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GC-MS ANALYSIS OF PHYTOCHEMICALS IN METHANOLIC LEAF EXTRACTS OF COMMONLY AVAILABLE HERBAL PLANTS INVELLORE, TAMIL NADU, INDIA.

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Abstract:

Clitorea ternatea, *Acalypha indica*, *Cissus quadrangularis*, *Catharanthusroseus* and *Coleus aromaticus* are the plants which are commonly available herbals in Vellore district, Tamil Nadu, India. In the present study, the methanolic leaf extracts of the plants are subjected to Gas chromatography- Mass spectrometry analysis and investigated for the important phytochemical constituents. The GC-MS analysis revealed the presence of 8 major compounds in *Clitorea ternatea*, 10 major compounds in *Acalypha indica*, 11 major compounds in *Cissus quadrangularis*, 9 major compounds in *Catharanthus roseus* and 5 major compounds in *Coleus aromaticus*. There were also certain compounds which are commonly available on comparing the phytochemicals. The results of the present comparative study may lead to the invention of new drugs, herbal medicines and in various medical fields for treating several maladies, which may lead to the development of novel drugs using nanotechnology.

***Index terms*: Clitorea ternatea, Acalypha indica, Cissus quadrangularis, Catharanthus roseus, Coleus aromaticus.**

1.INTRODUCTION:

Plants are the good source of medicine and it is inherited and used as the important compound in the health care system universally. India is called as the botanical garden of the world as it produces large quantity of valuable medicinal plants. Plant medicines are used to treat infectious diseases as well as chronic diseases. (Tandon and Yadav, 2017)

Drugs are being developed all the time since a growing number of people developvarious acute and chronic infections, diseases, cancer, heart problems, diabetes etc., Now, it has become the major threat to human race because the consequences are devastating. Any prescribed drug itself could lead to various other minor and major health issues. (Zhao et al., 2018) Therefore, people still prefer plant-based natural medicines which has lesser or no impact. More than 80,000 plant species are been used for the treatment of various diseases as traditional medicines acrossthe different regions of India.

It is generally reported that 5,000 of 35,000 species in China is used as the drugsin Chinese traditional medicine. A plant is considered as a medicinal plant, whenit has effects that are related to health (i.e,) which have been proven to be useful as drugs or that contains the constituents of drugs. The medicinal plants and theirconstituents are able to take the edge off or to reduce or to cure the human sickness and ailment.(Akerele et al., 1991)

National health portal reports that evidence still exist on Unani hakims, Indian vaids, European and Mediterranean cultures used herbs as medicines for over 4000 years. There is a high demand for the plant-based drugs and medicines because of the growing population, inadequate drug supply, cost of the medicinesand side effects.

India is a well-known country to use medicinal plants for treating the diseases. Medicinal plants and aromatic plants are being used as raw materials for the manufacture of drugs. There are about 8000 herbal remedies which have been systematized in AYUSH in INDIA. Drugs by natural plants are very safe with minimal side effects and it can be used

independent of any age and sex. Medicinal plants are used in drug development in pharmacopoeial, non-pharmacopoeial or synthetic drugs.("Introduction and Importance of Medicinal Plants and Herbs | National Health Portal of India," n.d.)

The bio-active compounds of the medicinal plants exhibit various pharmacological actions such as anti-fungal, anti-cancerous, ant-inflammatory and anti-oxidant properties. It can be prepared by crude plant extract or by the mixture of different phytochemicals. The bio-active compounds, flavonoids, phenolic acids, isoflavones, carotenoids, isothiocyanates etc., comprises the phytochemicals that acts as the strong reducing agent in the synthesis of nanoparticles. Extraction and characterization of such phytochemicals may lead to the discovery of many traditional medicineswhich can further be used to treat different diseases.(Mittal et al., 2013)

The present study was designed to determine and compare the various bio-activecompounds of the locally available plants *Clitorea ternatea, Acalypha indica, Cissus quadrangularis, Catharanthus roseus* and *Coleus aromaticus* using GC- MS method.

2. METHODS AND MATERIALS:

2.1 COLLECTION AND PREPARATION OF THE PLANT MATERIAL:

The fresh leaves of the medicinal plants *Clitorea ternatea, Acalypha indica, Catharanthus roseus, Coleus aromaticus* and the aerial parts of the plant,*Cissus quadrangularis* were collected from the local areas of Vellore district, Tamilnadu, India during the month of April 2021.

The methanolic extraction of the plants was done according to (Sivanandham, 2015) with some modifications. The freshly collected leaves were thoroughly washed in tap water for 5 minutes to remove the dirt and dust particles. Then, it is rinsed in distilled water before they were cut into pieces. The cut small pieces were dried in shade at roomtemperature for about 10 days. It is the powdered using a mechanical blender andstored in the air tight container.

The dried leaf samples were individually extracted with methanol. 5g of dried leaf samples were added to 100ml of the distilled water and kept overnight in the magnetic stirrer. It is then allowed to settle down and filtered and concentrated by evaporation and stored at 4℃ for future use.

2.2. GC-MS ANALYSIS:

Gas chromatography is an instrument to separate the volatile organic compounds present in the given sample at molecular level. On heating, the mixture of compounds gets separated into individual compounds, where inert gas is used as the carrier to pass through a column. Once they get separated, they flow into mass spectrometry to analyze the compounds by it's mass.

The bio-active compounds screening or analysis was carried out on GC- MS. Oven: Initial temp 60°C for 2.80 min, ramp 10°C/min to 300°C, hold 6 min,InjAauto=260°C, Volume=0 µL, Split=10:1, Carrier Gas=He, Solvent Delay=2.20 min, Transfer Temp=230°C, Source Temp=230°C, Scan: 40 to600Da, Column 30.0m x 250µm

3.RESULTS AND DISCUSSION:

3.1 Clitorea ternatea:

Clitorea ternatea, commonly called as butterfly pea is a perennial herb which is indigenous to India and found throughout the Indian sub-continent. (Mukhopadhyay et al., 2012). *Clitorea ternatea* is commonly said to have analgesic, anti-pyretic, anti-diabetic, anti-inflammatory etc., snake bite and scorpion sting are also treated using *Clitorea ternatea*.(Talpate et al., 2014). On screening the methanolic extract of *Clitorea ternatea*, 8 compounds are present of which cis-9,10 epoxyoctadecan-1-ol covers the area of about 50.656% The phytochemical compounds are tabulated in the Table 7.1.1.

3.2 Acalypha indica:

Acalypha indica is a indigenous species of Indian sub-continent which is commonly called as Indian copper-leaf and Indian nettle. It is annual herb foundall throughout the year.("The Evaluation of Nitric Oxide Scavenging Activity of*Acalypha indica* Linn Root-Indian Journals," n.d.)

The methanolic extraction of *Acalypha indica* was subjected to GC-MS and screened 10 compounds of which 4- fluoro- 1-methyl-5-carboxylic acid.ethyl ester is the major compound identified with 24.707%. The second major component is 9-Bromononaldehyde with 17.074%. The compounds identified are tabulated in the Table 7.2.1.

3.3 Cissus quadrangularis:

Cissus quadrangularis is a perennial medicinal herb which belongs to the familyVitaceae. Some common names are hadjod, pirandai, adamant creeper vajravallietc., It is indigenous to Indian sub-continent and commonly found in India, Bangladesh and Sri Lanka. It is used in the treatment of female disorders, bone disorders etc., (Ayesha siddiqua et al., 2017)

The methanolic extract was prepared from the aerial parts of the *Cissus quadrangularis* and subjected to GC-MS and screened for phytochemical compounds of which Dodecanal is found as the major component with 29.392%.The second major component is Trans-z-alpha-bisabolene epoxide with 22.001%. The results are tabulated in the Table 7.3.1.

3.4 Catharanthus roseus:

Catharanthus roseus is a plant which belongs to the class Apocyanaceae. It is used to treat diabetes by making decoction with leaves. (Nammi et al., 2003). The methanaloic extract of the leaves of *C.roseus* was prepared and subjected to GC-MS and screened 9 different phytochemical components of which 13-Tetradece-11-YN-1-Ol is the top major component with 50.660%. The phytochemical components are tabulated in Table 7.4.1.

3.5 Coleus aromaticus:

Coleus aromaticus is a medicinal plant which belongs to the family lamiaceae. Itplays a vital role to treat malaria, hepatopathy, cough, chronic asthma, bronchitisetc., It is highly aromatic. It is found in all parts of India.(Wadikar and Patki, 2016)

The methanolic extract of *Coleus aromaticus* leaves were prepared and subjectedto GC-MS study. On screening the extract 4-fluoro-1-methyl-5-Carboxylic Acid,Ethyl Ester is identified as the major component with 48.279%. The second major component is tetradecane,1- chloro with 17.556%. The phytochemical compounds are tabulated in the tabular column 7.5.1.

In the methanolic extract of *C.ternatea* hydrogen bond donor count of cis-9,10 epoxyoctadecan-1-ol is 1 (PubChem, n.d.). cis-9,10 epoxyoctadecan-1-ol is reported to have antimicrobial activity.(Pv and R.D et al, 2020). On screening themethanolic extract of *Clitorea ternatea* in GC-MS (Department of Molecular Biology and Genetic Engineering, CBSH, G. B. Pant University of Agriculture and Technology, Pantnagar 263145, India et al., 2018) reported 24 different compounds with 1,2-benzenedicarboxylic acid, Butyl 2-Ethylhexyl ester with 30.19% and 1,2-benzenedicarboxylic acid, Bis(2_methylpropyl)ester with20.11%.

In the methanolic extract of *A.indica* hydrogen bond donor count of the compound 4- fluoro- 1-methyl-5-carboxylic acid.ethyl ester is 0. the hydrogen bond donor count of the compound 9-bromononaldehyde is 0. (Hussain and Kumaresan et al., 2013) prepared the whole plant methanolic extraction of *Acalypha indica* and subjected it to GC-MS. He reported the presence of 7 compounds. (Ravi et al., 2017) reported 13 major compounds in the methanolic extraction of the leaves of *Acalypha indica*.

The major components of the plant *C.quadrangularis* dodecanal and Trans-z- alpha-bisabolene epoxide has the hydrogen bond donor count 0. (Ramasamy et al., 2012) prepared the alcoholic extraction of *Cissus quadrangularis* plant material and subjected to GC-MS screened and reported 10 compounds where 2are unknown compounds.

The methanolic extract of the leaves of *Catharanthus roseus* has a compound 2,6,10-dodecatrien, where the hydrogen bond donor count is 2. (Thanwar et al.,2017) prepared the methanolic extract of leaves of *Catharanthus roseus* usingSoxhlet apparatus and subjected it to GC-MS study. On screening, it is reported that 12 different compounds are present. (Syeda and Riazunnisa, 2020) reported 40 compounds in methanolic extraction and 25 compounds in aqueous extractionof *Catharanthus roseus*.

The methanolic extract of the leaves of *C.aromaticus* has a major compound 4- fluoro-1-methyl-5 and tetradecane,1- where the hydrogen bond donor count is 0.(Mamani and Alhaji, 2019.) prepared the methanolic extract of coleus aromaticusand screened 26 different phytochemical compounds.

Considering all the points mentioned above, it is clear that plants are the good sources of chemical compounds. Since these plants have medicinal properties with minimal side effects the plant extracts can be used for the synthesis of nanoparticles as they contain phytochemicals which are reducing agents as well.

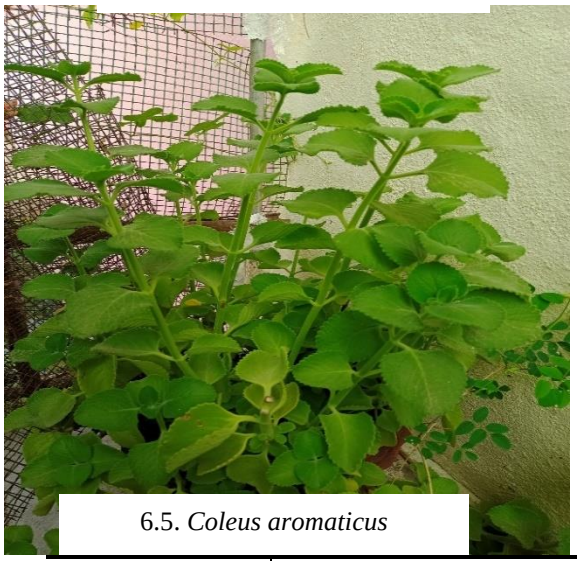
6. IMAGES OF COMMONLY AVAILABLE HERBAL PLANTS IN VELLORE

6.1. *Clitorea ternatea*

6.2. *Acalypha indica*

6.3. *Cissus quadrangularis*

6.4. *Catharanthus roseus*



6.5. *Coleus aromaticus*

7. TABLES

TABLE:7.1

GC-MS qualitative report of *Clitorea ternatea*

#	RT	Scan	Height	Area	Area %	Norm %
1	21.131	3785	3,255,134	812,112.5	2.801	5.53
2	22.072	3973	6,998,487	4,611,399.0	15.906	31.40
3	26.613	4881	5,425,324	1,354,004.9	4.670	9.22
4	27.008	4960	12,937,254	2,979,973.5	10.279	20.29
5	28.274	5213	10,631,749	14,685,824.0	50.656	100.00
6	28.829	5324	7,348,528	1,489,238.5	5.137	10.14
7	28.884	5335	7,381,573	2,406,754.0	8.302	16.39
8	29.750	5508	2,796,292	651,785.6	2.248	4.44

TABLE:7.2

GC-MS qualitative report of *Acalypha indica*

#	RT	Scan	Height	Area	Area %	Norm %
1	18.360	3231	3,962,621	1,336,455.8	5.775	23.38
2	18.770	3313	3,192,464	1,139,084.5	4.922	19.92
3	21.161	3791	4,273,134	2,310,808.0	9.986	40.42
4	27.129	4984	8,855,922	3,951,078.0	17.074	69.11
5	27.799	5118	8,619,705	5,717,321.0	24.707	100.00
6	28.214	5201	7,032,893	1,309,546.9	5.659	22.90
7	28.424	5243	6,718,174	2,022,590.8	8.740	35.38
8	28.919	5342	11,234,985	2,838,848.5	12.268	49.65
9	29.254	5409	5,952,241	2,007,878.8	8.677	35.12
10	29.755	5509	3,233,297	507,222.3	2.192	8.87

TABLE:7.3

GC-MS qualitative report of *Cissus quadrangularis*

#	RT	Scan	Height	Area	Area %	Norm %
1	3.314	223	1,990,561	610,083.6	1.592	5.42
2	10.947	1749	2,019,262	478,579.4	1.249	4.25
3	24.698	4498	9,176,450	1,123,369.8	2.931	9.97
4	25.138	4586	10,575,033	1,320,444.5	3.445	11.72
5	26.308	4820	16,824,064	3,242,286.0	8.459	28.78
6	27.104	4979	11,760,155	5,800,801.0	15.135	51.49
7	27.519	5062	14,607,230	11,265,328.0	29.392	100.00
8	28.529	5264	9,236,145	1,809,872.6	4.722	16.07
9	28.844	5327	13,173,924	3,439,159.2	8.973	30.53
10	29.224	5403	13,705,042	8,432,637.0	22.001	74.85
11	30.240	5606	3,648,304	805,480.5	2.102	7.15

TABLE :7.4

GC-MS qualitative report of *Catharanthus roseus*

#	RT	Scan	Height	Area	Area %	Norm %
1	18.215	3202	8,883,284	1,877,154.1	2.018	3.98
2	18.595	3278	6,558,613	2,046,327.9	2.200	4.34
3	20.011	3561	35,063,172	21,985,862.0	23.641	46.67
4	21.271	3813	52,761,884	47,114,000.0	50.660	100.00
5	24.542	4467	25,462,584	2,048,840.5	2.203	4.35
6	26.828	4924	28,703,138	5,474,275.0	5.886	11.62
7	27.934	5145	9,388,389	2,823,972.2	3.037	5.99
8	29.595	5477	17,860,328	4,647,492.0	4.997	9.86
9	30.105	5579	15,910,271	4,982,653.5	5.358	10.58

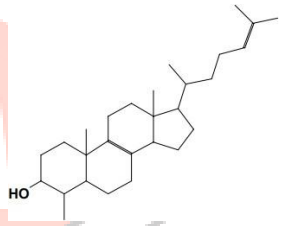
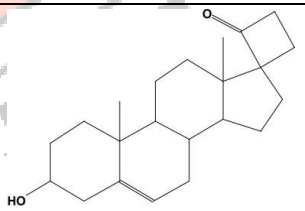
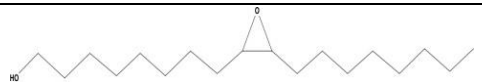
TABLE: 7.5

GC-MS qualitative report of *Coleus aromaticus*

#	RT	Scan	Height	Area	Area %	Norm %
1	27.579	5074	9,726,877	7,947,029.0	48.279	100.00
2	28.294	5217	7,223,506	2,889,819.8	17.556	36.36
3	29.104	5379	7,774,174	2,696,173.2	16.379	33.93
4	29.279	5414	7,425,718	2,015,677.5	12.245	25.36
5	29.794	5517	3,882,207	912,038.2	5.541	11.48

TABLE:7.1.1

Major compounds present in methanolic extract of *Clitorea ternatea*

S.NO	COMPOUND	R.T	AREA %	MOL.WT	MOL. FORMULA	NIST REF. NO	MOL.STRUCTURE	BIOLOGICAL ACTIVITY
1	HEXADECANAL	21.131	2.801	240	$C_{16}H_{32}O$	5691		Flavouring agent
2	HEXADECANAL	22.072	15.906	240	$C_{16}H_{32}O$	5691		Not reported
3	CHOLESTA-8,24-DIEN-3-OIL,4METHYL-,(3,BETA.,4,ALPHA.)-	26.613	4.670	398	$C_{28}H_{46}O$	3103		Not reported
4	SPIRO[ANDROST-5-ENE-17,1'-CYCLOBUTAN]-2'ONE,3-HYDROXY-,(3.BETA.,17.BETA)-	27.008	10.279	398	$C_{22}H_{32}O_2$	2214		Diuretic, cancer preservative, anti-arthritic,hepatoprotective, anti-asthma and anti-inflammatory
5	CIS-9,10 EPOXYOCTADECAN-1-OL	28.274	50.656	284	$C_{18}H_{36}O_2$	17516		Anti- microbial

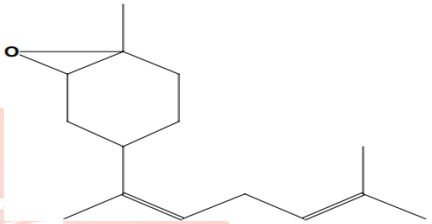
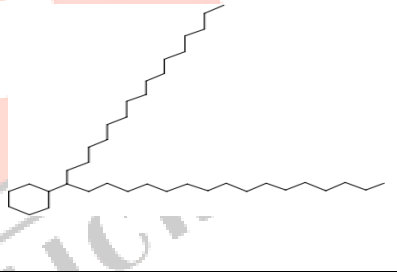
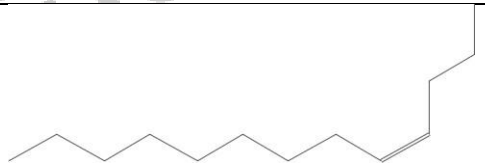
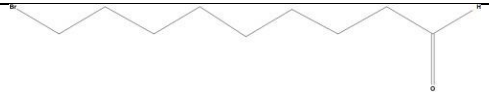
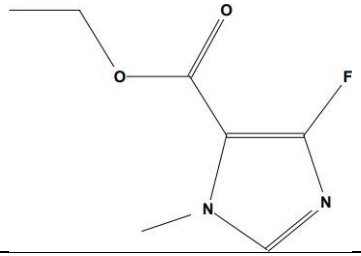
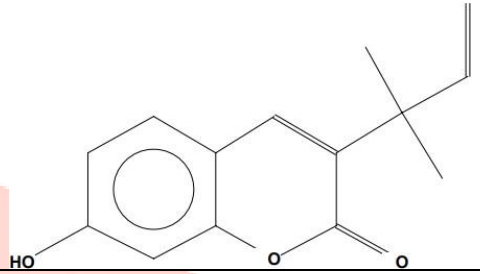
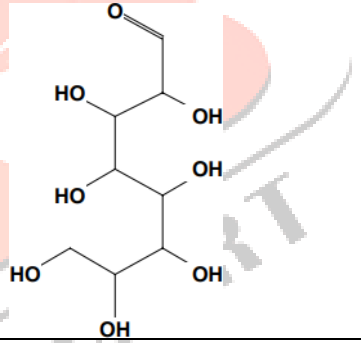
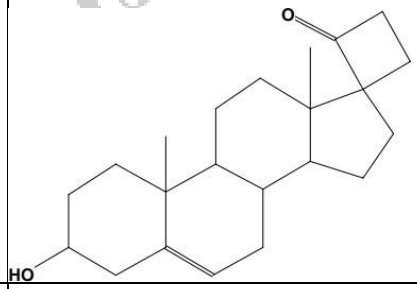
6	HEXADECANAL	28.829	5.137	240	$C_{16}H_{32}O$	5691		Flavouring agent
7	ACETOXYACETIC ACID, NONYL ESTER	28.884	8.302	244		5571		Not reported
8	TRANS-Z-ALPHA-BISBOLENEEPOXIDE	29.750	2.248	220	$C_{15}H_{24}O$	5520		Anti-tumor, analgesic, anti-bacterial, anti-inflammatory, sedative and fungicide.

TABLE:7.2.1

Major compounds present in methanolic extract of *Acalypha indica*

S.NO	COMPOUND	RT	AREA %	MOL.WT	MOL. FORMULA	NIST REF NO	MOL.STRUCTURE	BIOLOGICAL ACTIVITY
1	HEXADECANAL	18.360	5.775	240	$C_{16}H_{32}O$	5691		Flavouring agent
2	CYCLOHEXANE,(1-HEXADECYLHEPTODECYL)-	18.770	4.922	546	$C_{39}H_{78}$	193603		Not reported
3	4-TRIDECENE,(Z)-	21.161	9.986	182	$C_{13}H_{26}$	2486		Biological control of pest
4	9-BROMONONALDEHYDE	27.129	17.074	220	$C_9H_{17}OBr$	17359		Not reported

5	4-FLUORO-1-METHYL-5-CARBOXYLICACIDD,ETHYL(ESTER)	27.799	24.707	172	$C_7H_9O_2N_2F$	2365		Not reported
6	7-HYDROXY-3-(1,1-DIMETHYLPROP2-ENYL)COUMARIN	28.214	5.659	230	$C_{14}H_{14}O_3$	6399		Not reported
7	L-GALA-L-IDO-OCTOSE	28.424	8.740	240	$C_8H_{16}O_8$	6311		Important compound in memory drug protection.
8	SPIRO[ANDROST-5-ENE-17,1'-CYCLOBUTAN]-2'ONE,3-HYDROXY- ,(3.BETA.,17.BETA)-	28.919	12.268	328	$C_{22}H_{32}O_2$	2214		Diuretic, cancer preservative, anti-arthritic,hepatoprotective,anti-asthma and anti- inflammatory
9	DODECANAL	29.254	8.677	184	$C_{12}H_{24}O$	2141		Plant metabolite and flavouring agent

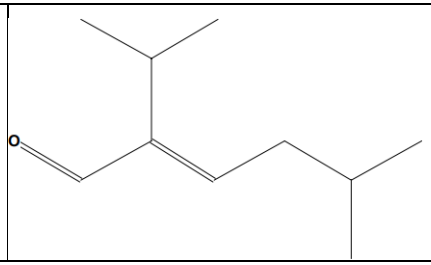
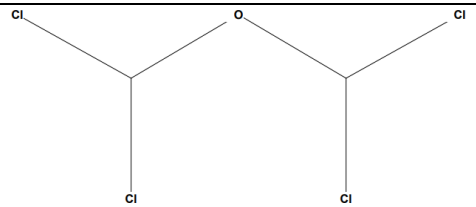
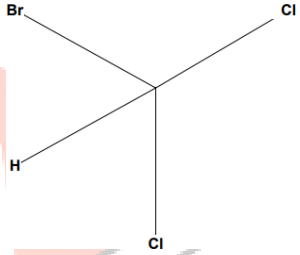
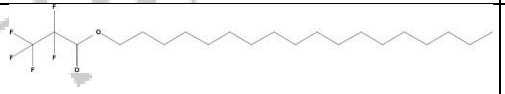
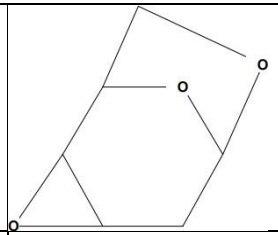
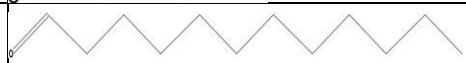
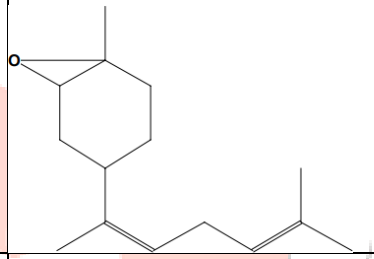
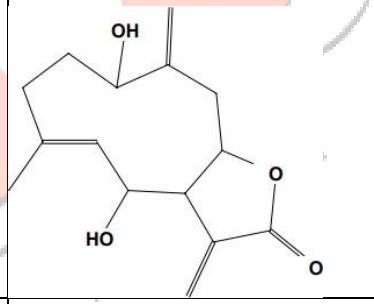
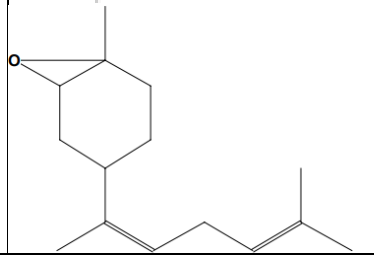
10	CIS-5-METHYL-2- ISOPROPYL-2-HEXEN-1-AL	29.755	2.192	154	$C_{10}H_{18}O$	2160		Flavouring agent

TABLE:7.3.1

Major compounds present in methanolic extract of *Cissus quadrangularis*

S.NO	COMPOUND	RT	AREA %	MOL.WT	MOL. FORMULA	NIST REF NO	MOL.STRUCTURE	BIOLOGICAL ACTIVITY
1	METHANE,OXYBIS[DI-CHLORO-	3.314	1.1592	182	$C_2H_2OCl_4$	45131		Not reported
2	METHANE,BROMODICHLORO-	10.947	1.249	162	$CHCl_2Br$	201831		Not reported
3	6,11DIMETHYL-2,6.10-DODECAMEN-1-OL	24.698	2.931	208	C14H24O	30081		Not reported
4	PENTAFLUOROPROPIONIC ACID,OCTADECYL ESTER	25.138	3.445	416	$C_{21}H_{37}O_2F_5$	7195		Not reported
5	HEXATRIACONTANE	26.308	8.459	506	$C_{36}H_{74}$	196935		Production of detergents and proteins

6	1,6,3,4-DIANHYDRO-2-DEOXY-BETA.-D-LYXO-HEXAPYRANOSE	27.104	15.135	128	$C_6H_8O_3$	22195		Anti-microbial
7	DODECANAL	27.519	29.392	184	$C_{16}H_{32}O$	193516		Plant metabolite and flavouring agent
8	TRANS-Z-,ALPH.-BISBOLENEEPOXIDE	28.529	4.722	220	$C_{15}H_{24}O$	5520		Anti-tumor, analgesic, anti-bacterial, anti-inflammatory, sedative and fungicide.
9	3H-CYCLODECA[B]PURAN-2-ONE,4,9-DIHYDROXY-6-METHYL-3,10-DIMETHYLENE3A,4,7,8,9,10,11,11A-OCTAHYDRO	28.844	8.973	264	$C_{15}H_{20}O$	2193		Not reported
10	TRANS-Z-,ALPH.-BISBOLENEEPOXIDE	29.224	22.001	220	$C_{15}H_{24}O$	5520		Anti-tumor, analgesic, anti-bacterial, anti-inflammatory, sedative and fungicide.

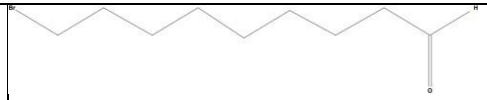
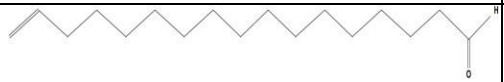
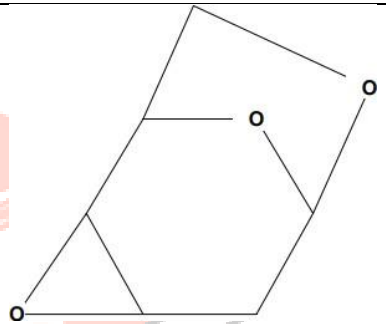
11	9-BROMONONALDEHYDE	30.240	2.102	220	$C_9H_{17}OBr$	17359		Not reported

TABLE:7.4.1

Major compounds present in methanolic extract of *Cathranthus roseus*

S.NO	COMPOUND	RT	AREA %	MOL.WT	MOL. FORMULA	NIST REF.NO	MOL.STRUCTURE	BIOLOGICAL ACTIVITY
1	16-HEPTADECANAL	18.215	2.018	252	$C_{17}H_{32}O$	43925		Not reported
2	1,6;3,4DIANHYDRO-2-DIOXY- ,BETA,D-LYXO-HEXAPYRANOSE	18.595	2.200	128	$C_6H_8O_3$	22195		Anti-microbial
3	N-HEXADECANOIC ACID	20.011	23.641	256	$C_{16}H_{32}O$	8479		Anti-oxidant, 5 alpha reductase, pesticide, nematicide, lubricant, hypercholesterolemic and anti-androgenic
4	13-TETRADECE-11-YN-1-OL	21.271	50.660	208	$C_{14}H_{24}O$	17369		Not reported

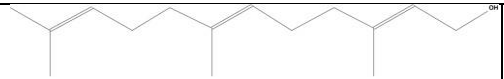
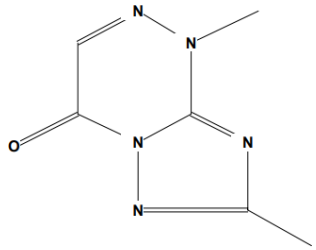
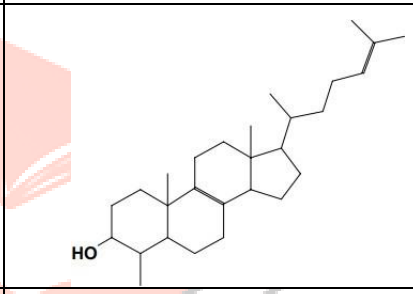
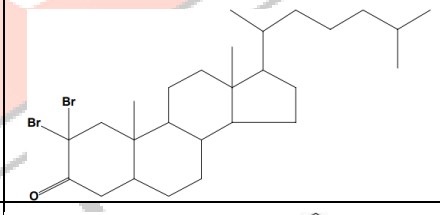
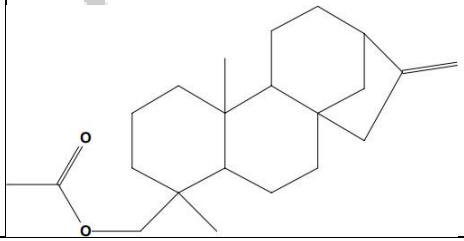
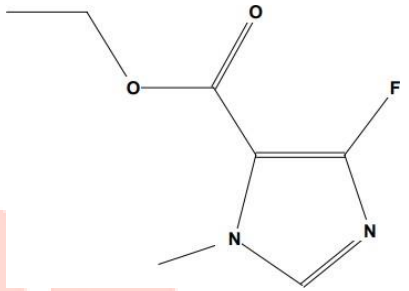
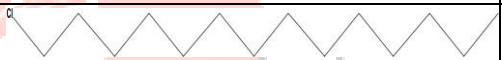
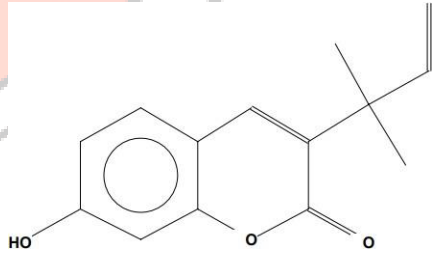
5	2,6,10-DODECATRIEN-1-OL,3,7,11-TRIMETHYL	24.542	2.203	222	$C_{15}H_{26}O$	198987		Anti-tumor, analgesic and anti-bacterial
6	2,4-DIMETHYL-7-OXO- 4,7,DIHYDRO-TRIAZOLO(3.2.-C)TRIAZINE	26.828	5.886	165	$C_6H_7ON_5$	122610		Not reported
7	CHOLESTA-8,24.DIEN-3-OL,4METHYL-,(3.BETA.,4.ALPHA)	27.934	3.037	398	$C_{28}H_{46}O$	3103		Not reported
8	2,2-DIBROMOCHOLESTANONE	29.595	4.997	542	$C_{27}H_{44}OBr_2$	6672		Not reported
9	KAUREN-18-OL,ACETATE(4.BETA)	30.105	5.358	330	$C_{22}H_{34}O_2$	7880		Not reported

TABLE:7.5.1

Major compounds present in methanolic extract of *Coleus aromaticus*

S.NO	COMPOUND	RT	AREA %	MOL.WT	MOL.FORMULA	NIST REF NO	MOL.STRUCTURE	BIOLOGICAL ACTIVITY
1	4-FLURO-1-METHYL-5 CARBOXYLIC ACID,ETHYL(ESTER)	27.579	48.279	172	$C_7H_9O_2N_2F$	2365		Not reported
2	TETRADECANE,1-CHLORO	28.294	17.556	232	$C_{14}H_{29}Cl$	197005		Not reported
3	7-HYDROXY-3-(1,1-DIMETHYLPOP-2-ENYL)COUMARIN	29.104	16.379	230	$C_{14}H_{14}O_3$	6399		Not reported
4	1-OCTADECANESULPHONYL CHLORIDE	29.279	12.245	352	$C_{18}H_{37}O_2CIS$	21670		Not reported
5	2-METHYL-6-METHYLENE-OCTA-1,7-DIEN-3-OL	29.794	5.541	152	$C_{10}H_{16}O$	2273		Not reported

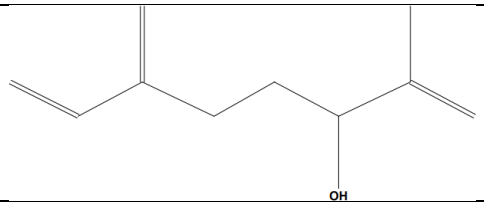
								

TABLE:7.6

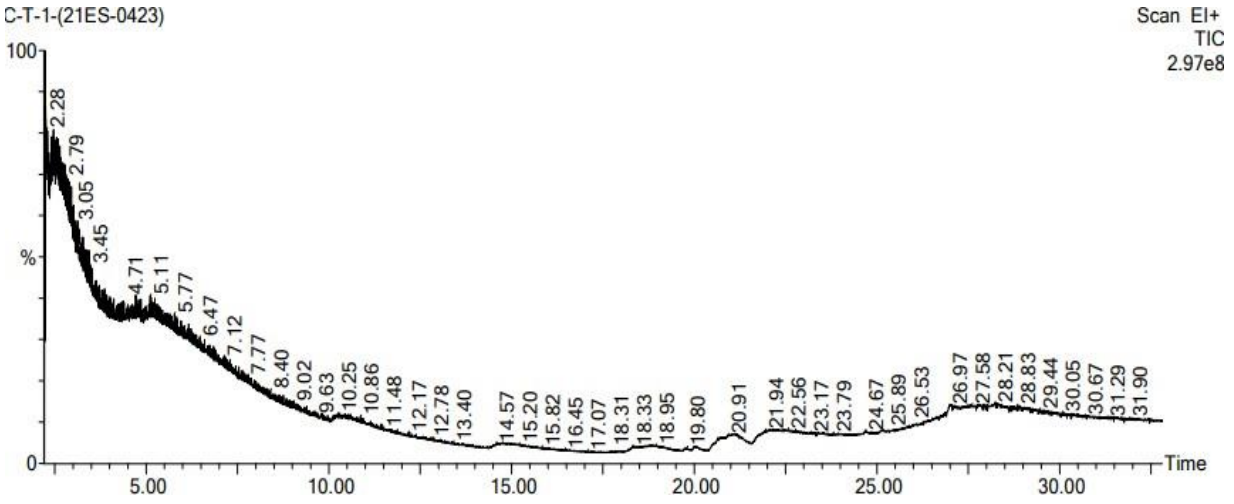
Common compounds identified in the medicinal plants

S.NO	COMMON COMPOUND	PLANTS
1	HEXADECANAL	*Clitorea ternatea* & *Acalypha indica*
2	CHOLESTA-8,24-DIEN-3-OIL,4METHYL-,(3,BETA.,4,ALPHA.)-	*Clitorea ternatea* & *Catharanthus roseus*
3	TRANS-Z-,ALPH.-BISBOLENE EPOXIDE	*Clitorea ternatea* & *Cissus quadrangularis*
4	9-BROMONONALDEHYDE	*Acalypha indica* & *Cissus quadrangularis*
5	4-FLURO-1-METHYL-5 CARBOXYLIC ACID,ETHYL(ESTER)	*Acalypha indica* & *Coleus aromaticus*
6	7-HYDROXY-3-(1,1-DIMETHYLPOP-2-ENYL)COUMARIN	*Acalypha indica* & *Coleus aromaticus*
7	DODECANAL	*Acalypha indica* & *Cissus quadrangularis*
8	SPIRO[ANDROST-5-ENE-17,1'-CYCLOBUTAN]-2'ONE,3-HYDROXY-,(3.BETA.,17.BETA)-	*Clitorea ternatea* & *Acalypha indica*
9	1,6;3,4DIANHYDRO-2-DIOXY-,BETA,D-LYXO-HEXAPYRANOSE	*Cissus quadrangularis* & *Catharanthus roseus*

8. GRAPHS

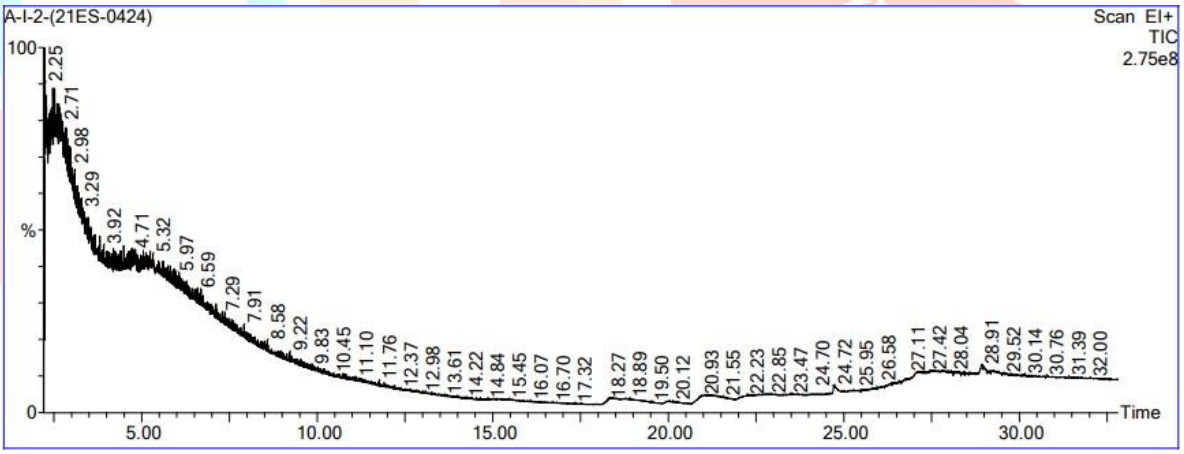
Graph 8.1:

Area of compounds present in *Clitorea ternatea*



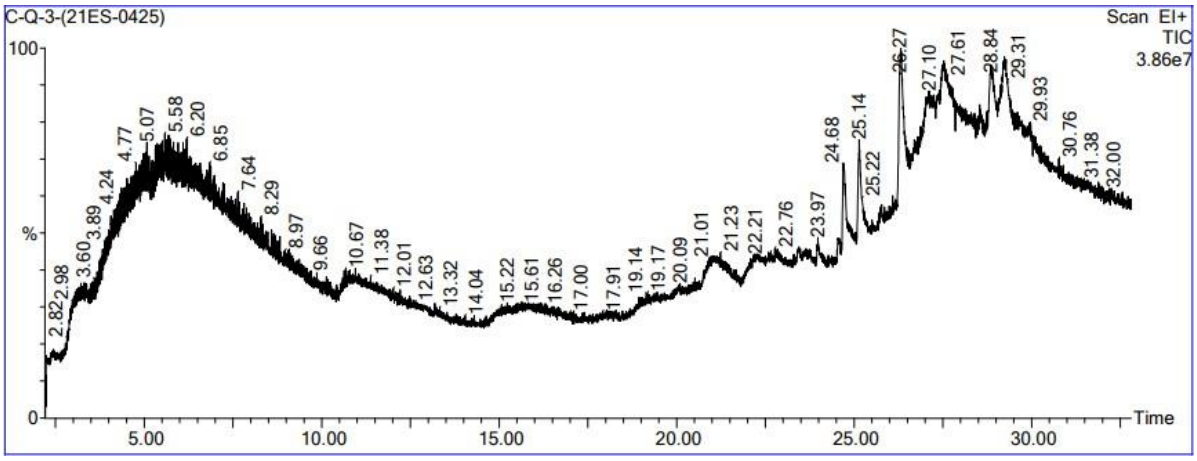
Graph:8.2

Area of compounds present in *Acalypha indica*



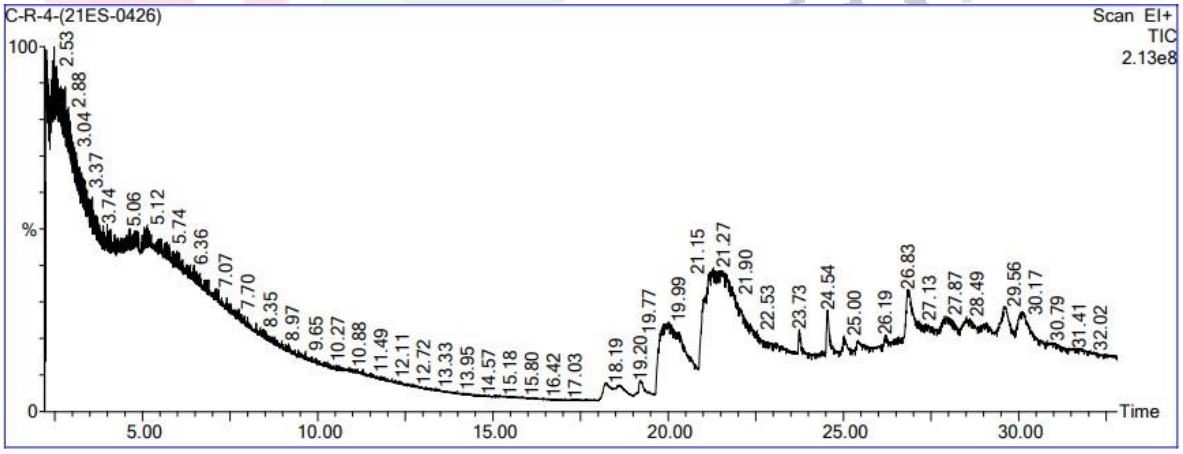
Graph:8.3

Area of compounds present in *Cissus quadrangularis*



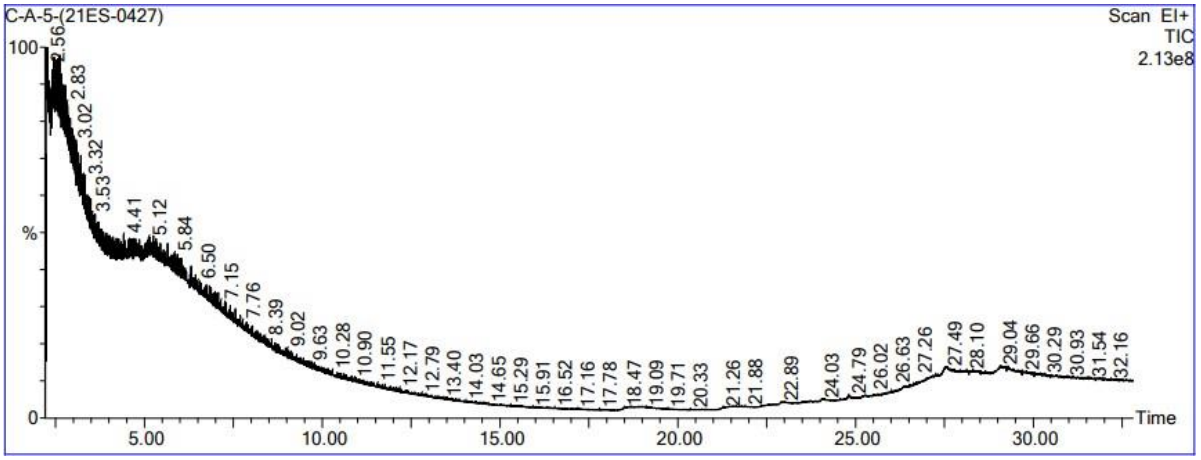
Graph:8.4

Area of compounds present in *Cathranthus roseus*



Graph:8.5

Area of compounds present in *Coleus aromaticus*



4. CONCLUSION:

Extracts of the plants can be used for anti-viral, antioxidant, anti-inflammatory, anti-cancer and as well as for anti-diabetic activities. Since plant compounds are rich in phenolics, flavonoids and many other compounds which are therapeutic in nature. It is also used in the invention of novel drugs and to treat various maladies people are suffering from. Plant phytochemicals are highly rich in nutrient s, vitamins and minerals.

Traditionally parts of the plants are used to prevent certain diseases and the phytochemicals are been found as the replacement for conventional medicines. Be it the ancient time or the modern time, plants play the important role in treating various health related problems and diseases.

In the ancient times, plants fresh or dried are used as powders, tea, tablets and capsulesIt leads to the discovery of drugs, development of drugs and helps in assisting nanoparticle synthesis.

TABLE:7.7

S.NO	*PLANT*	TYPE OF NANOPARTICLE	SIZE(nm)	REFERENCE
1	*Clitorea ternatea*	AuNP, AgNP	250-650	(Fatimah et al., 2020)
2	*Clitorea ternatea*	AgNP	28	(Krithiga et al., 2015)
3	*Acalypha indica*	AgNP	20-30	(Krishnaraj et al., 2010)
4	*Acalypha indica*	AgNP	20-50	(Menon et al., 2017)
5	*Cissus quadrangularis*	AgNP		Vanaja, M., Gnanajobitha, G., Paulkumar, K. et al. Phytosynthesis of silver nanoparticles by Cissus quadrangularis: influence of physicochemical factors. J Nanostruct Chem 3, 17 (2013).
6	*Cissus quadrangularis*	AgNP		(S. et al., 2020)

7	*Catharanthus roseus*	AgNP	50-100	(Valli and Vaseeharan, 2012)
8	*Catharanthus roseus*	AgNP	48-67	(Mukunthan et al., 2011)
9	*Coleus aromaticus*	AgNP	40-50	(Vanaja and Annadurai, 2013)
10	*Coleus aromaticus*	AgNP	79.46-89.89	Dass AK, Mariappan P (2018) Insecticidalactivity of Green Synthesized silver Nanoparticles using Coleus aromaticus and Wrightia tinctoria Leaf Extracts against Culex quinquefasciatus. Vector Biol J 3:2. doi: 10.4172/2473-4810.1000131

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