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Gas Chromatography Mass Spectroscopy (GC-MS) Fingerprinting of Methanol Extract and Ethanol based Fractions of Corchorus olitorious (Jute) Leaves.

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Abstract: Gas Chromatography-Mass Spectrometry (GC-MS) is a powerful analytical technique used to identify and quantify bioactive compounds in complex mixtures like plant extracts. The study therefore, aimed at fingerprinting bioactive compounds of crude and ethanol based fractions of Corchorus olitorius leaves using qualitative analysis and Gas Chromatography Mass Spectroscopy (GC-MS). Qualitative screening revealed moderate levels of phenols, tannins, flavonoids, glycosides, and alkaloids in the crude and most fractions. The compounds with major peaks for GC-MS were: Fumaric acid, 2-methylpentyl 2,3-dichlorodichlorophenyl ester,4-Methyl-6-phenylpyrimidin-2-yl)(4,6,8-trimethylquinazolin-2-yl) amine, Fumaric acid, 4-heptyl tridecyl ester, and Dodecanoic acid, 1,2,3-propanetriyl ester in the crude extract. Ethanol 100 % fraction also revealed 4-Methoxy-3-nitrobenzyl alcohol, 4,4'-Bi-1,3-dioxolane, 2,2,2',2'-tetramethyl- and 2-(2-(2-Methoxyethoxy) ethoxy) ethyl pentanoate. While the Ethanol/methanol 80:20 fraction had Hexadecanoic acid methyl ester, Lauric anhydride, Citral, 2,6-Octadienal 3,7-dimethyl-, (Z)-. Ethanol/methanol 60:40 fraction further revealed Geranic acid, n-Hexadecanoic acid, Hexadecanoic acid, methyl ester, and 1,4-Cyclohexadiene, 6-isopropenyl-2,4-dimethyl-1,3-bis(trimethylsilyl)-. The methanol crude extract and ethanol based fractions of Corchorus olitorius leaves have revealed diverse classes of chemical compositions, which may be harnessed for therapeutic purposes.

Keywords: Chromatography; Phytochemicals; Medicinal chemistry; Terpenes; Corchorus olitorious

1. Introduction

Jute (Corchorous) is a genus of annual herbs belonging to the *Tiliaceae* family that contains about 50–60 species, but only two species, *C. olitorius* and *C. capsularis*, are well-known for commercially bast fiber production and are distributed throughout the world's tropics, subtropics, and warm-temperate regions (Loumerem&Alercia 2016; Kumari et al., 2019). In Nigeria, the leaves of jute mallow are mostly consumed as soup across the geopolitical zones. It is an erect dicotyledon plant found in the wild, but also largely cultivated in Africa and Asia as a green leafy vegetable (Islam, 2013). It has simple, finely indented leaves and small yellow flowers having five petals (Adebo et al., 2018).

Gas Chromatography-Mass Spectrometry (GC-MS) identifies and quantifies volatile and semi-volatile organic compounds in a sample, including phytochemicals. It also utilises the principle of separating compounds based on their boiling points and mass-to-charge ratio using mass spectrometry (Olivia et al., 2021).

Previous studies of jute leaves have revealed volatile components including, cis-3-hexen-1-ol, cis-4-hexen-1-ol, terpinolene, sabinene, and phytol have been found in the leaves (Roy, 2018). Abdallah et al. (2020) also revealed Theophylline, Trans-2,3 dimethoxycinnamic acid, 7-Hydroxy-4-methyl coumarin, Digitoxin, Apigenin 7-glucoside and Glycitein as the most important compounds for aqueous and chloroform extracts of *Corchorus olitorius* L leaves. Hexadecanoic acid methyl ester, 9-Octadecenoicacid (z), and Methyl stearate were also revealed in the methanol leaves extract with the major peaks (Abdallah et al., 2020).

Although various chemical compositions have been reported in the GC-MS analysis of C.olitorius leaves extract, there is need for information regarding the volatile and semi-volatile compounds of the crude and ethanol based fraction of the leaves' spectrum. Hence, the study is aimed at fingerprinting the bioactive compounds of crude and ethanol based fractions of Corchorus olitorius leaves.

2. MATERIALS AND METHODS

2.1 Materials

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Fig. 1. Leaves of *Corchorus olitorious*

Corchorus olitorius leaves were purchased from Wurukum Market in Markurdi, Markurdi Local Government Area, and were identified and authenticated in the Department of Botany, Joseph Sarwuan Tarka University, Markurdi, Benue State.

2.1.1 Chemicals and Reagents

The chemicals and reagents used for this study met analytical grade standards and were purchased from Standard Chemical and Reagent Stores within Benue State. They comprise methanol, ethyl acetate ($C_4H_8O_2$), N-hexane (C_6H_{14}), ethanol, distilled water and Silica gel

2.1.2 Equipment, Apparatus, and Instruments

The following are the equipment's and apparatus used for this study: Micropipette, Water bath (TE-7 Tempette), Digital Scale (Techne 7), Measuring Cylinder, sterile sample bottles, beaker, whatman filter paper, desiccator, burette, retort stand, conical flask, and Blender.

2.2 Methods

2.2.1 Preparation of *Corchorus olitorius* leaves extract.

The *corchorus olitorius* leaves were air dried for two weeks on table tops in the laboratory, then the dried leaves were pulverized into fine powder using an electric blender. The reagents to be used was taken to be distilled at a specialized laboratory (Joseph Sarwuan Tarka, University Makurdi, Benue state) to remove the impurities, thereby making it 99.5% pure.

The leaves were cleaned of sand and debris. They were further dried at room temperature to a constant weight and pulverised with a blender. The pulvarised plant material (1500 g) was macerated in 2500 mL of methanol and extracted three times at room temperature. The extracts were filtered using whatman no 1 filter paper and further concentrated using a rotary evaporator. The extract was finally exposed to air in order to completely eliminate residual solvent. The crude extracts were stored in air-tight bottles, and aliquots were taken when required.

2.2.2 Column Chromatography of Methanol Extract using Silica Gel 60:120 (0.2-0.5mm) mesh.

The dried crude extract was subjected to chromatography using silica gel 60-120 mesh. The mobile phase consisted of n-hexane, ethyl acetate, ethanol, methanol, and water solvent combinations of increasing polarity. The wet packing method was employed for packing the column (Coskun, 2016). Briefly, a wad of cotton wool was used to pack the lower part of the column. 75g of silica gel with 200 mL of n-hexane-ethylacetate (50:50) was used to prepare the slurry, which was carefully poured down into the column. The tap of the column was left open in order to allow free solvent flow. The packing process culminated in closing the tap and allowing the gel to set. The clear solvent on top of the silica gel was allowed to drain down to the silica gel bed. Thereafter, the loading of plant extract via solvent systems of increasing polarities began after opening the tap to allow flow of purified fractions. 65g of the crude was introduced by the following ratios of solvent combinations sequentially in the elution process;

Solvent combination Ratios

- n-Hexane:Ethylacetate 50:50, 40: 60, 30:70, 20:80, 10:90, 0:100
- Ethyl acetate: Ethanol 80:20, 60:40, 40:60, 20:80, 0:100
- Ethanol: Methanol 80:20, 60:40, 40,60, 20:80, 0:100

  Methanol: Water 80:20, 60:40, 40,60, 20:80, 0:100

Each solvent system was 100 mL, and a total of 168 fractions were collected in to small glass vial bottles of 8 vials per solvent system. The collected eluates were further pooled together based on the solvent system into 21 fractions

2.2.3 Preliminary saponin test

Frothing test was further conducted for the crude and pooled fractions for the selection of saponin-rich fractions (Sofowora, 1993).

2.2.4 Qualitative phytochemical analysis of crude extract and ethanol based fractions of *Corchorus olitorious* leaves

The qualitative phytochemical screening of the sample for tannins, terpenoids, flavonoids, alkaloids, glycosides, steroids, and phenols was carried out using the method described by Harborn (1998). The screened for saponins was done using the method of Sofowora (1993).

i. Test for Tannins

To 1 ml of plant extract, 2 mL of 5% ferric chloride was added. Formation of dark blue or greenish color indicates the presence of tannins

ii. Test for Saponins

Test for Saponins to 1g of crude and fractions, 5-10 mL of distilled water was added and shaken in a graduated cylinder for 15 min. Formation of 1 cm layer of foam indicated the presence of saponins.

iii. Test for Alkaloids

To 1g of crude and fractions, 2 mL of conc. Hydrochloric acid was added. The 3 drops of Mayer's reagent were added. The presence of green color or white precipitate indicates the presence of alkaloids.

iv. Test for Flavonoids

i. To 1g of crude and fractions, 1mL of aqueous NaOH solution was added and observed for the formation of yellow-orange coloration.

ii. One (1g) of plant extract was treated with 4 drops of concentrated H_2SO_4 and observed for the formation of orange color.

v. Test for Glycosides

To 1g of crude and fractions, 1 mL of glacial acetic acid and 5% ferric chloride were added. To these, 3 drops of conc. H_2SO_4 was added. The presence of greenish-blue color indicated the presence of glycosides.

vi. Test for Steroids

To 1g of crude and fractions, an equal volume of chloroform and 3 drops of conc. H_2SO_4 was added. Formation of a brown ring indicated

the presence of steroids.

vii. Test for Phenols.

To 1g of crude and fractions, 2 ml of distilled water, followed by 5 drops of 10% ferric chloride, was added. The formation of blue or green color indicated the presence of phenols.

2.2.5 Gas Chromatography-Mass Spectrometry (GC-MS) analysis

The crude extract and saponin rich fractions of *C. olitorius* leaves were analyzed through GC-MS for the identification of different compounds. The GC-MS analysis was carried out using a GC (Agilent Technologies 7890A) interfaced with a mass selective detector (MSD, Agilent 7 000) equipped with a polar Agilent HP-5ms (5%-phenyl methyl polysiloxane) capillary column (30 m × 0.25 mm i.d. and 0.25 µm film thickness). The oven temperature was programmed initially at 40°C (for 3 min) to 280°C final at an increasing rate of 5°C/min (for 5 min). The carrier gas was helium with a linear velocity of 1 mL/min. The electron ionization system with ionization energy of 70 eV was used.

Interpretation of the mass spectrum of GC-MS was based on using the database of the National Institute Standard and Techniques (NIST 14L). The relative percentage amount of each component was calculated by comparing its average peak area to the total area. The spectrum of the unknown compound was compared with the spectrum of the compound stored in the NIST data library (NIST14L)

3. Results and Discussion

3.1 Qualitative analysis of phytochemical constituents of crude extract and ethanol based fractions of *Corchorus olitorious* leaves

The qualitative phytochemical analysis revealed that phenols and tannins were present in moderate amounts in the crude extract (+) and all fractions tested. Saponin was the most abundant phytochemical, observed in the ethanol (100%) fractions (++). Flavonoids and glycosides were moderately present (+) in all fractions, including the crude extract. Alkaloids were also moderately present (+) in the crude extract, ethanol (100%), and ethanol/methanol (80:20) fractions but absent in the ethanol/methanol (60:40) fraction. Steroids were present (+) in the crude extract only (**Table 1**).

Table 1. Qualitative analysis of phytochemical constituents of crude extract and ethanol based fractions of *Corchorus olitorious* leaves

Phytochemicals	Crude	ETH:100	ETH/MET 80:20	ETH/MET 60:40
Phenol	+	+	+	+
Tannins	+	+	+	+
Saponins	+	++	+	+
Alkaloid	+	+	+	+
Flavonoid	+	+	+	+
Steroid	+	-	-	-
Glycoside	+	+	+	+

[**KEYWORDS**; ETH: Ethanol, MET: Methanol, +(Positive),-(negative)]

3.2 Summary of spectral and characterization for crude extract of *Corchorus olitorious* leaves.

The retention time of major peaks in the crude revealed Fumaric acid, 2-methylpentyl 2,3-dichlorodichlorophenyl ester (25.49), 4-Methyl-6-phenylpyrimidin-2-yl)(4,6,8-trimethylquinazolin-2-yl) amine (25.85), Fumaric acid, 4-heptyl tridecyl ester (27.50) and Dodecanoic acid, 1,2,3-propanetriyl ester (31.65) with high retention time (**Table 2**).

3.3 Summary of spectral and characterization for Ethanol 100% fraction of Corchorus olitorious leaves

Ethanol 100% fraction revealed 4-Methoxy-3-nitrobenzyl alcohol (23.41), 4,4'-Bi-1,3-dioxolane, 2,2,2',2'-tetramethyl-(8.26) and 2-(2-(2-Methoxyethoxy) ethoxy) ethyl pentanoate (13.91) with high retention time (**Table 3**).

3.4 Summary of spectral and characterization for Ethanol/ Methanol 80:20 fraction of Corchorus olitorious leaves.

Ethanol/methanol 80:20 fraction revealed Hexadecanoic acid, methyl ester (17.62), Lauric anhydride (24.47), Citral (9.74), 2,6-Octadienal, 3,7-dimethyl-, (Z)-(9.31) and Benzeneacetaldehyde (6.25) with high retention time (**Table 4**).

3.5 Summary of spectral and characterization for Ethanol/ Methanol 60:40 fraction of Corchorus olitorious leaves

Ethanol/methanol 60:40 fraction also revealed Geranic acid (10.92), Lethane(12.08) ,n-Hexadecanoic acid (17.98), Hexadecanoic acid, methyl ester (17.62), 1,4-Cyclohexadiene, 6-isopropenyl-2,4-dimethyl-1,3-bis(trimethylsilyl)- (14.32) with high retention time (**Table 5**).

Table 2. Summary of spectral and characterization *for* crude extract of *Corchorus olitorious*

Peak	Retention Time	Area %	Name of compounds	Class of compounds
55	17.9864	1.8581	n-Hexadecanoic acid	Saturated fatty acid
65	19.4703	0.5731	Phytol	Acyclic Diterpene
67	19.7169	1.8026	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	Polyunsaturated fatty acid
98	25.4901	7.3771	Fumaric acid, 2-methylpentyl 2,3-dichlorophenyl ester	Organic ester derivative of fumaric acid
99	25.8571	8.752	(4-Methyl-6-phenylpyrimidin-2-yl)(4,6,8-trimethylquinazolin-2-yl)amine	Pyrimidines and quinazolines
102	27.5064	6.7032	Fumaric acid, 4-heptyl tridecyl ester	Diester of fumaric acid
107	29.3191	3.3982	2-Ethylacridine	Heterocyclic aromatic amines
108	31.6541	17.2781	Dodecanoic acid, 1,2,3-propanetriyl ester	Triglyceride and dodecano-ate ester

Plant leaves contain a wide array of bioactive compounds, which are naturally occurring substances that can have beneficial effects on human health. These compounds include phenolics, terpenoids, alkaloids, flavonoids, and other nitrogen-containing and organosulfur compounds. They exhibit a diverse range of bioactivities, such as antioxidant, anti-inflammatory, antimicrobial, and anticancer properties (Fotsing et al., 2022).

The qualitative phytochemical screening of the crude and saponin-rich fractions of leaves revealed variability in phytochemical content across different solvent fractions. Saponins were the most abundant phytochemical (++) in the ethanol (100%) fraction, suggesting their solubility in both moderately polar and polar solvents, aligning with their amphipathic chemical nature (Hostettmann & Marston, 1995). This is in accordance with the work of Summi et al. (2023) who reported high saponin concentrations when extracted with ethanol at higher percentage ranges. Flavonoids and glycosides were consistently detected in moderate amounts across all fractions, indicating that they are less influenced by solvent polarity. The absence of alkaloids in the ethanol/methanol (60:40) fraction suggests that this solvent combination might not be ideal for alkaloid extraction. Steroids detected only in the crude extract indicate their presence in minimal quantities or bound to matrices that are not efficiently extracted by ethanol or methanol fractions. Omenna & Ojo (2018) correlated this finding by revealing the presence of saponin, tannin, glycoside, flavonoid, steroid, and alkaloid in jute leaves extract.

The major band peaks of the GC-MS analysis of the crude profile were dominated by fatty acids, esters, and terpenoid-related compounds. Fumaric acid, 2-methylpentyl 2,3-dichlorophenyl ester which is a synthetic ester of fumaric acid with potential biological activity, that include immunomodulatory, neuroprotective, antioxidant, anti-inflammatoryproperties (Jadeja et al., 2020) and anticancer (Ratul et al., 2016)properties employing different mechanisms. 4-Methyl-6-phenylpyrimidin-2-yl)(4,6,8-trimethylquinazolin-2-yl) amine is a pyrimidine derivative, which is known for antiviral, antitumor, anti-inflammatory, and antimicrobial properties. Specifically, pyrimidine derivatives have been explored for their potential in treating degenerative diseases and as anticancer agents (Sabiu et al., 2024). Fumaric acid, 4-heptyl tridecyl ester (also known as dimethyl fumarate), has shown various biological activities, including immunomodulatory and neuroprotective effects. They have been studied for their potential in treating conditions like psoriasis and multiple sclerosis due to their ability to modulate the immune system and protect nerve cells (Gold et al., 2011). Dodecanoic acid, 1,2,3-propanetriyl ester also known as trilaurin, is a triglyceride (ester of glycerol and lauric acid) withbiological activities thatincludeantioxidant, antibacterial, antiviral, candidicide, hypocholesterolemic, antiarthritic, hepatoprotective, and mosquito repellent properties (Sundari et al., 2023).N-hexadecanoic acid (palmitic acid), 9,12,15-octadecatrienoic acid (α-linolenic acid), and phytol, all of which are consistently reported in green leafy vegetables and specifically in *C. olitorius* leaves as also reported by (Abdallah et al., 2020; Roy, 2018).

The 100% ethanol fraction revealed 4-Methoxy-3-nitrobenzyl alcohol as a building block for synthesizing other compounds with specific biological activities. Its nitro and methoxy groups, along with the alcohol functional group, contribute to its reactivity and make it suitable for various chemical transformations. These transformations can lead to the creation of enzyme inhibitors, receptor ligands, and other bioactive molecules. 4,4'-Bi-1,3-dioxolane, 2,2,2',2'-tetramethyl- containing 1,3-dioxolane substituents have been proven to exhibit a broad spectrum of biological activities such as antifungal (Baji et al., 1997), antibacterial (Crawley & Briggs 1995), antineoplastic (Shirai et al., 2000), antiviral (Bera et al., 2003), anesthetic (Aepkers et al., 2005). 2-(2-(2-Methoxyethoxy)ethoxy) ethyl pentanoate derivatives of related compounds, such as lincomycin derivatives with ether chains, have demonstrated antibacterial activity. This suggests that modifications in the ether chain, like the one present in 2-(2-(2-Methoxyethoxy) ethoxy) ethyl pentanoate, could influence antimicrobial efficacy. Ethanol/methanol 80:20 fraction further revealed hexadecanoic acid, methyl ester, which has been recognized for its hepatoprotective effects (Gupta et al., 2023) and inhibitory property of phospholipase A2 (Aparna et al., 2012). Lauric anhydride, derived from lauric acid, has potential biological properties, including antimicrobial and anti-inflammatory effects. Lauric anhydride may exhibit similar activity and could be used in various applications like drug delivery and potentially in food preservation (Sandhya et al., 2016). The presence of citral was also detected is consistent with leaf metabolite profiles and is also in line with the works of Loumerem & Alercia (2016). According to Rahhal et al. (2024), citral possesses diverse medicinal properties, including antioxidant, cytotoxic activities against cancer cell lines

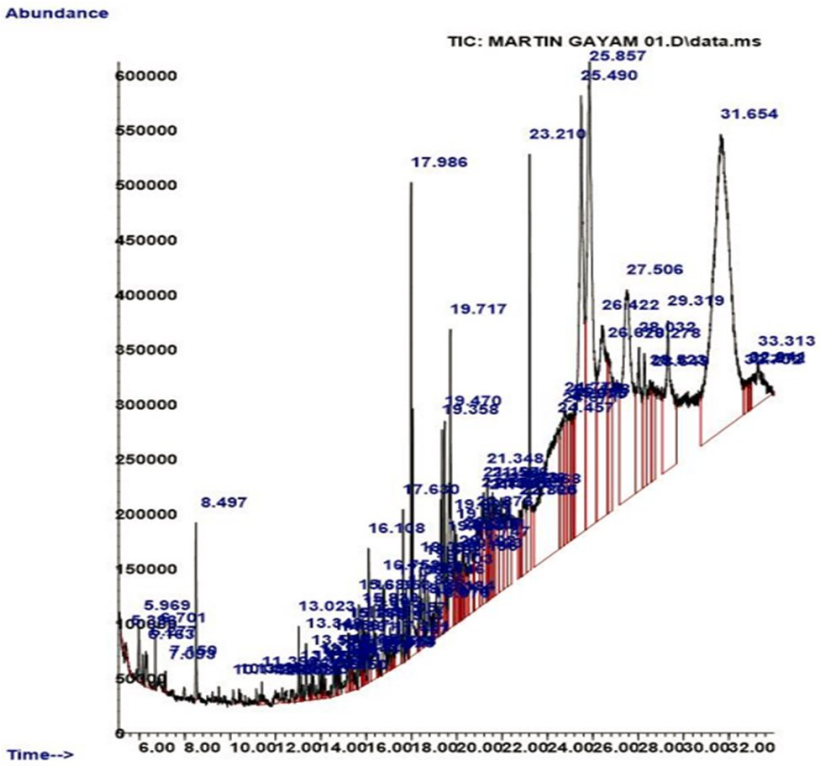


Fig. 2. Spectral for crude extract of *Corchorus olitorious* leaves

Table 3. Summary of spectral and characterization for Ethanol 100% fraction of Corchorus olitorious leaves

Peak	Retention Time	Area %	Name of compound	Class of compound
2	8.2663	5.833	4,4'-Bi-1,3-dioxolane, 2,2,2',2'-tetramethyl-	Cyclic ethers
4	8.6811	3.5766	1,2,4-Thiadiazole, 5-amino-	Heterocyclic
11	12.0801	2.5083	2-Isopropoxyethyl propionate	Carboxylic acid esther
15	13.7735	3.3172	1,3-Dimethyl-4,8-dioxatricyclo[5.1.0.0(3,5)]octane-2,6-diol	Tricyclic,cyclic,acetal diol
16	13.9103	9.1925	2-(2-(2-Methoxyethoxy)ethoxy)ethyl pentanoate	Glycol esther
24	17.6288	2.3739	Hexadecanoic acid, methyl ester	Fatty acid methyl esther
44	23.4195	19.928	4-Methoxy-3-nitrobenzyl alcohol	Benzyl alcohol

Table 4. Summary of spectral and characterization for Ethanol/methanol 80:20 fraction of *Corchorus olitorious* leaves

Peak	Retention Time	Area %	Name of compounds	Class of compounds
1	5.4096	1.435	Ethylene, 1,2-dichloro-, (Z)-	Dichloroethene
2	6.2522	1.7767	Benzeneacetaldehyde	*Phenylacetaldehyde*
10	9.3193	1.3736	2,6-Octadienal, 3,7-dimethyl-, (Z)-	Aldehydes and monoterpenoids
13	9.7443	1.7121	Citral	Acyclic monoterpenoid
34	17.627	1.2253	Hexadecanoic acid, methyl ester	Fatty acid methyl esther

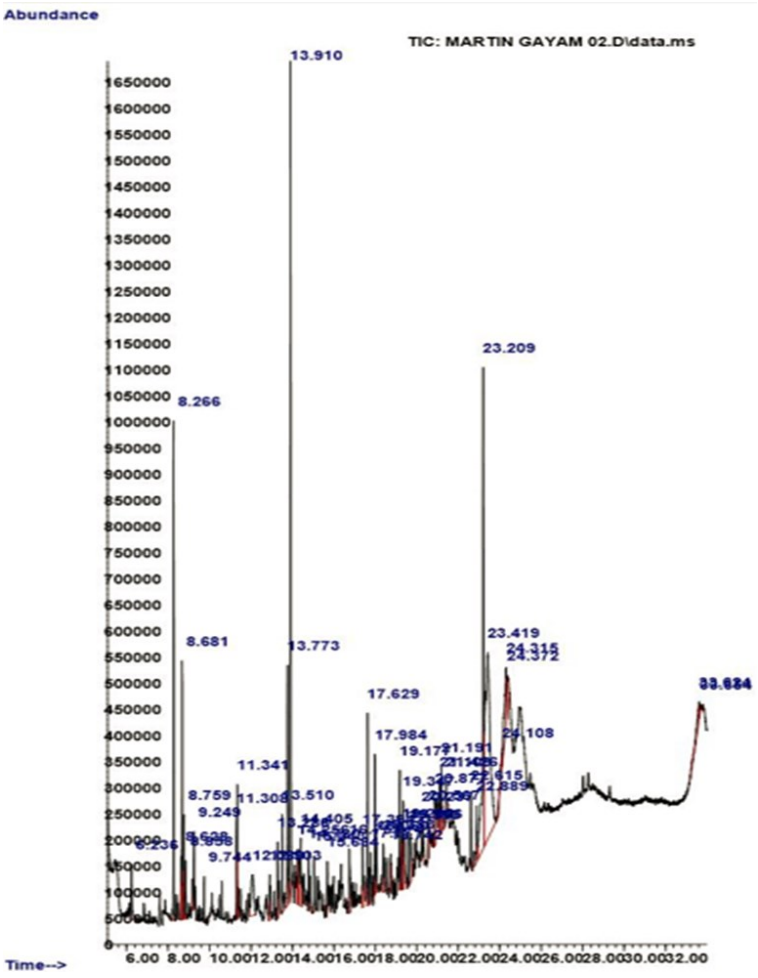


Fig. 3. Spectral for Ethanol 100% fraction of *Corchorus olitorious*

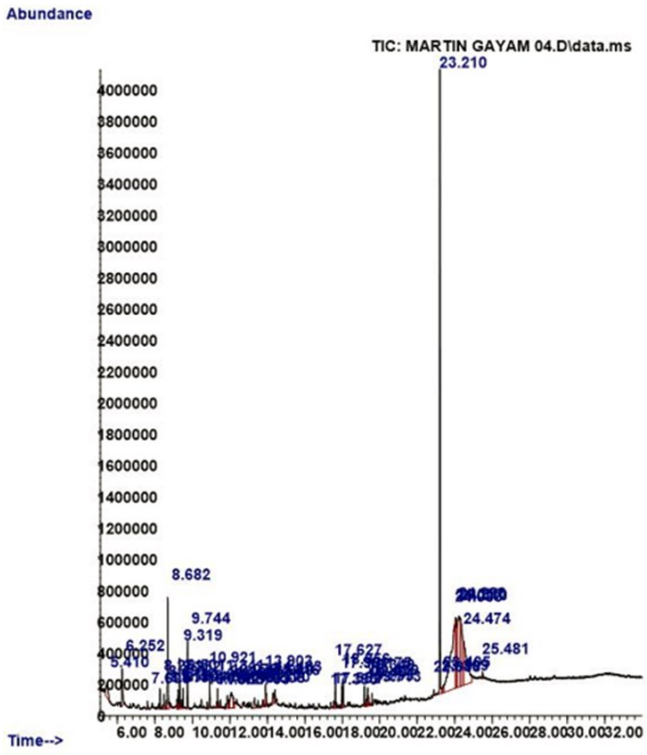


Fig. 4. Spectral for Ethanol/Methanol 80:20 fraction of *Corchorus olitorious* leaves

Table 5. Summary of spectral and characterization for Ethanol/Methanol 60:40 fraction of Corchorus olitorious leaves

Peak	Retention Time	Area %	Name of compounds	Class of compounds
1	6.2556	4.1576	Benzeneacetaldehyde	*Phenylacetaldehyde*
6	8.6815	5.59	Butanoic acid, 4-(2-methoxy-1-methyl-2-oxoethoxy)-, methyl ester	Ester and carboxylic acid derivative
14	10.923	2.4957	Geranic acid	Acyclic monoterpenes
20	12.0889	2.7408	Lethane	Thiocyanate
28	14.321	2.1793	1,4-Cyclohexadiene, 6-isopropenyl-2,4-dimethyl-1,3-bis (trimethylsilyl)-	Organosilicon
33	17.6289	2.6887	Hexadecanoic acid, methyl ester	Fatty acid methyl esther
34	17.9815	2.6167	n-Hexadecanoic acid	Saturated fatty acid

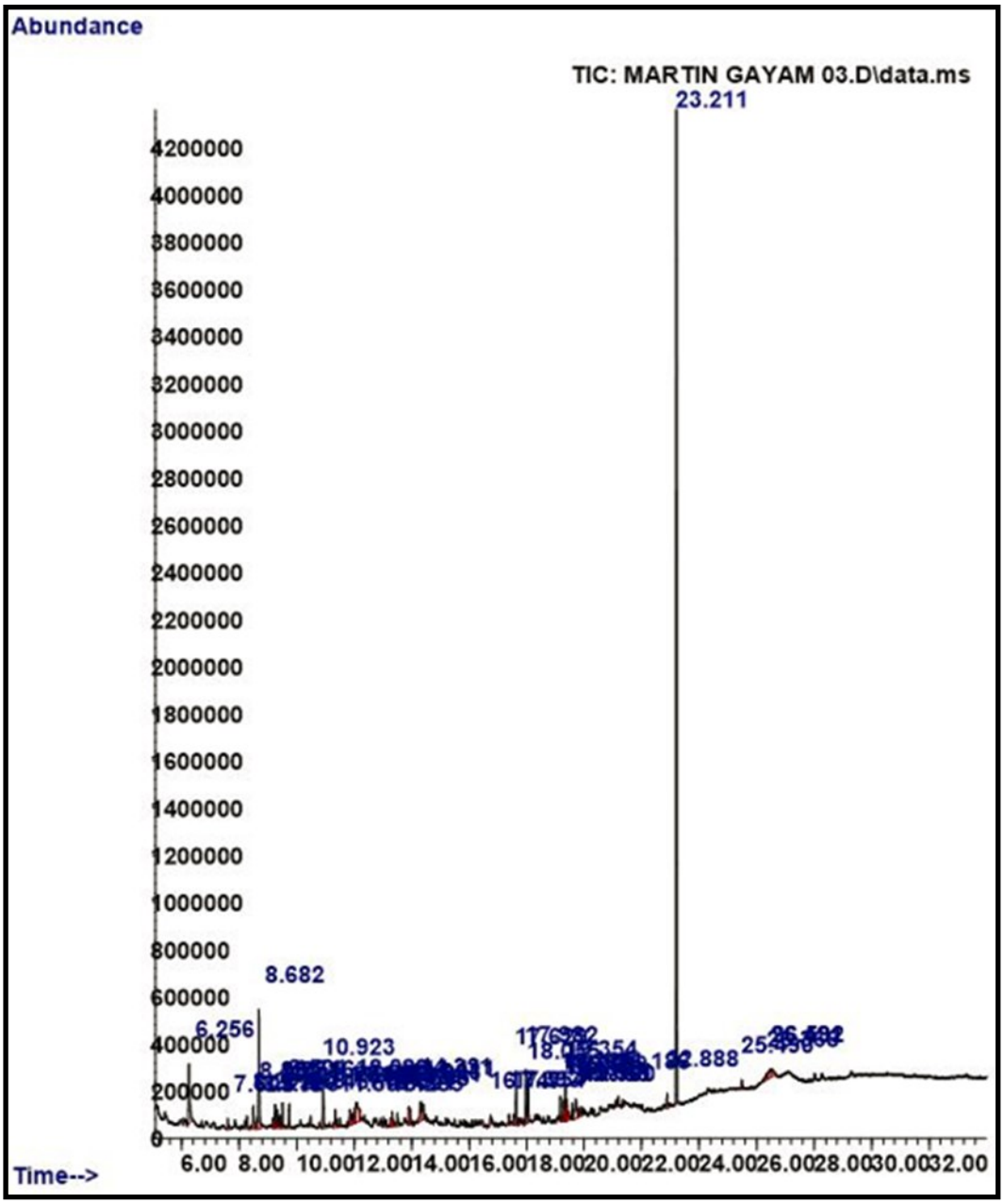
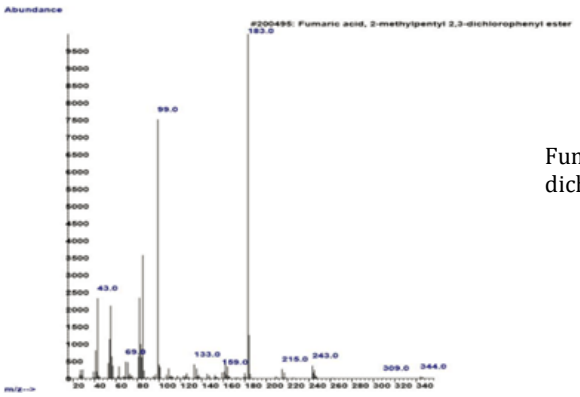
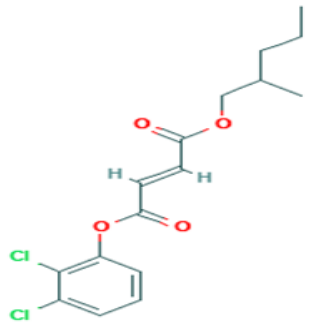
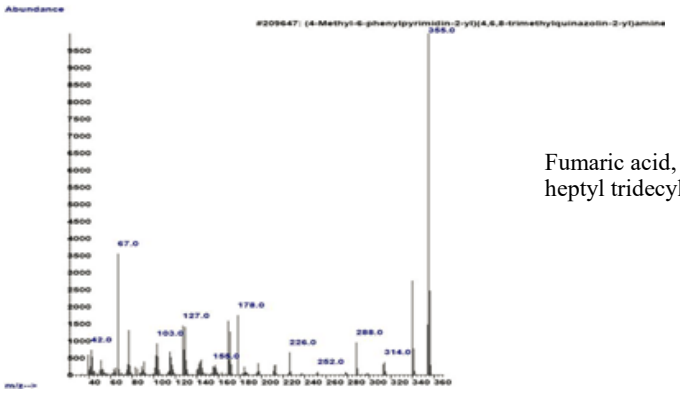


Fig. 5. Spectral for Ethanol/Methanol 60:40 fraction of *Corchorus olitorious* leaves

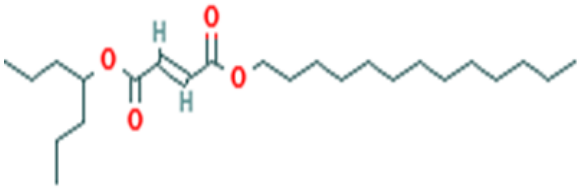


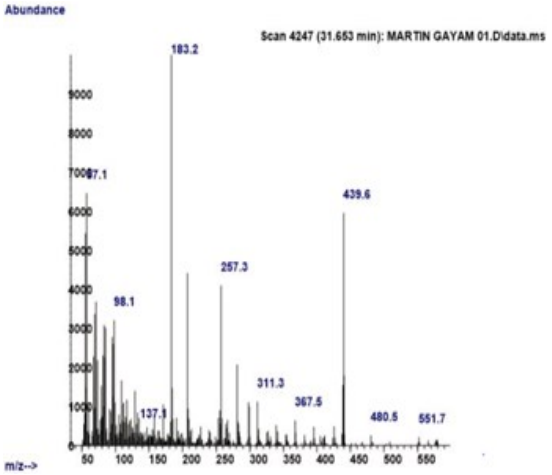
Fumaric acid, 2-methylpentyl 2,3-dichloro dichlorophenyl ester





Fumaric acid, 4-heptyl tridecyl ester





Dodecanoic acid, 1,2,3-propanetriyl ester

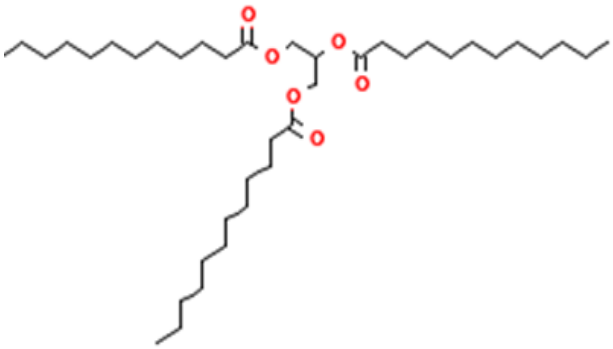
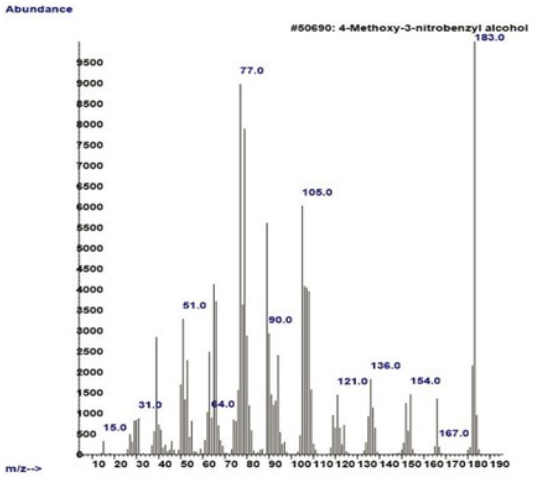


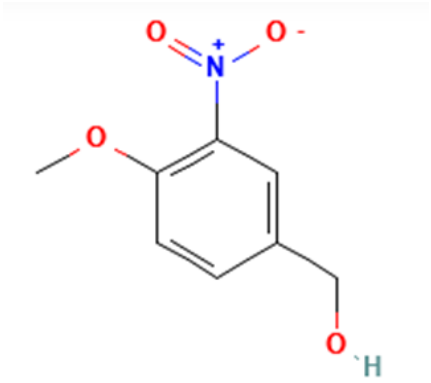
Fig. 6. The individual fragmentation pattern of the compounds with a high retention time of the crude

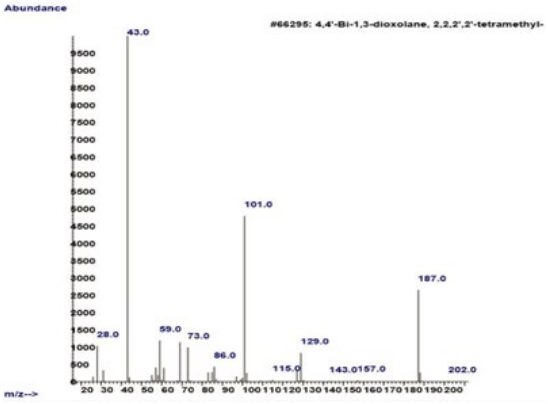
and antidebetic properties by acting against enzymes like α-amylase involved in the metabolism of glucose. Also, Sharma et al. (2020) further revealed their potential roles as anti-inflammatory agents.

The ethanol/methanol 60:40 fraction also revealed Benzeneacetaldehyde (phenylacetaldehyde). Biologically, it is known for its use in fragrances and flavors due to its floral, hyacinth -like odor. It's also an intermediate in the synthesis of certain pharmaceuticals and can be found as a metabolite in various organisms (Sanjeev et al., 1998). Butanoic acid, 4-(2-methoxy-1-methyl-2-oxoethoxy)-, methyl ester (methyl 4-methoxy-2-methyl-4-oxobutanoate) is an ester of a substituted butanoic acid. The presence of the methoxy and methyl groups, along with the keto functionality, suggests potential for interactions with enzymes and receptors, possibly influencing inflammation and pain pathways (Oulaï et al., 2018). Geranic acid was also identified, which is also in line with the works of Loumerem & Alercia (2016). Geranic acid is a naturally occurring fatty acid that is present in plants, several studies have revealed it medicinal properties such as antimicrobial, anti-inflammatory and antioxidant effects. Also, its inhibitory activities against tyrosinase, an enzyme responsible for the production of melanin (Toshiya et al., 2008).

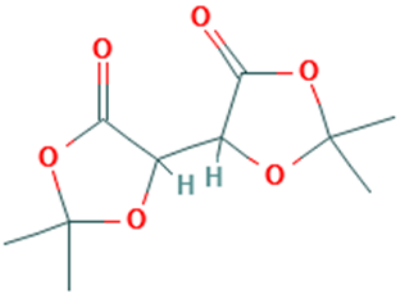


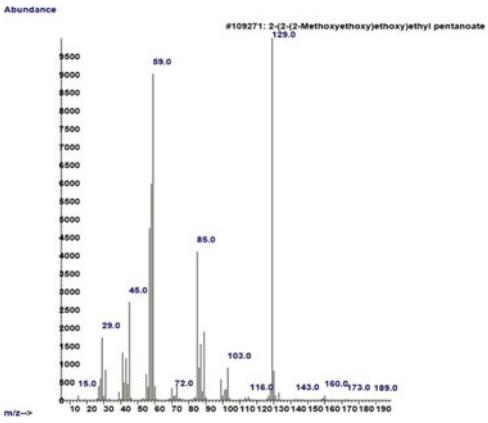
4-Methoxy-3-nitrobenzyl alcohol





4,4'-Bi-1,3-dioxolane, 2,2,2',2'-tetramethyl





2-(2-(2-Methoxyethoxy) ethoxy) ethyl pentanoate

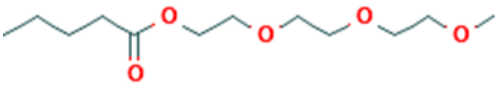
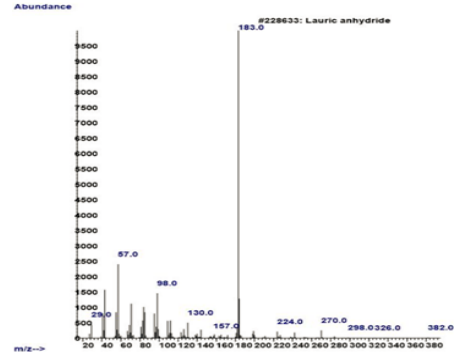


Fig. 7. The individual fragmentation pattern of the compounds with high retention time of ethanol 100% fraction



Lauric anhydride

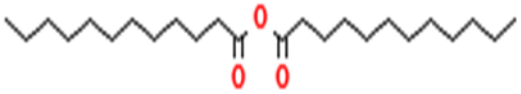
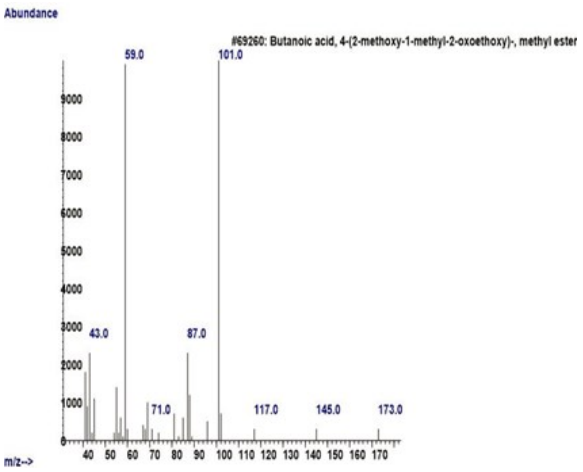


Fig. 8. The individual fragmentation pattern of the compounds with high retention time of ethanol/methanol 80:20 fraction



Butanoic acid, 4-(2-methoxy-1-methyl-2-oxoethoxy)-, methyl ester

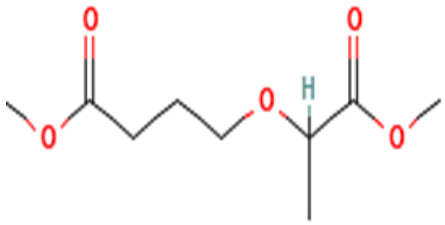


Fig. 9. The individual fragmentation pattern of the compounds with high retention time of ethanol/methanol 60:40 fraction

4. Conclusion

The extract of *Corchorus olitorius* leaves revealed chemical composition, comprising of fatty esters and terpenoid volatiles compounds. Specifically, the crude revealed dodecanoic acid, 1,2,3-propanetriyl ester, ethanol 100% revealed 4-methoxy-3-nitrobenzyl alcohol, ethanol/methanol 80/20 also revealed citral and benzeneacetaldehyde and ethanol/methanol 60/40 revealed n -hexadecanoic acid with the highest retention time. Hence, the leaves of *Corchorus olitorius* may have promising potential for therapeutic purposes.

Conflict of interest

The authors declared no conflict.

Data availability

Data will be made available on request.

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