GC-MS analysis of *SpondiasCytherea fruits and leaves*

ABSTRACT

The chemical composition of the fruit *Spondiascytherea* using GC-MS analysis showed the presence of the following compounds in their various portions; 2,2-dichloro acetate nonyl (3.13%), n-hexadecan-1-ol (4.43%), 6-octadecanoic acid (15.93%), n-octaddecanoic (10.44%), L-(+)- ascorbic acid, 2,6-dihexadecanoate (17.49%), 1-ethyl-1-cyclohexanol (5.22%), nonadec-1-ene (4.17%), 1-heptadecene (5.22%), hexanoic acid (2.61%), 6-methyl-1-heptanol (3.13%), 5 hydroxymethylfuran-2-carbaldehyde (4.17%), 1,1,3-trimethylcyclopentane (1.31%), 2(5H)-furanone (9.14%), 3-furaldehyde (3.65%), methyl 2-oxopropanoate (2.61%), 2-methyl but-enal (2.06%) and 2H-pyran-2yl-3-benzoyloxy-3,6-dihydro-6-methoxy, methyl benzoate (5.22%). The chemical composition of leaves comprises of 2-oxo-2-phenlethane-1,1, diyldiacetate (5.08%), 1,1,3-trimethylcyclopentane (1.52%), 6-methyl/heptan-1-ol (2.53%), 9-octadecene (3.55%), (E)-lcos-9-ene (3.05%), 2-methylhexadecanoic acid (10.15%), L-(+)-ascorbic aci, 2,6-dihexadecanoate (15.22%), (E)-2-methyl octadec-7-enoic acid (34.01%), (E)-octadec-6-enoic acaid (15.22%), 2-(dodecan-2-yl) cyclohexanone (0.36%), 2,3,4-trimethyl dodecan-5-yl-cydopentane (.036%) and 15-methylhexanoic acid (2.53%). These compounds may be responsible for the antioxidant properties exhibited by this plant.

Keywords: Chemical composition, Antioxidant,n-hexadecan-1-ol

Introduction

Spondiascytherea is a medicinal plant which is widely used as food for the intestine. It is used in phytomedicine to cure various diseases such as diarrhea, constipation, female tract infection, wounds, burns, rashes, cuts, colds, sore throats, eye and ear infections. It is laxative that protects the intestine. The numerous therapeutic properties have been attributed to the presence of phytochemicals available in the plant (Akpabio *et al*., 2012a). Phytochemicals constitute one of the most numerous and widely distributed groups of compounds available in plants (Akpabio *et al*., 2012b; Akpakpan*et al*., 2017). Plants produce chemicals, known as secondary metabolites, which are not directly involved in the process of growth but act as deterrents to bacteria, virus, fungal and microbial attack (Okwu, 2001; Akpakpan*et al*., 2020).

Spondiascytherea is a pleasant tasting acidic fruit and has a pineapple – mango flavor and crunchy texture. The part nearer to the peel is quite sour getting sweeter near the seed. The ripe fruit is also much sweeter than the less mature green fruit. The fruit is eaten fresh. It is used in making delicious jelly, pickles, relishes, soups and stews. The fruits yield a delicious jelly, pickles, relishes, soups and stews. The fruits yield a delicious juice, which can be made into drinks and sherbets or mixed with other topical fruit juices to enhance flavor, aroma and taste.

MATERIALS AND METHODS:

The experiment was carried out in the department of chemistry, Michael Okpara University of Agriculture, Umudike, Nigeria.

SOURCE OF MATERIAL

The fruit and leaves of exotic plum (*Spondiascytherea*) were harvested from the main campus of Michael Okpara University of Agriculture, Umudike, Nigeria. The plum species was identified and authenticated by Dr. A. Nneregini of Taxonomy section, Forestry Department, Michael Okpara Unversity of Agriculture Umudike, Nigeria.

PREPARATION OF PLANT EXTRACTS

The epicarps of the exotic plum was peeled off. The leaves and peels were air dried for 15 days and then ground into powder using moulinexnut grinder machine. The powdered materials were stored in airtight bottles for chemical analysis.

GC-MS ANALYSIS

GC-MS analysis of the acetylated total extract was conducted using GCMS-QP2010 PLUS, SHIMADZU, Japan series. The extract was obtained by dissolving 2g of sample in acetone. The injection temperature and detector temperature were fixed at 250^{o}C. Helium was used as the carrier gas at a flow rate 6.2ml/min. The oven temperature was programmed at 60^{o}C (held for 1min), from 60 to 100^{o}C at 10^{o}C/min and from 100 to 300^{o}C at 5^{o}C/min (held for 35mins). Injection was made in split less mode. Component identification was accomplished by comparison of mass spectra and gas chromatographic retention times of the extracted materials to that of known standards which were available in the reference library.

3.0 RESULTS AND DISCUSSION

GC-MS analysis of *Spondiascytherea*fruit

Table 1: Percentage content of compounds in *Spondiascytherea* fruits

Peaks	Height (cm)	Percentage content
1	1.15	3.13
2	1.65	4.43
3	5.85	15.93
4	3.83	10.44
5	6.42	17.49
6	1.92	5.22
7	1.53	4.17
8	1.92	5.22
9	0.96	2.61
10	1.15	3.13
11	1.53	4.17
12	0.48	1.31
13	3.35	9.14
14	1.34	3.65
15	0.96	2.61
16	0.76	2.06
17	1.92	5.22

Table 2: GC-MS analysis of the various fractions from the fruit of *Spondiascytherea*

Peak	Compound name	Molecular formula	Molecular weight (g/mol)	Retention time (Mins)	Percentage content	Fragment peaks (m/z) and % Abundance
1	2,2-Dichloro acetate nonyl	$C_{11}H_{20}Cl_2O_2$	254	31.917	3.13	26(20%), 41(50%), 55(70%), 69(90%), 70(60%), 98(100%), 207(10%), 281(10%)
2	n-Hexadecan-1-ol	$C_{16}H_{34}O$	242	30.642	4.43	39(10%), 41(60%), 55(100%), 69(60%), 83(90%), 97(70%), 111(40%)
3	6-Octodecanioc acid	$C_{18}H_{34}O_2$	282	29.467	15.93	27(20%), 41(90%), 55(100%), 69(70%), 83(70%), 97(50%), 98(40%), 114(20%), 264(4%), 282(10%)
4	n-Octadecanioc acid	$C_{18}H_{36}O_2$	284	29.575	10.44	27(10%), 41(60%), 43(90%), 69(70%), 73(100%), 85(50%), 98(40%), 115(30%), 129(60%), 185(30%), 284(40%)
5	L-(+)-ascorbic acid, 2,6-dihexadecanoate	$C_{38}H_{66}O_8$	652	28.283	17.49	27(10%), 41(4%), 43(90%), 57(90%), 73(100%), 85(60%), 98(40%), 115(30%), 129(60%), 185(30%), 284(40%)
6	1-ethyl-1-cyclohexanol	$C_8H_{12}O$	124	27.933	5.22	27(10%), 41(20%),

						55(20%), 68(60%), 81(100%), 95(60%) 109(40%), 123(20%)
7	1-nonadecene	$C_{19}H_{33}$	266	29.942	4.17	27(10%), 41(70%), 42(80%), 57(80%), 83(90%), 97(100%), 111(60%), 125(40%) 126(30%), 140(10%)
8	1-heptadecene	$C_{17}H_{34}$	238	25.067	5.22	(10%), 41(80%), 55(90%), 80(100%), 111(50%), 168(5%), 238(5%)
9	Hexanoic acid	$C_6H_{12}O_2$	116	24.192	2.61	27(40%), 41(50%), 43(30%), 60(100%), 73(60%), 87(10%0
10	6-methyl-1-heptanol	$C_8H_{18}O$	130	22.133	3.13	27(40%), 41(80%), 55(100%), 69(70%), 70(50%), 84(60%), 98(5%), 112(5%)
11	5-hydroxymethylfuran-2-carbaldehyde	$C_6H_6O_3$	126	18.325	4.17	29992050, 41(60%), 53(20%), 69(40%), 97(100%), 100(20%), 126(10%)
12	1,1,3 Trimetylcyclopentane	C_8H_{16}	112	16.633	1.31	27(30%), 41(80%), 55(100%), 83(50%), 97(50%), 112(10%)
13	2(5H)-Furanone	$C_4H_4O_2$	84	7.917	9.14	27(60%), 29(30%), 55(100%), 84(60%)
14	3-Furaldehyde	$C_5H_4O_2$	96	5.442	3.65	29(50%),

						67(100%), 96(60%)
15	Methyl 2-oxopropanoate	$C_4H_6O_3$	102	4.392	2.61	15(5%), 43(100%), 112(10%)
16	2-methyl but-2-enal	C_5H_8O	84	4.192	2.06	27(60%), 29(70%), 55(100%), 83(10%), 84(80%)
17	2H-pyran-2-yl 3-(benzoyloxy)-3, 6-dihydro-6-methoxy, methyl benzoate	$C_{21}H_{20}O_6$	38	3.533	5.22	40(5%), 44(10%), 77(60%), 15(100%), 105(100%), 122(5%), 204(5%)

Table 3: Percentage content of *Spondiascytherealeaves*

Peak	Height (cm)	Percentage content
1	0.98	5.08
2	0.29	1.52
3	0.49	2.53
4	0.68	3.55
5	0.59	3.05
6	1.95	10.15
7	2.92	15.22
8	6.53	34.01
9	2.92	15.22
10	0.07	0.36
11	0.07	0.36
12	0.49	2.53

Table4:GC-MS analysis of the various fractions from the leaves of *Spondiascytherea*

Peak	Compound name	Molecular formula	Molecular weight (g/mol)	Retention time (Mins)	Percentage content	Fragment peaks (m/z) and % Abundance
1	2-oxo-2-phenyl enthane-1,-1,-diyldiacetate	$C_{27}H_{22}O_8$	474	3.525	5.08	51(20%), 77(80%), 105(100%)
2	1,1,3-trimethyl-cyclopentane	C_8H_{16}	112	16.633	1.52	27(20%), 41(80%), 55(100%), 83(60%), 97(50%)
3	6-methylheptan-1-ol	$C_8H_{18}O$	130	22.133	2.53	27(20%), 41(80%), 55(100%), 83(80%),

						97(69%), 111(20%)
4	9-Octadecene	$C_{18}H_{36}$	252	25.067	3.55	27(10%), 41(80%), 55(100%), 83(80%), 97(69%), 111(20%)
5	(E)-lcos-9-ene	$C_{20}H_{40}$	280	26.942	3.05	27(10%), 41(80%), 55(100%), 83(80%), 97(69%), 111(20%), 125(10%), 207(10%)
6	2-methylhexadecanoic acid	$C_{17}H_{34}O_2$	270	27.975	10.15	27(10%), 41(20%), 57(20%), 74(100%), 87(60%), 143(10%)
7	L-(+)-ascorbic acid, 2,6-dihexadecanoate	$C_{38}H_{68}O_8$	652	28.275	15.22	27(10%), 41(60%), 43(80%), 57(100%), 73(100%), 85(40%), 98(20%), 115(10%), 120(40%), 13(20%), 239(20%), 36(20%), 143(10%), 57(20%), 171(20%), 256(10%)
8	(E)-2-methyl octadec-7-enoic acid	$C_{19}H_{36}O_2$	296	29.175	34.01	27(10%), 41(100%), 55(100%), 69(60%), 74(80%), 849(60%), 98(40%), 123(10%), 222(10%), 64(20%), 296(20%)
9	6-octadecanoic acid	$C_{18}H_{34}O_2$	282	29.467	15.22	27(109%), 1(100%), 55(100%), 69(60%), 83(60%), 97(50%), 114(10%), 37(10%), 264(20%)

10	2-(dodecan-2-yl)-cyclohexanone	$C_{18}H_{34}O$	266	30.375	0.36	41(20%), 55(60%), 69(10%), 83(10%), 98(100%), 207(10%)
11	2,3,4-trimethyldodecan-5-yl-cyclopentane	C_8H_{36}	252	30.642	0.36	43(90%), 69(80%), 83(110%), 97(60%), 207(10%)
12	15-methylhexanoic acid	$C_8H_{36}O_2$	284	33.383	2.53	43(40%), 57(10%), 74(100%), 87(60%), 281(10%)

Gas chromatography (GC) mass spectrophotometry (MS) allows for identification and quantification of relevant secondary metabolites. GC-MS permits the combination of powerful separation techniques with sophisticated structural elucidation devices (Udo *et al*., 2020; Christopher *et al*., 2022)

The *Spondiascytherea* fruits was analysed by GC-MS. Figure 1 shows a chromatogram of *Spondiascytherea* fruit. Seventeen peaks were observed representing 17 compounds in the fruits. the percentage content of the components in *Spondiascytherea* fruit is also listed in Table 1.

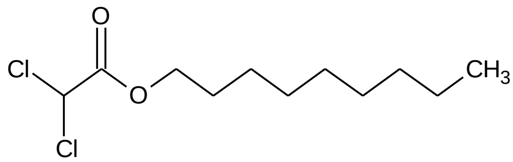
The major compound in *Spondiascytherea* fruit is L-(+)-ascorbic acid 2,6-dihexadecanoate (17.49%). Ascorbic acid acts as an antioxidant in the skin by scavenging and quenching free radical generated by ultra violet radiation stabilization (Okwu, 2008). It is required for connective metabolism especially the scar tissue, bones, and teeth. It is necessary as an anti-stress and protector against cold, chills and damp (Okwu, 2006). Ascorbic acid in the body aids in iron absorption from the intestine. It prevents muscle fatigue and scurvy that is characterized by skin hemorrhages, bleeding gums, fragile bones, anemia and pains in joints and defect in skeletal calcification. It also accounts for normal wound healing.

Other major compounds in the fruits include terpenes. These include 1,1,3-trimethylcyclopentane (1.31%), 1-nonadecene (4.17%) and 1-heptadecene (5.22%). Terpenes are large and varied class of organic compounds produced primarily by a wide variety of plants particularly conifers though also by some insects such as termites or swallow tail butterflies which emit terpenes from their osmetenum (Oliver, 1986). They are the major components of resin and of turpentine produced from resin.

In addition to their roles as and products in many organisms, terpenes are biosynthetic blocks within nearly every living creature. Terpenes and terpeniods are the primary constituents of the essential oils of many plants and flowers. Essential oils are used widely as natural flavor additives for food, as fragrances in perfumery and in traditional and alternative medicines such as aroma therapy (Oliver, 1986).

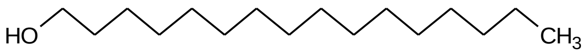
The present of terpenes is responsible for the sedative and antispasmodic property of this plant. Their use is recommended for those people who are suffering from nervousness in somia, palpitations, migraine or asthma. It is also commonly used in the treatment of acute or chronic bronchitis and related conditions (Okwu, 2008).

Esters identified in the fruit include nonyl, 2,2-dichloracetate., 2H-pyran-2-yl, 3-(benzoyloxy)-3, 6-dihydro-6-methoxy, methyl benzoate (5.22%), and methyl, 2-oxopropanoate (2.61%). The fatty acid composition of the fruit includes 6-octadecanoic acid (15.93%), n-octadecanoic acid (10.44%) and hexanoic acid (2.6%) are the fatty acid component of the fruit. Fatty acids provided either by in gestion by drawing on triglycerides stored in fatty tissues are distributed to cells to serve as fuel for muscular contraction and metabolism. They are consumed by mitochondria to produce ATP through beta oxidation (David, 2006). Alcohols identified include n-hexadecan-1-ol (4.43%), 1-ethyl-1-cyclohexanol (5.22%) and 6 methyl-1-heptanol (3.13%). The aldehydes identified include 5-hydroxymethyl furan-2-carbaldehyde (4.17%), 3-furaldehyde (3.65%) and 2-methylbut-2-enal (2.06%). 2(5H) furanone (9.14%) is the ketone compound in the fruit.



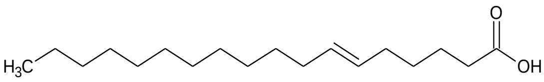
nonyl -2,2-dichloroacetate

1



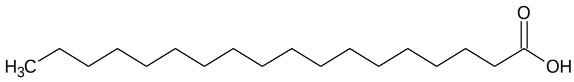
n-hexadecane-1-ol

2



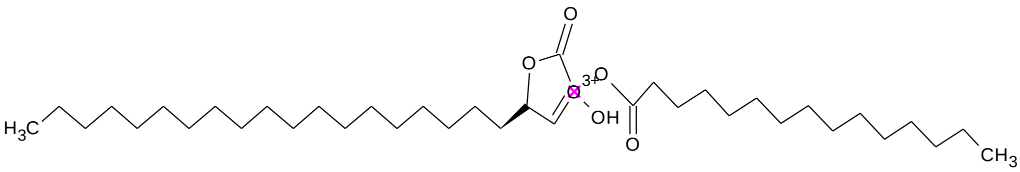
6-octadecanoic acid

3



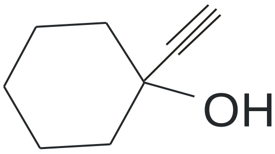
n-octadecanoic acid

4



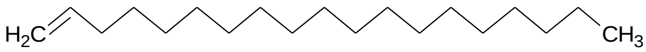
Ascorbic acid, 2,6-dihexadecanoic acid

5



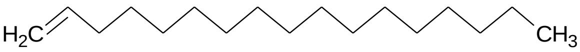
1-ethynyl-1-cyclohexanol

6



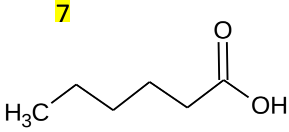
nonadec-1-ene

7



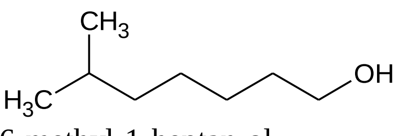
1-heptadecene

8



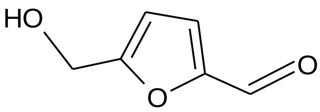
hexanoic acid

9



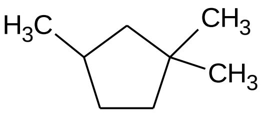
6-methyl-1-heptan-ol

10



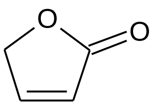
5-(hydroxymethyl)furan-2-carbaldehyde

11



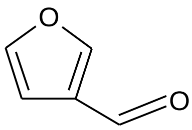
1,1,3-trimethylcyclopentane

12



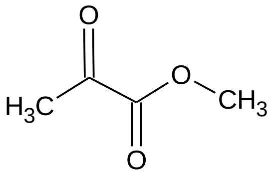
2(5H) Furanone

13



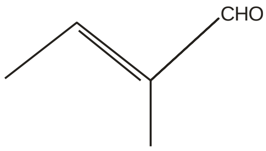
3-Furalaldehyde

14



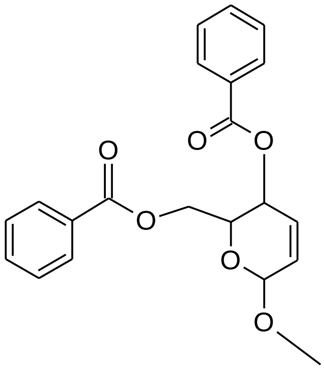
methyl-2-oxopropanoate

15



(H)-2-methylbut-2-enal

16



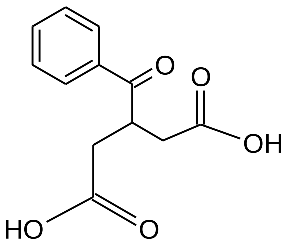
2H-pyran-2-yl(3-benzoyloxy)-6-dihydro-6-methoxymethyl benoate

17

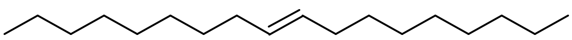
Fig 1. Chemical Compositions of Spondias Cytherea Fruit

Table 4present the results of the interpretation of the GC-MS chromatogram of the samples. It is noted that some compounds identified in the fruits are also present in the leaves. These compounds include L-(+)-ascorbic acid 2,6-dihexadecanoate, and 6-octadecanoic acid. This result indicates that both the fruits and leaves of this plant may exhibit antioxidant property. The major compound in *S.cytherea* leaves are fatty acids which include (E)-2-methyl octadec-7-enoic (34.01%), 6-octadecanoic acid (15.22%), 15-methylhexanoic acid (2.53%) and 2-methylhexadecanoic acid (10.15%). These esters identified in the leaves include 2-oxo-2-phenylethane 1,1, diyldiacetate (5.08%) and L-(+)-ascorbic acid 2,6-dihexadecanoate (15.22%).

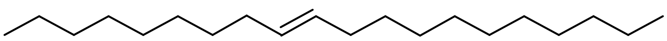
Terpene identified include 1,1,3-trimethylcyclo pentane (1.52%), (E)-9-octadecene (3.55%), (E)-icos-9-ene (3.05%) and 2,3,4-trimethyldodecan-5-yl-cyclopentane (0.36%). Alcohol and ketone component of the leaves include 6-methylheptan-1-ol (2.53%) and 2-(dodecan-2-yl)-cyclohexanone (0.36%) respectively.



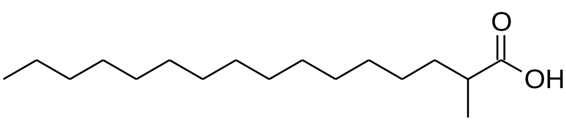
2-oxo-2-phenylethane-1,1-diylacetate



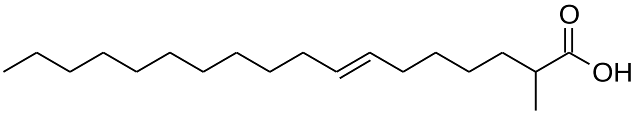
9-octadecene



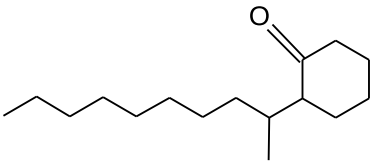
(E)-icos-9-ene



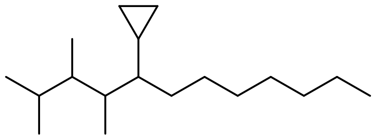
2-methylhexadecanoic acid 2-methylhexadecanoic acid



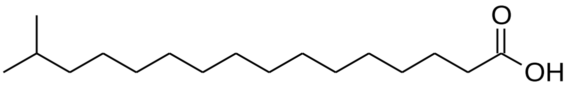
(E)-2-methyloctadec-7-enoic acid



2-(dodecan-2-yl)cyclohexnone



(2,3,4-triethyldodecan-5-yl)cyclopane



15-methylhexadecanoic acid

Fig 2. Chemical Compositions of Spondias Cytherea Leaves

CONCLUSION

The results obtained from this study have strongly indicated the chemical composition of the fruits and leaves of *Spondiascytherea*. From this work, the concentration of ascorbic acid is higher than the other chemical observed. More ascorbic acid is found in the fruits than the leaves. This supports the reason the fruit perform more antixodant activity than the leaves. *S. cytherea* fruit may be used in wine and fruits juice production to combat some health problems.However, the biological activities of the identified compounds should be investigated in order to explore more medicinal benefit of the plant

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