

A Review on Neolamarckia Cadamba

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Abstract—Neolamarckia cadamba, widely known as Kadamba or the burflower tree, is a tropical evergreen species b Department of analysis, Sri Vasavi institute of pharmaceutical sciences, pedatadepalli, Tadepalligudem, Andhra Pradesh elonging to the Rubiaceae family. The plant possesses significant ecological, medicinal, and pharmacological properties. It improves soil quality by increasing organic carbon and nutrient availability through leaf litter decomposition. Morphologically, the plant is characterized by a dark brown bark, leathery leaves, and yellow-orange spherical flowers. The mesophyll region shows distinct palisade and spongy layers with collateral vascular bundles. Phytochemical investigations reveal the presence of indole alkaloids, terpenoids, saponins, steroids, glycosides, tannins, flavonoids, and essential oils. Various plant parts—bark, leaves, flowers, fruits, roots, and stems—demonstrate pharmacological activities including antidiabetic, antioxidant, anti-inflammatory, antimicrobial, anticancer, hepato protective, and immune modulatory effects. These activities have been validated through in vitro, in vivo, and in silico studies. Overall, Neolamarckia cadamba is an important medicinal plant offering broad therapeutic potential and ecological benefits.

Index Terms—Neolamarckia cadamba, phytochemistry, pharmacological activity, antioxidant, antidiabetic, traditional medicine

I. INTRODUCTION

Neolamarckia cadamba (Kadamba) is an evergreen tropical tree native to South and Southeast Asia. It is known by several common names including burflower-tree, laran, and Leichhardt pine. In India, it holds cultural and medicinal significance and is widely used in Ayurveda. The species grows optimally under humid tropical conditions with well-drained alluvial soils. Traditional practitioners use

various parts of the plant to treat fever, anemia, tumors, wounds, urinary tract disorders, and blood-related ailments. Its ability to shed large amounts of organic litter enhances soil fertility by increasing carbon content, nutrient availability, and cation exchange capacity.

II. PLANT PROFILE

- Plant name: Neolamarckiacadamba
 - Synonyms: *Neolamarckiacadamba*, *Naucleacadamba* (Roxb.), *Anthocephaluscadamba* (Roxb.) Miq., *Samamacadamba* (Roxb.) Kuntze, *Anthocephalusmorindifolius*Korth. *Naucleamegaphylla* S. Moore, *Neonaucleamegaphylla* (S. Moore) S. Moore, etc. e *Neolamarckiacadamba*, *Naucleacadamba* (Roxb.), *Anthocephaluscadamba* (Roxb.) Miq., *Samamacadamba* (Roxb.) Kuntze, *Anthocephalusmorindifolius*Korth. *Naucleamegaphylla* S. Moore, *Neonaucleamegaphylla* (S. Moore) S. Moore, etc.
 - Category: anti-diabetic, anti-oxidant, anti-pyretic, anthelmintic, anti-cancer, anti-hyperglycemic, anti-diuretics, laxative, hepato-protective, anti-inflammatory, anti-bacterial, analgesic, antimicrobial[5]
- 2.1. Morphological characteristics [2]
- Growth Habitat: an evergreen, tropical tree native to South and Southeast Asia.
 - Leaves: leaves are leathery, entire, elliptical or ovate, with a pulvinus, and acut or shortly acuminate.
 - Flowers: flowers are small, yellow or Orange colored and globose heads.

- Fruits: fruits are fleshy globose pseudocarpfragacious green, orange, and yellow ripe.

- Seeds: seeds are small and muriculate.
- Bark: bark is dark brown, rough, longitudinally fissured peeling off in thin plates.



FIG: 1 TREE OF CADAMBA



FIG:2 LEAVES OF CADAMBA



FIG: 3 FLOWER OF CADAMBA



FIG: 4 FRUIT OF CADAMBA



FIG: 5 BARKS OF CADAMBA



FIG: 6 SEEDS OF CADAMBA

2.2. Microscopic analysis:[6]

- The transverse section revealed a single-layered upper epidermis composed of rectangular to square-shaped cells protected by a thick cuticle. The lower epidermis showed similar cellular organization but with a thinner cuticle layer and the presence of stomata.
- The mesophyll tissue displayed clear differentiation into palisade and spongy regions. The palisade tissue consisted of a single layer of elongated, closely arranged cells rich in chloroplasts. The spongy tissue comprised 4-5 layers of loosely arranged parenchyma cells with prominent intercellular spaces; facilitating efficient gas exchange. The vascular bundle exhibited a collateral arrangement with xylem positioned adaxially and phloem abaxially. The xylem vessels were arranged in distinct radial rows, while phloem tissue showed typical sieve elements and companion cells. A well-defined bundle sheath of parenchymatous cells encompassed the vascular tissues.

2.3. Chemical constituents:[7]

- Whole Plant: Compounds such as indole alkaloids, terpenoids, saponins, steroids, or terpenes
- Bark: Astringent, Tannins
- Stem: Triterpenic acid, cadambagenic acid, quinovic acid, β sitosterol
- Leaf: In regards to glycosidic indole alkaloids, caambine, 3 α hydrocadambineisodihydrocadambine and two non-glycosidic alkaloids, cadamine and isocadamine.
- Fruit: Essential oils and main oil constituents, linalool, geraniol, geranyl acetate, linalyl acetate, α -selinene, 2-nonanol, β - phellandrene, α -bergamottin, p-cymol, curcumene, terpinolene, camphene, and myrcene.
- Seeds: The seeds of *Anthocephalusindicus* contain D-xylose and D-mannos, which are water-soluble polysaccharides.

III. PHYTO CHEMICAL ANALYSIS:[6]

3.1.1. Tests for Alkaloids

- Wagner's Test: 2mL extract + Wagner's reagent. Reddish-brown precipitate indicated alkaloids.

- Mayer's Test: 2mL extract + Mayer's reagent. Cream-colored precipitate indicated alkaloids.
- Dragendorff's Test: 2mL extract + Dragendorff's reagent. Reddish-brown precipitate indicated alkaloids.

3.1.2. Tests for Phenolic Compounds

- Ferric Chloride Test: 2mL extract + 5% FeCl₃. Blue-black color indicated phenols.
- Lead Acetate Test: 2mL extract + few drops lead acetate. White precipitate indicated phenols.
- Gelatin Test: 2mL extract + 1% gelatin solution. White precipitate indicated phenols.

3.1.3. Tests for Saponins

- Foam Test: 2mL extract + 2mL distilled water, shaken vigorously. Persistent foam for 10 minutes indicated saponins.
- Hemolysis Test: Extract + few drops of blood on slide. Clear zone formation indicated Saponins.

3.1.4. Tests for Proteins and Amino Acids

- Million's Test: 2mL extract + Million's reagent. Brick red color indicated proteins.
- Ninhydrin Test: 3mL extract + 3 drops 5% ninhydrin, heated at 100°C for 10 minutes. Purple/bluish color indicated amino acids.

3.1.5. Tests for Flavonoids

- Alkaline Reagent Test: Extract + few drops NaOH. Yellow color that turns colorless with HCl indicated flavonoids.
- Shinoda Test: Extract + magnesium turnings + concentrated HCl. Pink color indicated flavonoids.

IV. PHARMACOLOGICAL ACTIVITY

Table 1: Pharmacological Activities of Neolamarekia cadamba (Format as per Cadamba journal guidelines)

S.NO	PLANT PARTS	ACTIVITY	METHOD
1.	Bark	<ul style="list-style-type: none"> • Anti-diabetic[8], • Antioxidant[9], • Immuno modulatory activity[10] <p>Anti inflammatory and Analgesic activity[11]</p> <ul style="list-style-type: none"> • Anti-pyretic activity [12], • Antimicrobial[13] • Anti-Alzheimer[14] • Anti-cancer[15] • Anti – bacterial[16] 	<ul style="list-style-type: none"> • INVIVO: White-Evans at by alloxan[8] • INVITRO:phenolic content, DPPH free radical scavenging assay, and ferric reducing antioxidant power[9] • INVITRO:Wistar albino rats [10] • INVIVO:Rodent[11] • INVIVO:Wistarrats[12] • INVITRO: Bacteria [13] • IN SILICO: Computer-based modeling/docking[14] • INVITRO: Human cancer cell lines[15] • INVITRO:[16]
2.	Fruit	<ul style="list-style-type: none"> • Anti-oxidant, Anti-helminthic activity[17] • Anti-bacterial activity[18] • Diuretic activity[19] <p>Geranyl acetate esterase inhibitory activity (GAE)[20]</p>	<ul style="list-style-type: none"> • INVITRO: Earthworms [17] • INVITRO [18] • INVIVO: Albino rats[19] <p>INVITRO: Enzyme inhibitory activity[20]</p>

3.	Leaf	<ul style="list-style-type: none"> • Anti-diabetic[8] • Anticancer activity[21], • Antimicrobial[22] • Antioxidant activity[9] • Anti-helminthic activity[23] • Anti-bacterial activity[24] • Anti-fungal activity[25] 	<ul style="list-style-type: none"> • INVIVO: White-Evans rat by alloxan[8] • INVITRO: Cultured cancer cell lines [21]. • INVITRO: Bacteria & Fungi[22] • INVITRO: phenolic content, DPPH free radical scavenging assay, and ferric reducing antioxidant power[9] <ul style="list-style-type: none"> • INVIRO: Earthworms (Pheretimaposthuma)[23] • INVITRO: Agar diffusion method[24] • INVIRO: Agar diffusion and radical scavenging[25]
4.	Flower	<ul style="list-style-type: none"> • Anti-diabetic[8], • Anti-nociceptive [26] • Anti-cancer[27] 	<ul style="list-style-type: none"> • INVIVO: White-Evans rat by alloxan [8] <ul style="list-style-type: none"> • INVIVO: Mice (or) rat[26] • INVIVO: wistar rats[27]
5.	Root	<ul style="list-style-type: none"> • Anti-diabetic[8] • Anti-inflammatory[28] 	<ul style="list-style-type: none"> • INVIVO: White-Evans rat by alloxan[8] <ul style="list-style-type: none"> • INVIVO: Rats or Mice
6.	Stem	<ul style="list-style-type: none"> • Anti-diabetic activity[8] 	<ul style="list-style-type: none"> • INVIVO: White-Evans rat by alloxan[8]

V. MATERIALS AND METHODS

The study included morphological, microscopic, and phytochemical analyses of different parts of *Neolamarckia cadamba*. Standard qualitative phytochemical tests were performed including Wagner’s, Mayer’s, Dragendorff’s, ferric chloride, lead acetate, foam test, and others to detect alkaloids, phenolics, Saponins, proteins, amino acids, and flavonoids. Microscopic sectioning and analysis were

conducted to study epidermal layers, mesophyll tissue arrangement, and vascular bundle structure. Data from published pharmacological studies were reviewed and compiled.

VI. RESULTS

Morphological observations confirmed that the plant possesses leathery, elliptic leaves, yellow-orange spherical flowers, rough dark brown bark, and small

textured seeds. Microscopy revealed a well-defined epidermis, thick cuticle, single-layered palisade cells, and multiple layers of spongy parenchyma with collateral vascular bundles. Phytochemical analysis confirmed the presence of alkaloids, phenolic compounds, Saponins, proteins, amino acids, and flavonoids in various extracts. Different plant parts demonstrated significant pharmacological properties: antidiabetic (bark, leaf, flower, root), antioxidant (bark, leaf, fruit), antimicrobial (leaf, bark, stem), anticancer (bark, leaf, flower), and anti-inflammatory activities.

VII. DISCUSSION

The findings highlight the diverse chemical composition and pharmacological relevance of *Neolamarckia cadamba*. The presence of alkaloids, terpenoids, flavonoids, and essential oils explains many of its traditional uses. The strong antioxidant and antidiabetic properties correlate with earlier reported studies. Its anticancer and antimicrobial actions suggest potential for developing plant-based therapeutic agents. The ecological importance of the tree further enhances its usefulness in sustainable forestry.

VIII. CONCLUSION

Neolamarckia cadamba is a valuable species with broad ecological, medicinal, and pharmacological applications. Its phytochemical richness and proven therapeutic activities support its traditional use and indicate potential for future drug development. Further research on dosage, toxicity, and clinical applications would strengthen its role in modern medicine.

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