Yobe State, Nigeria. The stem bark was transported to the laboratory and dried under shade. The dried sample was pounded to coarse form using mortar and pestle under controlled condition prior to analysis.

Extraction Procedure

The air dried powdered stem bark (250 g) was cool macerated in 600 ml ethanol for two weeks, the extract was concentrated using rotary evaporator under controlled temperature of 40-45˚C and later dried in desiccator.

Phytochemical Screening

The extract of *Khaya senegalensis* stem bark was subjected to preliminary qualitative phytochemical analysis for the presence of phyto- constituents such as saponin, flavonoids, tannins, alkaloids, glycosides, steroids, carbohydrates and terpenoids using standard laboratory techniques as reported by [6].

GC-MS Analysis

The crude ethanolic extract was dissolved in ethanol and votex mixed for 1 minutes and then centrifuged at 3000 rpm for 10 minutes. 1µL of the supernatant was injected into the GC and run for 30 minutes.

The volatile compounds in the sample were analyzed by Gas Chromatography Mass Spectrometer (GC/MS) on an Agilent 7890B Gas Chromatography (GC) directly coupled to the Mass Spectrometer system (MS) of an Agilent 5977A. The ion source was set at 230°C and the ionization voltage at 70 eV.

The GC oven temperature was programmed from 80°C, with an increase of 15°C/min, to 200°C, then 5°C/min to 280°C, ending with a 5 min isothermal at 280°C. The carrier gas helium was at a flow rate of 1 ml/min.

III. RESULT AND DISCUSSION

The present study was designed to know the phytochemical profile of ethanolic extract of *Khaya senegalensis* by GC-MS. The choice of the extracting solvent (ethanol) reflected how the local communities locally used its concoction in traditional treatment of aliment using the plant. The utilization of this plant for traditional medicine by the people also predicted that the plant have some bioactive ingredient which was supported by the research of [7] and [5] claim that extract from this plant is used for the treatment of bacterial and fungal infection. This was among reasons that motivated the research for the actual chemical content in the extract.

The chemical composition of ethanolic stem bark extract of *Khaya senegalensis* indicated the presence of alkanoid, flavonoids, tannins, terpenoids, steroids, saponins, carbohydrate as presented in Table 1 with an absent of glycoside in the ethanolic extract.

These classes of chemical compound were known to exert pharmacological effect [6] more especially on the vital organs of the body. The presence of flavonoids indicates that this plant has antioxidant and anti-inflamatory activities, and the alkaloid too can be applied in the treatment of some aliment.

The total ion chromatogram of the ethanolic extract of *Khaya senegalensis* by GC-MS showed nineteen distinct peaks with five as the major peaks (Figure 1). Peaks 2 and 1 showed the highest percentage. Each peak demonstrates a particular chemical compound. In Figure 2, the chromatogram of ethanolic extracts of the sample showed 14 distinct minor peaks. Peak 2 had the highest percentage followed by Peaks 14 and 12.

Table 2 present the major and minor GC-MS peaks report of ethanolic stem bark extracts of *Khaya senegalensis* in respect of their retention time, name of the compound, molecular formula, molecular weight and percentage peak area (availability) respectively.

The highest compound in the ethanolic stem bark extract identified was N, N- Dimethyloctylamine; with retention time of 10.25 minutes and percentage peak area of 49.80%, followed by Methylamine, N, N-dimethyl-; with retention time and percentage peak area of 9.208 minutes and 40.82% respectively. Least observed were 3-Hydroxy-2,5,5,8a-tetramethyl-3,4,4a,5,6,7,8,8a-octahdronaphthalene-1-carboxylic acid, methyl ester; with retention time and percentage peak area of 18.089 minutes and 0.02% respectively, followed by those with the same percentage availability of 0.05% Germacrene A, 9-(methylthio); wuth retention time of 17.734 minutes and 0.04%. next to them in availabilities are 4-chloro-3-n-hexyltetrahydropyran (12.962 minutes), Estran-3-one, 17-hydroxy-(5α, 17β); (16.326 minutes), i-propyl 9-hexadecanoate; (17.059 minutes). The molecular weight of the observed compounds ranged from low to high with carbon skeleton of between C_3 and C_{20} in both aromatic and aliphatic nature.

Table 1: Qualitative phytochemical screening of *Khaya senegalensis*

S/No	**Phytochemical Composition of *Khaya senegalensis***	**Inteference**
1	Tannins	+
2	Flavonoids	+
3	Terpenoids	+
4	Steroids	+
5	Saponins	+
6	Carbohydrates	+
7	Glycosides	-
8	Alkanoids	+

Key: +Present, -Absent.

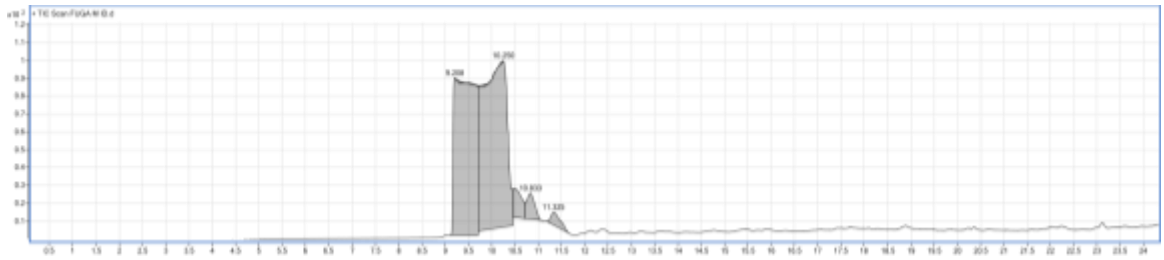


Fig 1: GC-MS Chromatogram of Major Peaks of Ethanolic Extract

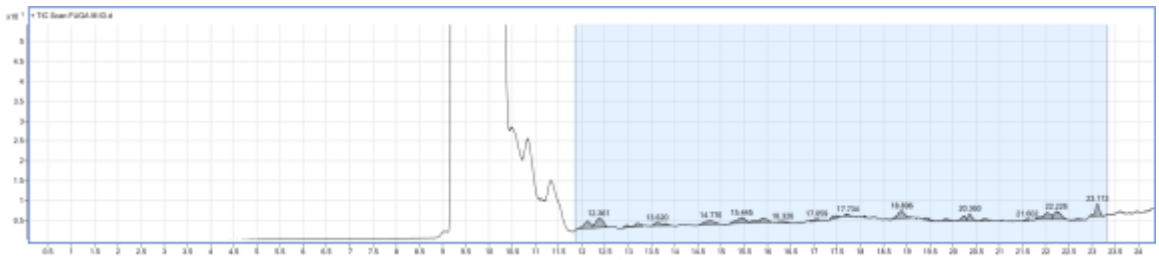
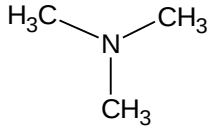


Fig 2: GC-MS Chromatogram of minor Peaks of Ethanolic Extract

Table 2: Major Peaks chemical composition of ethanolic extract of *Khaya senegalensis*as identified by GC-MS

S/N	Retention Time	Name of Compound	Molecular Formula	Molecular Weight	Peak Area (%)
1.	9.208	Methylamine, N, N-dimethyl-	C_3H_9N	59	40.82
2.	10.250	N, N- Dimethyloctylamine	$C_{10}H_{23}N$	157	49.80
3.	10.484	1-Hexene, 3,4- dimethyl	C_8H_{16}	112	3.04
4.	10.833	1-nonanol	$C_9H_{20}N$	144	2.60
5.	11.325	Benzaldehyde, 3-benzyloxy-2-fluoro-4-methoxy	$C_{15}H_{13}FO_3$	260	1.53
6.	12.132	7-Tetradecene	$C_{14}H_{28}$	196	0.25
7.	12.361	Bicyclo[2.1.1] hexane-2-ol, 2-ethenyl	$C_8H_{12}O$	124	0.39
8.	12.962	4-chloro-3-n-hexyltetrahydropyran	$C_{11}H_{21}CIO$	204	0.05
9.	13.214	5-ethyl-5-methyl-2-phenyl-2-oxazoline	$C_{12}H_{15}NO$	189	0.10
10.	13.620	Cis 5, 8, 11, 14, 17-Eicosapentaenoic acid	$C_{20}H_{30}O_2$	302	0.15
11.	14.776	2,4′-Dihydroxydiphenylsulphone	$C_{12}H_{10}O_4S$	250	0.22
12.	15.445	Phenylphosphonous acid	$C_6H_7O_2P$	142	0.26
13.	15.909	3-Hydroxy-2,5,5,8a-tetramethyl-3,4,4a,5,6,7,8,8a-octahdronaphthalene-1-carboxylic acid, methyl ester	$C_{16}H_{26}O_3$	266	0.23
14.	16.326	Estran-3-one, 17-hydroxy-(5α, 17β)	$C_{18}H_{28}O_2$	276	0.05
15.	17.059	i-propyl 9-hexadecanoate	$C_{19}H_{36}O_2$	296	0.05
S/N	Retention Time	Name of Compound	Molecular Formula	Molecular Weight	Peak Area (%)
16.	17.425	Octahydro-benzo[b]furan,2cyclohexylimino 7a-methyl	$C_{15}H_{25}NO$	235	0.10
17.	17.734	Germacrene A, 9-(methylthio)-	$C_{16}H_{26}S$	250	0.04
18.	18.089	3-hydroxy-2,5,5,8a-tetramethyl-3,4,4a,5,6,7,8,8a-octahydronaphthalene-1-carboxylic acid, methyl ester	$C_{16}H_{26}O_3$	266	0.02
19.	18.896	5-[(2,4-Dinitrophenyl)-hydrazonomethyl]-dihydrofuran-2-one	$C_{11}H_{10}N_4O_6$	294	0.29

(1)



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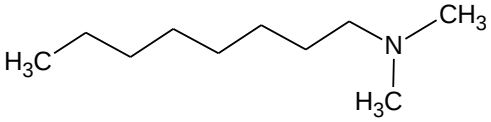

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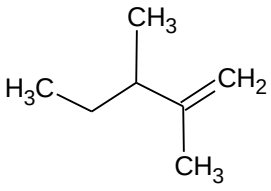

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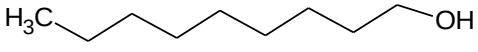

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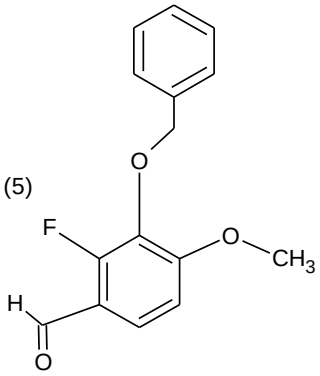

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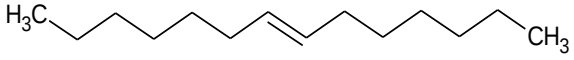

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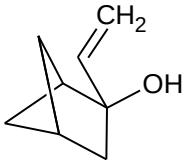

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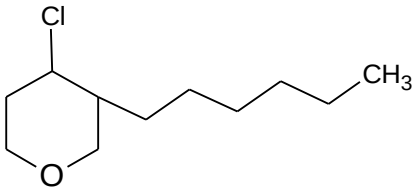

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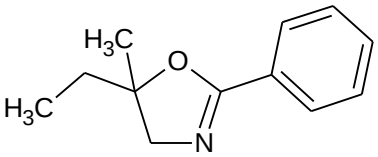

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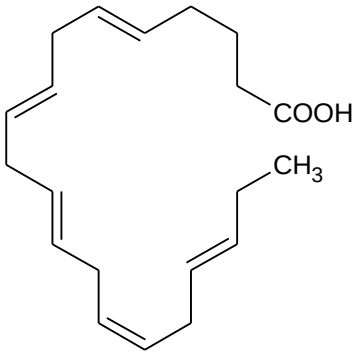

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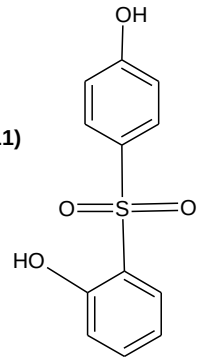

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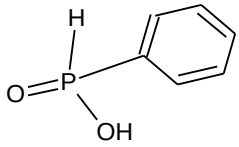

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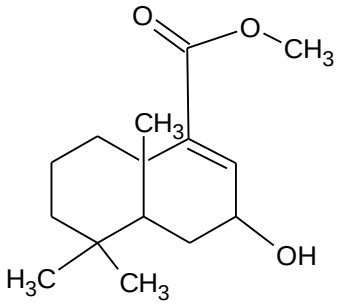

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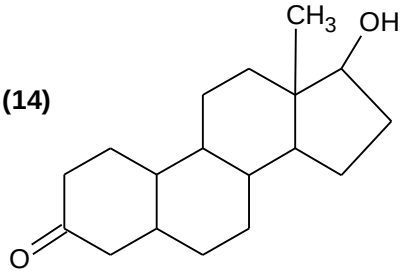

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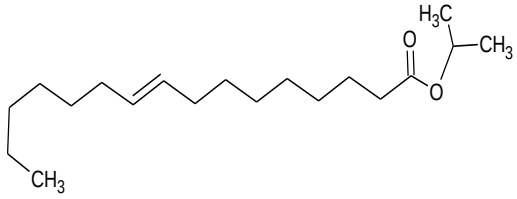

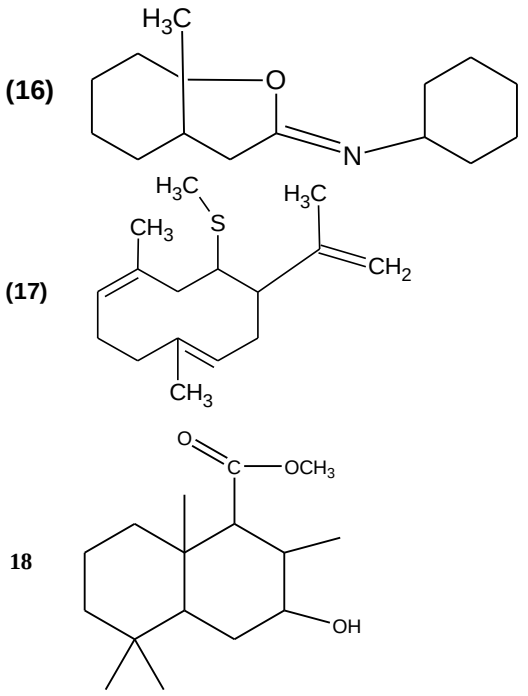

Figure 3.Chemical structures of compounds from *Khaya senegalensis* as identified by GC-MS.

IV. CONCLUSION

The result revealed good number of bioactive secondary metabolites more especially Estran-3-one, 17-hydroxy-(5α, 17β) that is keto-enolic tautomeric hydrogenated estradiol, and this is use to treat symptoms in and around the vigina as widely reported by WebMD. The phytochemical compounds identified by GC-MS are responsible for medicinal and physiological activities of the plant.

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REFERENCES

[1]. Abalaka, M. E., Daniyan, S. Y., Akpor, O. B. and Inyinbor, A. A. (2016). Antimicrobial, *In-vitro* Free Radical Scavenging, Antioxidant Properties of Leaf, Bark and Root Extracts from *Khaya senegalensis*. *J.Microbio. Res.* 1(1):54.

[2]. Makut M. D., Gyar S. D., Pennap G. R. I., Anthony P (2007).Phytochemical screening and antimicrobial activity of the ethanolic and methanolic extracts of the leaf and bark of *Khaya senegalensis.African Journal of Biotechnology* 7(9):1216-1219.

[3]. Aliyu B. S. (2006). *Common ethnomedicinal plants of the Semarids Region of West Africa, their description and phytochemicals.* Triumph Publishing Company Limited Kano, Nigeria. pp. 199-200.

[4]. Abdelgaleil S.A., Iwagawa T., Doe M., Nakatani M. (2004). Antifungal limonoids from the fruit of *Khaya senegalensis. Fitoterapia* 77: 566-572.

[5]. Abuzeid N., Kalsum S., Koshy R.J., Larsson M., Glader M., Andersson H. (2014).Antimicrobacterial activity of selected medicinal plants traditionally used in sudan to treat infectiousdiseases. *J. Ethno pharmacology.*157(0):134-139

[6]. Idris M. (2014). Phytochemical Screening and Some Pharmacological Studies of Leaf Extract of *TerminaliaavicennioidesGuilland Pers(Combretaceae).* M. Sc. Dissertation submitted to University of Maiduguri. Pp.100.