

LC-MS analysis of phytochemical constituents in leaf extracts of *Neolamarckia cadamba*

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ABSTRACT

Neolamarckia cadamba is one of the medicinal plants used in the treatment of various diseases. This study was conducted to identify the phytochemical constituents of *Neolamarckia cadamba* leaf extracts using Soxhlet method. The aqueous extracts were analysed using LC-MS of the compounds found in the respective extract. There are 44 compounds were found in *Neolamarckia cadamba* plant extract. Some of the identified compounds have been reported to possess various biological activities such as antioxidant, antimicrobial, anesthetic, antiseptic, antidiabetic, hypocholesterolemic, etc. The results thus concluded that *Neolamarckia cadamba* leaves possess various bioactive compounds and recommended as a plant of phytopharmaceutical importance.

Keywords: *Neolamarckia cadamba*, liquid chromatography-mass spectrometry (LC-MS), Phytochemical, Secondary metabolite, Antioxidant.

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INTRODUCTION

Neolamarckia cadamba is very important medicinal plant belongs to the family Rubiaceae. It is having various medicinal properties. *Cadamba* is an ornamental plant and commonly known as “*Kadamba*”. It is tropical evergreen tree found in different parts of India, Bangladesh, Nepal, and Sri Lanka, Cambodia, Malaysia and Australia. It is crucially significant as it has the largest number of phytochemicals and secondary metabolites (viz., cadambagenic acid, cadamine, quinovic acid, β -sitosterol, cadambine, etc.)²¹. Having pharmacological and biological properties. It can be used as an alternative to various synthetic chemical compounds in the prevention as well as the treatment of several incurable diseases. More than 100 years of research has been done to discover various phytochemicals and their implications.

Higher plants continue to be important sources of chemicals that are bioactive for maintaining human health. Secondary metabolites with exciting biological functions are abundant in plants²⁵. It is also one of the plants to get natural antioxidants for many medical purposes, including treating ageing and diseases like cancer that are caused by radical mechanisms. *Neolamarckia cadamba* is one of the traditional Indian medicinal plants². The treatment of fever, anaemia, diabetes, uterine and liver complaints, menorrhagia, blood and skin ailments, diarrhoea, colitis, stomatitis, dysentery, and improvement of semen quality have been all recorded in numerous Indian medical literatures. This plant's different parts have traditionally been used to treat a variety of ailments¹⁰.

Studies on the plant's bioactivity have identified its antibacterial, antioxidant, and wound-healing abilities and also its antimalarial, antihepatotoxic, hepatoprotective, analgesic, anti-inflammatory, antipyretic, anthelmintic,

diuretic, laxative, and antidiabetic properties¹. In addition, *Aspogillus fumigatus* and *Candida albicans* were resistant to the antifungal properties of this plant's leaves and bark extracts³³.

Various phytochemical compounds have been identified from *Neolamarckia cadamba* using phytochemistry approaches to date. The leaf extracts of *Neolamarckia cadamba* revealed the presence of various secondary metabolites and these include glycosides, alkaloids, tannins, phenolic, and flavonoids⁴⁸. The bark contains triterpenoids, cadambagic acid, quinovic acid, saponins, glycosides, cadambine and its derivatives, and also β -sitosterol, cadambagic acid, and glycosides. In many seizure models, certain alkaloids, steroids, and flavonoids exhibit significant antiepileptic effects²¹. Additionally, saponins have shown significant anti-convulsant impacts and the ability to change neurotransmitter levels in the brain. The bark powder of *Neolamarckia cadamba* included alkaloids, proteins, terpenes, saponins, and carbohydrates, determined by qualitative chemical evaluation³³.

The methanolic extract of *Neolamarckia cadamba* received phytochemical analysis to reveal the presence of flavonoids, alkaloids, carbohydrates, proteins, and glycoside chemicals (Gurjar et al., 2010). The essential oil produced by the flowers of *Neolamarckia cadamba* contains linalool, geraniol, geranylacetate, linalyl acetate, α -selinene, 2-nonanol, phellandrene, β -bergamottin, p-cymol, curcumen, terpinolene, camphene, and myrcene as its primary ingredients.

According to a literature review, almost each portion of the *Neolamarckia cadamba* is used in conventional medicine to treat a variety of ailments. The purpose of the current

study was to use liquid chromatography mass spectrometry (LC-MS) to determine the phytochemical components of *Neolamarckia cadamba* leaves. This study is expected to be a valuable resource for future phytochemical extraction from this species that can be used as supplements for nutrition. All currently available scientific evidence supports the long-standing application of the principle.

MATERIALS AND METHODS

1) Collection and identification of plant

Neolamarckia cadamba plant was collected manually from adjoining areas of Karad Tehsil. The plant was authenticated by Department of Botany, Shivaji University Kolhapur and voucher specimens (KMG 002) were deposited in the department for future reference.

2) Extraction of plant material

Neolamarckia cadamba leaves were properly washed four to five times with running water and kept with for drying in shade for a week and then 30 gms of dried leaves were ground into fine powder by using electric blender extraction. 30 gms of powdered plant material underwent an intensive 48-hour (1:10), Soxhlet extraction were done using the aqueous. The extract was dried in a water bath shaker after being filtered through Whatman filter paper No.1. All of the extracts were subjected to preliminary phytochemical screening and LC-HRMS analysis.

3) Preliminary analysis of *Neolamarckia cadamba* leaf extracts

A small portion of the dry extract was subjected to the phytochemical test using Harborne (1983) methods for detection of alkaloid, tannins, terpenoids, saponins, flavonoid and glycosides.

Test for Alkaloids

5 ml of the extract was added to 2 ml of HCl. To this acidic medium, 1 ml of Wagner's reagent was added. A reddish precipitate brown produced immediately indicates the presence of alkaloids.

Test for Flavonoids

In 2 ml of extract solution add with 2 ml of diluted 10% sodium hydroxide (NaOH), was added. Golden yellow precipitate shows presences of flavonoids.

Test for Glycoside

0.5 ml of each extract was treated with 0.2 ml glacial acetic acid then dropwise 3.5% ferric chloride was added to the solution. This was layered with 1 ml of conc. sulfuric acid. A reddish-brown ring that has occurred at the interface indicates the presence of glycosides.

Test for Tannins

0.5 ml of extract and 5 ml of distilled water was taken in a test tube 1% ferric chloride was added. Deep green, brownish-green, or blue coloration indicates the presence of tannin.

Test for Saponins

About 0.2 g of the extracts shaken with 5 ml of distilled water and then heated to boil frothing (appearance of creamy mix of small bubbles) shows the presence of saponins

Test for Terpenoids

2 ml of chloroform was mixed with 5 ml of extract. To make a layer, 3 ml of concentrated H₂SO₄ was added. Terpenoids were detected by the formation of a reddish-brown precipitate at the interface.

Test for Steroid

2 ml of extract solution then add 1 ml of ethyl acetate and mix into 2 ml of chloroform and few drops of concentrated H₂SO₄ side by side carefully. Red precipitate shows that steroid is present.

Test for phenol

About 0.5 g of extract treated with 3-4 drops of ferric chloride solution. A bluish black colour appeared; this shows presence of phenols.

Test for carbohydrate

2 ml of Fehling A and 2 ml of Fehling B added into 2 ml of extract. Then mixture is boiled. This gives brick red ppt at bottom of test tube. It shows presence of carbohydrate.

Test for protein and amino acids

0.5 mg of extract was taken and 2 drops of freshly prepared 0.2% ninhydrin reagent was added and heated. The appearance of pink or purple colour indicates the presence of proteins, peptides or amino acids.

4) Liquid chromatography-mass spectrometry (LC-MS) Analysis

LC/MS analysis of *Neolamarckia cadamba* leaves' aqueous extract was performed using an Agilent Q-ToF G6540B connected to Agilent 1260 Infinity II HPLC. An aqueous extract (1 mL) was then injected into the LC/MS apparatus. Next, the data were displayed on a column, Agilent Eclipse XDB-C18, 3X150 mm, 3.5 micron (CAMS -Venture Laboratory, Pune). LC oven temperature started at 40 °C and was held for 0-2 min at 5 % and then for 25 min with program rate 95%. The injector and detector temperatures were set at 300 °C - 350 °C, respectively. The mass range was scanned from 100 to 1700 amu. The identification of components was based on the comparison of their mass spectra with those of Meltin Database.

RESULTS AND DISCUSSION

Phytochemical analysis of *Neolamarckia cadamba* revealed the presence of sterols, flavonoids, alkaloids, saponins, glycosides, and tannins and terpenes in the leaf aqueous extract. It is crucially significant as it has the largest number of phytochemicals and secondary metabolites.

Table 01: Qualitative phytochemical analysis of *Neolamarckia cadamba* leaves extract in aqueous

Sr. No	Test	Aqueous
1	Alkaloids	+Ve
2	Flavonoids	+Ve
3	Glycoside	+Ve
4	Tannins	+Ve
5	Saponins	+Ve
6	Terpenoids	+Ve
7	Steroid	-Ve
8	Phenol	-Ve
9	Carbohydrate	+Ve
10	protein and amino acids	+Ve

Note - (+) Present; (-) Absent

Table 2: Phytochemicals screening of aqueous extracts of *Neolamarckia cadamba* leaves by LC-MS

Sr. No	Name of compound	Chemical formula	Rt time	Mass	Score
	2-Methyl-2-buten-1-ol O-beta-D Glucopyranoside	C ₁₁ H ₂₀ O ₆	2.475	248.1248	93.71
	Adefovir Dipivoxil	C ₂₀ H ₃₂ N ₅ O ₈ P	2.651	501.1981	95.04
	Pirbuterol	C ₁₂ H ₂₀ N ₂ O ₃	2.886	240.1464	95.42
	Cis-5-Caffeoylquinic acid	C ₁₆ H ₁₈	3.616	240.1464	95.42
	3-Hydroxycoumarin	C ₉ H ₆ O ₃	3.655	162.0311	96.12
	2- Dodecylbenzenesulfonic acid	C ₁₈ H ₃₀ O ₃ S	3.742	326.1925	91.21
	Cadambine	C ₂₇ H ₃₂ N ₂ O ₁₀	13.005	544.1898	47.34
	Cyanidin 3-rhamnoside 5-glucoside	C ₂₇ H ₃₁ O ₁₅	11.343	326.1925	91.21
	Crotamiton	C ₁₃ H ₁₇ N O	12.839	203.1301	95.17
	(-)-Sedamine	C ₁₄ H ₂₁ N O	13.829	219.1631	93.26
	7- Hydroxydehydroglucine	C ₂₁ H ₂₃ N O ₅	13.950	369.1560	93.03
	Cyclic de-hypoxanthine futasine	C ₁₄ H ₁₄ O ₇	14.580	294.0748	96.13
	Proglumide	C ₁₈ H ₂₆ N ₂ O ₄	15.343	334.1899	98.22
	6-beta-DGlucopyranosyl-4',5-dihydroxy-3',7'- dimethoxyflavone	C ₂₃ H ₂₄ O ₁₁	15.524	476.1318	94.78
	Fluoxetine	C ₁₇ H ₁₈ F ₃ N O	15.527	309.1348	97.61
	Mycinamicin IV	C ₃₇ H ₆₁ N O ₁₁	15.779	695.4262	90.41
	1-(9H-Pyrido[3,4-b] indol-1-yl)-1,4-butanediol	C ₁₅ H ₁₆ N ₂ O ₂	15.891	256.1223	94.54
	Fortimicin A	C ₁₇ H ₃₅ N ₅ O ₆	16.378	309.1348	97.61
	Wistin	C ₂₃ H ₂₄ O ₁₀	16.475	460.1372	90.74
	Ethyl undecanoate	C ₁₃ H ₂₆ O ₂	16.756	214.1942	93.03
	Azacridone A	C ₁₈ H ₁₆ N ₂ O ₃	17.191	308.1172	95.91
	Beta- soster	C ₂₉ H ₅₀ O	23.877	414.3739	0.03
	Alkaloid AQC2	C ₁₉ H ₂₂ N ₂ O ₃	17.219	326.1635	92.55
	1-Methoxy-1H-indole-3-acetonitrile	C ₁₁ H ₁₀ N ₂ O	18.553	186.0785	95.51
	Linalyl propionate	C ₁₃ H ₂₂ O ₂	18.828	144.398	94.18
	Dihydroxyfumitremorgin C	C ₂₂ H ₂₅ N ₃ O ₅	19.333	411.1801	91.94
	Ucharidin	C ₂₉ H ₃₈ O ₉	19.353	210.1609	94.18
	Cadamine	C ₂₁ H ₂₁ N ₃ O ₃	21.963	363.1612	39.14

(3beta,5alpha,6beta,7alpha,22E,24R)-Ergosta8,22-diene-3,5,6,7-tetrol	C ₂₈ H ₄₆ O ₄	19.600	446.3394	99.50
Corchorifatty acid F	C ₁₈ H ₃₂ O ₅	20.236	328.2234	92.16
Fumitremorgin B	C ₂₇ H ₃₃ N ₃	20.259	479.2398	90.09
9,10-Dihydroxy-12,13-epoxyoctadecanoate	C ₁₈ H ₃₄ O ₅	21.165	330.2392	93.03
1-Methylnicotinamide	C ₇ H ₉ N ₂ O	21.172	137.0719	94.80
Dehydroanonaine	C ₁₇ H ₁₃ N O ₂	21.345	263.0934	94.12
Sphinganine	C ₁₆ H ₃₅ N O ₂	23.645	273.2656	94.77
(S)-Angelicaicain	C ₁₅ H ₁₆ O ₆	23.736	292.0953	96.18
Cadambagenic Acid	C ₃₀ H ₄₆ O ₅	17.775	486.3241	23.43
Dolasetron	C ₁₉ H ₂₀ N ₂ O ₃	24.006	324.1485	95.44
gamma-Tocopheryl quinone	C ₂₈ H ₄₈ O ₃	25.417	432.3600	95.93
Cassinine	C ₄₄ H ₅₁ N O ₁₇	25.443	865.3180	90.14
Melatonin	C ₁₃ H ₁₆ N ₂ O ₂	25.792	232.1221	92.54
Aegelinol	C ₁₄ H ₁₄ O ₄	26.486	246.0898	94.32
Methyl linoleate	C ₁₉ H ₃₄ O ₂	26.830	294.2564	95.50
Guazatine	C ₁₈ H ₄₁ N ₇	28.843	355.3430	90.13

30 grams of dried leaf powder was mixed with water and allowed to percolate for three days before being filtered, extraction process was done by soxhlet method, and 4.30 gm of crude extract was produced from *Neolamarckia cadamba* leaves. By using LC-MS analysis, the chemical components of *Neolamarckia cadamba* leaf extracts were discovered. The active principals with their retention time (RT), molecular formula, molecular mass (MW) and score in the aqueous extracts of *Neolamarckia cadamba* leaves are presented in Table 2. 44 compounds detected in the *Neolamarckia cadamba* leaves aqueous extracts. Most of the compounds found in this study have been reported elsewhere in other species, which is according to previous findings, 2-Methyl-2-buten-1-ol O-beta-D Glucopyranoside, Adefovir Dipivoxil, Pirbuterol, Cis-5-Caffeoylquinic acid, 3-Hydroxycoumarin, 2-Dodecylbenzenesulfonic acid, Uscharidin, Cyanidin 3-rhamnoside 5-glucoside, Crotafamin, (-)-Sedamine, 7-Hydroxydehydroglucine, Cyclic de-hypoxanthine futasoline, Proglumide, 6-beta-D Glucopyranosyl-4',5'-dihydroxy-3',7'-dimethoxyflavone, Fluoxetine, Mycinamicin IV, 1-(9H-Pyrido[3,4-b] indol-1-yl)-1,4-butanediol, Fortimicin A, Wistin, Cadambine, cadambagenic acid, Cadamine, Ethyl undecanoate, Azacridone A, 1-Methoxy-1H-indole-3-acetonitrile, Linalyl propionate, Uscharidin, Dihydroxyfumitremorgin C, (3beta,5alpha,6beta,7alpha,22E,24R)-Ergosta8,22-diene-3,5,6,7-tetrol, Corchorifatty acid F, Fumitremorgin B, 9,10-Dihydroxy-12,13-epoxyoctadecanoate, 1-Methylnicotinamide, Dehydroanonaine, Sphinganine, (S)-Angelicaicain, Dolasetron, gamma-Tocopheryl quinone, Cassinine, Melatonin, Aegelinol, Methyl linoleate, Guazatine, Methyl ester.

2-Methyl-2-buten-1-ol O-beta-D Glucopyranoside, Adefovir Dipivoxil it has an enzyme activity that accelerate the action of the cell functioning, which also effect on the viral chronic diseases and this will help out the cell activity.6&12 Cis-5-Caffeoylquinic acid, 3-Hydroxycoumarin it is used to prevent and treat wheezing, shortness of breath, coughing, and chest tightness caused by asthma, chronic bronchitis, emphysema, and other lung

diseases, in addition to inhibiting important signalling pathways and immune-related enzymes, antioxidants can influence the expression of transcription factors, which involved in the immune response.2&45 3-Hydroxycoumarin, 2-Dodecylbenzenesulfonic acid having growth-regulating activity and also work as a Microreactors, industrial production.18&46 Cyanidin 3-rhamnoside 5-glucoside it is used in Antipruritic properties (Crotafamin is used to treat scabies infection. It is also used to relieve the itching of certain skin conditions).10&15 (-)-Sedamine, 7-Hydroxydehydroglucine Respiratory ailments, having Glycine which is very effective in improving the health and supports the growth and well-being of humans and animals.36&51 Cyclic de-hypoxanthine futasoline, Proglumide having enzymatic properties shows efficient growth of the *Streptomyces coelicolor* mutant and also Inhibited gastrin-stimulated growth& treatment of stomach ulcers.44 6-beta-D Glucopyranosyl-4',5'-dihydroxy-3',7'-dimethoxyflavone, it is used in control viral infections. Fluoxetine also used as Fluoxetine medicines to treat depression, panic attacks, obsessive compulsive disorder, a certain eating disorder.38&43 Mycinamicin IV, 1-(9H-Pyrido[3,4-b] indol-1-yl)-1,4-butanediol, Fortimicin A is substance that kills or slows the growth of microorganisms, including bacteria, viruses, fungi and protozoans, Via macrolide antibiotic and it's also used of compounds to treat a variety of disorders, diseases and pathologic conditions.4&47 Wistin and Ethyl undecanoate helps in better growth of hair and nails. Supports a healthy and moisturized skin and also helps in boosting the body's energy with severe bacterial infections. which also flavour and fragrance agent in aroma and flavour Chemicals.43 Cadambagenic acid and Cadambine having Growth-Regulating Activity.41 Azacridone A, 1-Methoxy-1H-indole-3-acetonitrile having cytotoxicity and anticancer activity, antimicrobial and antiparasitic properties, and enzyme inhibition and also anti-inflammatory, Antibacterial activity and to inhibit the growth of several types of cancer cells.17 Uscharidin, (3beta,5alpha,6beta,7alpha,22E,24R)-Ergosta8,22-diene-

3,5,6,7-tetrol bioactive compounds has pesticidal activity and antibacterial activity).²² &³⁷ Corchorifatty acid F and Fumitremorgin B having growth-regulating activity and antifungal activity. Antifungal medicines are used to treat fungal infections, which most commonly affect your skin, hair and nails.²⁸ 10-Dihydroxy-12, 13-epoxyoctadecanoate, Dehydroanonaine are having antioxidant, Anti-inflammatory and anti-thrombotic properties, and also, antimalarial and antiprotozoal activity, antimalarial drugs are used for the treatment and prevention of malaria infection. Most antimalarial drugs target the erythrocytic stage of malaria infection, which is the phase of infection that causes symptomatic illness antiprotozoal.³² Melatonin, gamma-Tocopheryl quinone, Cassinine, having regulating properties plant growth and use in vitamin supplements, antioxidative activity.^{5&40}

Additional nutrient sources are necessary to meet the nutritional requirements for several insects, which will be

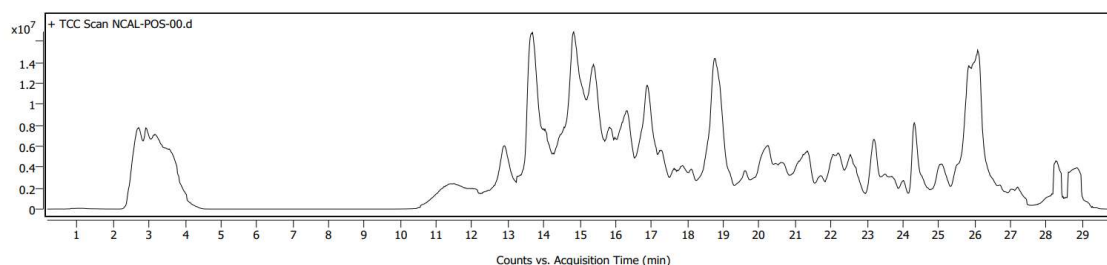
useful in determining the requirement and impact of various fortification agents in silkworm nutrition.¹⁹ The larval weight was lowered greatly in Vitex negundo chloroform (0.391 gm), acetone (0.401 gm), and methanol extract (0.420 gm) extracts (0.621 gms) (Shewale, et al., 2022). Comparison research was conducted by feeding the larvae two different mulberry kinds, V1 and M5. Among the seasons, summer saw a significant rise in amylase activity in all test tissues, while winter saw an increase in invertase activity in all test tissues of silkworm larvae, V1 and M5 mulberry leaves were consumed.²⁴

The phytochemical screening has identified 44 compounds from all the aqueous extracts from the *Neolamarckia cadamba* leaves and some of the identified compounds have been reported to possess various biological activities such as anti-microbial, anti-cancer, antimutagenic, anticancer, fungicide and hypocholesterolemic activities as summarized in Table 3. Fig.1, 2,3,4,5,6,7,8,9 shows the peak value of given compound.

Table 3: Summary of phytochemical compounds identified from *Neolamarckia cadamba* leaf extracts and their general biological activities

Sr. No	Name of compound	Biological activity
	2-Methyl-2-buten-1-ol O-beta-D Glucopyranoside	Enzyme activity
	Adefovir Dipivoxil	Used to treat a chronic viral infection of the liver.
	Pirbuterol	Used to treat wheezing, shortness of breath, coughing, and chest tightness caused by asthma, chronic bronchitis, emphysema, and other lung diseases.
	Cis-5-Caffeoylquinic acid	Anti-inflammatory and antioxidant activity
	3-Hydroxycoumarin	Growth-Regulating Activity
	2- Dodecylbenzenesulfonic acid	Microreactors, industrial production.
	Cyanidin 3-rhamnoside 5-glucoside	Natural inhibitor of intestinal lipid digestion and absorption
	Crotamiton	Antipruritic properties
	(-)-Sedamine	Respiratory ailments
	Cadambine	Growth regulator
	7- Hydroxydehydroglauicine	Supports the growth and well-being of humans and animals.
	Cyclic de-hypoxanthine futasine	Enzymatic properties
	Proglumide	Inhibited gastrin-stimulated growth.
	6-beta-DGlucopyranosyl-4',5'- dihydroxy-3',7'- dimethoxyflavone	Antifungal activity
	Fluoxetine	Used to treat depression, panic attacks, obsessive compulsive disorder, a certain eating disorder.
	Mycinamicin IV	Kills or slows the growth of microorganisms.
	1-(9H-Pyrido[3,4-b] indol-1-yl)-1,4-butanediol	Use of compounds to treat a variety of disorders, diseases and pathologic conditions
	Fortimicin A	Antibacterial activity

1.	1. Wistin	1. Supports a healthy and moisturized skin and also helps in boosting the body's energy with severe bacterial infections.
2.	2. Ethyl undecanoate	2. flavor and fragrance agent in aroma and flavor Chemicals.
3.	3. Azacridone A	3. cytotoxicity and anticancer activity, antimicrobial and antiparasitic properties, and enzyme inhibition
4.	4. 1-Methoxy-1H-indole-3- acetonitrile	4. Anti-inflammatory, Anticancer, Antibacterial activity and to inhibit the growth of several types of cancer cells.
5.	5. Beta- sistoster	5. Reduce cholesterol levels by limiting the amount of cholesterol that is able to enter the body.
6.	6. Linalyl propionate	6. Anti- bacterial, Antioxidant and Anti-proliferative activity
7.	7. Dihydroxyfumitremorgin C	7. Mycotoxin
8.	8. Uscharidin	8. Pesticidal effects
9.	9. (3beta,5alpha,6beta,7alpha,22E,24R)- Ergosta8,22-diene-3,5,6,7-tetrol	9. Antibacterial activity
10.	10. Corchorifatty acid F	10. Growth-Regulating Activity
11.	11. Fumitremorgin B	11. Antifungal activity
12.	12. 9,10-Dihydroxy-12,13- epoxyoctadecanoate	12. Antioxidant activity
13.	13. 1-Methylnicotinamide	13. Anti-inflammatory and anti-thrombotic properties.
14.	14. Dehydroanonaine	14. Antimalarial, antiprotozoal
15.	15. Sphinganine	15. cell growth, differentiation, and apoptosis
16.	16. (S)-Angelicaicain	16. Antibiotic, Antifungal activity
17.	17. Dolasetron	17. Anticancer activity
18.	18. gamma-Tocopheryl quinone	18. Use in vitamin supplements, antioxidative activity
19.	19. Cadamine	19. plant growth regulator
20.	20. Cassinine	20. plant growth regulator
21.	21. Melatonin	21. Regulating plant growth and development
22.	22. Aegelinol	22. Antimicrobial and Antioxidant Activities
23.	23. Cadambagenic Acid	23. Growth regulator
24.	24. Methyl linoleate	24. Antifungal and antioxidant activity
25.	25. Guazatine	25. Flavour, hypocholesterolemic, perfumery, suppository
26.	26. Methyl ester	26. Fungicide



Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*.

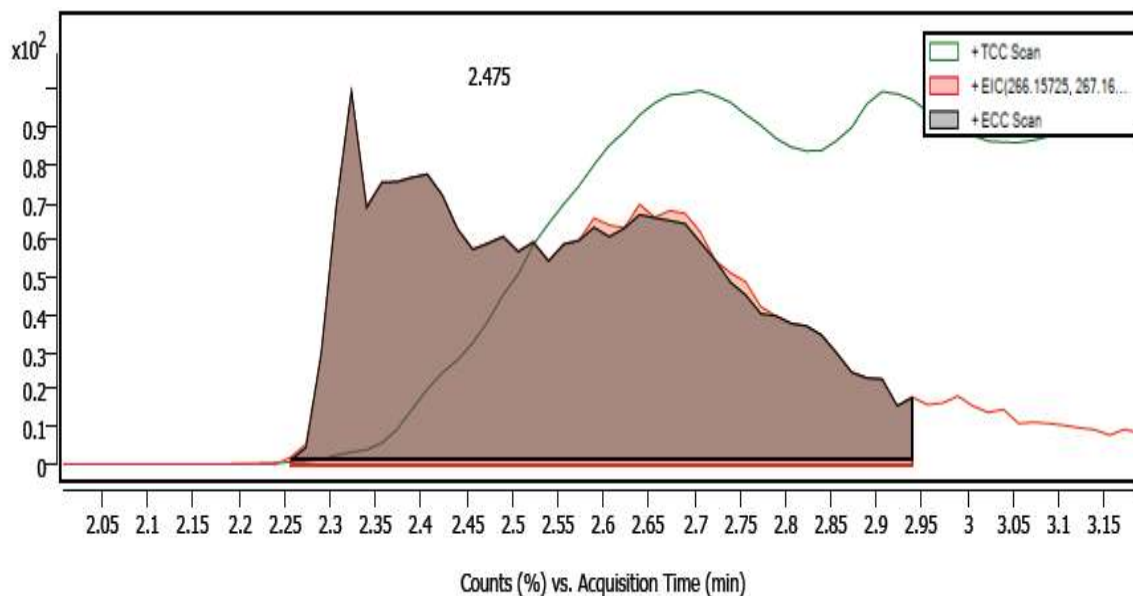


Fig. 1: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba* 2-Methyl-2-buten-1-ol O-beta-D Glucopyranoside.

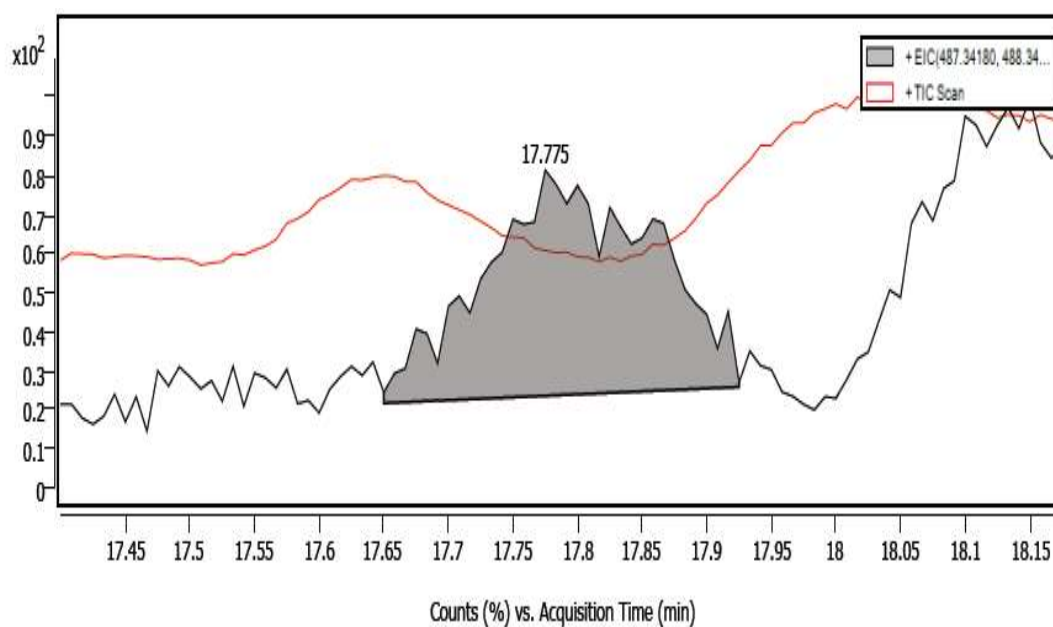


Fig. 2: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, Cadambagenic acid

Compound Chromatograms (overlaid)

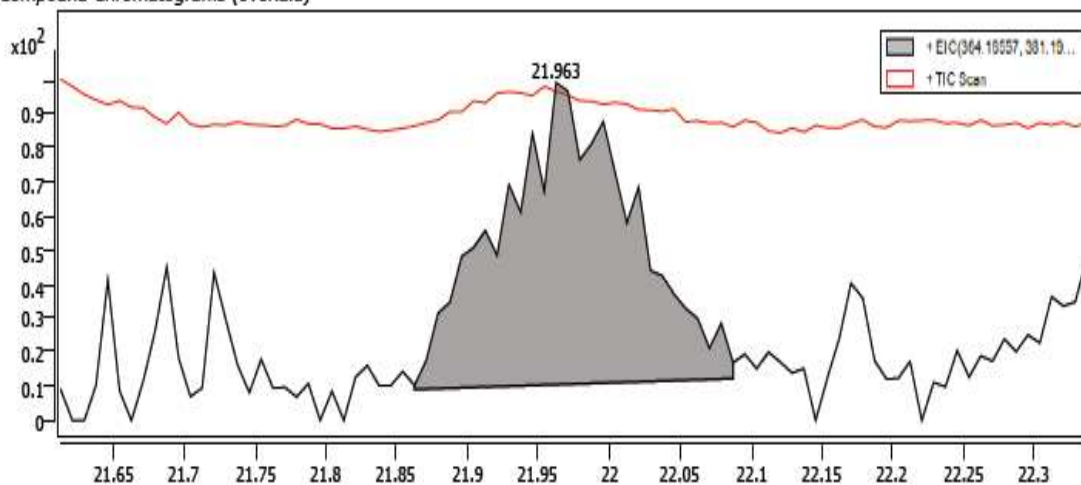


Fig. 3: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, Cadamine

Compound Chromatograms (overlaid)

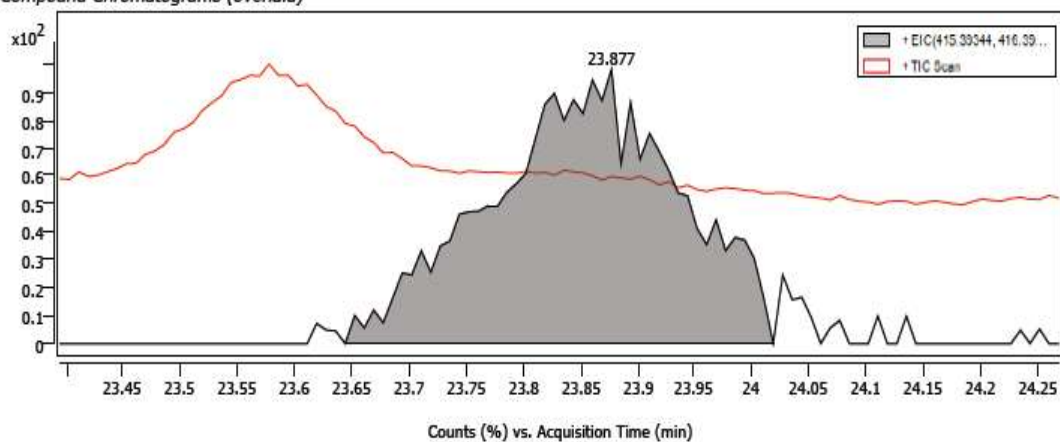


Fig. 4: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, Beta-sitoster

Compound Chromatograms (overlaid)

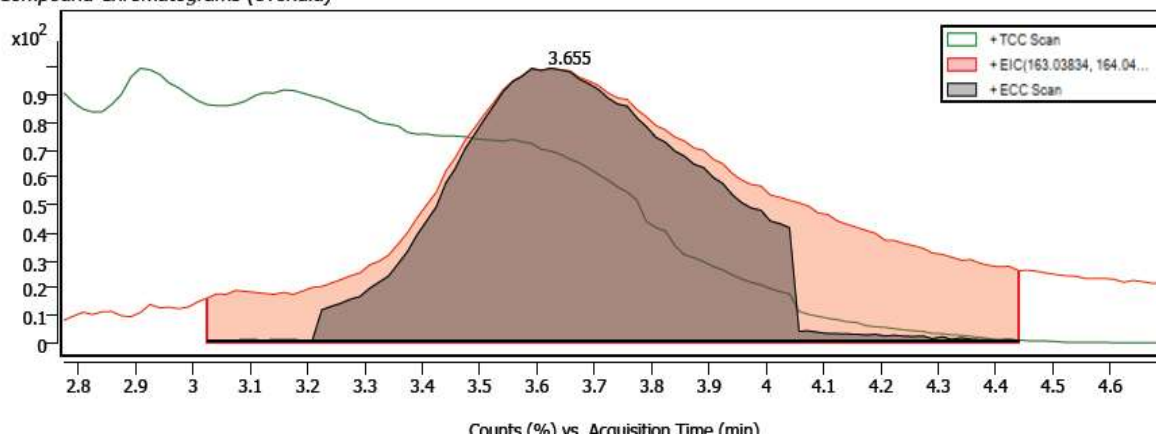


Fig. 5: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, 3-Hydroxycoumarin.

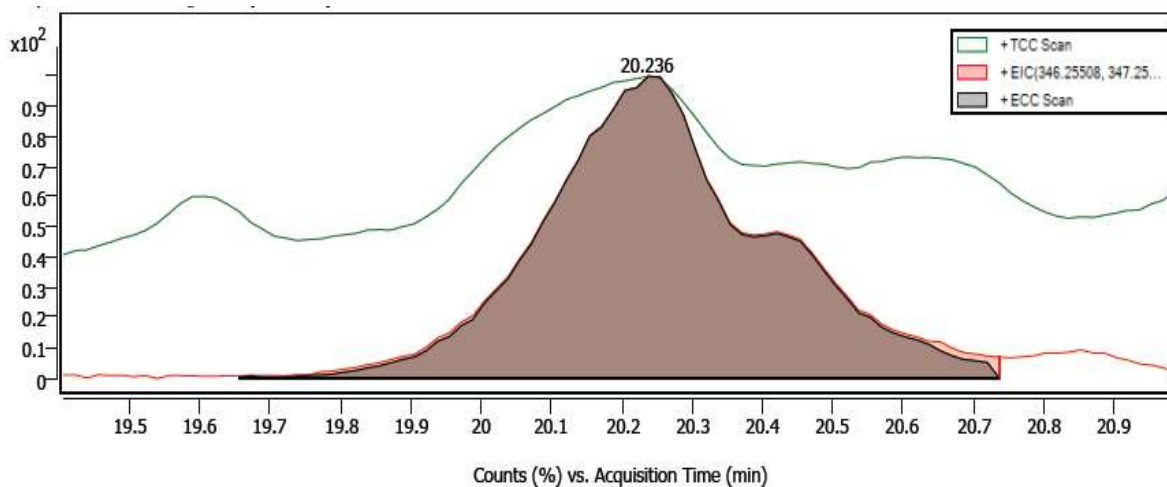


Fig. 6: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, Corchorifatty acid F.

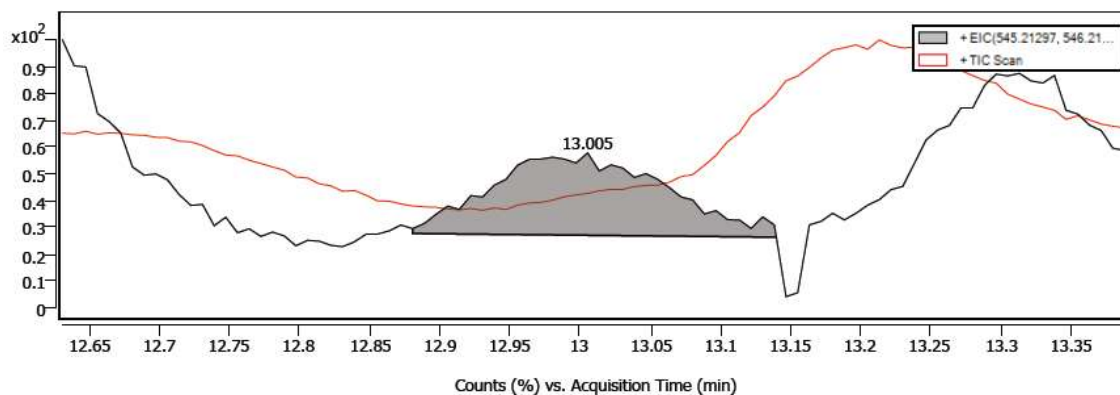


Fig. 7: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, Cadambine

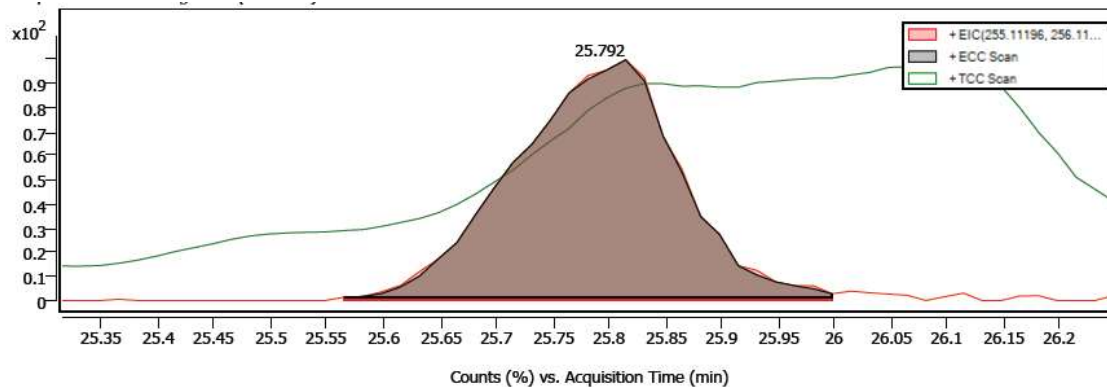


Fig. 8: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, Melatonin.

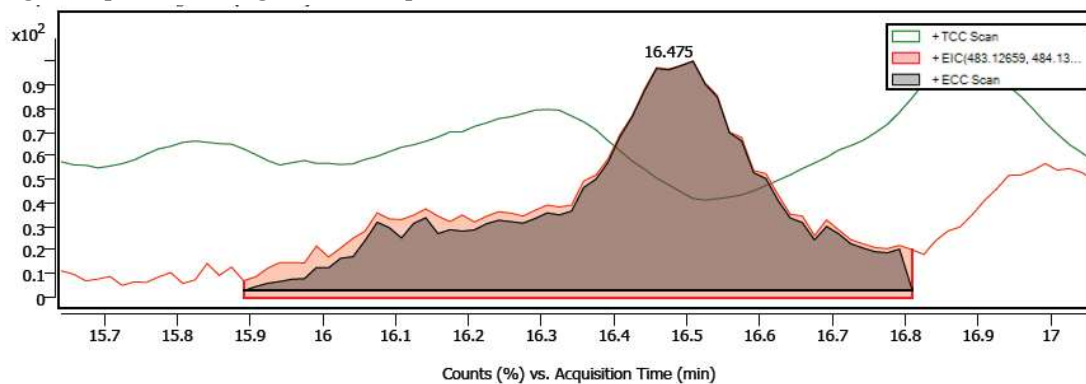


Fig.9: Liquid chromatogram of the aqueous extract of the leaves of *Neolamarckia cadamba*, Wistin.**CONCLUSION**

The present phytochemical study of *Neolamarckia cadamba* aqueous leaf extract compiles variety of powerful bioactive compounds. The LC-MS of aqueous extract of *Neolamarckia cadamba* leaves shows compounds with antibacterial, antiparasitic, antimalarial, anticancer, pesticide, antiandrogenic, hypocholesterolemic, antioxidant, antiprotozoal, antiarthritic, hepatoprotective, neuroactive, analgesic and growth regulator properties. The existence of many bioactive components has justified traditional practitioners who used *Neolamarckia cadamba* leaf extracts for diverse diseases.

Neolamarckia cadamba is a powerful plant with the to hundreds of benefits. As the aqueous extract of leaf of *Neolamarckia cadamba* contains Cadambagenic acid, Cadambine, 3-Hydroxycoumarin, Melatonin, 2-Methyl-2-9-buten-1-ol-O-beta-D Glucopyranoside, Wistin, Cadamine, Beta-sitosterol etc. compounds with growth regulatory properties this will be the best resolution as growth remedy.

CONFLICT OF INTEREST:

There is no conflict of interest.

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REFERENCE:

- Acharyya, S., Dash, G. K., Mondal, S., & Dash, S. K. (2010). *Anthocephalus cadamba* (Roxb.) Miq. Roots. *Int J Pharm Bio Sci*, 1(2).
- Alcázar Magaña, A., Kamimura, N., Soumyanath, A., Stevens, J. F., & Maier, C. S. (2021). Caffeoylquinic acids: Chemistry, biosynthesis, occurrence, analytical challenges, and bioactivity. *The plant journal*, 107(5), 1299-1319.
- Alekhyia V, Deepan T, Shaktiprasanna S, Dhanaraju MD. (2013). Preliminary phytochemical screening and evaluation of in vitro antioxidant activity of *Anthocephalus cadamba* by using solvent extracts. *Eur J Biol Sci* (1):34-7.
- An, J., Ryu, G., Shin, S. A., Kim, H., Ahn, M. J., Lee, J. H., & Lee, C. S. (2022). Wistin Exerts an Anti-Inflammatory Effect via Nuclear Factor- κ B and p38 Signaling Pathways in Lipopolysaccharide-Stimulated RAW264.7 Cells. *Molecules*, 27(17), 5719.
- Arnao, M. B., & Hernández-Ruiz, J. (2014). Melatonin: plant growth regulator and/or biostimulator during stress? *Trends in plant science*, 19(12), 789-797.
- Aronow, J., Stanetty, C., Baxendale, I. R., & Mihovilovic, M. D. (2019). Methyl glycosides via Fischer glycosylation: translation from batch microwave to continuous flow processing. Springer, *Monatshefte für Chemie-Chemical Monthly*, 150, 11-19.
- Azwanida, N. N. (2015). A review on the extraction methods uses in medicinal plants, principle, strength and limitation. *Med Aromat Plants*, 4(196), 2167-0412.
- Basile, A., Sorbo, S., Spadaro, V., Bruno, M., Maggio, A., Faraone, N., & Rosselli, S. (2009). Antimicrobial and antioxidant activities of coumarins from the roots of *Ferulago campestris* (Apiaceae). *Molecules*, 14(3), 939-952.
- Bhat, Z. A., Kumar, D., & Shah, M. Y. (2011). *Angelica archangelica* Linn. is an angel on earth for the treatment of diseases. *International Journal of Nutrition, Pharmacology, Neurological Diseases*, 1(1), 36-50.
- Choi, D. S., Ji, Y., Jang, Y., Lee, W. J., & Shim, W. S. (2020). Crotamiton, an anti-scabies agent, suppresses histamine- and chloroquine-induced itch pathways in sensory neurons and alleviates scratching in mice. *Biomolecules & Therapeutics*, 28(6), 569.
- Dubey, A., Nayak, S., & Goupale, D. C. (2011). A review on phytochemical, pharmacological and toxicological studies on *Neolamarckia cadamba*. *Der. Pharm. Let*, 3, 45-54.
- Dando, T. M., & Plosker, G. L. (2003). Adefovir dipivoxil: a review of its use in chronic hepatitis B. *Drugs*, 63, 2215-2234.
- Dey, P., Kundu, A., Kumar, A., Gupta, M., Lee, B. M., Bhakta, T., ... & Kim, H. S. (2020). Analysis of alkaloids (indole alkaloids, isoquinoline alkaloids, tropane alkaloids). In *Recent advances in natural products analysis* (pp. 505-567). Elsevier.
- Fan, J., Xie, Y., Zhang, Z., & Chen, L. (2018). Melatonin: a multifunctional factor in plants. *International Journal of Molecular Sciences*, 19(5), 1528.
- Felpin, F. X., & Lebreton, J. (2002). A highly stereoselective asymmetric synthesis of (-)-lobeline and (-)-sedamine. *The Journal of Organic Chemistry*, 67(26), 9192-9199.
- from safflower (*Carthamus tinctorius* L.) oil cake augments the proliferation of normal human and mouse fibroblasts in synergy with basic fibroblast growth factor (bFGF) or epidermal growth factor (EGF). *The journal of biochemistry*, 125(5), 910-915.

17. Ge, Y. H., & Luo, Y. H. (2015). Methoxy-and methyl-substituted indole-3-acetonitrile (IAN): crystal structure and Hirshfeld surfaces analysis. *Research on Chemical Intermediates*, *41*, 2915-2927.
18. Geng, Y., Huang, J., Tan, B., Xu, Y., Li, P., & Xu, J. (2020). Efficient synthesis of dodecylbenzene sulfonic acid in microreaction systems. *Chemical Engineering and Processing-Process Intensification*, *149*, 107858.
19. Ghorpade, K., Netam, V., Desai, N., & Shewale, V. (2022). Ascertain Role and Importance of Artificial Diet and Botanicals Mediated Serifed for The Strengthening of Sericulture Industry. *Uttar Pradesh Journal of Zoology*, *43*(22), 46-54.
20. Gurjar, H., Jain, S. K., Nandanwar, R., & Sahu, V. K. (2010). Phytochemical screening on the stem bark of *Anthocephalus cadamba* (Rox B) Miq. *Int. J. Pharm. Sci. Res*, *1*(7), 108-115. The Wealth of India. A dictionary of Indian raw materials and industrial products. New Delhi: NISCAIR press publishers; 2006.
21. Harborne, A. J. (1998). *Phytochemical methods a guide to modern techniques of plant analysis*. Springer science & business media.
22. Hegde, K., Thakker, S. P., Joshi, A. B., Shastry, C. S., & Chandrashekhar, K. S. (2009). Anticonvulsant activity of *Carissa carandas* Linn. root extract in experimental mice. *Tropical Journal of Pharmaceutical Research*, *8*(2).
23. Hussein, H. I., Kamel, A., Abou-Zeid, M., El-Sebae, H., & Saleh, M. A. (1994). Uscharin, the most potent molluscicidal compound tested against land snails. *Journal of Chemical Ecology*, *20*, 135-140
24. Kaushik, R., Jain, J., Rai, P., Sharma, Y., Kumar, V., & Gupta, A. (2018). Pharmacognostical, physicochemical and preliminary phytochemical studies of *Anthocephalus cadamba* (Roxb.) leaves. *Research Journal of Pharmacy and Technology*, *11*(4), 1391-1397.
25. Kadam, V., Shewale, V., Khairmode, P., Netam, V., & Tare, V. (2021). Seasonal Impact on Amylase and Invertase Activity in Silkworm *Bombyx Mori* (L) Reared on V1 And M5 Mulberry Variety. *Uttar Pradesh Journal of Zoology*, *42*(24), 404-409.
26. King, P. (2008). Role of arformoterol in the management of COPD. *International Journal of Chronic Obstructive Pulmonary Disease*, *3*(3), 385-392.
27. Kothandaraman, G. P., Kumar, K. S., Rithika, J., & Dhanasree, S. (2019). Synthesis and Anti-Proliferative Effect of Linalool propionate Loaded Carbon Nanoparticles. *Beilstein Archives*, *2019*(1), 56.
28. Lal, C., & Verma, L. R. (2006). Use of certain bio-products for insect-pest control.
- Li, S. M. (2011). Genome mining and biosynthesis of fumitremorgin-type alkaloids in ascomycetes. *The Journal of antibiotics*, *64*(1), 45-49.
- Li, S., Anzai, Y., Kinoshita, K., Kato, F., & Sherman, D. H. (2009). Functional Analysis of MycE and MycF, Two Methyltransferases Involved in the Biosynthesis of Mycinamicin Macrolide Antibiotics. *Chembiochem*, *10*(8), 1297-1301.
- Oderinlo, O. O., Iwegbulam, C. G., Ekweli, O. A., Alawode, T. T., & Oyenyin, O. E. (2022). Acridone Alkaloids: In-Silico Investigation Against SARS-CoV-2 Main Protease. *Chemistry Africa*, *5*(5), 1441-1450.
- Pal, D., Sannigrahi, S., & Mazumder, U. K. (2009). Analgesic and anticonvulsant effects of saponin isolated from the leaves of *Clerodendrum infortunatum* Linn. in mice.
33. Panwar, P., Burusco, K. K., Abubaker, M., Matthews, H., Gutnov, A., Fernández-Álvarez, E., & Nirmalan, N. (2020). Lead optimization of dehydroemetine for repositioned use in malaria. *Antimicrobial agents and chemotherapy*, *64*(4), e01444-19.
- Parekh, J., & Chanda, S. (2007). In vitro antimicrobial activity and phytochemical analysis of some Indian medicinal plants. *Turkish journal of biology*, *31*(1), 53-58.
35. Patel DA, Patel YK, Shah PB. (2012). Pharmacognostical study of *Neolamarckia cadamba* (Roxb.) Bosser bark. *Int Res J Pharm*; *3*(6):120-21.
- Pinto, M. E., Araújo, S. G., Morais, M. I., Sa, N. P., Lima, C. M., Rosa, C. A., ... & Lima, L. A. (2017). Antifungal and antioxidant activity of fatty acid methyl esters from vegetable oils. *Anais da Academia Brasileira de Ciências*, *89*, 1671-1681.
- Raffauf, R. F., Zennie, T. M., Onan, K. D., & Le Quesne, P. W. (1984). Funebrine, a structurally novel pyrrole alkaloid, and other. Gamma. -hydroxyisoleucine-related metabolites of *Quararibea funebris* (Llave) Vischer (Bombacaceae). *The Journal of Organic Chemistry*, *49*(15), 2714-2718.
- Razak, M. A., Begum, P. S., Viswanath, B., & Rajagopal,

- S. (2017). Multifarious beneficial effect of nonessential amino acid, glycine: a review. *Oxidative medicine and cellular longevity*, 2017.
39. Rivera, A., Benavides, O. L., & Rios-Motta, J. (2009). (2248. E)-Ergosta-6, 22-diene-3 β , 5 α , 8 α -triol: A new polyhydroxysterol isolated from *Lentinus edodes* (Shiitake). *Natural Product Research*, 23(3), 293-300.
40. Rossi, A., Barraco, A., & Donda, P. (2004). Fluoxetine: a review on evidence-based medicine. *Annals of General Hospital Psychiatry*, 3(1), 1-8.
41. Scordino, M., Sabatino, L., Traulo, P., Gagliano, G., Gargano, M., Pantò, V., & Gambino, G. L. (2008). LC/MS/MS detection of fungicide guazatine residues for quality assessment of commercial citrus fruit. *European Food Research and Technology*, 227, 1339-1347.
42. Shah and Seth. (2010) Textbook of Pharmacognosy and Phytochemistry. ELSEVIER A division of Reed Elsevier India Private Limited.
43. Shahik, S. M., Salauddin, A., Hossain, M. S., Noyon, S. H., Moin, A. T., Mizan, S., & Raza, M. T. (2021). Screening of novel alkaloid inhibitors for vascular endothelial growth factor in cancer cells: an integrated computational approach. *Genomics & Informatics*, 19(1).
44. Shewale, V. S., Khairmode, P. V., Lawand, S. T., Netam, V. S., & Bhosale, A. R. (2022). Antifeedant and Insecticidal Activity of Different Solvent Extracts of *Vitex negundo* (L) against Cotton Leafworm *Spodoptera litura* (Fab.). *Asian Journal of Research in Zoology*, 5(4), 32-38.
45. Singh, A., Gautam, A., & Singh, B. (2022). Antiviral effects of medicinal plants and their active phytochemical constituents against respiratory diseases and associated biological functions. In *Coronavirus Drug Discovery* (pp. 23-54). Elsevier.
46. Smith, J. P., & Solomon, T. E. (1988). Effects of gastrin, proglumide, and somatostatin on growth of human colon cancer. *Gastroenterology*, 95(6), 1541-1548.
47. Stanchev, S., Boyanov, T., Geneva, M., Boychinova, M., Stancheva, I., & Manolov, I. (2010). Growth-regulating activity of three 4-hydroxycoumarin derivatives on inoculated soybean plants. *Journal of plant growth regulation*, 29, 1-5.
- Thilavech, T., & Adisakwattana, S. (2019). Cyanidin-3-rutinoside acts as a natural inhibitor of intestinal lipid digestion and absorption. *BMC complementary and alternative medicine*, 19(1), 1-10.
- Thornsberry, C., Barry, A. L., Jones, R. N., Baker, C. N., Badal, R. E., & Packer, R. R. (1981). Antibacterial activity of fortimicin A compared with those of five other aminoglycosides, and factors affecting susceptibility tests. *Antimicrobial Agents and Chemotherapy*, 19(1), 122-129.
- Usman, M. R. M., Purushottam, S. R., Abullais, M. D. U. M., & Usman, M. (2012). Evaluation of anti-pyretic activity of *Anthocephalus cadamba* Roxb. leaves extracts. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 3(1), 825-834.
- Verma, R., Chaudhary, F., & Kumar, J. (2019). Pharmacognostical Evaluation and Phytochemical Screening of *Neolamarckia Cadamba*. *Journal of Complementary Medicine & Alternative Healthcare*, 9(2), 1-4.
- Xu, J. Z., Sheng, S. J., Yao, J. F., & Yu, X. P. (2000). Regulation on growth and accumulation of total alkaloid in *Leonurus artemisia* (Lour.) SY Hu by various microfertilizers. *Zhongguo Zhong yao za zhi= Zhongguo Zhongyao Zazhi= China Journal of Chinese Materia Medica*, 25(1), 20-23.
- Yajima, A., Kouno, S., Dairi, T., Mogi, M., Katsuta, R., Seto, H., & Nukada, T. (2011). Synthesis of (\pm)-cyclic dehydropurine futasine, the biosynthetic intermediate in an alternative biosynthetic pathway for menaquinones. *Tetrahedron letters*, 52(38), 4934-4937.
- Yousuf, S., Bachheti, R. K., Joshi, A., & Mathur, A. (2014). Evaluation of antioxidant potential and phytochemicals of *Morina longifolia*. *Int J Pharm Pharm Sci*, 6(6), 208-12.