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Gas Chromatography-Mass Spectrometry (GC-MS) Analysis of Ethanolic Extracts of *Barleria acuminata* Nees

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Abstract

Barleria acuminata Nees (Acanthaceae) commonly known as Vellaikurunji. It is used as one of the most important drugs in traditional system of medicine. The GC-MS analyses showed that the presence of Twenty two different phytocompounds in ethanolic extract of leaf of *B. acuminata*. The highest peak area of 34.13% for 9,12,15-Octadecatrienoic acid,(z,z,z)- was identified in leaf of *B. acuminata*. The ethanolic stem extract of *B. acuminata* showed that the presence of Twenty six different phytocompounds. The highest peak area of 46.73% for Piperidine,2,2,6,6-tetramethyl-. The root extract of *B. acuminata* showed that the presence of Twenty four different bioactive compounds. The root of *B. acuminata* showed Piperidine,2,2,6,6-tetramethyl- with the highest peak area of 39.58%. The present study confirmed that the presence of active compounds in different parts of *B. acuminata*. In future, the isolation of above mentioned bioactive compounds from the different part of *B. acuminata* would be useful to find out the novel drugs.

Keywords: Phytocompounds; ethanolic extract; *Barleria acuminata*; leaf; stem; root.

1. Introduction

India is endowed with a wealth of medicinal plants, which have been a valuable source of natural products for maintaining human health. Plants are the richest resource of drugs of traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs [1]. Medicinal plants are an important source of therapeutic remedies for various ailments. Scientific experiments on the antimicrobial properties of plant components were first documented in the late 19th Century [2]. The use of plants and plant products as medicines could be traced as far back as the beginning of human civilization.

The earliest mention of medicinal use of plants in Hindu culture is founds in “Rigveda”, which is said to have been written between 4500 - 1600 B.C. and is supposed to be the oldest repository of human knowledge. A special feature of higher plants is their ability to produce a large number of organic chemicals of high structural diversity of the so-called secondary metabolites [3]. Such metabolites are divided into three different categories based on their mechanism of function viz., bacteriostatic, antimicrobial and chemotherapeutic [4]. Medicinal plants are a source of great economic value all over the world. Nature has bestowed on us a very rich botanical wealth and a large number of diverse types of plants grow in different parts of the country. This Herbal and natural products have been used in folk medicine for centuries throughout the world, but there are relatively lower incidences of adverse reactions to plant preparations compared to modern conventional pharmaceuticals, this coupled with their reduced cost, is encouraging for both the consuming public and national health care institutions to consider plant medicines as alternatives to synthetic drugs [5].

B. acuminata grows as a shrub up to 3m tall. The leaves are dark green on the upper surface and pale green on the lower surface. They are elliptic to narrowly ovate. The flowers are about 5 cm long, funnel-shaped in violet, pink, or white color. Leaves to 4-5 x 2.5-3 cm, ovate-orbicular, apex acute, apiculate, base rounded, tomentose; petiole to 3.5 cm, pubescent. Racemes axillary and terminal; bracts 1.3 cm long, lanceolate, glandular, pubescent, acute; outer calyx lobes larger, 13 x 2 mm; inner smaller to 6 x 2 mm, lanceolate, pubescent; corolla tube to 3 cm, lobes 1 cm, obovate, obtuse, imbricate; filaments 7 mm; ovary 3 mm, ovoid, style 3.5 cm long, hairy at the base. Cultivated as an ornamental plant in villages and gardens. The shrub grows also as a ruderal species along roadsides and disturbed areas from near sea level to about 100 m. Found along the forest edges and scrub jungles from plains to 600m. Common. Peninsular India. The present study was emphasized the phytochemical constituent of ethanolic extracts from the various parts of *B. acuminata*.

2. Materials and Methods

2.1 Collection and Preparation of Plant Material

The medicinal plant *Barleria acuminata* was collected from Pachaimalai , Tiruchirappalli District, Tamilnadu, India. The plant was identified and authenticated (BSI/SRC/5/23/2014-15/Tech/539) by Dr. G.V.S. Murthy, Scientist 'F' & Head of Office, Botanical Survey of India, Southern Regional Centre, Coimbatore, Tamilnadu, India. The leaf, stem and root were separated and washed thoroughly in running tap water to remove soil particles and adhered debris and then finally washed with sterile distilled water. The parts leaf, stem and root of *B. acuminata.* were shade dried separately and grind well into powder. The powdered materials were stored in air tight containers at 4°C.

2.2 Plant Sample Extraction

10 g of the powdered plant material of leaf, stem and root were soaked in 60 mL of 95% ethanol for 24 hrs. After 24 hrs, the extracts were filtered through Whatmann filter paper No. 1 along with 2 gm of sodium sulfate to remove the sediments and traces of water in the filtrate. Before filtering, the filter paper along with sodium sulphate was wetted with 95% ethanol. The filtrate was then concentrated to 1 ml by bubbling nitrogen gas into the solution. From this, 2 µL of ethanolic extract of different parts of *B. acuminata* was subjected to GC-MS analysis [6].

2.3 GC-MS Analysis

GC-MS analysis of the ethanol extracts of different parts of *B. acuminata* (leaf, stem and root) were performed using a Bruker ScionTM GC-MS/MS with Scion 436 GC. Auto-sampler and a Gas Chromatograph interfaced to a Mass Spectrometer (GC-MS) equipped with an Elite- 1MS (95% Dimethyl poly siloxane) fused capillary column (30 m x 0.25 mm ID x 0.25µm df). For GC-MS detection, an electron ionization system was operated in electron impact mode with ionization energy of 70eV. Helium gas (99.999%) was used as carrier gas at a constant flow rate of 1ml/min, and an injection volume of 0.5 EI was employed (split ratio of 50:1). The injector temperature was maintained at 280°C, the ion-source temperature was 250°C, the oven temperature was programmed from 80°C (isothermal for 2 min), with an increase of 20°C/min to 160°C, then 5°C/min to 280°C, ending with a 10 min isothermal at 300°C. Mass spectra were taken at 70eV; a scan interval of 0.5 seconds and fragments from 50-500Da [7]. The solvent delay was 0 to 3.5 min and the total GC-MS running time was 46 min. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas. The Mass detector used in this analysis was TQ Quadrupole Mass Spectrometer and the software adopted to handle mass spectra and chromatogram was a MS Work Station 8.

2.4 Identification of Components

The relative percentage amount of each component was calculated by comparing its average peak area to the total areas. The detection employed by using the NIST (National Institute of Standards and Technology) library ver.2.0 (2005). The prediction of biological activity of compounds was based on Dr. Duke's Phytochemical and Ethnobotanical Databases created by Dr. Jim Duke of the Agricultural Research Service/USDA. Interpretation of GCMS was conducted using the database of NIST library having more than 62,000 patterns. The spectrum of the unknown component was compared with the spectrum of the known the components stored in the NIST library ver. 2.0. The name, molecular weight and molecular formula of components of the test materials were ascertained.

3. Results and Discussion

The phytoconstituents are the major important compounds which are responsible for the medicinal properties of the shrubs. Hence medicinal plants could be a potential source for nutraceuticals. The phytochemical substances namely phenols and flavonoids are the major important substances responsible for the medicinal value of the plants including antioxidant, anticancer, antimicrobial activities, etc. The identification of the phytocompounds was carried out based on the retention time and molecular formula. The name of identified compounds in the different parts of *B. acuminata* with their retention time (RT), molecular formula (MF), molecular weight (MW) and peak area percentage were represented in Tables 1, 2 and 3.

The leaf extract of *B. acuminata* showed twenty two phytocomponds such as Methanaminium, 1-carboxy-N,N,N-trimethyl-, hydroxide, inner salt (12.63%), Catechol (2.21%), Benzofuran, 4,7-dimethyl- (7.15%), Bicyclo[3.1.1]hept-2-ene-2-methanol, 6,6-dimethyl- (7.04%), Dodecanoic acid (2,92%), 3,4-Dimethyl-2-prop-2-enyl-2,5-dihydrothiophene 1,1-dioxide (2.40%), Tetradecanoic acid (2.28%), Phytol, acetate (0.72%), 9-Octadecen-1-ol, (Z)- (2.17%), 3,7,11,15-Tetramethyl-2-hexadecen-1-ol (3.78%), n-Hexadecanoic acid (28.54%), PhytolPhytol (17.48%), 9,12,15-Octadecatrienoic acid, (Z,Z,Z)- (34.13%), Octadecanoic acid (6.33%), Eicosanoic acid (0.71%), Diisooctyl phthalate (4.50%), Squalene (19.73%), 2-methyltetracosane (1.65%), dl-α-Tocopherol (4.43%), Campesterol (3.54%), Stigmasterol (9.80%), β-Sitosterol (19.25%).(Table 1 and Fig. 1).

The twenty six different phytocomponents were identified in stem extract of *B. acuminata* such as Piperidine, 2,2,6,6-tetramethyl- (46.73%), 5-Hydroxymethylfurfural (7.02%), Benzofuran, 4,7-dimethyl- (3.72%), Sucrose (3.56%),

Benzoic acid, 4-hydroxy-3-methoxy-, methyl ester (0.85%), 3-Hydroxy-4-methoxybenzoic acid (1.84%), Phenol, 3,4,5-trimethoxy- (0.28%), 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol (0.79%), Tetradecanoic acid (0.30%), Phytol, acetate (1.14%), 9-Octadecen-1-ol, (Z)- (0.55%), 3,7,11,15-Tetramethyl-2-hexadecen-1-ol (0.46%), n-Hexadecanoic acid (8.12%), Phytol (1.82%),9,12,15-Octadecatrienoic acid, (Z,Z,Z)- (10.57%), Octadecanoic acid (1.55%), Eicosanoic acid(0.13%), Diisooctyl phthalate (3.02%), Hentriacontane (0.55%), Squalene (1.81%), Friedelan-3-one (0.38%), 2-methyltetracosane (0.39%),dl-α-Tocopherol (0.24%), Campesterol (0.28%), Stigmasterol (2.32%), β-Sitosterol (1.57%). (Table 2 and Fig. 2).

Twenty four phytocompounds such as Piperidine, 2,2,6,6-tetramethyl- (39.58%), 5-Hydroxymethylfurfural (8.68%),4-Hydroxy-2-methylacetophenone (2.85%), Vanillin (1.61%), Benzofuran, 4,7-dimethyl- (4.64%), Benzoic acid, 4-hydroxy-3-methoxy-, methyl ester (1.54%), 3-Hydroxy-4-methoxybenzoic acid (4.43%), Phenol, 3,4,5-trimethoxy- (0.63%), 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol (1.03%), Tetradecanoic acid (2.03%), 9-Octadecen-1-ol, (Z)- (1.10%), n-Hexadecanoic acid (8.26%), 9,12-Octadecadienoic acid (Z,Z)- (3.89%), 9,12,15-Octadecatrienoic acid, (Z,Z,Z)- (3.53%), Octadecanoic acid (1.70%), Eicosanoic acid (0.09%), Diisooctyl phthalate (7.39%), Hentriacontane (1.31%), Squalene (0.80%), 2-methyltetracosane (0.57%), Ergost-5-en-3-ol, acetate, (3β,24R)- (0.07%), Campesterol (0.03%), Stigmasterol (3.04%), β-Sitosterol (1.17%) were identified in the root extract of *B. acuminata* (Table 3 and Fig. 3).

In this study, the phytocompounds were identified in the ethanol extract of *B. acuminata* by GC-MS analysis and predicted their biological activities based on Dr. Duke's Phytochemical and Ethnobotanical Databases created by Dr. Jim Duke of the Agricultural Research Service/USDA [8].

Table 1: List of identified phytocompounds in the extract of leaf of *B. acuminata* by GC-MS analysis

No.	RT	Name of the compound	Molecular Formulae	Molecular Weight	Peak Area %	Compound Nature	**Activity
1.	4.74	Methanaminium, 1-carboxy-N,N,N-trimethyl-, hydroxide, inner salt	$C_5H_{11}NO_2$	117	12.63	Nitrogen compound	Antimicrobial
2.	6.21	Catechol	$C_6H_6O_2$	110	2.21	Phenolic compound	Antimicrobial, Antioxidant, Anti-inflammatory
3.	8.25	Benzofuran, 4,7-dimethyl-	$C_{10}H_{10}O$	146	7.15	Aromatic compound	No activity reported
4.	9.12	Bicyclo[3.1.1]hept-2-ene-2-methanol, 6,6-dimethyl-	$C_{10}H_{16}O$	152	7.04	Methanolic compound	Antimicrobial
5.	9.43	Dodecanoic acid	$C_{12}H_{24}O_2$	200	2.92	Lauric acid	Antioxidant, Antibacterial, COX-1 & COX-2 inhibitor, Antiviral, Hypocholesterolemic, Candidicide.
6.	10.75	3,4-Dimethyl-2-prop-2-enyl-2,5-dihydrothiophene 1,1-dioxide	$C_9H_{14}O_2S$	186	2.40	Sulfur compound	Antimicrobial
7.	12.39	Tetradecanoic acid	$C_{14}H_{28}O_2$	228	2.28	Myristic acid	Antioxidant, Cancer preventive, Nematicide, Lubricant Hypocholesterolemic
8.	13.70	Phytol, acetate	$C_{22}H_{42}O_2$	338	0.72	Diterpene compound	Antimicrobial, Anti-inflammatory, Anticancer, Diuretic
9.	14.08	9-Octadecen-1-ol, (Z)-	$C_{18}H_{36}O$	268	2.17	Unsaturated alcoholic compound	No activity reported
10.	14.39	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	$C_{20}H_{40}O$	296	3.78	Terpene alcohol	Antimicrobial, Anti-inflammatory
11.	15.84	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	28.54	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Anti androgenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
12.	18.33	Phytol	$C_{20}H_{40}O$	296	17.48	Diterpene	Antimicrobial, Anti-inflammatory Anticancer, Diuretic
13.	18.82	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	$C_{18}H_{30}O_2$	278	34.13	Linolenic acid	Hypocholesterolemic Nematicide Antiarthritic Hepatoprotective Anti androgenic Hypocholesterolemic 5-Alpha reductase inhibitor Antihistaminic Anticoronary Insectifuge Antieczemic Antiacne
14.	19.26	Octadecanoic acid	$C_{18}H_{36}O_2$	284	6.33	Stearic acid	No activity reported
15.	22.58	Eicosanoic acid	$C_{20}H_{40}O_2$	312	0.71	Alkane compound	No activity reported
16.	25.17	Diisooctyl phthalate	$C_{24}H_{38}O_4$	390	4.50	Plasticizer compound	Antimicrobial, Antifouling

Table 1 continue……..							
17.	29.31	Squalene	$C_{30}H_{50}$	410	19.73	Triterpene	Antibacterial, Antioxidant, Antitumor, Cancer preventive, Immunostimulant, Chemo preventive, Lipoxygenase-inhibitor, Pesticide
18.	30.45	2-methyltetracosane	$C_{25}H_{52}$	352	1.65	Alkane compound	No activity reported
19.	32.74	dl-α-Tocopherol	$C_{29}H_{50}O_2$	430	4.43	Vitamin E	Antiageing, Analgesic, Antidiabatic Antiinflammatory, Antioxidant, Antidermatitic, Antileukemic, Antitumor, Anticancer, Hepatoprotective, Hypocholesterolemic, Antiulcerogenic, Vasodilator, Antispasmodic, Antibronchitic, Anticoronary
20.	33.95	Campesterol	$C_{28}H_{48}O$	400	3.54	Steroid	Antimicrobial, Anti-inflammatory Anticancer, Antiasthma Diuretic, Hepatoprotective
21.	34.30	Stigmasterol	$C_{29}H_{48}O$	412	9.80	Steroid	Antimicrobial, Anti-inflammatory Anticancer, Antiasthma, Diuretic Hepatoprotective
22.	35.16	β-Sitosterol	$C_{29}H_{50}O$	414	19.25	Steroid	Antimicrobial, Anti-inflammatory Anticancer, Antiasthma Diuretic, Hepatoprotective

**Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

Table 2: List of identified phytocompounds in the extract of stem of *B. acuminata* by GC-MS analysis

No.	RT	Name of the compound	Molecular Formulae	Molecular Weight	Peak Area %	Compound nature	**Activity
1.	4.86	Piperidine, 2,2,6,6-tetramethyl-	$C_9H_{19}N$	141	46.73	Alkaloid	Antimicrobial, Anti-inflammatory
2.	6.06	5-Hydroxymethylfurfural	$C_6H_6O_3$	126	7.02	Aldehyde compound	Antimicrobial, Anti-inflammatory
3.	8.20	Benzofuran, 4,7-dimethyl-	$C_{10}H_{10}O$	146	3.72	Aromatic compound	No activity reported
4.	8.41	Sucrose	$C_{12}H_{22}O_{11}$	342	3.56	Sugar moiety	Preservative
5.	8.95	Benzoic acid, 4-hydroxy-3-methoxy-, methyl ester	$C_9H_{10}O_4$	182	0.85	Aromatic acid compound	Antimicrobial
6.	9.58	3-Hydroxy-4-methoxybenzoic acid	$C_8H_8O_4$	168	1.84	Aromatic acid compound	Antimicrobial
7.	10.03	Phenol, 3,4,5-trimethoxy-	$C_9H_{12}O_4$	184	0.28	Phenolic compound	Antioxidant, Analgesic, Antibacterial Anti-inflammatory, Antiseptic, Vasodilator, Pesticide, Antiviral, Cancer preventive
8.	12.12	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	$C_{10}H_{12}O_3$	180	0.79	Phenolic compound	Antimicrobial, Antioxidant, Anti-inflammatory
9.	12.34	Tetradecanoic acid	$C_{14}H_{28}O_2$	228	0.30	Myristic acid	Antioxidant, Cancer preventive, Nematicide, Lubricant, Hypocholesterolemic
10.	13.65	Phytol, acetate	$C_{22}H_{42}O_2$	338	1.14	Diterpene compound	Antimicrobial, Anti-inflammatory Anticancer, Diuretic
11.	14.07	9-Octadecen-1-ol, (Z)-	$C_{18}H_{36}O$	268	0.55	Unsaturated alcoholic compound	No activity reported
12.	14.38	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	$C_{20}H_{40}O$	296	0.46	Terpene alcohol	Antimicrobial, Anti-inflammatory
13.	15.84	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	8.12	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Anti androgenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
14.	18.35	Phytol	$C_{20}H_{40}O$	296	1.82	Diterpene	Antimicrobial, Anti-inflammatory Anticancer, Diuretic
15.	18.85	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	$C_{18}H_{30}O_2$	278	10.57	Linolenic acid	Hypocholesterolemic Nematicide Antiarthritic Hepatoprotective Anti androgenic Hypocholesterolemic 5-Alpha reductase inhibitor Antihistaminic Anticoronary Insectifuge Antieczemic Antiacne
16.	19.29	Octadecanoic acid	$C_{18}H_{36}O_2$	284	1.55	Stearic acid	No activity reported
17.	22.56	Eicosanoic acid	$C_{20}H_{40}O_2$	312	0.13	Saturated fatty acid	No activity reported

Table 2 continue……..							
18.	25.15	Diisooctyl phthalate	$C_{24}H_{38}O_4$	390	3.02	Plasticizer compound	Antimicrobial, Antifouling
19.	26.25	Hentriacontane	$C_{31}H_{64}$	436	0.55	Alkane compound	No activity reported
20.	29.29	Squalene	$C_{30}H_{50}$	410	1.81	Triterpene	Antibacterial, Antioxidant, Antitumor, Cancer preventive, Immunostimulant, Chemo preventive, Lipoxygenase-inhibitor, Pesticide
21.	30.03	Friedelan-3-one	$C_{30}H_{50}O$	426	0.38	Ketone compound	No activity reported
22.	30.42	2-methyltetracosane	$C_{25}H_{52}$	352	0.39	Alkane compound	No activity reported
23.	32.72	dl-α-Tocopherol	$C_{29}H_{50}O_2$	430	0.24	Vitamin E	Antiageing, Analgesic, Antidiabatic Antiinflammatory, Antioxidant, Antidermatitic, Antileukemic, Antitumor, Anticancer, Hepatoprotective, Hypocholesterolemic, Antiulcerogenic, Vasodilator, Antispasmodic, Antibronchitic, Anticoronary
24.	33.93	Campesterol	$C_{28}H_{48}O$	400	0.28	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Diuretic, Hepatoprotective
25.	34.31	Stigmasterol	$C_{29}H_{48}O$	412	2.32	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Diuretic Hepatoprotective
26.	35.17	β-Sitosterol	$C_{29}H_{50}O$	414	1.57	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Diuretic, Hepatoprotective

**Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

Table 3: List of identified phytocompounds in the extract of Root of *B. acuminata* by GC-MS analysis

No.	RT	Name of the compound	Molecular Formulae	Molecular Weight	Peak Area %	Compound Nature	**Activity
1.	4.68	Piperidine, 2,2,6,6-tetramethyl-	$C_9H_{19}N$	141	39.58	Alkaloid	Antimicrobial, Anti-inflammatory
2.	6.06	5-Hydroxymethylfurfural	$C_6H_6O_3$	126	8.68	Aldehyde compound	Antimicrobial, Anti-inflammatory
3.	6.82	4-Hydroxy-2-methylacetophenone	$C_9H_{10}O_2$	150	2.85	Ketone compound	No activity reported
4.	7.67	Vanillin	$C_8H_8O_3$	152	1.61	Phenolic compound	Food fragrance, Antimicrobial Anti-inflammatory, Antioxidant
5.	8.23	Benzofuran, 4,7-dimethyl-	$C_{10}H_{10}O$	146	4.64	Aromatic compound	No activity reported
6.	9.09	Benzoic acid, 4-hydroxy-3-methoxy-, methyl ester	$C_9H_{10}O_4$	182	1.54	Aromatic acid compound	Antimicrobial
7.	9.46	3-Hydroxy-4-methoxybenzoic acid	$C_8H_8O_4$	168	4.43	Aromatic acid compound	Antimicrobial
8.	10.02	Phenol, 3,4,5-trimethoxy-	$C_9H_{12}O_4$	184	0.63		Antioxidant, Analgesic, Antibacterial, Anti-inflammatory Antiseptic, Vasodilator, Pesticide, Antiviral, Cancer preventive
9.	12.09	4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol	$C_{10}H_{12}O_3$	180	1.03	Phenolic compound	Antimicrobial
10.	12.36	Tetradecanoic acid	$C_{14}H_{28}O_2$	228	2.03	Myristic acid	Antioxidant, Cancer preventive, Nematicide, Lubricant, Hypocholesterolemic
11.	14.05	9-Octadecen-1-ol, (Z)-	$C_{18}H_{36}O$	268	1.10	Unsaturated fatty acid alcohol	No activity reported
12.	15.77	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	8.26	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Anti androgenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
13.	18.70	9,12-Octadecadienoic acid (Z,Z)-	$C_{18}H_{32}O_2$	280	3.89	Linoleic acid	Hypocholesterolemic Nematicide Antiarthritic Hepatoprotective Anti androgenic, Hypocholesterolemic 5-Alpha reductase inhibitor Antihistaminic Anticoronary Insectifuge Antieczemic Antiacne
14.	18.82	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	$C_{18}H_{30}O_2$	278	3.53	Linolenic acid	Hypocholesterolemic Nematicide Antiarthritic Hepatoprotective Anti androgenic

							Hypocholesterolemic 5-Alpha reductase inhibitor Antihistaminic Anticoronary Insectifuge Antieczemic Antiacne
15.	19.23	Octadecanoic acid	$C_{18}H_{36}O_2$	284	1.70	Stearic acid	No activity reported
16.	22.54	Eicosanoic acid	$C_{20}H_{40}O_2$	312	0.09	Saturated fatty acid	No activity reported
17.	25.15	Diisooctyl phthalate	$C_{24}H_{38}O_4$	390	7.39	Plasticizer compound	Antimicrobial, Antifouling
18.	26.26	Hentriacontane	$C_{31}H_{64}$	436	1.31	Alkane compound	No activity reported
19.	29.14	Squalene	$C_{30}H_{50}$	410	0.80	Triterpene	Antibacterial, Antioxidant, Antitumor, Cancer preventive, Immunostimulant, Chemo preventive, Lipoxygenase-inhibitor, Pesticide
20.	30.46	2-methyltetracosane	$C_{25}H_{52}$	352	0.57	Alkane compound	No activity reported
21.	32.30	Ergost-5-en-3-ol, acetate, (3β,24R)-	$C_{30}H_{50}O_2$	442	0.07	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Diuretic, Hepatoprotective
22.	33.92	Campesterol	$C_{28}H_{48}O$	400	0.03	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Diuretic, Hepatoprotective
23.	34.30	Stigmasterol	$C_{29}H_{48}O$	412	3.04	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Diuretic, Hepatoprotective
24.	35.16	β-Sitosterol	$C_{29}H_{50}O$	414	1.17	Steroid	Antimicrobial, Anti-inflammatory, Anticancer, Antiasthma, Diuretic, Hepatoprotective

**Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

GC-MS Chromatogram

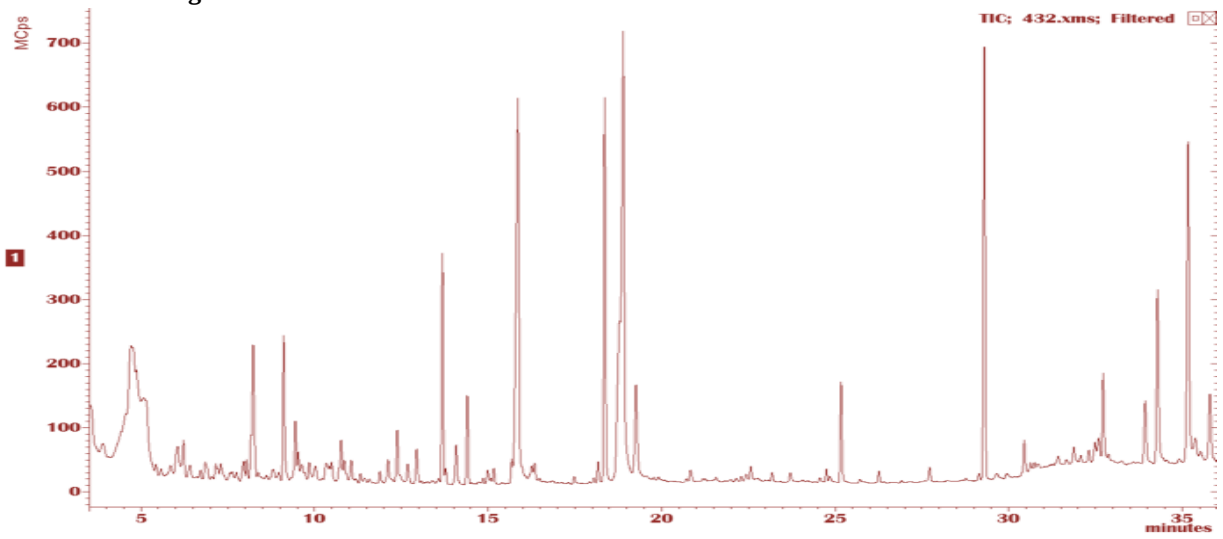

Figure 1: GC-MS chromatogram of ethanolic extract of leaf of *B. acuminata* Nees.

GC-MS Chromatogram

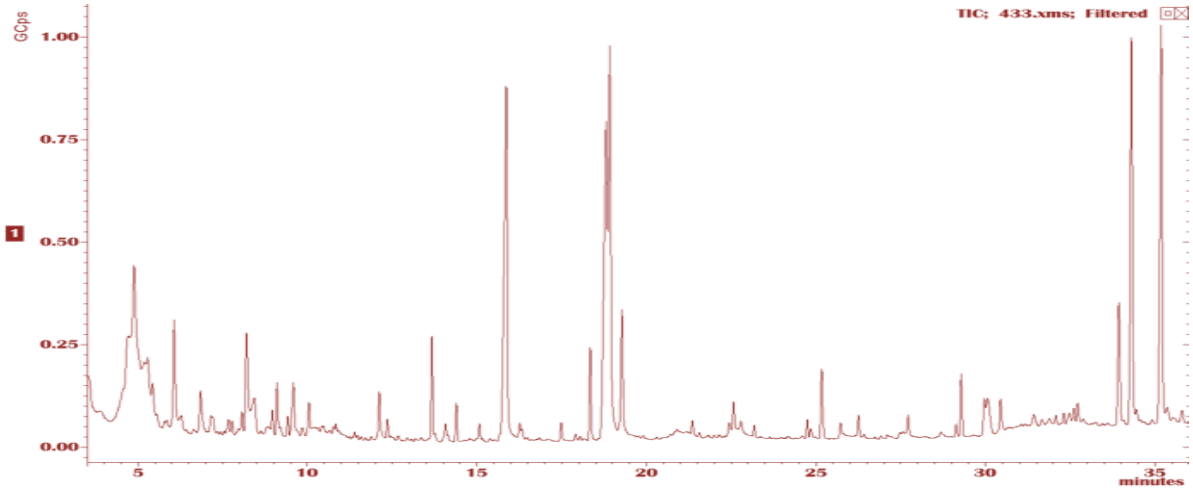

Fig. 2: GC-MS chromatogram of ethanolic extract of stem of *B.acuminata* Nees.

GC-MS Chromatogram

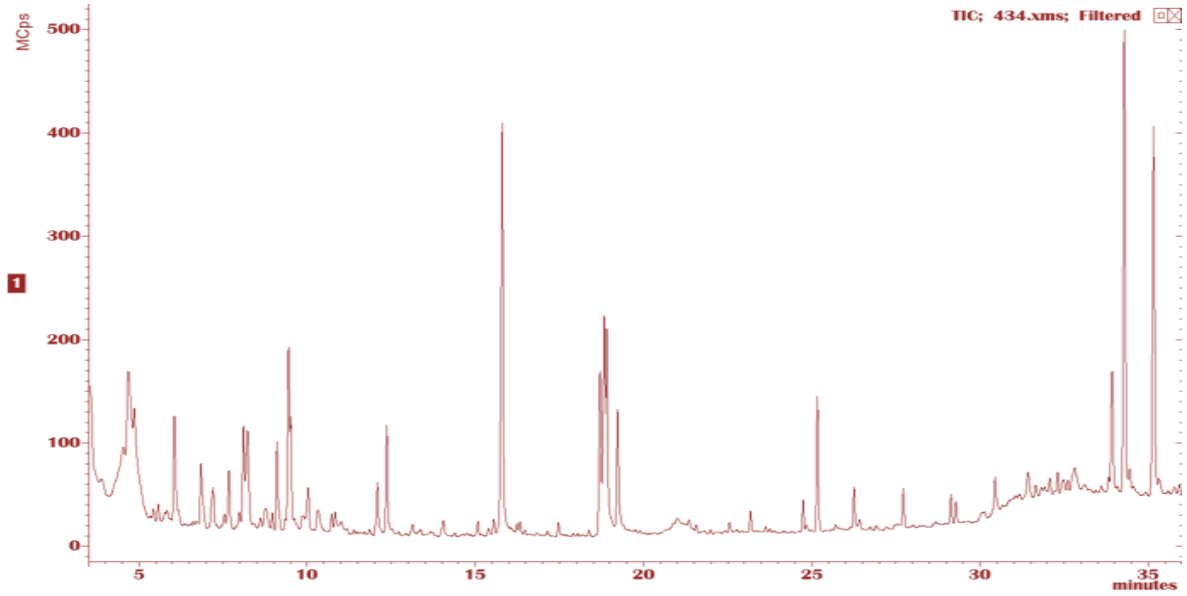

Fig. 3: GC-MS chromatogram of ethanolic extract of root of *B.acuminata* Nees.

4. Conclusion

The results of the present investigation revealed that the presence of phytocompounds in the ethanol extracts of different parts of *B. acuminata* by GC MS analysis. The phytoconstituents present in the different parts of *B. acuminata* may be attributed to the medicinal characteristics. In future, the isolation and purification of above mentioned phytocompounds would be useful in the preparation of novel drugs for treating diseases.

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