

Comparative Analysis of Latex Plants by GC-MS using Methanol Extraction

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Abstract : Plants are able to produce a large number of diverse bioactive compounds. Solvent extraction is used for isolation of plant metabolites. The extract yield for plant metabolite extraction strongly depends on the nature of solvent. A review showed the methanol can yield more bioactive compounds. Drying of the sample material is also important for the extraction of plant material. The present study was carried out to analyze the phytochemicals of 5 different latex producing plants. The plants like *Calotropis gigantea*, *Carica papaya*, *Nerium oleander*, *Ficus benghalensis* and *Plumeria alba* leaves and latex. The GC-MS analysis of the metabolites revealed phytochemicals. *Calotropis gigantea* leaves showed 14 compounds and latex produced 5 compounds out of this 4,4,6A,6B,8A,11,11,14B-Octamethyl-1,4,4A,5,6,6A,6B,7,8,8A,9,10,11,12,12A,14,14A,14B-Octadecahydro-2 and 2R-Acetoxyethyl-1,3,3-trimethyl-4T-(3-Methyl-2-Buten-1-YI)-1T-Cyclohexanol compound was present in both latex and leaf extraction. Beta. -carotene compound was present in both latex and leaf of *Carica papaya*. It was observed that *Ficus benghalensis* contained 2R-Acetoxyethyl-1,3,3-trimethyl-4T-(3-Methyl-2-Buten-1-YI)-1T-Cyclohexanol was same in latex and leaf extraction.

Key words : Methanol extraction, GC-MS analysis, phytochemicals, latex plants, magnetic stirrer

Introduction

Medicinal plants are the backbone of traditional remedies.¹ The plants may contain many biological components with medicinal values and also be used for application purposes. It is the source for making new drugs.² Plants can produce a wide range of phytochemicals that can protect against free radicals that accumulate in fruits and vegetables. Phytochemicals are a collective term for both bioactive and non-nutritive plant substances. Recently, the use of phytochemicals has increased, especially in the areas of functional foods and pharmaceuticals.^{3,4} There are about 10% of flowering plants that produce latex. Over 40 families are represented, including *Euphorbiaceae*, *Apocynaceae*, *Caricaceae*, *Moraceae* and *Asclepiadaceae*. Latex is a milky white fluid that is secreted by ducts of lactiferous tissue in leaves, stems, fruits and even in roots. Some plants, like *Euphorbia hirta*, *Euphorbia tirucalli*, *Jatropha gossypifolia*, *Plumeria rubra*, *Nerium oleander*, *Calotropis procera*, *Ficus benghalensis*, *Ficus*

religiosa and *Carica papaya* latex, were used to identify the phytochemicals present in it but not the methanol extraction study. The naturally synthesised chemical compounds are used to defend against predators like insects, fungi, and herbivorous mammals.⁵ Phytochemical screening is the method that has been used to detect antioxidant compounds in plants.⁶ Extraction is one method for extracting phytochemicals from the selective plant materials. The phytochemicals yield not only depend on the extraction technique but also depend on the solvent which is used for extraction.⁷ There are so many techniques involved in the extraction method, like maceration, infusion, percolation, microwave assisted extraction, the Soxhlet extraction technique, and also other extraction methods like accelerated solvent extraction and supercritical fluid extraction.⁸ (Figure 7 and 8) In this research, magnetic stirrer was used for extraction process. The primary goal of extraction is to extract as much of the specific compound as possible while obtaining the highest biological activity from the extract. Many solvents like methanol, ethanol, chloroform, acetone, and water, have been used for extraction depending upon the plant material. A review showed the highest extraction yield by methanol.

It has been proven to be more effective in the extraction of polyphenols with lower molecular weight. Methanol was found to be more effective than ethanol to extract a large number of phenolic compounds.² Likewise, (Figure 6) drying the plant material is also important because fresh plant materials may have active enzymes that produce the active constituent's intermediates and metabolic reactions in the plants. Many researchers have done their research by drying plant material in an air-dry process in the shade in a dark room because overheating can cause the volatile

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Figure 1. Latex collection.



Figure 2. Latex with methanol.



Figure 3. Shade dry.

substance and light-sensitive constituents to be lost.¹¹ *Calotropis procera*, *Carica papaya* and *Ficus benghalensis* latex were used for extraction by petroleum ether and methanol for antibacterial and antioxidant activity.¹²

Material and methods

Selected plants and collection

The leaves and latex of 5 different latex producing plants like *Calotropis gigantea*, *Carica papaya*, *Nerium oleander*, *Ficus benghalensis*, and *Plumeria alba* in Vellore district, Tamil Nadu, India.

Extract preparation

For latex, (Figure 1) incisions were made using a sharp, clean knife in the fresh green fleecy stem region of the *Calotropis*, *Nerium*, *Ficus*, *Plumeria*, and from papaya fruit. The latex was collected in a sterile vial, and immediately, the methanol was added to it to avoid a coagulation in a 1:1 ratio (Figure 2).¹²

For leaf extraction, the collected leaves were shade – dried (Figure 3) for 10 to 15 days to fully dry and then crushed into a powder using an electrical grinder. The dried leaf powder was then dissolved in 50 mL of methanol and placed in a magnetic stirrer set to maximum speed at 60 to 70°C for 3 hours (Figure 4). The setup was kept without disturbance for 24 hours, and then the extract was filtered using normal filter paper. The filtrate was kept there for methanol evaporation in clear petri dishes, and the sample was sent there for GC-MS analysis.¹³

GC-MS analysis

GC-MS analysis of the methanol extract of *Calotropis gigantea*, *Carica papaya*, *Nerium oleander*, *Ficus benghalensis* and *Plumeria alba* leaves and latex was performed using Clarus 680 GC employed a fused silica column, packed with



Figure 4. A-Leaf sample with methanol, B-Latex sample with methanol.

Elite-5MS (5% biphenyl, 95% dimethylpolysiloxane, 30 m × 0.25 mm ID × 250 µm df). Helium was used as the carrier gas at a constant flow of 1ml/min using an injection volume of 1 µL. The injector temperature was set to 260°C and the ion source temperature to 240°C, with a scan time 0.2 seconds and scan interval of 0.1 seconds. The spectrums of the components were compared with the database of spectra of known components stored in the GC-MS NIST (2008) library.

Result and discussion

The Identification of phytocomponents in plants has become more common in recent years because of their source of availability and their activity as bioactive compounds in various fields. Many studies have been undertaken to identify the compounds from the plants, but there are only a few latex producing plants that were used for analysis with methanol extraction. GC-MS analysis is a very good technique to identify the phytocomponents in the plant extract. In the present study, phytocomponents were taken from 5 different latex producing plants, namely *Calotropis gigantea*, *Carica papaya*, *Nerium oleander*,

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Ficus benghalensis and *Plumeria alba*, of both leaf and latex.

Analysis of *Calotropis gigantea* leaf and latex:

The GC-MS technique revealed the result completely. The *Calotropis gigantea* plant contained 19 compounds, (Table 1) 14 of which were from leaf and (Table 2) 5 from the latex. This 2R-Acetoxyethyl-1,3,3-trimethyl-4T-(3-Methyl-2-Buten-1-YL)-1T-Cyclohexanol (Figure 5A) compound was observed at RT-30.325, with a molecular formula of C₁₇H₃₀O₃ and molecular weight of 282, and 4,4,6A,6B,8A,11,14B-Octamethyl-1, 4, 4A, 5, 6, 6A, 6B, 7, 8, 8A, 9, 10, 11, 12,

12A, 14, 14A, 14B Octadecahydro-2 (Figure 5B) was detected at RT 28.854, molecular formula is C₃₀H₄₈O, and its molecular weight 424, which were the same in both the leaf and latex methanol extractions and it is the major compound (Figure 5B) present in the latex at a concentration of 48.750% . However, (Figure 5C) the major compound in the leaf extract 3-Tetradecyn-1-ol was found at RT 20.851, molecular formula C₁₄H₂₆O and molecular weight 210 with the area 26.36 % in leaf.

The *Calotropis gigantea* plant latex and leaf were used for methanol extraction using the Soxhlet apparatus.^{12,14} However, the compounds discovered in this study and those mentioned in

Table 1. Phytochemicals identified in the methanolic leaf extract of *Calotropis gigantea* by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	14.693	2,3,4,5,6,7 Hexahydro-3,6-Dihexyl-10,11-Diphenyl-Bis[1,3] Oxazino[6,5-F:5',6'	C ₃₂ H ₄₄ O ₂ N ₄	564	
2	17.059	Heptanal	C ₇ H ₁₄ O	114	
3	19.285	N-Hexadecanoic acid	C ₁₆ H ₃₂ O ₂	256	
4	19.410	N-Hexadecanoic acid	C ₁₆ H ₃₂ O ₂	256	
5	20.286	Pentadecanoic acid	C ₁₅ H ₃₀ O ₂	242	
6	20.851	3-Tetradecyn-1-ol	C ₁₄ H ₂₆ O	210	
7	22.542	Hexadecanal	C ₁₆ H ₃₂ O	240	
8	23.302	Dodecanal	C ₁₂ H ₂₄ O	184	
9	24.492	Squalene	C ₃₀ H ₅₀	410	
10	27.899	4,22-Stigmastadien-3-one	C ₂₉ H ₄₆ O	410	
11	28.854	4,4,6A,6B,8A,11,11, 14B-Octamethyl-1,4, 4A, 5,6,6A,6B,7,8,8A,9,10, 11,12,12A,14,14A,14B-Octadecahydro-2	C ₃₀ H ₄₈ O	424	

Table 1. Continued.

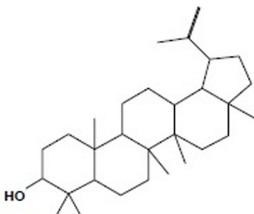
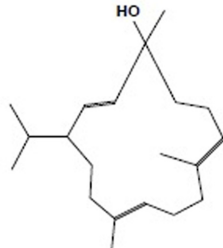
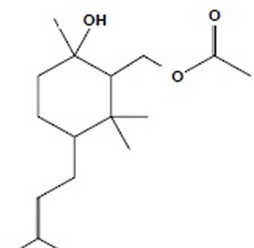
Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
12	29.284	Lupeol	C ₃₀ H ₅₀ O	426	
13	29.449	Thunbergol	C ₂₀ H ₃₄ O	290	
14	30.325	2R-Acetoxymethyl-1, 3,3-trimethyl-4T-(3-Methyl-2-Buten-1-YL)-1T-Cyclohexanol	C ₁₇ H ₃₀ O ₃	282	

Table 2. Phytochemicals identified in the methanolic latex extract of *Calotropis gigantea* by GC-MS.

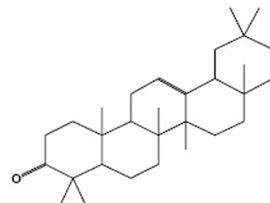
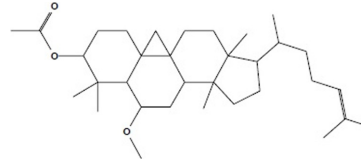
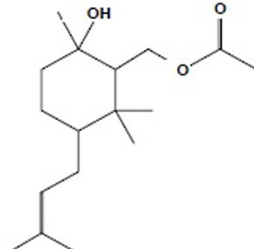
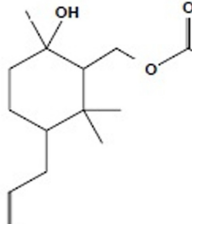
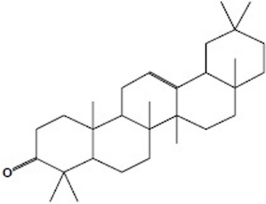
Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	14.693	4,4,6A,6B,8A,11,11,14B-Octamethyl-1,4,4A,5,6,6A,6B,7,8,8A,9,10,11,12,12A,14,14A,14B-Octadecahydro-2	C ₃₀ H ₄₈ O	424	
2	17.059	3-O-Acetyl-6-Methoxy-cycloartenol	C ₃₃ H ₅₄ O ₃	498	
3	19.285	2R-Acetoxymethyl-1,3,3-trimethyl-4T-(3-Methyl-2-Buten-1-YL)-1T-Cyclohexanol	C ₁₇ H ₃₀ O ₃	282	

Table 2. Continued.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
4	19.410	2R-Acetoxyethyl-1,3,3-trimethyl-4T-(3-Methyl-2-Buten-1-YL)-1T-Cyclo hexanol	C ₁₇ H ₃₀ O ₃	282	
5	20.286	4,4,6A,6B,8A,11,11,14B-Octamethyl-1,4,4A,5,6, 6A,6B,7,8,8A,9,10,11,12, 12A,14,14A,14B-Octa decahydro-2	C ₃₀ H ₄₈ O	424	

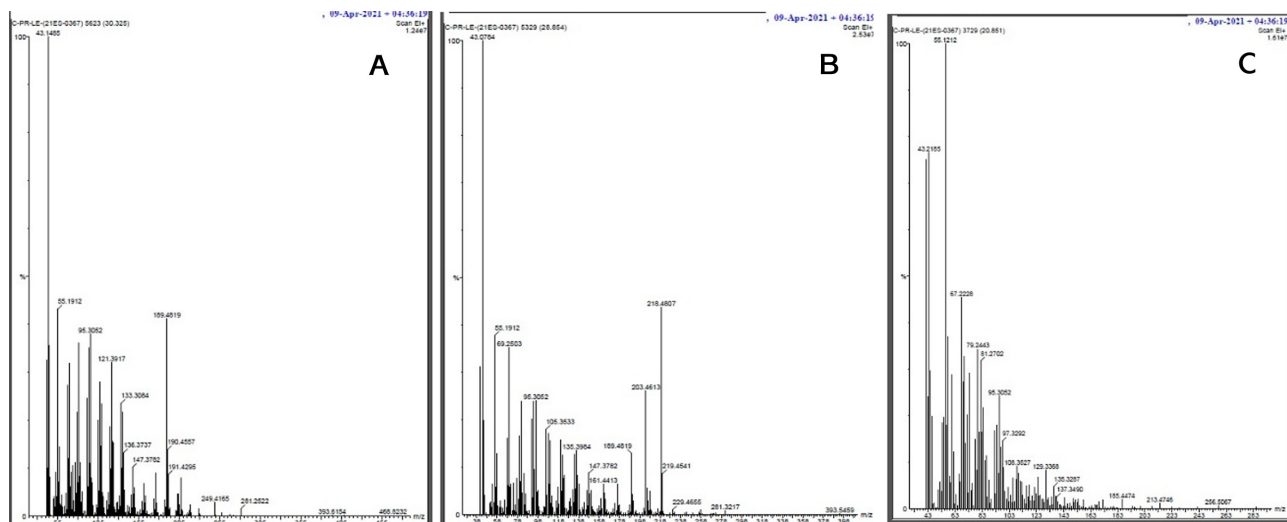


Figure 5. Mass spectra of same and major compound in *Calotropis* leaf and latex. A) 2R-Acetoxyethyl-1,3,3-trimethyl-4T-(3-Methyl-2-Buten-1-YL)-1T-Cyclohexanol. B) 4,4,6A,6B,8A,11,14B-Octamethyl-1, 4, 4A, 5, 6, 6A, 6B, 7, 8, 8A, 9, 10, 11, 12, 12A, 14, 14A, 14B Octadecahydro-2. C) 3-Tetradecyn-1-ol.

the literature were not the same.¹⁵ has done the extraction of phytochemicals using *Calotropis gigantea* flowers not the methanol extraction; they identified the hexa-decanoic acid and squalene compounds which were the same in this present study in *Calotropis gigantea* leaves. These compounds showed anti-oxidant and anti-tumour biological activity.

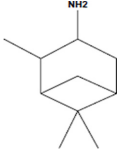
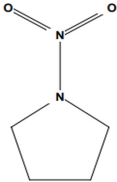



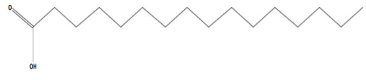


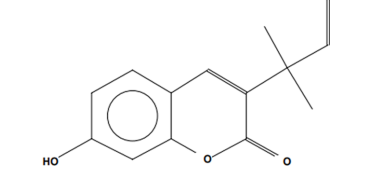

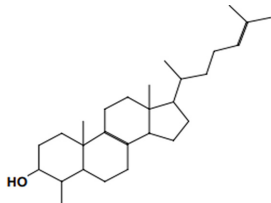
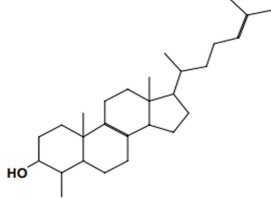
Analysis of *Carica papaya* leaf and latex

In *Carica papaya*, GC-MS analysis showed total of about 20 compounds, of which (Table 3) 15 compounds were identified in leaf extract and (Table 4) 5 in latex methanol extraction. This Beta- carotene phytochemical had the same molecular formula C₄₀H₅₆ and molecular weight 536 in both leaves and latex at RT 29.314. The major compound in the leaf was hexa-decanal, with a RT of 21.156, a molecular formula

C₁₆H₃₂O, a molecular weight of 240, and an area of 18.507 %. The main compound in latex was (1R,2R,8AS) -2,4,4,7A-Tetramethyl-1-(3-oxobutyl)-trans-hydrindan-2-carboxylic acid with a RT of 27.929, a molecular formula of C₁₈H₃₀O₃ and molecular weight of 294 and a peak area of 63.574%.

Analysing the phytochemicals found in *Carica papaya* leaf and latex was one of the research. In the methanol extraction of papaya red lady variety leaf¹⁶ and in this investigation, it was demonstrated that no compound was same. However, the research revealed that n-hexadecanoic acid, which is present in methanol extraction of papaya leaf, is present. The same component was discovered in an aqueous papaya fruit extract that exhibited anti-microbial, anti-cancer, anti-haemolytic and anti-diabetic properties.¹⁷ Squalene was discovered in this study methanol leaf extraction; the same

Table 3. Phytocomponents identified in the methanolic extract of *Carica papaya* leaf by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	14.758	2,6,6-Trimethyl-bicyclo[3.1.1]hept-3-ylamine	C ₁₀ H ₁₉ N	153	
2	15.569	Pyrrolidine,1-nitro-	C ₄ H ₈ O ₂ N ₂	116	
3	17.885	Hexadecanal	C ₁₆ H ₃₂ O	240	
4	18.335	Phytol	C ₂₀ H ₄₀ O	296	
5	19.080	Cyclopropanepentanoic acid, 2-undecyl-,methyl ester,trans-	C ₂₀ H ₃₈ O ₂	310	
6	19.785	N-Hexadecanoic acid	C ₁₆ H ₃₂ O ₂	256	
7	19.945	Pentadecanoic acid	C ₁₅ H ₃₀ O ₂	242	
8	21.156	Hexadecanal	C ₁₆ H ₃₂ O	240	
9	23.337	7-Hydroxy-3-(1,1- Dimethylprop-2-enyl) Coumarin	C ₁₄ H ₁₄ O ₃	230	
10	24.492	Squalene	C ₃₀ H ₅₀	410	
11	26.393	Cholesta-8,24-Dien-3 -ol, 4-methyl-,(3.beta., 4.alpha.)-	C ₂₈ H ₄₆ O	398	
12	26.748	Cholesta-8,24-Dien-3-ol, 4-methyl-,(3.beta., 4.alpha.)-	C ₂₈ H ₄₆ O	398	

Comparative Analysis of Latex Plants by GC-MS using Methanol Extraction

Table 3. Continued.

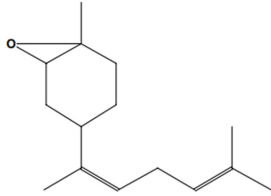
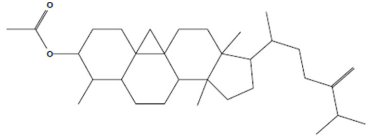
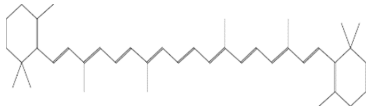

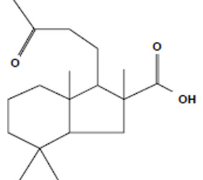
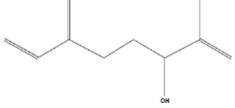
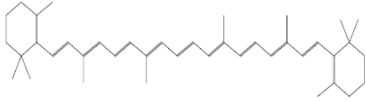

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
13	27.909	Trans-z-.alpha.- bisabolene epoxide	C ₁₅ H ₂₄ O	220	
14	28.649	9,19-Cycloergost-24(28) -en-3-ol,4,14-dimethyl-, acetate,(3.beta.,4.alpha.,5. Alpha	C ₃₂ H ₅₂ O ₂	468	
14	29.314	Beta carotene	C ₄₀ H ₅₆	536	

Table 4. Phytochemicals identified in the methanolic extract of *Carica papaya* latex by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	16.574	Benzene,1-isocyano-4-methyl	C ₈ H ₇ N	117	
2	27.929	(1R,2R,8AS) -2,4,4,7A- Tetramethyl-1-(3-oxobutyl) -trans-hydrindan-2-carboxylic acid	C ₁₈ H ₃₀ O ₃	294	
3	28.794	2-Methyl-6-methylene-octa-1,7-dien-3-ol	C ₁₀ H ₁₆ O	152	
4	29.424	Beta.carotene	C ₄₀ H ₅₆	536	
5	29.789	Arachidonic amide,N-[5-Hydroxy-N-Pentyl]	C ₂₅ H ₄₃ O ₂ N	389	

substance had previously been discovered by chloroform extracted latex.¹⁸

Analysis of *Ficus benghalensis* leaf and latex

GC-MS analysis of *Ficus benghalensis* revealed a total of 16 phytochemicals, (Table 5) 11 of which were found in the leaf and (Table 6) 5 in the latex after methanol extraction. 2R-

Acetoxymethyl-1,3,3-trimethyl-4T-(3-methyl-2-buten-1-yl)-1T Cyclohexanol at RT 28.124, with a molecular formula of C₁₇H₃₀O₃ and a molecular weight of 282 was found in both the leaf and the latex of *Ficus* methanol extraction. The major compound in the leaf was N- hexadecanoic acid at RT 21.461, molecular formula C₁₆H₃₂O₂ and molecular weight 256, with an area of 20.907 % peak area. The latex main constituent

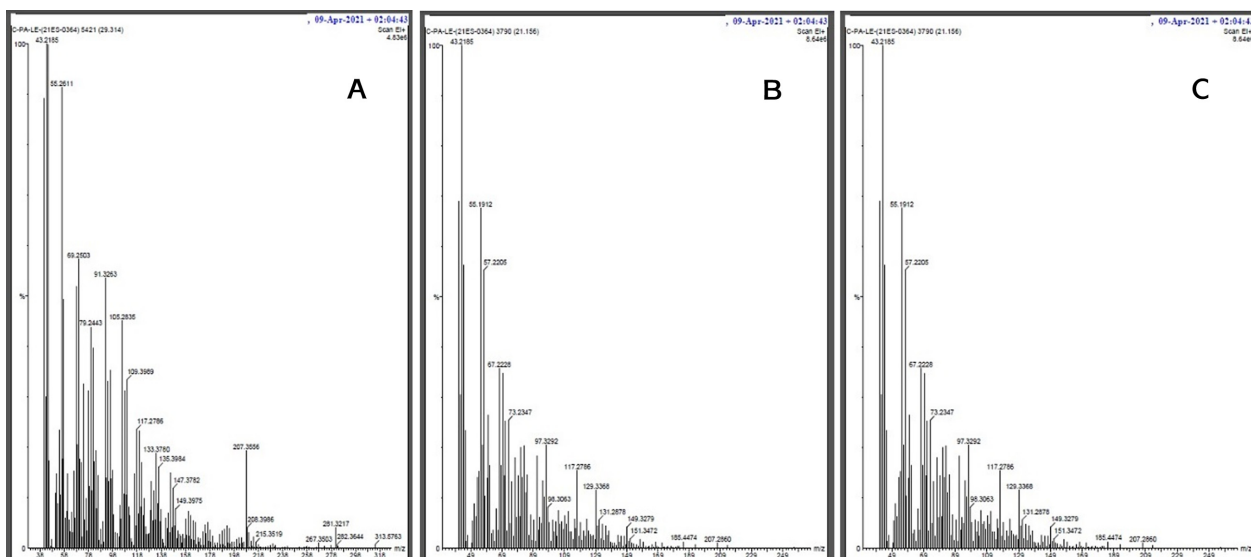


Figure 6. Mass spectra of same and major compound in *Carica papaya* leaf and latex. (A) Beta- carotene, (B) Hexa-decanal, (C) (1R,2R,8AS) -2,4,4,7A-Tetramethyl-1-(3-oxobutyl)-trans-hydrindan-2-carboxylic acid.

Table 5. Phytocomponents identified in the methanolic extract of *Ficus benghalensis* leaf by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	15.394	Methanecarbothiolic Aid	C2H4OS	76	
2	18.280	Isoxazolidine,5-ethyl -2,4-dimethyl-,trans-	C7H15ON	129	
3	20.036	N- hexadecanoic acid	C16H32O2	256	
4	21.461	N- hexadecanoic acid	C16H32O2	256	
5	24.252	Hexadeca-2,6,10,14-tetra-1-ol,3,7,11,16- tetramethyl-(E,E,E)-	C20H34O	290	
6	24.788	Pterin-6-carboxylic acid	C7H5O3N5	207	
7	26.643	Dihydroartemisinin, 6- Deshydro-5-deshydroxy-3-desoxy	C15H22O3	250	

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Table 5. Continued.

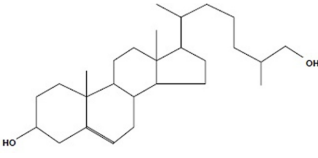
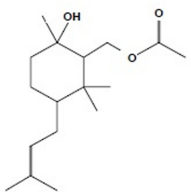
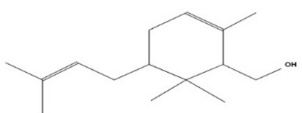
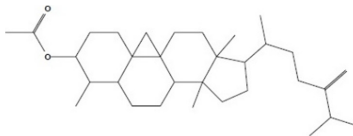
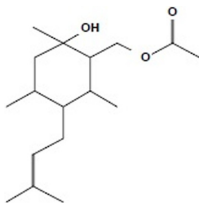
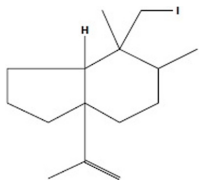

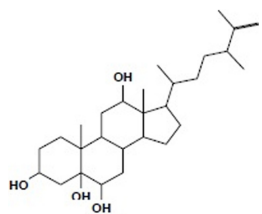
Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
8	27.334	26-Hydroxycholesterol	C ₂₇ H ₄₆ O ₂	402	
9	28.124	2R-Acetoxyethyl-1,3,3-trimethyl-4T-(3-methyl-2-buten-1-yl)-1T-Cyclo Hexanol	C ₁₇ H ₃₀ O ₃	282	
10	28.444	2,4,4-Trimethyl-3-hydro xymethyl-5A-(3-methyl- but-2-enyl)-cyclohexene	C ₁₅ H ₂₆ O	222	

Table 6. Phytocomponents identified in the methanolic extract of *Ficus benghalensis* latex by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	27.274	9.19-Cycloergost-24(28) -en-3-ol,4,14dimethyl-,acetate,(3.beta.,4.alpha., 5.alpha.)-	C ₃₂ H ₅₂ O ₂	468	
2	27.359	2R-Acetoxyethyl-1,3,5-trimethyl-4c-3-(methyl-2-buten-1-yl)-1c-cyclo Hexanol	C ₁₇ H ₃₀ O ₃	282	
3	27.684	6.Beta.bicyclo[4.3.0] nonane.5 beta-iodomethyl-1 beta-isopropenyl-4	C ₁₅ H ₂₅ I	332	
4	27.894	1,6,10,14,18,22-Tetra cosahexaen-3-ol, 2,6,10,15, 19,23-hexamethyl-,(ALL-E)-	C ₃₀ H ₅₀ O	426	
5	28.354	Ergost-25-ene-3,5,6,12- tetrol, (3.beta.,5.alpha.,6.beta.,12.beta.)-	C ₂₈ H ₄₈ O ₄	448	

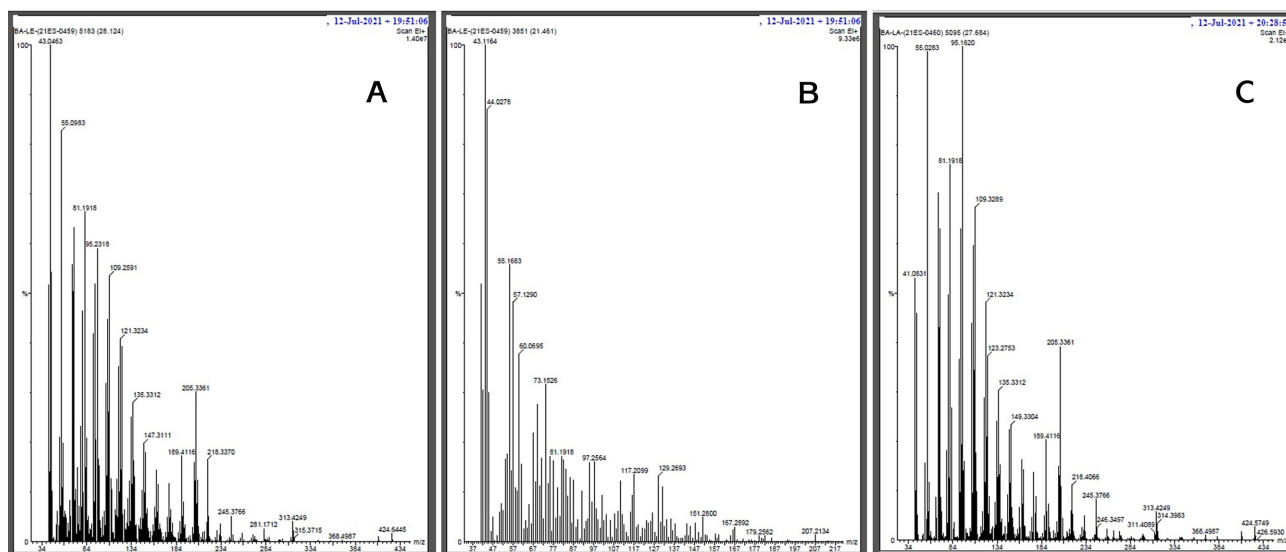


Figure 7. Mass spectra of same and major compound in *Ficus* leaf and latex. A) 2R-Acetoxyethyl-1,3,3-trimethyl-4T-(3-methyl-2-buten-1-yl)-1T Cyclohexanol, B) N- hexadecanoic acid, C) 6. Beta-bicyclo [4.3.0] nonane.5 beta-iodomethyl-1 beta-isopropenyl-4.

was 6. Beta-bicyclo [4.3.0] nonane.5 beta-iodomethyl-1 beta-isopropenyl-4 with a RT 27.684, a molecular formula of $C_{15}H_{25}I$, and a molecular weight of 332 with a peak area of 53.278%.

One of the study examined the phytochemicals in a methanol extract of *Ficus benghalensis* leaf. N-hexadecanoic acid was same in both studies in this as well. They state that this substance has anti-seborrheic, anti-inflammatory, cytoprotectant and anaesthetic properties.¹⁹ There are no studies was carried out using methanol extraction of *Ficus benghalensis* latex.

Analysis of *Nerium oleander*

GC-MS analysis of *Nerium oleander* revealed a total of 11 phytochemicals, (Table 7) 7 of which were found in the leaf and (Table 8) 4 compounds in the latex after methanol extraction. There is no similar compound found in *Nerium* methanol extraction leaf and latex. The major compound in the leaf was myo-inositol,4-c-methyl-at RT 20.185, molecular formula $C_7H_{14}O_6$, and molecular weight 194, with an area of 87.718% peak area. Lupeol was the major compound in the latex, with a RT of 28.474, a molecular formula of $C_{30}H_{50}O$,

Table 7. Phytochemicals identified in the methanolic extract of *Nerium oleander* leaf by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	20.185	Myo-inositol,4-c-methyl-	$C_7H_{14}O_6$	194	
2	23.917	Squalene	$C_{30}H_{50}$	410	
3	26.238	D1-alpha-Tocopherol	$C_{29}H_{50}O_2$	430	
4	27.723	9,11-Dimethyl tetracyclo [7.3.1.0(2.7).1(7.11)]tetradecane	$C_{16}H_{26}$	218	

Comparative Analysis of Latex Plants by GC-MS using Methanol Extraction

Table 7. Continued.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
5	28.199	Urs-12-en-24-oic acid,3-oxo-methyl, ester, (+)-	C ₃₁ H ₄₈ O ₃	468	
6	28.584	Lup-20(29)-en-3-ol, acetate,(3.beta.)-	C ₃₂ H ₅₂ O ₂	468	
7	28.669	3-O-Acetyl-6-methoxy-cycloartenol	C ₃₃ H ₅₄ O ₃	498	

Table 8. Phytocomponents identified in the methanolic extract of *Nerium oleander* latex by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	27.904	Thunbergol	C ₂₀ H ₃₄ O	290	
2	28.029	4,4,6A,6B,8A,11, 11,14B-Octamethyl-1, 4,4A,5,6,6A,6B,7,8, 8A,9,10,11,12,12A,14, 14A,14B-Octa Decahydro	C ₃₀ H ₄₈ O	424	
3	28.399	2R-Acetoxyethyl-1, 3,3-Trimethyl-4T-(3- Methyl-2-buten-1-yl)- 1T-Cyclohexanol	C ₁₇ H ₃₀ O ₃	282	
4	28.474	Lupeol	C ₃₀ H ₅₀ O	426	

a molecular weight 426, and an area of 55.852% peak area. This research's dl-alpha-tocopherol chemical compound,

which is also found in the leaf extract, was compared to a study that examined the phytocomponent in *Nerium oleander*

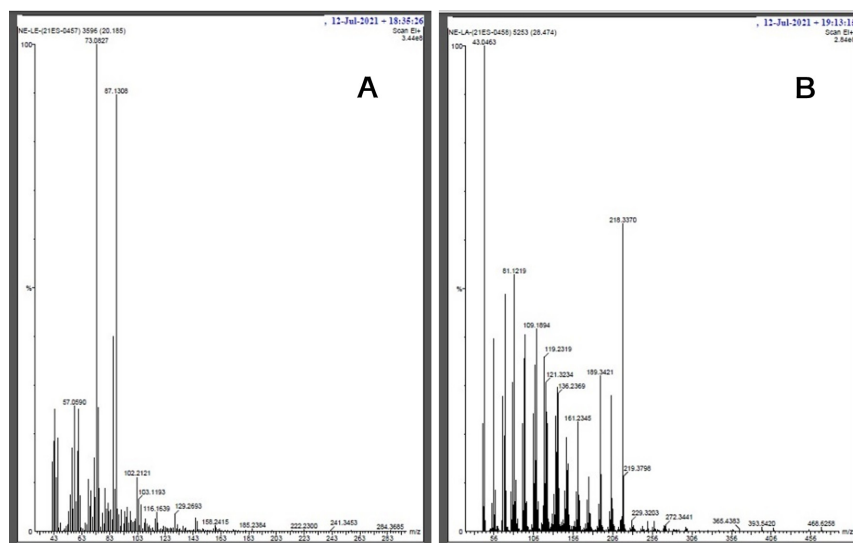


Figure 8. Mass spectra of same and major compound in Nerium leaf and latex. A) myo-inositol,4-c-methyl, B) Lupeol.

leaf part methanol extraction. They also emphasised the biological effects of this chemical, including its anti-oxidant, immunological, anti-cancer, anti-inflammatory properties.²⁰ There are no studies was carried out using methanol extraction of *Nerium oleander* latex.

Analysis of *Plumeria alba*

In *Plumeria alba*, GC-MS analysis showed total of 16 phytochemicals, of which (Table 9) 10 were found in the leaf and (Table 10) 6 compounds in the latex after methanol extraction. 2,4,4-Trimethyl-3-hydroxymethyl-5A-(3-Methyl-but-

Table 9. Phytochemicals identified in the methanolic leaf extract of *Plumeria alba* leaf by GC-MS.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	18.610	Eicosanoic acid, methyl ester	C ₂₁ H ₄₂ O ₂	326	
2	19.160	Tridecanoic acid	C ₁₃ H ₂₆ O ₂	214	
3	20.676	Beta-D-Manno furanoside, methyl	C ₇ H ₁₄ O ₆	194	
4	24.127	Squalene	C ₃₀ H ₅₀	410	
5	26.528	2,4-Dimethyl-7-Oxo-4,7-dihydro-triazolo (3,2-c)triazine	C ₆ H ₇ ON ₅	165	
6	28.069	2,4,4-Trimethyl-3- hydroxymethyl -5A-(3-Methyl-but-2-enyl) -cyclohexene	C ₁₅ H ₂₆ O	222	

Comparative Analysis of Latex Plants by GC-MS using Methanol Extraction

Table 9. Continued.

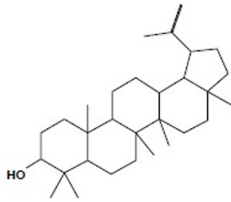
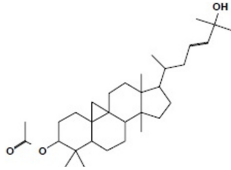
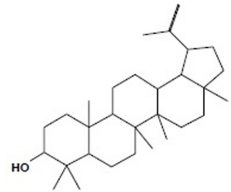
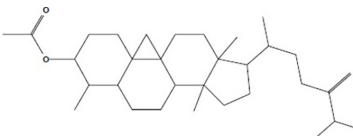
Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
7	28.284	Lupeol	C ₃₀ H ₅₀ O	426	
8	28.454	9,19-Cyclolanost-23-ene-3,25-diol, 3-Acetate, (3.β.,23E)-	C ₃₂ H ₅₂ O ₃	484	
9	28.789	Lupeol	C ₃₀ H ₅₀ O	426	
10	29.009	9,19-Cycloergost-24(28)-en-3-ol,4,14-dimethyl-,acetate (3.β.,4.α.,5.α.)-	C ₃₂ H ₅₂ O ₂	468	

Table 10. Phytochemicals identified in the methanolic leaf extract of *Plumeria alba* latex by GC-MS.

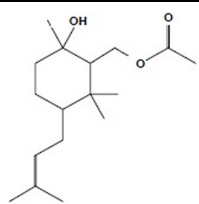
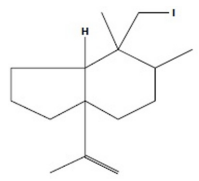
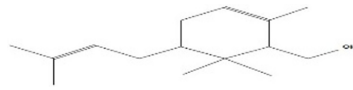
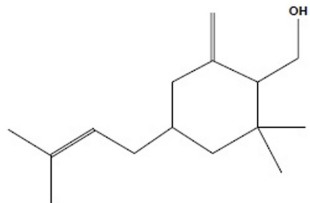
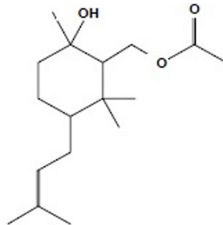
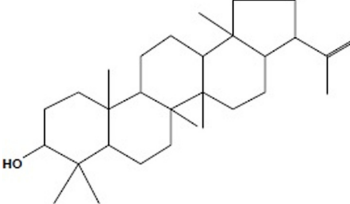
Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
1	27.554	2R-Acetoxyethyl-1,3,3-trimethyl-4t-(3--1t-cyclohexanol	C ₁₇ H ₃₀ O ₃	282	
2	27.654	6.β.Bicyclo[4.3.0]nonane,5.β-iodomethyl-1.β-isopropenyl-4.α.,5.α.-dimethyl	C ₁₅ H ₂₅ I	332	
3	27.854	2,4,4-Trimethyl-3-hydroxymethyl-5A-(3-methylbut-2-enyl)-cyclohexene	C ₁₅ H ₂₆ O	222	
4	27.919	1-Methylene-2B-Hydroxymethyl-3,3-dimethyl-4B-(3-Methylbut-2-enyl)-cyclohexane	C ₁₅ H ₂₆ O	222	

Table 10. Continued.

Si.no	RT	Compound name	Molecular formula	Molecular weight	Structure
5	28.424	2R-Acetoxyethyl-1,3,3-trimethyl-4t-(3-methyl-2-buten-1-yl)-1t-cyclo Hexanol	C ₁₇ H ₃₀ O ₃	282	
6	28.630	Hop-22(29)-En-3.beta-ol	C ₃₀ H ₅₀ O	426	

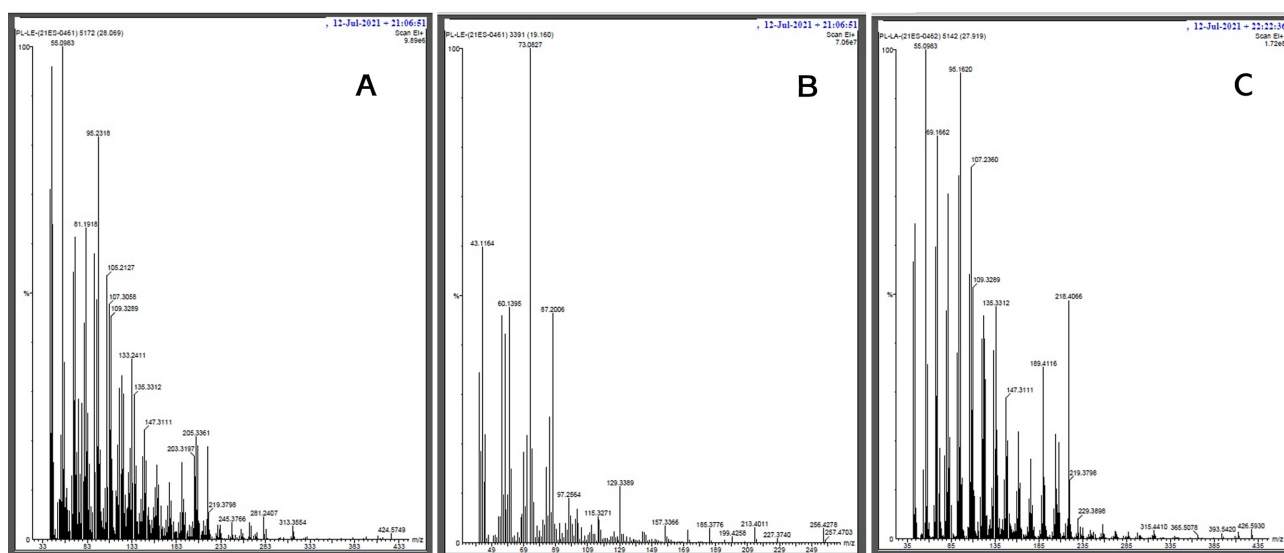


Figure 9. Chromatogram of same and major compound in *Plumeria* leaf and latex. A) 2,4,4-Trimethyl-3-hydroxymethyl-5A-(3-Methylbut-2-enyl)-cyclohexene, B) tridecanoic acid, C) 1-Methylene-2B-Hydroxymethyl-3,3-dimethyl-4B-(3-Methylbut-2-enyl)-cyclohexane.

2-enyl)-cyclohexene at RT 28.069, with a molecular formula of C₁₅H₂₆O and a molecular weight of 222 was found in both the leaf and the latex of *Ficus* methanol extraction. The major compound in the leaf was tridecanoic acid at RT 19.160, molecular formula C₁₃H₂₆O₂ and molecular weight 214, with a peak area of 53.664 %. At RT 27.919, molecular formula C₁₅H₂₆O, and molecular weight 222, the major compound in the latex was 1-Methylene-2B-Hydroxymethyl-3,3-dimethyl-4B-(3-Methylbut-2-enyl)-cyclohexane with the area 52.524% peak area.

One research did not analyse the methanol extraction, just the phytochemicals found in *Plumeria alba* flower. They named the substance Squalene.²¹ The *Plumeria alba* leaf in the current investigation contained the same chemical, as determined by methanol extraction.

Conclusion

The investigation in this study involves the leaves and latex of five different plants. As per the literature, this shows the presence of more identified phytochemicals and a few compounds that showed biological activity. The *Calotropis gigantea* plant latex and leaf were used for methanol extraction using the Soxhlet apparatus.^{13,14} But the compounds in this study and those mentioned in the literature were not the same.² It has done the extraction of phytochemicals using *Calotropis gigantea* flower, not the methanol extraction; they identified the hexa-decanoic acid and squalene compounds which were found in this study in *Calotropis gigantea* leaf, and *Carica papaya* leaf, and *Plumeria* leaf. These compounds showed the antioxidant and anti-tumour

biological activities. Beta carotene, which is present in the *Carica papaya* leaf as well as in the latex, was shown in the review to play a dynamic role in delaying aging, reducing inflammation, and preventing certain cancers.¹⁹ Literature showed that identified compound phytol in ethanolic leaf extraction of *Calotropis gigantea* that showed anti-inflammatory and anti-cholesteric activity, the same was identified in this study in *Carica papaya* leaf. The comparison of latex and leaf methanolic extraction reveals a large number of compounds, with some compounds present in both leaf and latex.

References

1. Saratha, V.; Subramanian, S.P. *International Journal of Pharmaceutical sciences and research* **2010**, 1, 88. [http://dx.doi.org/10.13040/IJPSR.0975-8232.1\(9\).88-96](http://dx.doi.org/10.13040/IJPSR.0975-8232.1(9).88-96).
2. Altemimi, A.; Lakhssassi, N.; Baharlouei, A.; Watson, D.G.; Lightfoot, D.A. *Plants* **2017**, 6, 42. <https://doi.org/10.3390/plants6040042>.
3. Sultana, B.; Anwar, F.; Ashraf, M. *Molecules* **2009**, 14(6), 2167–2180. <https://doi.org/10.3390/molecules14062167>.
4. Kaniyappan, V.; Rathinasamy, R.M.; Manivanan, J.G. *Mass Spectrom. Lett.* **2022**, 13, 166. <https://doi.org/10.5478/MSL.2022.13.4.166>.
5. Sarkar, S.; Sen, M.; Bhattacharya, P.; Ghosh, A. *J. Pharm. Res* **2013**, 5, 563.
6. Do, Q. D.; Angkawijaya, A. E.; Tran-Nguyen, P. L.; Huynh, L. H.; Soetaredjo, F. E.; Ismadji, S.; Ju, Y.-H. *Journal of food and drug analysis* **2014**, 22(3), 296. <https://doi.org/10.1016/j.jfda.2013.11.001>.
7. Sulaiman, C.; Shahida, V.; Balachandran, I. *Journal of Natural Remedies* **2015**, 58. <https://doi.org/10.18311/jnr/2015/498>.
8. Azwanida, N. *Med Aromat Plants* **2015**, 4, 2167. <https://doi.org/10.4172/2167-0412.1000196>.
9. Do, Q.D.; Angkawijaya, A.E.; Tran-Nguyen, P.L.; Huynh, L.H.; Soetaredjo, F.E.; Ismadji, S.; Ju, Y.-H. *Journal of food and drug analysis* **2014**, 22, 296. <https://doi.org/10.1016/j.jfda.2013.11.001>.
10. Gopalasatheeskumar, K. *Mintage Journal of Pharmaceutical & Medical Sciences* **2018**, 7, 43.
11. Ashok, C.; Prachu, B.; Umesh, J.; Manohar, P. *J Pharm Res* **2011**, 4, 406.
12. Sharma, S.; Kumari, A.; Sharma, M. *International Journal of Pharmacognosy and Phytochemical Research* **2016**, 8, 1823.
13. Madhavan, S.A.; Vinotha, P.; Uma, V. *Asian Journal of Advances in Medical Science* **2020**, 1.
14. Sangeetha, K.; Steffi, P.; Selvi, B.T.; Priyadarshni, S. *Journal of Pharmaceutical Sciences and Research* **2020**, 12, 789.
15. Beena Thomas, A.J Chacko, Reshma Thampy. Preliminary Phytochemical and GC-MS Profiling of Ethanolic Extract of Leaves of *Calotropis Gigantea* Linn. *International journal pharmacy and pharmaceutical* **2018**. 12.
16. Gorane, A.; Naik, A.; Nikam, T.; Tripathi, T.; Ade, A. *Journal of Pharmacognosy and Phytochemistry* **2018**, 7, 553.
17. Ezekwe, S.; Chikezie, P. *J Nutr Food Sci* 2017, 7, 1. <https://doi.org/10.4172/2155-9600.1000602>.
18. Chandrasekaran, R.; Seetharaman, P.; Krishnan, M.; Gnanasekar, S.; Sivaperumal, S. *3 Biotech* **2018**, 8, 1. <https://doi.org/10.1007/s13205-018-1105-6>.
19. Karthikeyan, M.; Subramanian, P.; Ramalingam, S. *Int. J. Pharma. Bio. Sci* **2019**, 10, 5. <http://dx.doi.org/10.22376/ijpbs.2019.10.4.p5-12>.
20. Mishra, D.; Kumar rout, S.; Kar, A. Priyadharshani. *Acta scientific pharmaceutical sciences* **2018**, 2(8), 11-14.
21. Mohamad, S.A.; Adzahar, N.S.; Akhtar, M.N.; Zareen, S.; Lee, T.C. 2020. Phytochemical Analysis and GC-MS Profiling in the Flower of *Plumeria alba*. In *Materials Science Forum: Trans Tech Publ.* 280. <https://doi.org/10.4028/www.scientific.net/msf.981.280>.