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GC-MS ANALYSIS OF PHYTOCHEMICAL COMPOUNDS PRESENT IN *ZEHNERIA SCABRA* (L.F.) SOND. (TUBER), *ORMOCARPUM SENNOIDES* (WILLD) DC. (LEAF) AND *BAUHINIA TOMENTOSA* L. (LEAF)

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ABSTRACT

The investigation was carried out to determine the presence of secondary metabolites in *Zehneria scabra* (tuber), *Ormocarpum sennoides* (leaf) and *Bauhinia tomentosa* (leaf) by the qualitative analysis of Preliminary Phytochemical Screening and also other possible chemical components present in them were studied through GC-MS analysis. GC-MS analysis showed about 33 phytochemicals in *Zehneria scabra* and 18 phytochemicals in *Ormocarpum sennoides* and 25 phytochemicals in *Bauhinia tomentosa* (leaf). A wide range of fatty acids, heterocyclic compound which are having antifungal anti -inflammatory antibiotic activity, antioxidant were identified so that these medicinal plants can be recommended as a plant of phytopharmaceutical importance.

KEYWORDS: phytochemicals, phytopharmaceutical, antifungal, antimicrobial, antioxidant.

INTRODUCTION

Phytochemicals are naturally occurring, biologically active chemical compounds formed during the plants' normal metabolical processes (Okigbo *et al.,* 2009). Often referred to as secondary metabolites they include alkaloids, flavonoids, coumarins, glycosides, gums, polysaccharides, phenols, tannins, terpenes and terpenoids (Okwu, 2004). Besides activity as a natural defense system for host plants they also provide colour, aroma and flavour. More than 4000 of these compounds have been discovered to date. Historically, plants have provided a source of inspiration for novel drug compounds, as plant derived medicines have made large contributions to human health and well being (Aiyegoro *et al.,* 2008). Among the 120 active compounds currently isolated from the higher plants many are widely used in modern medicine and today 80% show a positive correlation between their modern therapeutic use and the traditional use of the plants from which they are derived (Fabricant, 2001). The importance of medicinal plants and the contribution of phytomedicine to the well-being of a significant number of the world's population have attracted interest from a variety of disciplines. The screening of plant extracts for antimicrobial activity has shown that higher plants represent a potential source of novel antibiotic prototypes (Afolayan, 2003). Hence, in the present investigations, phytochemical studies of certain native medicinal plants of Gingee hills are carried on with a view to analyze the presence of chemical constituents that include primary and secondary metabolites and to recommend their application to pharmaceutical industry.

MATERIALS AND METHODS

Plant Collection and Identification

Fresh leaves of *Ormocarpum sennoides* (RHT 65365) and *Bauhinia tomentosa* (RHT 65253) and tuber of *Zehneria scabra* (RHT 65356) were collected from Pakkamalai hills (2263.81 ha) and Thandavasamuthiram hills (318.49 ha) of Gingee, Villupuram during February – March, 2014. Villupuram district lies between 11 38' 25" N and 12 20' 44" S: 78 15' 00" W and 79 42' 55" E with an area of 7222.03 Hec and between 11 – 8' latitudes and 78 – 38' longitudes. Taxonomic identification of these plants was carried out by John Britto, Director and Head, The Rapinant Herbarium (RHT), St. Joseph's College, Tiruchirappalli. A voucher specimen of each experimental plant was deposited at The Rapinant Herbarium.

Study Plants

*Ormocrapum sennoides (*Willd) DC. (Papilionoideae)

Straggler. Erect subshrubs. Branchlets glabrescent, warty; Leaves pinnately 10-13 foliolate; leaflets alternate, 2-3 x 1.2 cm, obovate-oblong, obtuse; petiole slender; stipule ovate. Flowers in slender axillary, 6-10 cm long, racemes; bracts ovate; calyx 6 mm long, lobes ovate, acute, hairy; corolla 8 mm, long, yellow; standard clawed, wings 5 x 4 mm, orbicular, auricled; stamens monadelphous, splitting later; ovary linear, many-ovuled, hispid. Pods 2-3 cm long, 1-4 jointed; joints oblong with soft echinate process. Seed oblong. The medicinal use of this plant is mentioned in Table 1.

***Zehneria scabra* (L.f.) Sond. (Cucurbitaceae)**

Vine. Leaves ovate, tendrils simple, glabrescent, base truncate, margin denticulate, apex acuminate, flowers dioecious, umbellate racemes, corolla greenish-white, petals ovate, fruit ovoid, glabrous, apically beaked. Fruits are red when ripe. The medicinal use of this plant is mentioned in Table 1.

***Bauhinia tomentosa* L. (Caesalpinioideae)**

Shrub or tree, branchlets densely downy-pubescent; leaves orbicular, leaflets connate for about half their length; racemes terminal, 2-5 flowered, yellow fragrant, coloured obovate; pod light green, oblong, compressed, distinctly reticulate, downy pubescent; seeds ovoid. The medicinal use of this plant is mentioned in Table 1.

Plant Extraction for the Preliminary Phytochemical Screening

The leaves and tubers of selected species were washed thoroughly with normal tap water. The tuber was sliced into smaller pieces and the leaves were dried in shade at room temperature. They were crushed to powder using grinding machine. Powders were stored in air tight container bottle with proper labeling of the experimental samples. The powdered materials of 10 gm weighed using electronic balance and were soaked in ethanol, chloroform and aqueous using separate conical flaks. The mouths of the conical flasks were closed with aluminium foil to reduce the volatilization of the solvent. The flaks were kept in rotary shaker for 5 days. After 5 days, the solvent along with solubilized components were collected and filtered through Whatman No. 1 filter paper.

Plant extraction for GC-MS studies

Leaves and tubers were cleaned, shade dried and pulverized to powder in mechanical grinder. Required quantity of powder was weighed and transferred to Stoppard flask, and treated with hydroalcohol (70% v/v) until the powder was fully immersed. The flask was shaken every hour for the first 6 hrs and then it was kept aside and again shaken after 24 hrs. This process was repeated for 3 days and then the extract was filtered. The extract was collected and evaporated to dryness by using vacuum distillation unit. The final residue thus obtained was then subjected to GC-MS analysis.

Preliminary Phytochemical screening

Qualitative phytochemical tests for the identification of alkaloids, flavonoids, steroids and terpenoids were carried out for all the extracts by the method described by Mukherjee (2002).

Test for Phenol *(*Ferric chloride test*):* To 1ml of the leaf extract and 1ml of tuber extract 2ml of distilled water was added followed by few drops of 10% ferric chloride. Formation of blue or black colour indicates the presence of phenols.

Test for Sterols *(*Liebermann-Burchard test*)*: To the test solution, 3-4 drops of acetic anhydride was added, the solution was boiled cooled and conc. Sulphuric acid (3 drops) was added. A brown ring appears at the junction of the two layers. The upper layer turns green showing the presence of steroids.

Test for Tannins

(a) **Gelatin test:** To 2ml test solution, 1% Gelatin solution containing 10% sodium chloride was added to obtain a white precipitate.

Test for Flavanoids

(a) **Zinc chloride reduction test*):*** To 2ml test solution, a mixture of zinc dust (Merck, India) and conc. HCl (Qualigens, India) was added. A red colour is obtained after few minutes.

(b) **Alkaline reagent test:** To 2ml test solution, sodium hydroxide (Qualigens, India) solution was added to give a yellow or red colour.

Test for Alkaloids

(a) **Mayer's test:** To 2ml test solution, 2N HCl was added. The aqueous layer formed was decanted and Mayer's reagent (Qualigens, India) was added to it. A cream coloured precipitate indicates the presence of alkaloids.

Test for fats and fixed oils

(a) **Stain test:** Small amount of the extract was pressed between two filter papers; the stain on the filter paper indicates the presence of fixed oils.

(b) **Saponification test:** Few drops of 0.5N alcoholic potassium hydroxide was added in small quantity to the extract solution with a drop of phenolphthalein and heated on a water bath for 1-2h. The formation of soap or partial neutralization for the alkali indicates the presence of fats and fixed oils.

Test for Glycosides: To 2ml test solution, equal quantity of Fehling's solution A and B was added and solution was heated. A brick red precipitate indicates the presence of glycosides.

Test for proteins and amino acids

(a)* Millon's test*: To 2ml test solution, Millon's reagent is added which gives a white precipitate, which on heating changes to red.

***(b)* Ninhydrin test:** To 2ml test solution, Ninhydrin solution was added and the solution was boiled. Amino acids and proteins when boiled with 0.2% Ninhydrin reagent show a violet colour.

Instrument Specification in GC-MS

Detector: Flame Ionisation Detector/Library; *Fuel Gas*: Hydrogen; *Carrier Gas*: Nitrogen; *Flow Rate*:2.5 ml/mn; *Column*: HP-5 (5% Phenyl Methyl Siloxane) Capillary (30mX320umX0.25um); *Injection T*: 280^{0}C; *Detector T*: 250^{0}C; *Oven T*: 100 for 2 minutes: 100 to 200 @2/min, 200 to 250 @ 3/min and 250 maintained till end; *Split Ratio*: 60:1; *Split Flow:*60 ml/mn; *Total Run time*: 60 (-15) Minutes.

Procedure for GC-MS

The extracted oil from the plant powder was filtered through Wattmann filter paper. It was then diluted 1/10 using Hexane (60-80). 10 microlitre of the diluted sample was then injected using automatic injector (Agilent). The fuel gas was hydrogen and the carrier gas was nitrohen. The flow rate of the carrier gas was 2.50 ml/mn. The column used was HP-5 (5% Phenyl Methyl Siloxane) with a dimension 30 X 320 X 0.25). Then the injection temperature was maintained to 280° C and the detector temperature was 250° C. FID was used as detector. The oven temperature was programmed as 100° C for 2 minutes, 100 to 200 @ 2/min and 200 to 250 @ 3/min and 250° C was maintained till the end. The split ratio while injecting was 60:1. The split flow was 60 ml/mn.

RESULTS AND DISCUSSION

The extracts were examined for their physical characterization like colour, odor and consistency. The color of the aqueous extracts of the experimental samples were yellowish brown and while ethanolic extracts showed the colour of yellow and dark yellow. The consistency level of all the extracts were semi-solids and the odors were characteristic in two samples and sample tuber was odorless. Presence of odor showed the presence of desired phytochemicals. The result of the above study is compiled in Table 2. Different chemical tests were performed to determine the nature of the chemical constituents.

Preliminary phytochemical studies

The triphytochemical screening (aqueous, ethanolic and chloroform) of the extracts of *Ormocarpum sennoides* (leaf) revealed that tannins, alkaloids, proteins and amino acids were present in all the extracts and while phenol and saponins were present only in aqueous and ethanolic extracts. Flavonoid was observed only in aqueous extract and likewise steroid was observed only in chloroform extract. Tests showed that glycosides were totally absent in all the extracts (Table 3). *Bauhinia tomentosa* (leaf) in the triphytochemical screening revealed the presence of phenol, tannins, flavanoids and proteins in all the extracts. Steroids and saponins were present only in aqueous extracts and while the ethanolic and chloroform extracts showed the absence of them. Alkaloids were observed in aqueous and ethanolic extracts and while amino acids were observed in aqueous and chloroform extracts only (Table 3). *Zehneria scabra* (tuber) showed the presence of relatively very less amount of the secondary metabolites in the triphytochemical screening of the extracts. Phenol, proteins and amino acids were present in all the extracts and while steroids and glycosides were observed in only aqueous and ethanolic extracts. Only chloroform extracts showed the presence of tannins and flavanoids. The study also showed the absence of alkaloids and saponins in all the extracts (Table 3). The triphytochemical screening of three medicinal plant extracts revealed the presence of secondary metabolites more in the leaf than the tuber or root as because leaf is involved in more metabolic activities as compared to the root or tuber.

GC-MS studies

The GC-MS study of *Zehneria scabra* (tuber), *Ormocarpum sennoides* (leaf) and *Bauhinia tomentosa* (leaf) have shown many phytochemicals which contributes to the medicinal activity. The tuber of *Zehneria scabra* contains about 33 phytochemical compounds such as terpinolene, citral, nerol, hexanol, heptadiene, linalool oxide, geranyl acetate and other compounds. These 33 compounds are responsible for antimicrobial, antifungal, sedative, antitumor, antioxidant and anti-inflammatory and insecticidal in this plant. Terpinolene is used as sedative; citral is used as antioxidant; nerol is used as antimicrobial; hexanol is used as antifungal; heptadiene is used as antitumor; linalool oxide is used as antileishmanial and geranyl acetate is used as antinociceptive (Table 4 and fig. 1).

GC-MS study of *Ormocarpum sennoides* (leaf) shows that the leaf contains about 18 phytochemical compounds such as menthol, eudesmol myrtenol, elemol, hotrienol, bisabool, octanol, geraniol and other compounds. These 18 compounds are responsible for antimicrobial, antifungal, antioxidant, antimutagenic, antiangiogenic, antitermitic and anti-inflammatory and insecticidal in this plant. Menthol is used anesthetic, insecticidal and anti-inflammatory; eudesmol is used as antiangiogenic and antimutagenic; elemol is used as antitermitic and antimicrobial; hotrienol is responsible for antioxidant; bisabool is responsible for antimicrobial; octanol is responsible for phychotomimetic and geraniol is responsible for antifungal and antibacterial (Table 5 and fig. 2).

The GC-MS study of *Bauhinia tomentosa* (leaf) shows that the leaf contains about 25 phytochemical compounds such as benzaldehyde, hexenol, pinocarveol, heptadienal and ledol and other compounds. These 25 compounds are responsible for antimicrobial, antifungal, antioxidant, antitumor and anxiolytic in this plant. Benzaldehyde is responsible for antitumor; hexenol is responsible for anxiolytic; pinocarveol is used as enzymatic catalyst; heptadienal is responsible for antifungal and antimicrobial and ledol is responsible for antioxidant and insecticidal (Table 6 and fig. 1).

About 33 phytochemical compounds are identified in *Zehneria* tuber. The presence of large number of phytochemicals indicates that the study plant *Zehneria scabra* is highly potent medicinal plant as compared to *Ormocarpum sennoides* (18 phytochemicals) and *Bauhinia tomentosa* (25 phytochemicals). However, less phytochemical compounds does not mean that they less potent in medicinal values, they also contribute medicinal properties very significantly in curing various ailments. GC-MS study also identifies the presence of some phytochemical compounds common to all the three study plants. Phytochemical compound geraniol is present in all the three study plants; terpinolene, citral, nerol, terpeneol, geranyl acetate are present only in *Zehneria* and *Bauhinia* and while eudesmol and bisabool are present only in *Ormocarpum* and *Bauhinia*. Phytochemical compounds eudesmol and bisabool are probably present only in leaves and while being absent in tuber/root. However, the presence of phytochemical compounds terpinolene, citral, nerol, terpeneol, geranyl acetate affirm that both root/tuber and leaves possess same compounds showing that both parts of the plants are potentially important for medicinal purposes. Often tubers are collected from the wild which has depleted the wild population. If leaves can be usefully exploited, it would serve as a guard against depletion of valuable natural population.

Table 1: Various medicinal uses of the experimental plants

Name of the plant	Part used	Uses
Ormocarpum sennoides	leaf	Leaf powder is taken along with honey or milk to strengthen bone and when its paste is tied on the fracture it heals the bone.
Bauhinia tomentosa	leaf	Leaf is taken with honey to stop vomiting; it is cooked and eaten as green vegetable to increase appetite.
Zehneria scabra	tuber	Tuber is consumed for the snakebites; the tuberous herbaceous perennial plant is grown at home to keep away snakes; it is also used for diabetes.

Table 2: Physical characteristics of the extracts

Name of the Extracts	Name of plant	Part used	Consistency	Colour	Odor
Ethanolic extract Aqueous extract	*Ormocarpum sennoides*	leaf	Semi-solid Semi-solid	dark green greenish brown	characteristic characteristic
Ethanolic extract Aqueous extract	*Bauhinia tomentosa*	leaf	Semi-solid Semi-solid	dark green greenish brown	characteristic characteristic
Ethanolic extract Aqueous extract	*Zehneria scabra*	tuber	Semi-solid Semi-solid	yellow Yellowish brown	no odor no odor

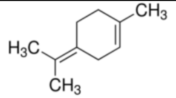
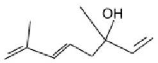
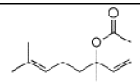
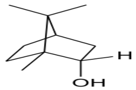
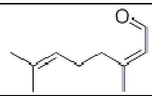
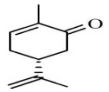
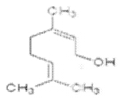
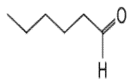
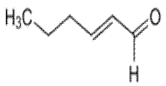
Table 3: Phytochemical tests in the aqueous, ethanolic and chloroform extracts

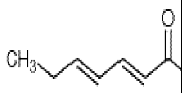
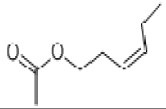
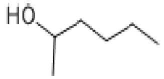
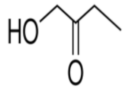
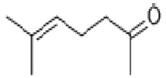
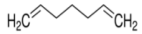
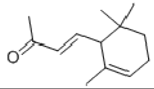
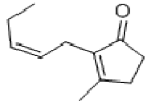
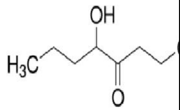
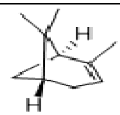
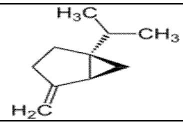
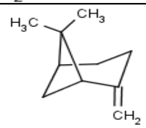
Name of the plants	Part used	Phytoconstituents	Aqueous extract	Ethanolic extract	Chloroform extract
Ormocarpum sennoides	leaf	Phenol	+	+	-
		Steroids	-	-	+
		Tannins	+	+	+
		Flavonoids	+	-	-
		Alkaloids	+	+	+
		Saponins	+	+	-
		Glycosides	-	-	-
		Proteins	+	+	+
		Amino acids	+	+	+
		Phenol	+	+	+
		Steroids	+	-	-
		Tannins	+	+	+
		Flavonoids	+	+	+

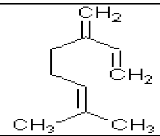
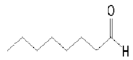
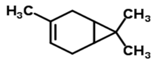
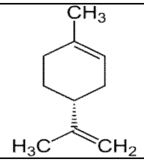
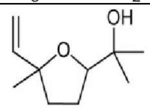
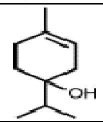
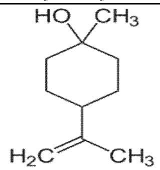
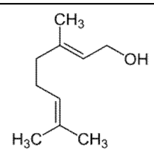
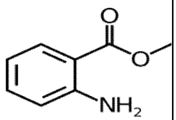
Bauhinia tomentosa	leaf	Alkaloids	+	+	-
		Saponins	+	-	-
		Glycosides	+	-	+
		Proteins	+	+	+
		Amino acids	+	-	+
Zehneria scabra	tuber	Phenol	+	+	+
		Steroids	+	+	-
		Tannins	-	-	+
		Flavanoids	-	-	+
		Alkaloids	-	-	-
		Saponins	-	-	
		Glycosides	+	+	-
		Proteins	+	+	+
		Amino acids	+	+	+

(+) = Present, **(-)** = Absent

Table 4: GC-MS Phytochemical Quantifications in *Zehneria scabra* (tuber)

Sl no	Compound name	Molecular formula	Molecular structure	Molecular Weight	Retention time in min	Percentage composition of the volatile matter (w/w)	Percentage Probability	Activity
1	TERPINOLENE	$C_{10}H_{16}$		136.23	1.25	1.25%	92%	Sedative
2	HOTRIENOL	C_{10} H_{16} O		152.23	1.55	0.25%	95%	Aromatic, Antimicrobial
3	LINAYL ACETATE	$C_{12}H_{20}O_2$		196.29	2.03	3.12%	96%	Anti-inflammatory
4	BORNEOL	$C_{10}H_{18}O$		154.25	2.45	3.25%	95%	Sedative, anti-depressant
5	ALPHA-CITRAL	$C_{10}H_{16}O$		152.24	3.25	0.45%	99%	Antioxidant
6	L-CARVONE	$C_{10}H_{14}O$		150.22	3.56	1.25%	93%	Anti-inflammatory
7	NEROL	$C_{10}H_{18}O$		154.25	3.19	1.62%	85%	Antimicrobial
8	HEXANAL	$C_6H_{12}O$		100.15	4.25	2.51%	86%	Antifungal
9	2-HEXANAL	$C_6H_{10}O$		98.14	5.02	1.02%	98%	Antimicrobial

10	2,4 HEPTADIENAL	$C_2H_5CH{=}CHCH{=}CHCHO$		110.15	6.40	2.15%	96%	Antimicrobial
11	HEXENYL ACETATE	$CH_3CO_2CH_2CH_2CH{=}CHC_2H_5$		142.20	7.15	3.05%	95%	Gene inducer , insecticidal
12	HEXANOL	$C_6H_{13}OH$		102.17	7.58	4.52%	98%	Antimicrobial, optical
13	HYDROXY-BUTANONE	$HOCH_2CH_2COCH_3$		88.11	7.29	0.52%	99%	Antioxidant
14	METHYL HEPTENONE	$C_8H_{14}O$		126.19	8.25	0.65%	96%	Antifungal
15	HEPTADIENE	C_7H_{12}		96.17	8.55	2.35%	95%	Antitumor
16	IONONE	$C_{13}H_{20}O$		192.30	10.24	1.25%	98%	Proliferative
17	JASMONE	$C_{11}H_{16}O$		164.24	12.35	0.21%	96%	Antimicrobial
18	OCTANONE	$C_8H_{16}O$		128.21	13.26	0.95%	95%	Inhibitory
19	ALPHA-PINENE	$C_{10}H_{16}$		136.23	13.55	1.25%	97%	Anti-inflammatory
20	SABINENE	$C_{10}H_{16}$		136.23	14.02	0.25%	96%	Antimicrobial
21	BETA-PINENE	$C_{10}H_{16}$		136.23	15.02	2.35%	96%	Antimicrobial, inhibitory

22	**MYRCENE**	**$C_{10}H_{16}$**		**136.23**	**15.32**	**7.25%**	**92%**	**Sedative**
23	**OCTANAL**	**$C_8H_{16}O$**		**128.21**	**15.55**	**0.54%**	**99%**	**Antifungal**
24	**CARENE**	**$C_{10}H_{16}$**		**136.24**	**16.24**	**2.01%**	**95%**	**Anthelmintic**
25	**LIMONENE**	**$C_{10}H_{16}$**		**136.23**	**16.54**	**0.32%**	**98%**	**Antioxidant**
26	**LINALOOL OXIDE**	**C_{10} H_{18} O_2**		**170.25**	**16.59**	**2.14%**	**94%**	**Antileishmanial**
27	**TERPIN-4 OL**	**$C_{10}H_{18}O$**		**154.25**	**17.22**	**1.25%**	**99%**	**Anticonvulsant**
28	**TERPENEOL**	**$C_{10}H_{18}O$**		**154.25**	**17.35**	**1.24%**	**98%**	**Gastroprotective**
29	**GERANIOL**	**$C_{10}H_{18}O$**		**154.25**	**18.25**	**0.21%**	**95%**	**Antimicrobial**
30	**METHYL – ANTHRANYLATE**	**$C_8H_9NO_2$**		**151.16**	**18.55**	**0.30%**	**96%**	**Antifungal**

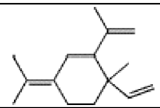
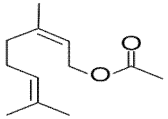
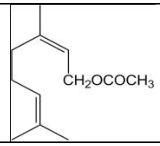
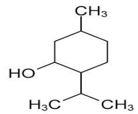
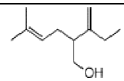
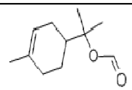
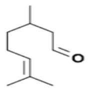
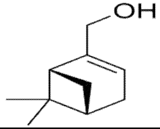
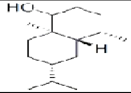
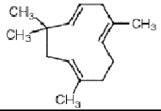
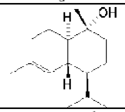
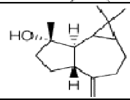
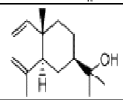
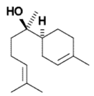
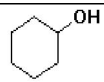
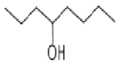
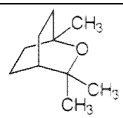
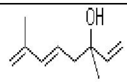
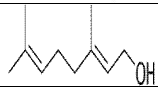
31	ELEMENE	$C_{15}H_{24}$		204.35	20.35	0.25%	98%	Antitumor, anticancer
32	NERYL ACETATE	$C_{12}H_{20}O_2$		196.29	35.40	0.45%	95%	Antioxidant, Antinociceptive
33	GERANYL ACETATE	$C_{12}H_{20}O_2$		196.29	36.20	5.01%	98%	Antinociceptive

Table 5: GC-MS Phytochemical Quantifications in *Ormocarpum sennoides* (leaf)

Sl no	Compound name	Molecular Formula	Molecular Structure	Molecular weight	Retention time in min	Percentage composition of the volatile matter (w/w)	Percentage probability	Activity
1	MENTHOL	$C_{10}H_{20}O$		156.27	2.25	1.29%	98%	Anaesthetic Anti-inflammatory Insecticidal
2	LAVANDULOL	$C_{10}H_{18}O$		154.25	3.56	0.25%	95%	Antimicrobial, antifungal
3	TERPENYL FORMATE	$C_{11}H_{18}O_2$		182	3.58	0.45%	96%	Antileishmanial Antifungal
4	CITRONELLAL	$C_{10}H_{18}O$		154.25	4.02	0.23%	99%	Antifungal, anti-inflammatory, antioxidant

5	MYRTENOL	$C_{10}H_{16}O$		152.23	4.35	0.51%	98%	Antifungal
6	EUDESMOL	$C_{15}H_{26}O$		222.37	9.56	0.24%	98%	Antiangiogenic, antimutagenic
7	CARYOPHELLENE	$C_{15}H_{24}$		204.36	10.12	1.23%	95%	Anesthetic, analgesic, anti-inflammatory
8	CADINOL	$C_{15}H_{26}O$		222.37	11.23	2.52%	95%	Antimitic
9	SPATHULENOL	$C_{15}H_{24}O$		220.35	12.02	6.21%	96%	Antitermitic, antimicrobial
10	ELEMOL	C_{15} H_{26} O		222.37	12.54	0.45%	94%	Antitermitic, antimicrobial
11	BISABOOL	$C_{15}H_{26}O$		222.37	24.55	0.62%	98%	Antimicrobial
12	CYCLO-HEXANOL	$C_6H_{12}O$		100.15	25.02	0.52%	95%	Catalytic
13	OCTANOL	$C_8H_{18}O$		130.23	25.35	0.33%	95%	Phychotomimetic
14	1,8 CINEOLE	$C_{10}H_{18}O$		154.25	27.48	1.25%	95%	Antibacterial, anticancer
15	HOTRIENOL	$C_{10}H_{16}O$		152.23	32.12	2.45%	96%	Antioxidant
16	GERANIOL	$C_{10}H_{18}O$		154.25	35.25	2.03%	98%	Antibacterial, antifungal

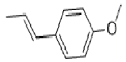
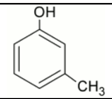
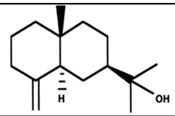
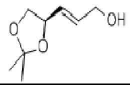
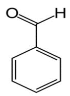
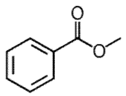
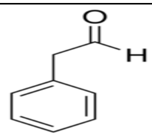
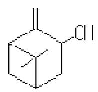
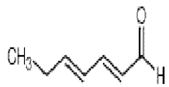
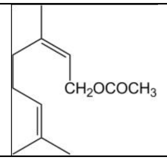
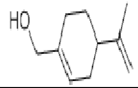
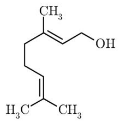
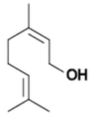
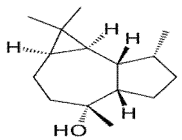
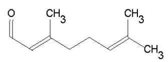
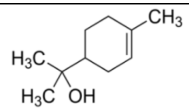
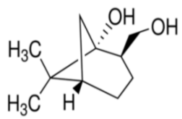
17	ANETHOL	$C_{10}H_{12}O$		148.20	38.45	2.21%	99%	Antifertility, insecticidal
18	CRESOL	C_7H_8O		108.14	42.56	3.02%	95%	Antioxidant, anti-inflammatory

Table 6: GC-MS Phytochemical Quantifications in *Bauhinia tomentosa* (leaf)

Sl no	Compound name	Molecular formula	Molecular structure	Molecular weight	Retention time in min	Percentage composition of the volatile matter (w/w)	Percentage probability	Activity
1	EUDESMOL	$C_{15}H_{26}O$		222.37	3.25	0.25%	98%	Antimutagenic, antiangiogenic
2	PENTENOL	$C_5H_{10}O$		86.13	3.54	1.24%	95%	Antimicrobial
3	HEXENOL	$C_6H_{12}O$		100.15	4.02	1.35%	96%	Anxiolytic
4	BENZALDEHYDE	C_7H_6O		106.12	5.12	2.52%	99%	Antitumor
5	METHYL BENZOATE	$C_8H_8O_2$		136.15	5.32	3.25%	95%	Antibacterial
6	PHENYL ACETALDEHYDE	C_8H_8O		120.15	5.45	3.65%	96%	Antimicrobial
7	PINOCARVEOL	$C_{10}H_{16}O$		152.23	8.25	4.25%	99%	Catalytic

8	HEPTADIENAL	$C_2H_5CH=CHCH=CHCHO$		110.15	8.54	4.65%	95%	Antifungal, antimicrobial
9	GERANYL ACETATE	$C_{12}H_{20}O_2$		196.29	9.02	5.26%	98%	Antinociceptive
10	CUMINYL ALCOHOL	$C_{10}H_{14}O$		150.22	9.45	1.02%	99%	Anticarcinogenic
11	GERANIOL	$C_{10}H_{18}O$		154.25	12.02	3.02%	95%	Antifungal, antibacterial
12	NEROL	$C_{10}H_{18}O$		154.25	12.42	4.25%	99%	Antimicrobial
13	LEDOL	$C_{15}H_{26}O$		222.37	12.45	3.02%	96%	Antioxidant, insecticidal
14	CITRAL	$C_{10}H_{16}O$		152.24	14.54	0.21%	98%	Antimicrobial, antifungal
15	TERPENIOL	$C_{10}H_{18}O$		154.25	15.24	0.54%	94%	Gastroprective
16	TERPENE-1 OL	$C_{10}H_{18}O$		154.25	16.25	9.25%	97%	Anticonvulsant

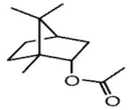
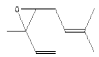
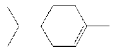
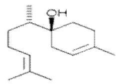
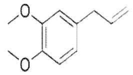
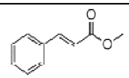
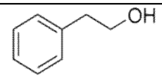
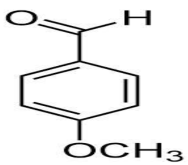
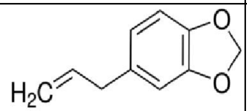
17	BORNYL ACETATE	$C_{12}H_{20}O_2$		196.29	17.45	2.04%	99%	Antioxidant
18	OCIMENE OXIDE	$C_{10}H_{16}O$		152.23	32.02	6.02%	98%	Antioxidant, antifungal, anti-inflammatory
19	TERPINOLENE	$C_{10}H_{16}$		136.23	32.21	6.25%	96%	Sedative
20	BISABOOL	$C_{15}H_{26}O$		222.37	33.54	5.26%	95%	Antimicrobial, antihyperalgesic, antiedematous
21	METHYL EUGENOL	$C_{11}H_{14}O_2$		178.23	36.25	5.24%	94%	Antifungal
22	METHYL CINNAMATE	$C_{10}H_{10}O_2$		162.19	37.25	1.25%	98%	Antimicrobial
23	PHENETHYL ALCOHOL	$C_8H_{10}O$		122.16	38.21	11.02%	99%	Antibacterial
24	ANISALDEHYDE	$C_8H_8O_2$		136.15	38.35	3.04%	95%	Antioxidant
25	SAFROLE	$C_{10}H_{10}O_2$		162.19	38.39	7.05%	96%	Antibacterial

Fig. GC-MS Chromatogram in *Zehneria scabra* (tuber)

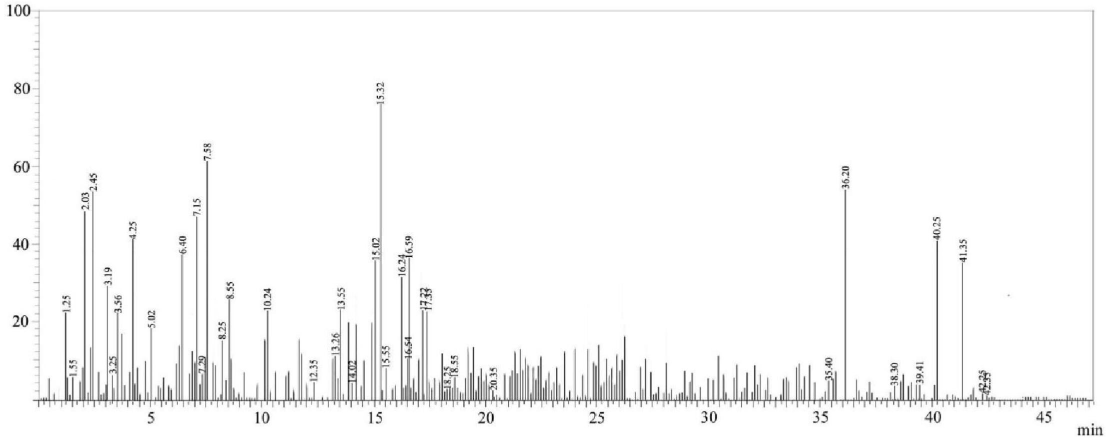


Fig. GC-MS Chromatogram in *Ormocarpum sennoides* (leaf)

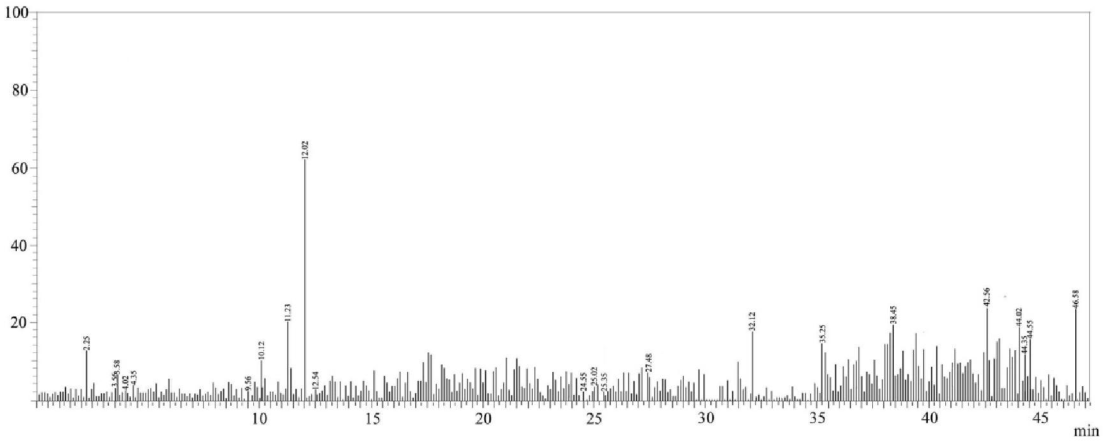
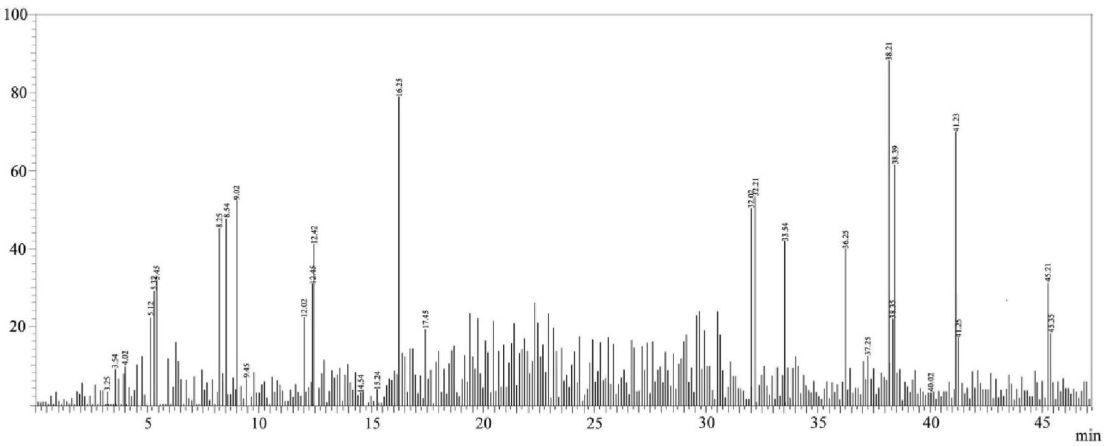


Fig. GC-MS Chromatogram in *Bauhnia tomentosa* (leaf)



CONCLUSION

With the increasing interest and so many promising drug candidates in the current development pipeline that are of natural origin, and with the lessening of technical drawbacks associated with natural product research, there are better opportunities to explore the biological activity of previously inaccessible sources of natural products. The phytochemical studies of the selected medicinal plants in Gingee hills also adds more importance that the pharmacoglogistic studies need to be carried out in all medicinal plants in order to discover more newer drugs for various ailments. In addition, the increasing acceptance that the chemical diversity of natural products is well suited to provide the core scaffolds for future drugs, there will be further developments in the use of novel natural products and chemical libraries based on natural products in drug discovery campaigns.

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