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Bio-activity and Spectral Analysis of Gas Chromatography/Mass Spectroscopy (GCMS) Profile of Crude Spomdias mombin Extracts

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Abstract

The purpose of this research work is to determine the biological activity and spectral analysis of Gas chromatography/mass Spectroscopy **(**GC-MS) profile of crude extract of *S monbin,S.mombin L.* (Anacardiacaea) is a plant that grows in almost every part of the world. It is fruitferious decidous plant of about 20m high that grows in the rain forest of Africa. *Smombin* parts were harvested early in the morning into a polythene bag. *S.mombin* plant (1kg) each of the different plant parts was extracted with 3 L of 70% (v/v) ethanol and ethyl acetate for 72 h at room temperature. GC-MS analysis of Ethanolic and ethyl acetate extracts of *S.mombin* plant was performed on a GC clarus 500 Perkin Elmer system comprising a AOC-20i auto sampler and gas chromatograph interfaced to a mass spectrometer instrument and Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 40 to 550 Da. Ethyl acetate leaf extract of *Spomdias mombin* contained five (5) compounds, Ethanolic Stem bark extract contained three (3) compounds, Ethyl acetate root **extract** contained seven (7)compounds, Ethanolicroot extract of *Spomdias mombin* contained seven (7) compounds and Ethyl acetate stem bark extract of *Spomdias mombin* contained fifteen (15)compounds respectively. In this study with GC-MS analysis, thirty nine (39) compounds were elucidated in the crude extracts of *Spomdias mombin*, all compoiund were used for different antimicrobial pharmacological properties. The highest number of compounds fifteen (15) was identified in the crude ethyl acetate stem bark of *Spomdias mombin*

Keywords

Bio-activity; Spectral Analysis; Gas Chromatography; Mass Spectroscopy

Introduction

Spomdias mombin L. (Anacardiacaea) also known as hog plum it is a plant that grows in almost every part of the world. It is fruitferious deciduous tree of about 20m high and it grows in the rain forest and the coastal area of Africa. It is known locally as " iyeye" and "iyawe" by the Yoruba and Hausa people of Nigeria [1]. The trees are used for fencing and in the construction of yam storage barns. Ripped fruits are eaten out of hand by the old and young and it can be processed into ice-cream, cool beverages,

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wine, jam. *Spomdias mombin* also found application in folk medicine.

Tradomedicine practitioners across Africa use all parts of the plant for medicinal purposes. The fruits decoction is drunk as a diuretic and febrifuge, while the decoction of the stem bark and leaves are used as an emetic, anti-diarrhea and dysentery.*Spomdias mombin* is agood recipe for the treatment of haemorrhoids as well as for gonorrhea and leucorrhea [2]. Infusion of its leaves has been used for a long time, without any report of collateral damaging effect on organs like kidney and liver due to its anti- vitrotic activity against the herpes virus.

A tea of the flowers and the leaves of *Spomdias mombin*is taken to relieve stomach ache biliousness, urethritis, cystitis and eye and throat inflammation. Herbalist in South West Nigeria use the plant in the treatment of typhoid, tuberculosis, diabetics, nervous disorders and psychiatric disorders [3]. The extract of the fresh crushed leaves and the powder of the dried leaves are used for healing wounds, inflammation, varicose ulcers, frost- bite and burn in herbal medicine [4].

The gum of *Spomdias mombin* is used as expectorant and to expel tapeworm [5,6,7] reported the abortifacient activity of the aqueous leaf extract of *Spondiamombin*, and the anthelmintic,molluscicidal, anxiolytic, anti-bacteria, antiviral effect of the plant.

2.0 Material and Methods

2.1 Collection of Plant Materials

Spomdias mombin parts were harvested early in the morning into a polythene bag at Oja Oba market, IkareAkoko, Ondo State, a tropical rainforest of Ondo State, Nigeria with latitude (7.21692 North) and longitude (5.21561 East). The plantparts were authenticated at the herbarium of the Department of Pharmaceutical chemistry, ObafemiAwolowoUniversity, Ile -Ife, Osun State, Nigeria and voucher was deposited. A voucher number was issue at the herbarium for proper documentation (DPC-SPM 0340).

2.2 Preparation and Extraction of *Spomdias mombin* Plant

The root, leaf and **s**tem-bark of *Spomdias mombin* plant were harvested and air-dried. The dried part**s**were milled into powdered form using manual grinder. Powdered plant material (1kg) each of the different plant parts was extracted with 3 L of 70% (v/v) ethanol and ethyl acetate for 72 h at room temperature. The extraction process was repeated four times until the extract became clear. The filtrates were combined and concentrated under reduced pressure Rotatory Evaporator at 35°C.

2.3.Gas chromatography and mass Spectroscopy (GC-MS)

GC-MS analysis of ethanolic and ethyl acetate extract of root, leaf and **s**tem-bark of *Spomdias mombin* plant was performed on a GC clarus 500 Perkin Elmer system comprising a AOC-20i auto sampler and gas chromatograph interfaced to a mass spectrometer instrument employing the following conditions: column Elite-1 fused silica capillary column (30 × 0.25 mm ID ×1EM df, composed of 100% Dimethyl poly siloxane), operating in electron impact mode at 70 eV; helium (99.999%) was used as carrier gas at a constant flow of 1ml/min and an injection volume of 0.5 EI was employed (split ratio of 10:1) injector temperature 250 °C; ion-source temperature 280 °C. The oven temperature was programmed from 110 °C (isothermal for 2 min), with an increase of 10 °C/min, to 200 °C/min, then 5 °C/min to 280 °C/min, ending with a 9 min isothermal at 280 °C. Mass spectra were taken at 70 eV; a scan interval of 0.5 s and fragments from 40 to 550 Da. 1H NMR and GC-MS analysis was carried out in Sophisticated Analytical Instrumentation facility (SAIF), Panjab University Chandigarh, India.

3.0 Result

3.1 Structural Profiling of Crude *Spomdias mombin* Spectrometric(GC/MS) Method of Identification

4.0 Discussion

The purpose of this research work is to determine the biological activity, importance and spectral analysis of Gas chromatography/mass Spectroscopy(GC-MS) profile of crude extracts of *Spomdias mombin.* The spectral analysis of GCMS Profile of crude ethyl acetate leaf extract of *Spomdias mombin extracts* (Table 1) revealed variouscompounds including Cyclo pentanecarboxylic acid, 2-oxo-, ethyl ester, also known as 2-furose acid. [8] Koig reported that 2-furose acidas a good preservative, exhibiting bactericide and fungicideas their mode of action.2-Thiophene carboxylic acid, 2-ethyl cyclohexyl ester,were recorded in table 1. 2-Thiophene carboxylic acid, 2-ethyl cyclohexyl esterwere reported by [8] that both compounds has the ability to induced both spontaneous restoration of bone [8]. [9, 10] reported that Undecanoic acid, 2-methyl-, methyl ester were used

Table 1: Spectral Analysis of GCMS Profile of Crude Ethyl Acetate Leaf Extract of Spomdias mombin

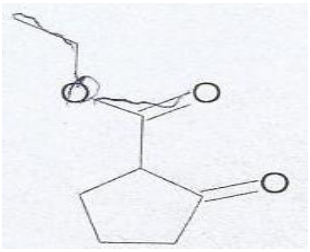
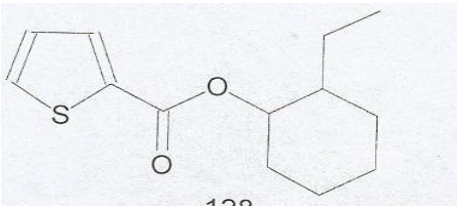
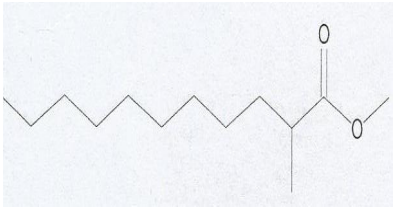
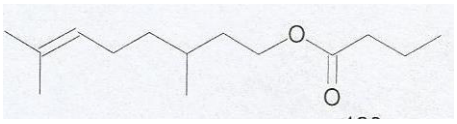
Name of Compound	Molecular Weight (Dalton)	Structural Formula	Non-Polar Retention Index (Iu)	Structural Profiling
1) Cyclopentanecarboxylic acid, 2-oxo-, ethyl ester	156	$C_8H_{12}O_3$	1198	
2) 2-Thiophenecarboxylic acid, 2-ethylcyclohexyl ester	238	$C_{13}H_{18}O_2S$	1782	
3) Undecanoic acid, 2-methyl-, methyl ester	214	$C_{13}H_{26}O_2$		
4) Citronellyl butyrate	226	$C_{14}H_{26}O_2$	1501	

Table 2: Spectral Analysis of GCMS Profile of Crude Ethanolic Stem Bark Extract of Spomdias mombin

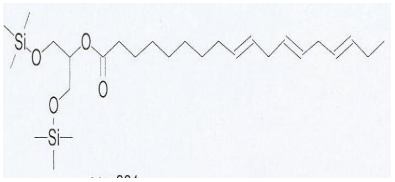
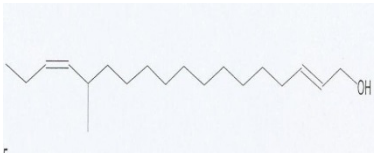
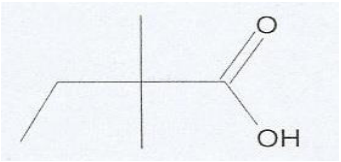
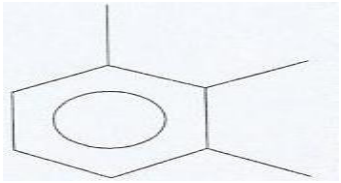
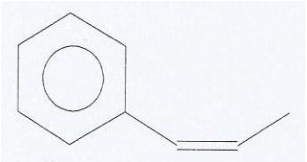
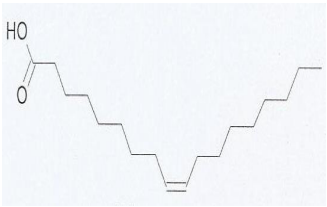
Name of Compound	Molecular Weight	Structural Formula	Non-Polar Retention Index (Iu)	Structural Profiling
1) 9,12,1 5-Octadecatrienoic acid 2-[(trimethylsilyl)oxy]-1 -[[(trimethylsilyl)oxy]methyl] ethyl ester, (Z,Z,Z)	496	$C_{27}H_{52}O_4Si_2$	2804	
2) 12-Methyl-E, E-2, 1 3-octadecadien-1 –ol	280	$C_{19}H_{36}O$	2104	
3) Butanoic acid, 2,2-dimethyl	116	$C_6H_{12}O_2$	: 890	

Table 3: Spectral Analysis of GCMS Profile of Crude Ethyl Acetate Root Extract of Spomdias mombin

Name of Compound	Molecular Weight	Structural Formula	Non-Polar Retention (Iu)	Structural Profiling
1) Benzene, 1 ,2,3-trimethyl	120	C_9H_{12}	1020	
2) (Z)-1-Phenylpropene	118	C_9H_{10}	973	
3) Oleic Acid	282	$C_{18}H_{34}O_2$	2175	

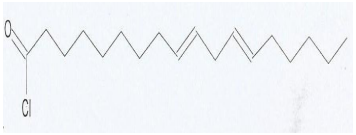
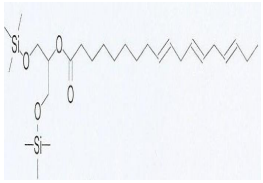
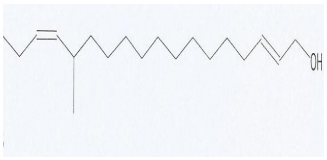
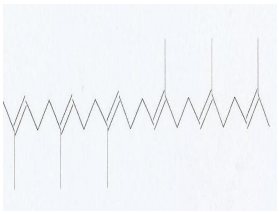
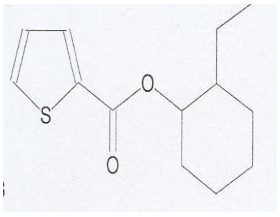
Name of Compound	Molecular Weight	Structural Formula	Non-Polar Retention (Iu)	Structural Profiling
4) 9,12-Octadecadienoyl chloride, (Z,Z)	298	$C_{18}H_{31}ClO$	2139	
5) 9,12,1 5-Octadecatrienoic acid, 2-[(trimehylsilyl) oxy]-1 -[[(trimethylsilyl)oxy] methyl]ethyl ester, (Z,Z,Z)	496	$C_{27}H_{52}O_4Si_2$	2804	
6) 12-Methyl-E,E-2,13-octadecadien-1-ol	280	$C_{19}H_{36}O$	2104	
7) Squalene	410	$C_{30}H_{50}$	2847	

Table 4: Spectral Analysis of GCMS Profile of Crude Ethanolic Root Extract of Spomdias mombin

Name of Compound	Molecular Weight	Structural Formula	Non-Polar Retention Index (Iu)	Structural Profiling
1) 2-Thiophenecarboxylic acid 2-ethylcyclohexyl ester	238	$C_{13}H_{18}O_2S$	1782	
2) 1,10-Decanediol	174.	$C_{10}H_{22}O_2$	1501	

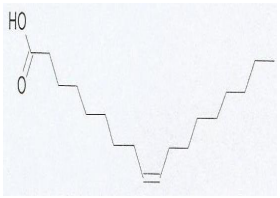
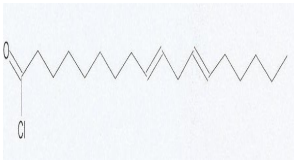
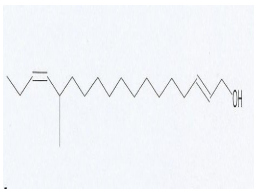
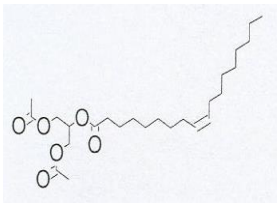
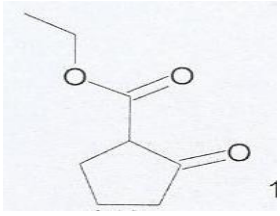
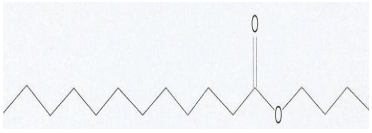
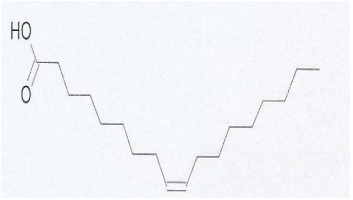
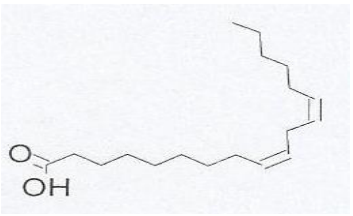
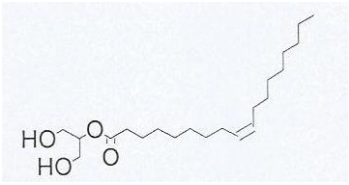
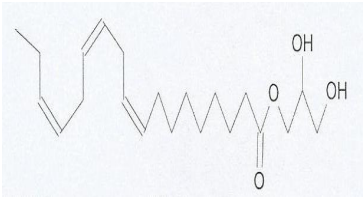
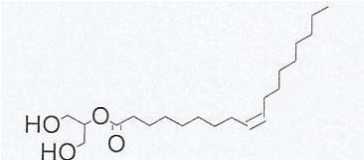
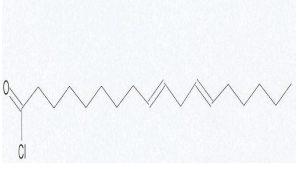
Name of Compound	Molecular Weight	Structural Formula	Non-Polar Retention Index (Iu)	Structural Profiling
3) Oleic Acid	282	$C_{15}H_{34}O_2$	2175	
4) 9,12-Octadecadienoic acid (Z,Z)	280	$C_{18}H_{32}O_2$	2183	
5) 12-Methyl-E, E-2, 1 3-octadecadien-1 –ol	280	$C_{19}H_{36}O$	2104	
6) 9-Octadecenoic acid (Z)-, 2-(acetyloxy)-1-[(acetyloxy) methyl]ethyl ester	440	$C_{25}H_{44}O_6$	2952	
7) Cyclopentanecarboxylic acid, 2-oxo-, ethyl ester	156	$C_8H_{12}O_3$	1198	

Table 5: Spectral Analysis of GCMS Profile of Crude Ethyl Acetate Stem Bark Extract of Spomdias mombin

Name of Compound	Molecular Weight	Structural Formula	Non-Polar Retention Index (Iu)	Structural Profiling
1) N-Butyl Laurate	256	$C_{16}H_{32}O_2$	1779	
2) Oleic Acid	282	$C_{18}H_{34}O_2$	2175	
3) 9,1 2-Octadecadienoi c Acid (Z,Z)	280	$C_{18}H_{32}O_2$	2183	
4) 9-Octadecenoic Acid (Z)-, 2-Hydroxy-1 -(Hydroxymethyl) Ethyl Ester	356	$C_{21}H_{40}O_4$	2705	
5) 9,12,1 5-Octadecatrienoic Acid, 2,3-Dihydroxypropyl Ester, (Z,Z,Z)	352	$C_{21}H_{36}O_4$	2705	
6) 9-Octadecenoic Acid (Z)-, 2-Hydroxy-1 -(Hydroxymethyl) Ethyl Ester	356	$C_{21}H_{40}O_4$	2705	
7) 9,12-OctadecadecadienoylChlorine, (Z.Z)	345	$C_{18}H_{31}C_{10}$	2139	

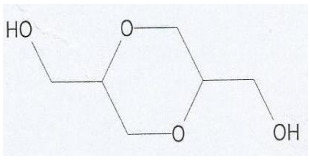
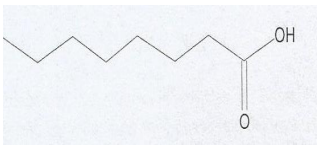
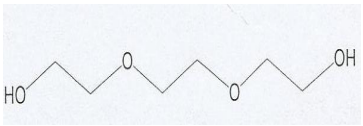
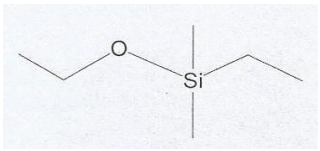
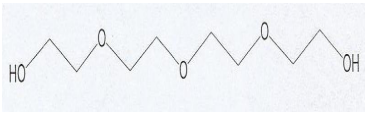
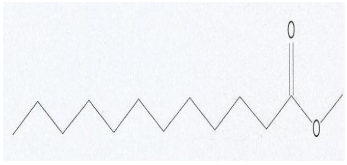
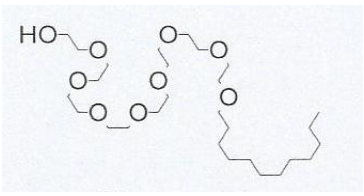
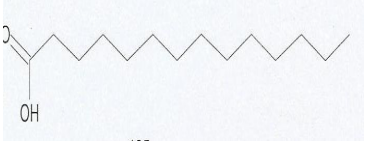
Name of Compound	Molecular Weight	Structural Formula	Non-Polar Retention Index (Iu)	Structural Profiling
8) P-Dioxane-2,5-Dimethanol	148	$C_6H_{12}O_4$	1305	
9) Octanoic Acid	144	$C_8h_{16}o_2$	1173	
10) Triethylene Glycol	150	$C_6h_{14}o_4$	1255	
11) Ethyl(Dimethyl)Ethoxysilane	132	$C_5h_{15}osi$	604	
12) Tetraethylene Glycol	194	$C_8h_{18}o_5$	1530	
13) Dodecanoic Acid, Methyl Ester	214	$C_{13}h_{26}o_2$	1481	
14) Octaethylene Glycol Monododecyl Ether	538	$C_{28}h_{58}o_9$	3654	
15) Tetradecanoic Acid	228	$C_{14}h_{28}o_2$	1769	

Figure 1: Spectral Analysis of GCMS Profile of Crude Ethyl Acetate Leaf Extract of Spomdias mombin

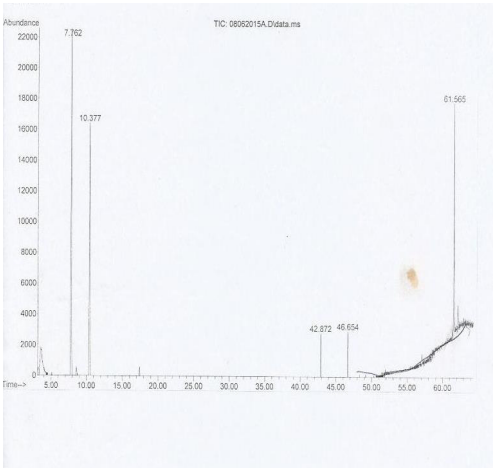


Figure 2: Spectral Analysis of GCMS Profile of Crude Ethanolic Stem bark Extract of Spomdias mombin

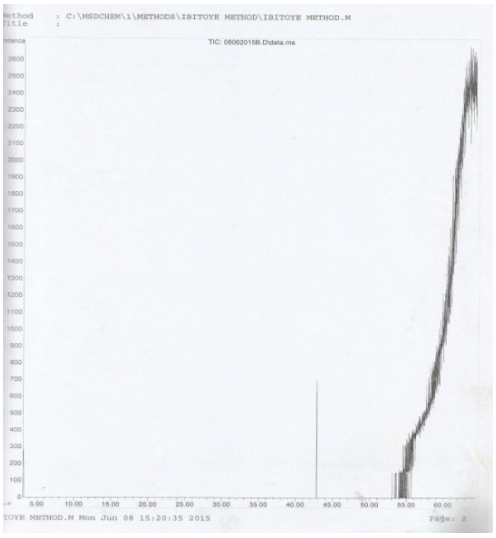


Figure 3: Spectral Analysis of GCMS Profile of Crudeethyl Acetate Root Extract of Spomdias mombin

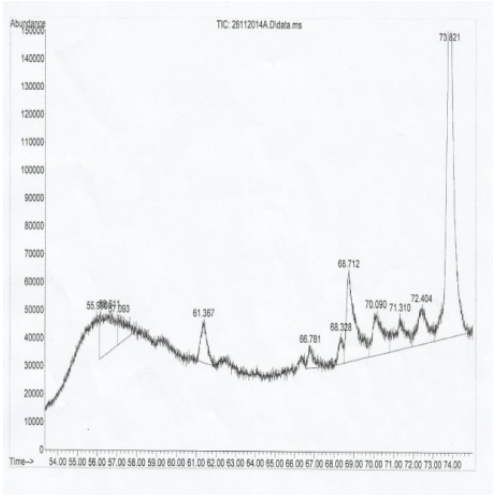


Figure 4: Spectral Analysis of GCMS Profile of Crude Ethyl acetate Root Extract of Spomdias mombin

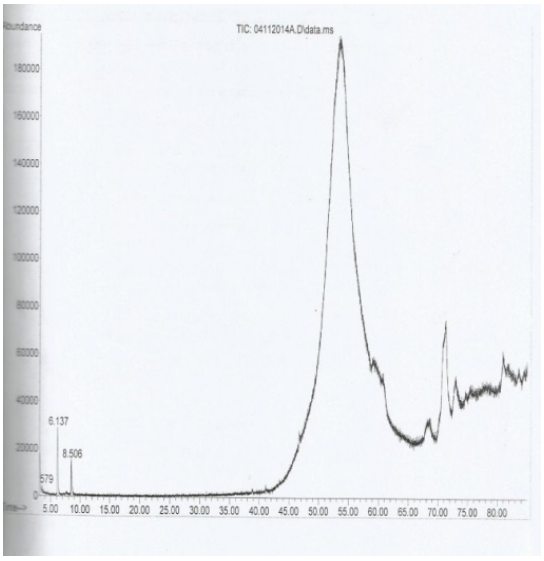
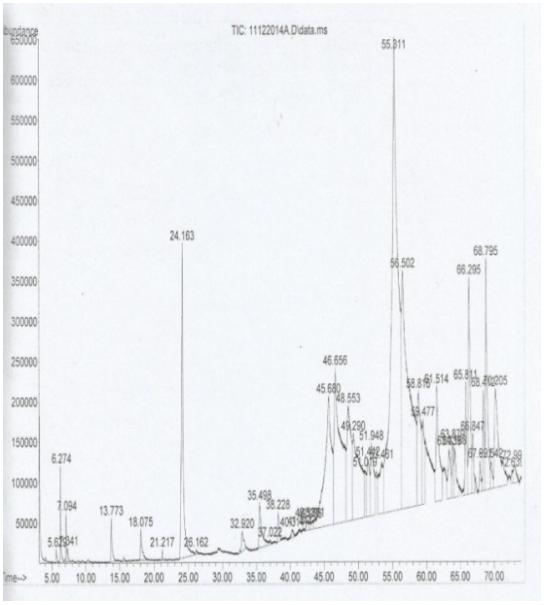


Figure 5: Spectral Analysis of GCMS Profile of Crude Ethyl Acetate Stem Bark Extract of Spomdias mombin



as antifungal agent, to treat ringworm and athlete's foot, and Citronellybutyrate were used as a good flavouring ingredient and cell signalling agent**,** this aresome the compound found in the *Spomdias mombin* leaf extract

Structural identification of crude ethanolic stem bark extract of *Spomdias mombin* (Table 2) revealed the presence of 9,12,1 5-Octadecatrienoic acid 2-[(trimethylsilyl)oxy]-1 -[[(trimethylsilyl) oxy] methyl] ethyl ester, (Z,Z,Z). Behal and Bahal,2005reported that B Docoseamide is used as antistatic agent, 12-Methyl-E, E-2, 13-octadecadien-1–ol and Butanoic acid.2,2-dimethyl are used as the major component of defensive secretion in human secretory system [11]**.**

Structural identification of crude ethyl acetate root extract of *Spomdias mombin* (Table 3) revealed the presence of Benzene-1,2,3-trimethyl and (Z)-1-Phenylpropene. Olar*et al*., 2005reported that Benzene-1,2,3-trimethyl and (Z)-1-Phenylpropene help to reduce oxidative stoke in the cell and selective inhibition of PABA & folic acid. Oleic acid is another important product of crude ethyl acetate root extract of *Spomdias mombin* which has been reported as a good diabetes control and other infectious diseases

(Pala *et al*., 2001). Other compounds found in the crude ethyl acetate root extract of *Spomdias mombin* include 9,12-Octadecadienoyl chloride, (Z,Z) and 12-Methyl-E,E-2,13-octadecadien-1-ol. Pan *et al*., 2012 reported that, some specific evidences that 9,12-Octadecadienoyl chloride, (Z,Z) and 12-Methyl-E,E-2,13-octadecadien-1-ol(ALA) consumption might have a slight preventative effect against cardiovascular diseases.

Squalene is another important compound identified in the crude ethyl acetate root extract of *Spomdias mombin*. [12] Kalvodona reported that squalene is not very susceptible to peroxidation and appears to function in the skin as a quencher of sunlight, singlet oxygen, protecting human skin surface from lipid peroxidation due to exposure to UV and other sources of ionizing radiation Other compounds elucidated from the crude ethanolic root extract of *Spomdias mombin*(table 4)include Cyclopentanecarboxylic acid, 2-oxo-, ethyl ester and 2-Thiophene carboxylic acid, 2-ethylcyclohexyl ester (Table 3). Sanchez and Sobarza,2015 reported that2-Thiophene carboxylic acid has been reported in the synthesis of unsaturated ketones which serve as the antiviral and cytotoxic agent, and as an intermediate to manufacture pharmaceuticals and aromatic compounds and 1,10-Decanediol which has anticonvulsant effects in the human system [13].

The structural identification of crude ethyl acetate stem bark extract of *Spomdias mombin* (Table 5) revealed the presence of 9-Octadecenoic acid (Z)-, 2-(acetyloxy)-1-[(acetyloxy) methyl] ethyl ester ,9,1 2-Octadec adienoic acid (Z,Z),Octanoic acid. [14] Clegg reported thatcaprylic acid can be used as an algaecide, bactericide and fungicide in nurseries, green house, garden centers and interiors scapies on ornamentals.

[15] La Storia reported thatTriethylene-glycolas a good antimicrobial agent and the antimicrobial activity of Triethylene-glycol against airborne solution suspension and surface bound microbes (*Streptococcus pneumoniae*type 1, *Streptococcus pyogenes* (Beta haemolytic*Streptococcus* group A) and *Influenza* A virus in the air) has been reported**.**

Conclusion

Spectroscopic techniques have become a powerful analytical tool for the qualitative and quantitative analysis of biological materials.In this study with GC-MS analysis 36compounds were detected in the *Spomdias mombin*extract,all are used for different pharmacological properties. The highest number of compounds fifteen (15) was identified in the crude ethyl acetate stem bark of*Spomdias mombin.*

5.0. Acknowledgements

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