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## TRADITIONAL HERBS IN MODERN HYGIENE: A REVIEW ON PHARMACOGNOSTICAL PROPERTIES OF POLYHERBAL PLANTS

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### Keywords:

Poly-herbs, Botanical properties, Anti-microbial, Anti-inflammatory, Anti-bacterial

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**ABSTRACT:** The growing interest in herbal medicine highlights the need to explore traditional plant-based therapeutics through modern pharmacognostic approaches. The review focuses on five well-documented polyherbal agents *Pongamia pinnata*, *Azadirachta indica*, *Ocimum tenuiflorum*, *Rubia cordifolia* and *Eclipta alba* valued in both ethnomedicine and pharmaceutical research. These plants are rich in phytoconstituents such as flavonoids, terpenoids, alkaloids, saponins and phenolic compounds, contributing to their broad pharmacological profile. Reported activities include antimicrobial, antiviral, anti-inflammatory, antioxidant, anticancer, hepatoprotective and immunomodulatory effects, indicating potential roles in disease management and hygiene applications. Pharmacognostic evaluation supports standardization by revealing key anatomical and phytochemical characteristics. By combining traditional knowledge with scientific validation, these botanicals exemplify models for translational research. Due to their efficacy, safety profile and cultural relevance, these plants are widely used in traditional medicine and are increasingly incorporated into pharmaceutical, nutraceutical and cosmetic preparations. Integrating traditional knowledge with scientific validation underscores the potential of these polyherbal agents in developing effective, natural therapeutic strategies.

**INTRODUCTION:** Throughout history, there has always been a connection between life, illness and the use of plants. There is no evidence that prehistoric humans used synthetic medicines; rather, they relied on easily available natural resources for treatment.

Microbes enter the body through ingestion, inhalation, contact, skin contamination, or ascending infection, where they interact with epithelial cells, macrophages, lymphocytes and protective barriers such as mucous membranes, subcutaneous junctions, or skin layers <sup>1</sup>.

The skin is the largest and most accessible organ, and since most topical treatments are applied to it, understanding its physiology and biochemistry is essential for designing effective formulations. In this review, there is a collective description of some polyherbs like *Pongamia pinnata*, *Azadirachta indica*, *Ocimum tenuiflorum*, *Rubia*

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*cordifolia* and *Eclipta alba*<sup>2</sup>. *Pongamia pinnata*, named after the Tamil word “pongam,” is a valuable Indian tree known for its resilience and usefulness. It improves soil, produces oil for biofuel and is used in traditional medicine. Its fast growth and ability to absorb carbon make it important for the environment and rural livelihoods. “Pinnata” denotes the tree’s feather-like leaf arrangement, and it belongs to the Leguminosae family. Native to South and Southeast Asia, *Pongamia pinnata* is a multipurpose leguminous tree recognised for its high-yielding seeds-around 20,000 per tree that produce non-edible oil. Traditional medicine systems have long employed various components of this plant to treat wounds and support overall health<sup>3</sup>.

*Azadirachta indica*, commonly known as neem, is a fast-growing evergreen tree found extensively across India, Africa and the Americas. Belonging to the Meliaceae family, *Azadirachta indica* has been valued in Ayurvedic medicine for millennia due to its wide-ranging healing properties<sup>4</sup>. Often called the “village dispensary” in India, this tree has earned global recognition for its role in tackling key health and environmental challenges, all while being considered safe for people and other life forms<sup>5</sup>.

Tulsi functions as an adaptogen, helping the body cope with stress by promoting physiological equilibrium and enhancing resilience. In Ayurvedic tradition, Tulsi is revered as the “elixir of life” for its potent aroma, sharp taste and reputed ability to promote longevity, with herbal tea, powdered form, and fresh leaves being popular ways to consume it<sup>6</sup>. Herbs are gaining prominence in formulation research due to their diverse therapeutic benefits, such as managing diabetes, regulating biological cycles, relieving spasms, reducing inflammation,

protecting liver function, enhancing immune response and combating tumour growth<sup>7</sup>.

*Rubia cordifolia* Linn., commonly known as Manjistha, is a flowering plant whose roots and stems are the primary active parts. It exhibits multiple pharmacological properties, including blood purification, anticancer, astringent, anti-acne, anti-inflammatory, antimicrobial, antidysenteric, antiseptic, nephroprotective, antirheumatic, and hepatoprotective activities. *Rubia cordifolia*, commonly referred to as Indian Madder or Common Madder, is a plant species classified under the Rubiaceae family. The plant is cultivated for its roots, which yield a red pigment. Globally, the *Rubia* genus includes approximately 70 distinct species, among which 36 species and 2 varieties have been recorded in China. *Rubia* plant extracts and their phytochemicals have garnered considerable attention due to their potent biological activities and therapeutic potential<sup>8</sup>.

Bhringraj, a herb indigenous to India and parts of Southwest America, is scientifically identified as *Eclipta alba* and classified under the Asteraceae family. Bhringraj is known to have four distinct varieties, each identified by the colour of its flowers. These come in yellow, white, blue, and red, with the white and yellow types used medicinally. The white variety is more common, growing wild in moist areas as a weed. The yellow variety, also known as *Wedelia chinensis*, is rare but spreads quickly<sup>9</sup>.

#### Plant Profile:

***Pongamia pinnata*- Fruit:** The tree produces elongated woody pods containing seeds encased in resilient, rough-like coverings. Approximately 30–40% of each seed yields oil, which serves as a key resource for lamp fuel, soap production and lubrication.



FIG. 1: FRUIT OF PONGAMIA PINNATA

## Taxonomical Classification of *Pongamia pinnata*:

**Kingdom:** Plantae

**Division:** Magnoliophyta

**Class:** Magnoliopsida

**Order:** Fabales

**Family:** Leguminosae

**Genus:** *Pongamia*

**Species:** *Pinnata*<sup>10</sup>.

### Vernacular Names of *Pongamia pinnata*:

**Sanskrit:** Ghrtakarauja, Karanjaka, Naktahva, Naktamala

**Bengali:** Daharakaranja, Karanja, Natakaranja

**Kannada:** Honge, Hulagilu

**Gujrathi:** Kanaji, Kanajo

**Telugu:** Ganuga, Kanugu

**Malayalam:** Pungu, Ungu, Unu, Avittal

**Tamil:** Pungai, Pongana<sup>11</sup>.

**Phytochemistry of *Pongamia pinnata*:** *Pongamia pinnata* contains several chemical constituents, with flavonoids and their derivatives being the most commonly isolated. Its flavonoid derivatives include flavones, flavones and chalcones.

This plant comprises a diverse spectrum of compounds, including sesquiterpenes, diterpenes, triterpenes, steroids, amino acids, disaccharides, fatty acids and esters—each contributing to its pharmacological potential.

Flavones are the dominant phytochemicals extracted from *Pongamia pinnata*, distributed extensively across its tissues.

Karanjin, a prominent furanoflavonoid derived from *Pongamia pinnata* seeds, has garnered attention for its anti-ulcer potential in recent research. As the primary bioactive constituent of Karanj, it also exhibits notable insecticidal properties<sup>12</sup>.

**TABLE 1: VOLATILE CONSTITUENT OF *PONGAMIA PINNATA***

Plant Part	Constituents
Seed	Caryophyllenes
	3,7,11,15-tetramethylhexadec-2-en-1-ol
	4-Allyl-2-methoxyphenol
	3,7-dimethyl-1-6-octadien-3-ol
	Phenyl methanol
	Pelargonic acid
	Hexanal

**TABLE 2: NON-VOLATILE CONSTITUENT OF *PONGAMIA PINNATA***

Plant Part	Constituents
Seed	3-Methoxy-2-phenylfuro[2,3-b] pyran-4-one
	1-(4-Methoxyphenyl)-3-phenylpropane-1,3-dione
	Cis-9-octadecadienoic acid
	9,12-octadecadienoic acid

### Pharmacological Activity:

- ❖ Anti-bacterial activity.
- ❖ Anti-inflammatory activity.
- ❖ Anti-oxidant and Anti-hyperammonaemia Activity.
- ❖ Anti-viral activity<sup>13</sup>.

***Azadiracta indica*-Leaf:** The leaflets are arranged oppositely, lack stipules and exhibit a lanceolate form with an oblique base, pointed apex, and finely serrated margins. They measure approximately 7–8.5 cm long and 1–1.7 cm wide, display a pale yellowish-green hue, and possess a mildly bitter flavor with a subtle scent.

When observed along the midrib, the leaflet exhibits a biconvex contour, with both epidermal layers enveloped by a robust cuticle. Beneath the epidermis lie 4–5 layers of collenchyma. These dorsiventral structures feature a thick cuticle externally and possess epidermal layers on both sides composed of thin-walled, tangentially elongated cells.

1. Palisade ratio: 3.0-4.5
2. Stomatal index: 13.0-14.5 on lower surface and 8.0-11.5 on upper surface.

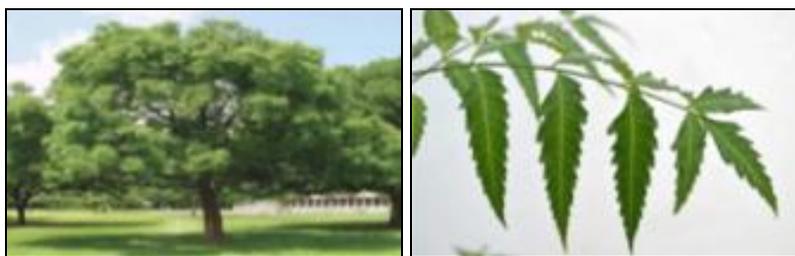


FIG. 2: LEAF OF AZADIRACTA INDICA

### Taxonomical Classification of *Azadirachta Indica*:

**Kingdom:** Plantae

**Division:** Magnoliophytes

**Class:** Dipsacales

**Order:** Rutales

**Family:** Maliaceae

**Genus:** Azadirachta

**Species:** indica<sup>14</sup>.

### Vernacular Names of *Azadirachta indica*:

**Tamil:** Vembu

**Telugu:** Nimbamu, Taruka, Vepa

**Marathi:** Kadukhajur, Limba, Nimbay

**English:** Indian Lilac, Margosa tree, Neem tree

**Malayalam:** Arytikta, Nimbam, Aryaveppu

**Oriya:** Limbo Kakopholo

**Burma:** Bawtamaka, Kamaka

**Hindi:** Balnimb, Nimb, Nim<sup>15</sup>.

### Phytochemistry of *Azadirachta indica*:

*Azadirachta indica* holds notable medicinal value owing to its abundant and varied bioactive constituents. Its intricate phytochemical profile includes numerous therapeutic agents, among which Nimbi, a bitter compound, was first extracted from neem oil in 1942. Neem harbours over 140 structurally diverse bioactive molecules, classified into isoprenoids such as terpenoids and steroids, and non-isoprenoids like polyphenolics, sulfur compounds and polysaccharides, all of which underpin its extensive pharmacological

potential. Neem's bioactive profile comprises isoprenoids such as diterpenoids, triterpenoids and steroids with notable compounds including protomeliacins, limonoids, azadirone, azadiradione, gedunin, vilasinin, and C-secomeliacins like azadirachtin, nimbin, salanin, and their analogs; in contrast, its non-isoprenoid constituents encompass proteins, carbohydrates, polysaccharides, sulfur-based molecules and polyphenolics like flavonoids, glycosides, dihydrochalcones, coumarins, tannins and aliphatic compounds<sup>16</sup>.

Neem major phytoconstituents span its various parts: the leaves contain azadirachtin, meliantriol, salanin, triterpenes,  $\beta$ -sitosterol, stigmasterol, and cyclic tri- and tetrasulfides; the seeds yield nimbin, nimbidin, azadirachtin, and limonoids like meliantriol, nimbidinine and nimbendol; while the seed oil is rich in nimbosterol, myricetin, vitamin B and essential fatty acids<sup>16</sup>.

**TABLE 3: VOLATILE CONSTITUENTS OF AZADIRACTA INDICA**

Plant Part	Constituents
Leaf	$\alpha$ -pinene $\beta$ -pinene Limonene $\beta$ -caryophyllene Camphor

**TABLE 4: NON-VOLATILE CONSTITUENTS OF AZADIRACTA INDICA**

Plant Part	Constituents
Leaf	Azadirachtin Nimbin Quercetin Gallic acid $\beta$ -sitosterol

### Pharmacological Activity:

- Anti-bacterial activity.
- Anti-fungal activity.
- Anti-gastric ulcer activity.

➤ Spermicidal activity<sup>17</sup>.

***Ocimum Tenuiflorum* –Leaf:** Leaf is green to dark green colour reaching 5cm in length, with an ovate margin and the petioles are 5mm in length. The leaf arrangement is opposite, and the stipule is absent.

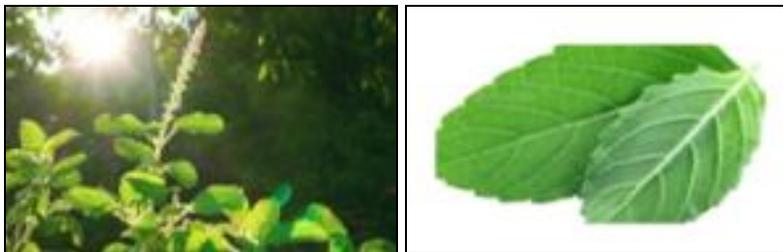


FIG. 3: LEAF OF *OCIMUM TENUIFLORUM*

### Taxonomical Classification of *Ocimum Tenuiflorum*:

**Kingdom:** Plantae

**Division:** Magnoliophyte

**Order:** Lamiales

**Family:** Lamiaceae

**Genus:** *Ocimum*

**Species:** *tenuiflorum* linn<sup>18</sup>.

### Vernacular Names of *Ocimum tenuiflorum*:

**Sanskrit:** Surasa, Krishna tulasi, Bana Tulasi.

**Tamil:** Tulaesi, Thulasii, Theiru Theezaei.

**English:** Holy Basil.

**Hindi:** Tulasii.

**Malayalam:** Tulsii, Tulasae.

**Telugu:** Tulasii<sup>19</sup>.

**Phytochemistry of *Ocimum tenuiflorum*:** Tulsi contains a potent mix of bioactive constituents-oleanolic acid, ursolic acid, rosmarinic acid, eugenol (~70%), carvacrol, linalool,  $\beta$ -caryophyllene (~8%),  $\beta$ -element (~11%), caryophyllene (~8%), and germacrene (~2%)-that collectively underpin its therapeutic potential.

Leaf essential oils contain eugenol, ursolic acid, carvacrol, linalool, and limonene. Seed oil is rich in sitosterol, while seed mucus has carbohydrates.

1. Palisade ratio: 2.5 - 3.8
2. Stomatal index: On the lower surface, 14 to 16 and on the upper surface, 10 to 15.

Green leaves possess anthocyanins, xylose, and polysaccharides<sup>20</sup>.

TABLE 5: VOLATILE CONSTITUENTS OF *OCIMUM TENUIFLORUM*

Plant Part	Constituents
Seed	Eugenol
	Methyl eugenol
	Linalool
	1,8-cineole
	Camphor
	$\alpha$ -humulene
	$\beta$ -caryophyllene
	Carvacrol

TABLE 6: NON-VOLATILE CONSTITUENTS OF *OCIMUM TENUIFLORUM*

Plant Part	Constituents
Leaf	Ursolic acid
	Rosmarinic acid
	Apigenin
	Luteolin
	Caffeic acid
	Tannin and Saponins

### Pharmacological Activity:

- ✚ Anti-bacterial activity.
- ✚ Anti-oxidant.
- ✚ Immunomodulator.
- ✚ Anti-diabetic.
- ✚ Nootropic activity.
- ✚ Anti-inflammatory activity.
- ✚ Larvicidal activity.

✚ Anti-cancer activity<sup>21</sup>.

**Rubia cordifolia-Root:** *Rubia cordifolia* produces perennial roots that are notably long, cylindrical and hexagonal, encased in thin bark ranging from reddish to rusty brown. Traditionally, these roots

have been employed to manage conditions such as uterine bleeding, haemorrhages, bronchitis, rheumatism, urinary and biliary calculi, dysentery and hypertension, alongside their diuretic properties.



FIG. 4: ROOT OF RUBIA CORDIFOLIA

#### Taxonomical Classification of *Rubia cordifolia*:

**Kingdom:** Plantae

**Class:** Dicotyledonae

**Subclass:** Sympetalae

**Order:** Rubiales

**Family:** Rubiaceae

**Genus:** Rubia

**Species:** cordifolia<sup>22</sup>.

#### Vernacular Names of *Rubia cordifolia*:

**Latin:** *Rubia cordifolia*

**English:** Indian Madder

**Bengali:** Manjith Gujrathi Manjith

**Hindi:** Majit, Manjit Marathi Manjestha

**Tamil:** Manjitti, Shevelli.

**Telugu:** Tamravalli,

**Kannada:** Manjustha

**Malayalam:** Manjitti<sup>23</sup>.

**Phytochemistry of *Rubia cordifolia*:** In *Rubia cordifolia*, two pigments were isolated from the root: alizarin and purpurin. They both were anthraquinone compounds which are responsible for the appearance of red colour, respectively. *Rubia cordifolia* roots contain diverse

anthraquinone derivatives like 1-acetoxy-6-hydroxy-2-methylantraquinone, rhamnolucoside, 1,4-dihydroxy-2-carbomethoxy anthraquinone and 1-hydroxy-2-carboxy-3-methoxyanthraquinone, along with pentacyclic triterpenes including rubiateriod, rubicoumaric acid, and rubifolic acid. Additionally, cyclic hexapeptides such as RA-I, RA-III, and RA-IV have been isolated and structurally characterised from *Rubia cordifolia* roots<sup>24</sup>.

**Volatile Constituents of *Rubia cordifolia*:** *Rubia cordifolia* root extract lacks consistently identified volatile constituents, indicating that its therapeutic properties are primarily attributed to non-volatile phytochemicals.

TABLE 7: NON-VOLATILE CONSTITUENTS OF RUBIA CORDIFOLIA

Plant Part	Constituents
Root	Alizarin (1,2-dihydroxy-9,10-antraquinone). Purpurin (1,2,4-trihydroxyanthraquinone). Rubiadin (1,3-dihydro-2-methyl-9,10-antraquinone). Mollugin & fuomollugin. Hexapeptides (RA-V, RA-VII, RA-XII). Triterpenoids.

#### Pharmacological Activity:

- ◆ Anti-microbial activity
- ◆ Anti-inflammatory activity
- ◆ Anti-ulcer activity

- ◆ Gastroprotective activity
- ◆ Hepatoprotective activity
- ◆ Immunomodulating activity
- ◆ Anti-cancer activity
- ◆ Anti-acne activity<sup>25</sup>.

FIG. 5: ROOT OF *ECLIPTA ALBA***Taxonomical Classification of *Eclipta alba*:****Kingdom:** Plantae**Division:** Tracheophyta**Class:** Magnoliopsida**Order:** Asteranae**Family:** Asteraceae**Genus:** *Eclipta***Species:** *alba*<sup>26</sup>.**Vernacular Names of *Eclipta alba*:****Latin name:** *Eclipta alba***Hindi:** Bhangra, Bhangraiya**Tamil:** Kaikhehsi**Telugu:** Galagara, Gunta, Galijaeru**Malayalam:** Cajenneam, Kanni<sup>27</sup>.

**Phytochemistry of *Eclipta alba*:** *Eclipta alba* harbors a rich spectrum of bioactive compounds, including coumestans, alkaloids, flavonoids, glycosides, polyacetylenes, and triterpenoids. The roots specifically produce hentriacontanol and heptacosanol, along with polyacetylene-linked thiophenes that contribute to its pharmacological profile. Extraction of *Eclipta alba*'s aerial parts with n-hexane yields  $\beta$ -amyrin, whereas polar

***Eclipta alba* –Root:** The root is the part of a plant that anchors it to the soil or a support, usually underground, and transports water and nutrients to other plant parts through its branches and fibers.

Roots contain chemicals such as thiophenes and hentriacontanol.

solvents isolate pharmacologically active constituents like luteolin-7-glucoside,  $\beta$ -glucoside of phytosterol, triterpenic acid glucoside and wedelolactone<sup>28</sup>.

**TABLE 8: VOLATILE CONSTITUENTS OF *ECLIPTA ALBA***

Plant Part	Constituents
Root 	2-Thiophene carbaldehyde 5- [5-(thien-2-yl) thien-2-yl] Dodecanoic acid Loliolide

**TABLE 9: NON-VOLATILE CONSTITUENTS OF *ECLIPTA ALBA***

Plant Part	Constituents
Root 	Wedelolactone Ecliptalbine Luteolin Apigenin Ursolic acid

**Pharmacological Activity:**

- Anti-bacterial activity.
- Anti-cancer activity.
- Anti-oxidant
- Anti-malarial activity
- Anti-asthmatic
- Anti-epileptic<sup>29</sup>.

**CONCLUSION:** This review paper presents an overview of the pharmacognostical details of polyherbs like *Pongamia pinnata*, *Azadirachta indica*, *Ocimum tenuiflorum*, *Rubia cordifolia* and *Eclipta alba*. These herbs were well-known for their essential oils, aromatic properties, and have traditionally been used as medicinal plants containing a large number of biologically active phytoconstituents with numerous therapeutic activities. Phytochemical studies of these plants reveal their antimicrobial, anti-inflammatory, antiviral, antioxidant, anti-ulcer, antidiarrheal and anticancer properties. Even combining these with other medicinal plants shows a massive effect.

Currently, these plants, *Pongamia pinnata*, *Azadirachta indica*, *Ocimum tenuiflorum*, *Rubia cordifolia* and *Eclipta alba* are used in the traditional medicinal system as both internal and external medicine for preventing and treating various diseases. Additionally, the pharmaceutical and cosmetic industries utilize *Pongamia*, *Neem*, *Manjistha* and *Tulsi* to develop numerous preparations and novel drugs targeting various pathogens.

These plants have multiple benefits, hence they are true miracle of nature. Over the past few decades, research in chemical analysis and therapeutic discovery has steadily increased. In the future, these plants will have a huge global demand in many phyto industries, nutraceuticals, food and cosmetics because of their lower cost, safety and fewer side effects.

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