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PHYTOCHEMICAL SCREENING OF TEN ETHNOMEDICINAL PLANTS OF LAMIACEAE FAMILY OF IMPHAL VALLEY DISTRICTS OF MANIPUR NORTHEASTERN INDIA

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ABSTRACT

A total of 39 genera with 110 species of Lamiaceae are distributed all over the state which includes some endemic plants. Among these species, some are found in cultivated form only and some are found in wild forms. Lamiaceae family is regarded as being one of the highly evolved plant families, at least from the viewpoint of floral structure. *Lamiaceae* is a well-known fact that many members under this family are useful economically for medicinal, culinary, ornamental and various commercial utilizations. The Manipur state also harbors a good diversity of Lamiaceae including one endemic species. Identification of active compounds by GCMS technique of ten plant species viz., *Clerodendrum colebrookianum* (7 compounds), *Clerodendrum indicum* (5), *Elsholtzia blanda* (6), *Elsholtzia communis (purple flower)* (6), *Elsholtzia communis (white flower)* (5), *Elsholtzia stachyodes* (6), *Hyptis suaveolens* (5), *Ocimum americanum* (6), *Ocimum basilicum* (5) and *Perilla frutescens* (6) was performed and many new compounds were recorded and represented only new compounds. Peak value of LCMS having integration peak list of chromatograms were also recorded.

Key words: Lamiaceae, Phytochemical screening, GCMS and LCMS, new compounds

INTRODUCTION

Lamiaceae is represented by 236 genera and 7,172 species (Harley *et al*., 2004) in the world with cosmopolitan distribution, however whose center is chiefly in the Mediterranean region, where they form a dominant part of vegetation (Lawrence, 1951). This family is regarded as being one of the highly evolved plant families, at least from the viewpoint of floral structure. Recently, there have been many workers dealing with taxonomic updating including nomenclature and classification of the family. The modern circumscription of Lamiaceae includes many genera which were formerly placed in the Verbenaceae (Cantino *et al*., 1992; Harley *et al*., 2004).

Several phylogenists believed that angiosperms are monophyletic i.e. group originated from single ancestor (Dahlgren, 1983). Cantino (1992) observed that the family Lamiaceae as circumscribed by Bentham (1876) and Briquet (1895-1897) was polyphyletic. The phylogenetic imperative dictates that all supra-specific taxa should be monophyletic, and it should be the central principle to the professional world view of many phylogenetic systematists (Cantino *et al*., 1999). The best classification would be a cladistic one, in which all recognized groups are strictly monophyletic. To circumscribe monophyletic groups of Lamiaceae, Cantino *et al*. (1992) introduced a revised classification following the earliest work of Junell (1934) which was modified by Harley *et al*. (2004).

Lamiaceae is a well-known fact that many members under this family are useful economically for medicinal, culinary, ornamental and various commercial utilizations. Many plants, especially those belonging to the *Lamiaceae* family show strong antioxidant activity (Marinova and Yanishlieva, 1997; Hirasa and Takemasa, 1998; Triantaphyllou *et al*., 2001). Thus, members of the family are very important due to their medicinal and aromatic properties leading to the production of herbal products and food supplements.

The Manipur state also harbors a good diversity of Lamiaceae including one endemic species, *Colquhounia elegans* Wall. *ex* Benth. (Chauhan, 2000). George Watt, C.B. Clarke, A. Meebold and S.K. Mukerjee were the earliest plant explorers of Manipur where they collected many plant species including several Lamiaceae members from the state. Among the dominant families of dicots in Manipur, Lamiaceae *S. stricto.* is found to be the fourth abundant family by Deb (1961) who reported 63 species under 32 genera with 2 varieties from the state.

Singh (1987) had studied 18 genera and 25 species from Tengnoupal district (Chandel) of Manipur, and work of Singh (1980) described 25 species distributed over 17 genera in the Tamenglong district in the said family. Sinha (1996) described 41 species under 24 genera and Singh *et al*. (2003) discuss 12 genera and 16 species under this family. Also, Khan (2005) noted 16 species from Thoubal district under this family excluding the recently shifted members from Verbenaceae regarding their ethnomedicinal uses. Singh (1997) described *Leucas manipurensis* Singh as new species from Manipur which is found to be endemic to India and confined to Assam, Nagaland, Manipur, Tripura and Meghalaya (Chauhan, 2000). Over and above these, three species *Clerodendrum lasiocephalum* C.B.Clarke, *Orthosiphon wattii* Prain, *Premna milleflora* C.B.Clarke are also found to be endemic to North-East India (Anon., 2010). Kumar (2008) described a newspecies of *Pogostemon* Desf. while revising the subfamily Pogostemonoideae for Flora of India as *Pogostemon manipurensis* which was earlier reported as *P.purpurescens* Dalz. from Kassome range, Manipur by Watt. Some species reported earlier by Deb (1961) could not be traced from their collection site or locality.

The state of Manipur which extends between 23°59´N-25°47´N and between 92°59´E-94°46´E with total geographical area of 22,327 km^2 lies in the Northeastern part of India falls under Indo-Myanmar hotspot regions of the world (Meyers *et al*., 2000) with extraordinarily rich flora. A total of 39 genera with 110 species of Lamiaceae are distributed all over the state which includes some endemic plants. Among these species, some are found in cultivated form only and some are found in wild forms.

MATERIALS AND METHODS

Plant material collection

The seeds of the selected ten taxa (*i. e. Elsholtzia blanda* Benth*., E. communis* (Coll. and Hemsl.) Diels var. purple flower, *E. communis* (Coll. and Hemsl.) Diels var. White flower, *E. stachyodes* (Link) Wu*, Hyptis suaveolens* Poit*, Ocimum americanum* L.*, O. basilicum* L., *Clerodendrum colebrookianum* Walp., Clerodendrum *indicum* (L.) Kuntze and *Perilla frutescens* L.) (Table 1), under the subfamily Nepetoideae of family *Lamiaceae* were collected locally and planted in experimental fields for this study.

All the selected taxa are used as culinary herbs in Manipur and are cultivated, the aerial parts of these plants were collected just before the flowering time. The collected samples were dried in shade and made into powder form by a grinder. Specimens were identified and the vouchers were deposited at the Manipur International University Museum of Plants (MIUMPs). The information regarding the selected ten plants (Table 1) are collected from the Manipur University Museum of Plants (MUMPs), Department of Botany, Manipur International University, Ghari, Imphal.

Methods of Plant Identification

Mounted herbarium specimens were used for the purpose of identification. Critical morphological studies have been made for the collected plant specimens. The specimens have been studied by making dissection of a few flowers both live and preserved. Herbarium are prepared as methodology recommended by Jain & Rao (1977). The authentic identification of the plants was done with the help of the available floristic literature such as Flora of British India vol.1-7 (Hooker, 1872 – 1897); Flora of India, vol. 1– 3 (Sharma *et al. Edt.* 1993); Flora of Tripura State, vol. I & II (Deb, 1981 & 1983). A complete morphological characterization of the vegetative and reproductive features of the plants is described, illustrated and photographed following Simpson (2006). Botanical illustration is done following Cook (1998). The second criterion of plant identification is having a list of the possibilities. Clarke (1884); Kanjilal *et al.* (1935-1940); Deb (1961); Singh (1987) and Singh (1990), flora are typically used to be sure that it encompasses that of the unknown plant. Morphological characters were critically studied, illustration and photographs were made from live specimens (Simpson 2006, Jiaqui *et al.* 2004).

Study Site

In the present investigation, 6 (six) different study sites were selected from every 5 (five) valley districts for survey program. All the relevant materials were thoroughly studied before the survey. Extensive field surveys were conducted in the different study areas of Imphal East, Imphal West, Thoubal, Kaching and Bishnupur districts (Fig. 1, 2). Field information regarding their habit, habitat, local uses and their ethno-medicinal uses are based on personal observation and detailed discussions with their tribe inhabiting these areas, particularly the aged people and local tribal medical practitioner during the regular field surveys. Regular visits were carried out in the study area in all seasons to collect the plant material in flowering and fruiting condition, to provide proper documentation of all members found in the valley districts. Attention will be given in preparing herbarium specimens by taking records of all necessary and pertinent data concerning characters of the specimens that may not appear after drying.

Lamiaceae plant species were collected from the survey and 10 ethnomedicinal plant species were examined and identified and collected plant materials for all the ten plants were processed in raw form for essential oil estimation and some materials were separately dried in the sum and the dried materials were crushed into powder and sieved in known pore size and stored in color glass containers for future use.

Crude fat extraction

From the dried materials, Crude fat is extracted by using Soxhlet apparatus, using the medium solvent by Petroleum Ether. Essential oil extraction for each species by using Hydro-distillation method. From the dried materials, Crude fat was extracted by using Soxhlet apparatus. Other biochemical and physiological experiments like volatile oil by water medium and bio-active compounds by using GCMS and LCMS were performed.

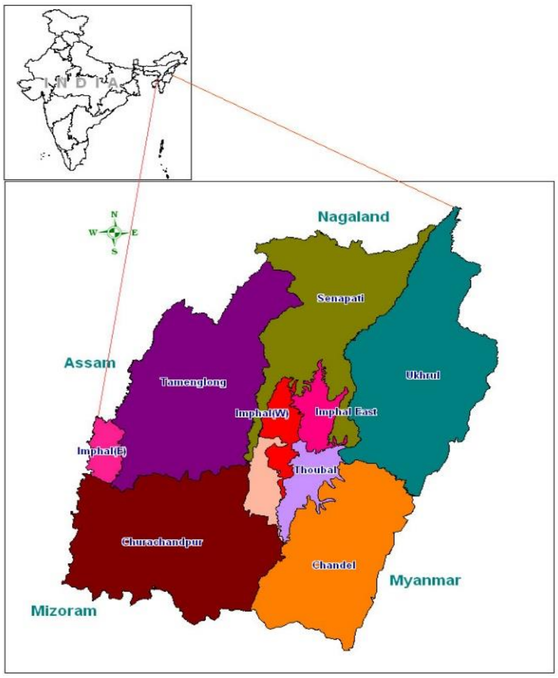


Fig. 1 Map of Manipur State showing the five valley Districts: Imphal East, Imphal West, Bishnupur, Thoubal and Kakching at the centre.

Fig. 2 Map of Manipur showing study sites, the five valley districts (Imphal west, Imphal east, Bishnupur, Thoubal and Kakching) in the centre.

Table 1 Ten selected species of *Lamiaceae* of Manipur with their local names and voucher numbers

SL. NO.	SPECIES	LOCAL NAME	VOUCHER NO.
1	*Clerodendrum colebrookianum* Walp.	*Kuthap*	*004269*
2.	*Clerodendrum indicum* (L.) Kuntze	*Moirang khanum*	*004262*
3.	*Elsholtzia blanda Benth.*	*Kanghuman*	*004302*
4.	*Elsholtzia communis* (Coll. and Hemsl.) Diels var.	*Lomba purple flower*	*004328*
5.	*Elsholtzia communis* (Coll. and Hemsl.) Diels var.	*Lomba white flower*	*004301*
6.	*Elsholtzia stachyodes* (Link) Wu	*Tekta*	*004303*
7.	*Hyptis suaveolens* Poit.	*Tukma*	*004311*
8.	*Ocimum americanum* L.	*Mayangba*	*004313*
9.	*Ocimum basilicum L.*	*Naoseklei*	*004312*
10.	*Perilla frutescens L.*	*Thoiding Angouba*	*004309*

RESULTS AND DISCUSSION

Characterization of active compounds for some selected Lamiaceae species

For characterization of active compounds ten plant species were selected for GCMS analysis from the dried materials of the plants viz., *Kuthap (Clerodendrum colebrookianum* Walp.), *Moirang khanum (Clerodendrum indicum* (L.) Kuntze), *Kanghuman* (*Elsholtzia blanda Benth.), Lomba purple flower (Elsholtzia communis* (Coll. and Hemsl.) Diels var.*), Lomba white flower (Elsholtzia communis* (Coll. and Hemsl.) Diels var.), *Tekta (Elsholtzia stachyodes* (Link) Wu), *Tukma (Hyptis suaveolens* Poit.), *Mayangba (Ocimum americanum* L.), *Naoseklei (Ocimum basilicum* L) and *Thoiding Angouba (Perilla frutescens* L.*).*

And for characterization of active compounds of volatile oil analysis by LCMS from the fresh materials, six plant species were selected, they are *Kuthap (Clerodendrum colebrookianum* Walp.), *Moirang khanum (Clerodendrum indicum* (L.) Kuntze), *Kanghuman* (*Elsholtzia blanda Benth.), Mayangba (Ocimum americanum* L.), *Naoseklei (Ocimum basilicum* L) and *Thoiding Angouba (Perilla frutescens* L.)

For every species highest10 peaks were accessed as GCMS analysis:

In case of Kanghuman (*Elsholtzia blanda* Benth.) Fig.3, 4 gives the readings of GCMS having the following compounds and Fig.5 gives LCMS having integration peak list of chromatograms recorded.

Fig. 3 Peak value 1 of GCMS of Kanghuman (*Elsholtzia blanda* Benth.)

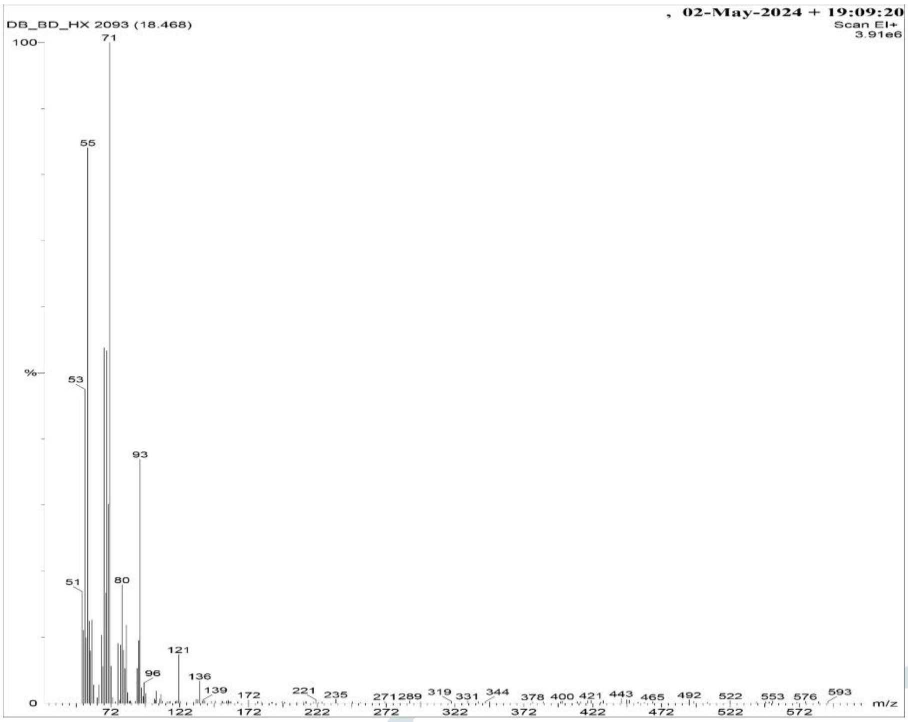
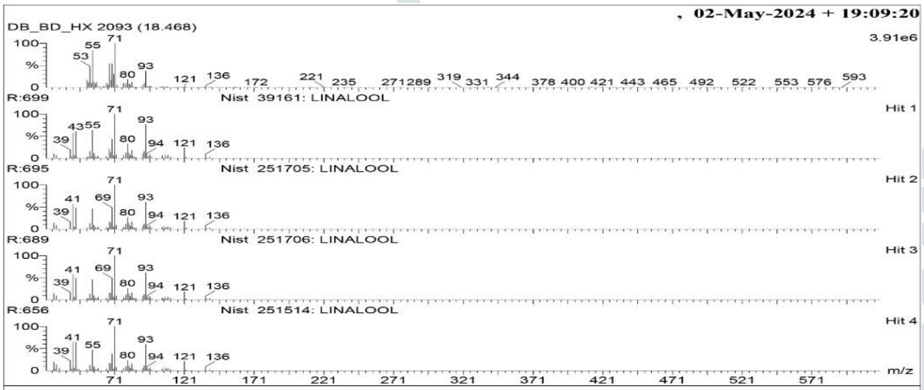


Fig.4 Peak value of GCMS of Kanghuman (*Elsholtzia blanda* Benth.) having names of compounds recorded



Hit	REV	for	Compound Name	M.W.
1	699	620	LINALOOL	154
2	695	617	LINALOOL	154
3	689	602	LINALOOL	154
4	656	573	LINALOOL	154
5	652	620	1-PENTANOL, 5-CYCLOPROPYLIDENE-	126
6	638	483	GERANYL ANGELATE	236
7	627	570	4-T-PENTYLCYCLOHEXENE	152
8	625	439	2-METHYLTHIOLANE, S,S-DIOXIDE	134
9	624	553	3-TRSNS-(1,1-DIMETHYLETHYL)-4-TRANS-METHOXYCYCLOHEXANOL	186
10	612	508	1,6-NONADIEN-3-OL, 3,7-DIMETHYL-	168
11	604	377	1,6-OCTADIEN-3-OL, 3,7-DIMETHYL-, PROPANOATE	210
12	599	483	1,6,10-DODECATRIEN-3-OL, 3,7,11-TRIMETHYL-	222
13	592	329	1-SILACYCLO-2,4-HEXADIENE	96
14	579	487	1,6,10-DODECATRIEN-3-OL, 3,7,11-TRIMETHYL-	222
15	576	475	3-T-PENTYLCYCLOPENTANONE	154
16	575	319	1-SILACYCLOHEXA-2,5-DIENE	96
17	565	415	2,6-OCTADIEN-1-OL, 3,7-DIMETHYL-, FORMATE, (Z)-	182
18	557	483	1,5-DIMETHYL-1-VINYL-4-HEXENYL BUTYRATE	224
19	555	492	NEROLIDOL	222
20	550	476	LINALYL ACETATE	196

Fig.5 LCMS of Kanghuman (*Elsholtzia blanda* Benth.) having integration peak list of chromatograms recorded

Qualitative Analysis Report

Data Filename	SAMPLE-FJ-120424.d	**Sample Name**	SAMPLE-FJ-120424
Sample Type	Sample	**Position**	Vial 34
Instrument Name	Instrument 1	**User Name**	
Acq Method	ESI +VE SCAN.m	**Acquired Time**	4/12/2024 1:32:03 PM
IRM Calibration Status	Not Applicable	**DA Method**	NDMA SCAN.m
Comment			

Sample Group **Info.**

User Chromatograms

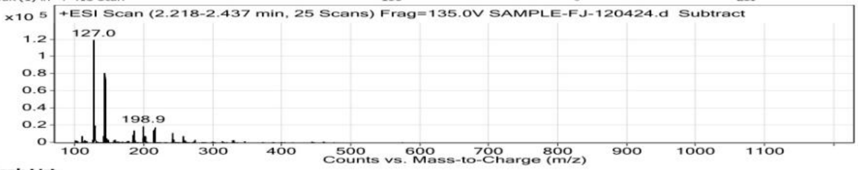
Fragmentor Voltage 135 **Collision Energy** 0 **Ionization Mode** ESI

Integration Peak List

Start	RT	End	Height	Area
2.155	2.318	2.473	5188674	43275539
2.5	2.619	2.855	1520863	14513576
3.473	3.573	3.755	551350	4884920
11.139	11.33	11.603	758860	7411412
12.157	12.321	12.567	359583	3549884
12.739	13.012	13.412	3086788	57990454
13.649	13.858	14.322	3205887	49428807
15.431	15.613	15.84	919938	8973246
20.105	20.287	20.696	1302997	24542983
21.86	21.987	22.387	2031775	29071438

User Spectra

Spectrum Source	Fragmentor Voltage	Collision Energy	Ionization Mode
Peak (1) in "+ TIC Scan"	135	0	ESI



Peak List

m/z	z	Abund
127	1	119779.5

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Identification of active compounds by GCMS technique

Plant species under Lamiaceae family are generally aromatic medicinal plants used by the communities of the valley districts of Manipur. Identification of active compounds by GCMS technique of ten plant species viz., *Clerodendrum colebrookianum, Clerodendrum indicum, Elsholtzia blanda, Elsholtzia communis (purple flower), Elsholtzia communis (white flower), Elsholtzia stachyodes, Hyptis suaveolens, Ocimum americanum, Ocimum basilicum* and *Perilla frutescens* was performed and many new compounds were recorded.

In *Clerodendrum colebrookianum* 7 compounds were found i.e. Diethylcyanamide, Cyclohexane, Methyl-, 2,4-Azetidinedione, 3,3-Diethyl-, Trans-2-Methyl-4-N-Butylthiane, S, S-Dioxide, 4-Undecene, 5-Methyl-, Cyclohexanone, 2-Butyl-, and 2-Octene, 4- Ethyl-, their chemical structures are given in Table 4.2.2.

In the case of *Clerodendrum indicum* 5 new conpounds were recorded viz.,Diallyl Disulphide, 2-Vinyl-1, 3-Dithiane, 1,2,7-Trimethoxyheptane, (Z) – Allyl (Prop-1-En-1-Yl) Sulfane, and Trisulfide, Di-2-Propenyl. In *Elsholtzia blanda* 6 important compounds were recorded 1-Pentanol, 5-Cyclopropylidene-, 3-Trsns-(1,1-Dimethylethyl)-4-Trans-Methoxycyclohexanol, 2,6-Octadien-1-Ol, 3,7-Dinethyl-, Formate, (Z)-, Nerolidol, Geranyl Angelate and 1,6-Nonadien-3-Ol, 3,7-Dimethyl- and selected structures were also presented.

In *Elsholtzia communis (purple flower)* 6 recommended compounds were recorded: Methyl 11, 12-Tepradecadienoate, 3-Nonen-1-Ol, (Z)-, 11-Tridecyn-1-Ol, 6-Octen-1-Ol, 3,7-Dimethyl-, Propanoate, 10-Undecyn-1- Ol, and Cyclohexane, 1-Methyl-4-Methylene-. In case of *Elsholtzia communis (white flower),*5 remarkable compounds were noticed: 11,14-Octadecadienoic Acid, Methyl Ester, Linoelaidic Acid, Cis-13,16-Docasadienoic Acid, N-Propyl 9,12-Hexadecadienoate and 2-Chloriethyl Linoleate, etc. In *Elsholtzia stachyodes* 6 important compounds were found: 5, 8, 11-Eicosatriynoic Acid, Methyl Ester, Benzene, 1, 3-Bis (1-Buten-3-Yl)-, 2H-Pyran, Tetrahydro-2-[(1-Methyl-4-Phenyl-2-Butynyl) Oxy]-, 5-Acetoxy-3-Methyl-Hexanoic Acid, Methyl Ester 7-Isopropyl-1,1,4A-Trimethyl-1,2,3,4,4A, 9,10,10A-Octahydrophenanthrene and 5,8,11-Eicosatriynoic Acid, TMS Derivative. In case of *Hyptis suaveolens* 5 remarkable compounds were recorded: 2-Propenoic Acid, Butyl Este,Neopentyl Glycol,N-Hexyl Acrylate,3-Chloro-2,2-Dimethyl-1-Propanol and1,3-Hexanediol, 2-Ethyl-, etc.

However, in 2 *Ocimum species viz., Ocimum americanum,* recorded 6 compounds: 4-Methylthiane, S, S-Dioxide,Cyclohexene, 4, 4-Dimethyl-, P-Mentha-1, 8- Dien-7-Ol,Phenylacetic Acid, Dodec-9-Ynyl Ester, 1,5-Pentanediol, Dimethanesulfonate and Bicyclo[4.1.0] Heptane, -3-Cyclopropyl, -7-Hydroxymethyl, Trans as valuable compounds and in *Ocimum basilicum* 5 compounds were present: Diethylcyanamide, 2,4-

Azetidinedione, 3,3-Diethyl-, Heptyl Tiglate, 4-, 3-Ethyl-3-Pentyl Methylphosphonofluoridate and Cyclooctanone. In *Perilla frutescens* 6 compounds were recorded: 2-Propenoic Acid, Butyl Ester, Sydnone, 3,3'-Tetramethylenedi-, Formic Acid, Hex-3-Yl Ester, 7-Oxabicyclo [4.1.0] Heptan-2-One, 4-Piperidinemethanamine and Oxirane, (1,1-Dimethylbutyl)- as new compounds (Table 4.2.2).

Table 4.2.2 Identification of active compounds by GCMS technique of ten plant species of Lamiaceae family of Imphal Valley Districts of Manipur

<table>
<tr><th>SL NO</th><th>PLANT NAME</th><th>REV</th><th>M.W.</th><th>COUMPOUND NAMES</th><th>SELECTED CHEMICAL STRUCTURE</th></tr>
<tr><td>1.</td><td>Clerodendrum colebrookianum</td><td>780
779
731
705
662
661
675</td><td>98
98
141
204
168
154
140</td><td>Diethylcyanamide,
Cyclohexane, Methyl-,
2,4-Azetidinedione, 3,3-Diethyl-,
Trans-2-Methyl-4-N-Butylthiane, S, S-Dioxide,
4-Undecene, 5-Methyl-,
Cyclohexanone, 2-Butyl-,
2-Octene, 4- Ethyl-,</td><td>Trans-2-Methyl-4-N-Butylthiane, S, S-Dioxide
O
||
S-C
/ \
CH_3 CH_2-CH_2-CH_2-CH_3
\ /
C-S
||
O
4-Undecene, 5-Methyl-
CH3-CH2-CH2-CH=CH-CH(CH3)-CH2-CH2-CH2-CH2-CH3
Cyclohexanone, 2-Butyl-
O
||
C1-C2-C3
/ | \
C6 C4 C5
|
CH2-CH2-CH2-CH3</td></tr>
<tr><td>2.</td><td>Clerodendrum indicum</td><td>654
592
491
533
432</td><td>146
146
190
114
178</td><td>Diallyl Disulphide
2-Vinyl-1, 3-Dithiane
1,2,7-Trimethoxyheptane
(Z) – Allyl (Prop-1-En-1-Yl) Sulfane
Trisulfide, Di-2-Propenyl</td><td>1,2,7-Trimethoxyheptane
OCH3
|
CH3-CH(OCH3)-CH2-CH2-CH2-CH2-CH2-OCH3
(Z) – Allyl (Prop-1-En-1-Yl) Sulfane
H2C=CH-CH2-S-S-CH=CH-CH3
| |
CH2 CH
|
CH2
Trisulfide, Di-2-Propenyl
CH2=CH-CH2-S-S-S-CH2-CH=CH2</td></tr>
<tr><td>3.</td><td>Elsholtzia blanda</td><td>652
624
565
555</td><td>126
186
182
222</td><td>1-Pentanol, 5-Cyclopropylidene-
3-Trsns-(1,1-Dimethylethyl)-4-Trans-Methoxycyclohexanol
2,6-Octadien-1-Ol, 3,7-Dinethyl-, Formate, (Z)-
Nerolidol</td><td>2,6-Octadien-1-Ol, 3,7-Dinethyl-, Formate, (Z)-
CH2=CH-CH(CH3)-CH=CH-CH(CH3)-CH2-CH2-O-COH
| | |
CH3 CH3 CH2
Nerolidol
CH3</td></tr>
</table>

<table>
<tr><td></td><td></td><td>638
612</td><td>236
168</td><td>Geranyl Angelate
1,6-Nonadien-3-Ol, 3,7-Dimethyl-</td><td>|
H3C-C-CH2-C-CH2-C-CH3
| | | |
CH2 CH2 CH2 CH2
|
OH
Geranyl Angelate
CH3
|
CH2=C-CH-CH=CH2
|
CH2
|
O
|
CH2-CH2-CH=CH-CH3</td></tr>
<tr><td>4.</td><td>Elsholtzia communis (purple flower)</td><td>753
684
635
622
631
659</td><td>238
142
196
212
168
110</td><td>Methyl 11, 12-Tepradecadienoate
3-Nonen-1-Ol, (Z)-
11-Tridecyn-1-Ol
6-Octen-1-Ol, 3,7-Dimethyl-, Propanoate
10-Undecyn-1- Ol
Cyclohexane, 1-Methyl-4-Methylene-</td><td>Methyl 11, 12-Tepradecadienoate
CH3-CH2-CH2-CH2-CH2-CH2-CH2-CH2-CH2-CH2-CH=CH-CH=CH-COOCH3
3-Nonen-1-Ol, (Z)-
OH
|
CH3-CH2-CH=CH-CH2-CH2-CH2-CH2-CH3
6-Octen-1-Ol, 3,7-Dimethyl-, Propanoate
CH3
|
CH2-C-CH2-CH2-CH2-CH=CH-CH2-CH2-O-CO-CH2-CH3
|
CH3</td></tr>
<tr><td>5.</td><td>Elsholtzia communis (white flower)</td><td>873
799
804
791
807</td><td>294
280
336
294
342</td><td>11,14-Octadecadienoic Acid, Methyl Ester
Linoelaidic Acid
Cis-13,16-Docasadienoic Acid
N-Propyl 9,12-Hexadecadienoate
2-Chloriethyl Linoleate</td><td>11,14-Octadecadienoic Acid, Methyl Ester
CH3-(CH2)8-CH=CH-CH=CH-(CH2)6-COOCH3
Linoelaidic Acid
CH3-(CH2)4-CH=CH-CH2-CH=CH-(CH2)6-COOH
| | |
trans trans
N-Propyl 9,12-Hexadecadienoate
CH3-(CH2)6-CH=CH-CH2-CH=CH-(CH2)6-COO-CH2-CH2-CH3</td></tr>
<tr><td>6</td><td>Elsholtzia stachyodes</td><td>691
689
478
445
603
626</td><td>314
186
244
202
270
372</td><td>5, 8, 11-Eicosatriynoic Acid, Methyl Ester
Benzene, 1, 3-Bis (1-Buten-3-Yl)-
2H-Pyran, Tetrahydro-2-[(1-Methyl-4-Phenyl-2-Butynyl) Oxy]-
5-Acetoxy-3-Methyl-Hexanoic Acid, Methyl Ester
7-Isopropyl-1,1,4A-Trimethyl-1,2,3,4,4A,
9,10,10A-Octahydrophenanthrene
5,8,11-Eicosatriynoic Acid, TMS Derivative</td><td>5, 8, 11-Eicosatriynoic Acid, Methyl Ester
CH3-(CH2)3-C≡C-(CH2)2-C≡C-(CH2)2-C≡C-(CH2)8-COOCH3
2H-Pyran, Tetrahydro-2-[(1-Methyl-4-Phenyl-2-Butynyl) Oxy]-
O
/ \
[6-membered ring]
\ /
C
|
O-[CH2]-C≡C-CH2-Ph
|
CH3
5,8,11-Eicosatriynoic Acid, TMS Derivative</td></tr>
</table>

					CH3-(CH2)4-C≡C-CH2-C≡C-CH2-C≡C-(CH2)6-COOSi (CH3)3
7.	*Hyptis suaveolens*	686 549 488 510 445	128 104 156 122 146	2-Propenoic Acid, Butyl Este, Neopentyl Glycol, N-Hexyl Acrylate, 3-Chloro-2,2-Dimethyl-1-Propanol and 1,3-Hexanediol, 2-Ethyl-	**Neopentyl Glycol** OH | CH3-CH2-C-CH2-CH3 | OH **3-Chloro-2,2-Dimethyl-1-Propanol** CH3 | CH3-C-CH2-CH2OH | Cl **1,3-Hexanediol, 2-Ethyl-** OH | CH3-CH-CH2-CH2-CH2-CH2-OH | CH2-CH3
8.	*Ocimum americanum*	610 502 518 516 564 540	148 110 152 300 260 166	4-Methylthiane, S, S-Dioxide Cyclohexene, 4, 4-Dimethyl- P-Mentha-1, 8- Dien-7-Ol Phenylacetic Acid, Dodec-9-Ynyl Ester 1,5-Pentanediol, Dimethanesulfonate Bicyclo[4.1.0] Heptane, -3-Cyclopropyl, -7-Hydroxymethyl, Trans	**Cyclohexene, 4, 4-Dimethyl-** CH3 | C6H8 | CH3 **Phenylacetic Acid, Dodec-9-Ynyl Ester** C6H5-CH2-COO-CH2-(CH2)5-C≡C-(CH2)2-CH3 **Bicyclo[4.1.0] Heptane, -3-Cyclopropyl, -7-Hydroxymethyl, Trans** C3 | C2 - C1 - C5 / \ / \ C7 - C6 - C4 C8 | CH2OH | Cyclopropyl
9.	*Ocimum basilicum*	800 725 630 623 612	98 141 198 196 126	Diethylcyanamide, 2,4-Azetidinedione, 3,3-Diethyl-, Heptyl Tiglate, 4-, 3-Ethyl-3-Pentyl Methylphosphonofluoridate and Cyclooctanone	**2,4-Azetidinedione, 3,3-Diethyl-** O || C1 - N | | O=C2 C3 | CH2-CH3 | CH2-CH3

					3-Ethyl-3-Pentyl Methylphosphonofluoridate O | CH3-P-O-C2H5 | O-P(OH)-F | C5H11 **Cyclooctanone** O ‖ C1-C2 / \\ C8 C3 | | C7 C4 \\ / C6-C5
10.	*Perilla frutescens*	901 880 484 627 460 455	128 226 130 112 114 128	2-Propenoic Acid, Butyl Ester, Sydnone, 3,3’-Tetramethylenedi-, Formic Acid, Hex-3-Yl Ester, 7-Oxabicyclo [4.1.0] Heptan-2-One, 4-Piperidinemethanamine and Oxirane, (1,1-Dimethylbutyl)-	**7-Oxabicyclo [4.1.0] Heptan-2-One** O | C1-C2-C3 / |\\ C4 C5 \\ / C6=C7 **Oxirane, (1,1-Dimethylbutyl)-** CH3 | CH3-C-CH2-CH2 | O | C **Sydnone, 3,3’-Tetramethylenedi-** CH2-CH2-CH2-CH2 | O=C-N-C=C | CH2-CH2-CH2-CH2 **4-Piperidinemethanamine** NH2 | CH2-C-CH2 / \\ C C | | C N \\ / C-C

CONCLUSIONS

These ten Lamiaceae plants are often used in many local dishes of Manipur, are strong free radical scavengers and can be considered as good sources of natural antioxidants for many dishes, medicinal and commercial utility. Although, the plants taken belong to same family Lamiaceae, each of them whether under same genus or same species has different concentration of phenolic compounds with varied flavonoids and tannin content leading to differing amounts of antioxidants. The use of plants, foods and herbal products as antioxidants is increasing due to consumer awareness of their various health benefits. So, the research programme will provide data on natural antioxidant sources in the family Lamiaceae which is found in Manipur. However, further research is needed for isolation and identification of the phenolic compounds, flavonoids and tannins and other biochemical and physiological parameters.

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