CHAPTER 06

Indian Boxwood (*Gardenia latifolia* Aiton)

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ABSTRACT

Gardenia latifolia commonly known as Indian boxwood or Ceylon boxwood, is a small deciduous tree widely distributed in tropical and subtropical regions of India. Traditionally, various parts of the plant have been used in indigenous medicine to treat ailments such as snake bites, skin diseases, stomach pain etc. Phytochemical analyses have revealed the presence of diverse bioactive constituents, including alkaloids, flavonoids, saponins, glycosides, terpenoids, phenolic compounds, and triterpenoids such as hederagenin, β-sitosterol, and oleanolic acid. Pharmacological studies confirm a broad spectrum of therapeutic properties, including antibacterial, antiviral, antioxidant, anti-inflammatory, hepatoprotective, cytotoxic, and antioxidant activities. These findings substantiate the traditional uses of *G. latifolia* and highlight its potential as a valuable source for novel bioactive compounds with diverse pharmacological applications.

KEYWORDS: Indian boxwood, traditional medicine, pharmacology, bioactive compounds

INTRODUCTION

The Rubiaceae family is renowned for producing a wide range of chemical compounds and has long been recognized as a rich source of alkaloids, which constitute the major group of bioactive substances studied within this family (Lakshmi and Jaganmohanreddy 2011). Among its diverse genera, *Gardenia* comprises about 140 species distributed across warm and tropical regions worldwide (Wong and Low 2011). *Gardenia latifolia*, commonly known as

Indian boxwood or Ceylon boxwood, is a small, densely foliated tree belonging to the family Rubiaceae. It is widely distributed throughout India, particularly in deciduous forests along streams (Vindhya and Leelavathi 2014). The native range of the species extends from India to Bangladesh, and it is also found across tropical and subtropical regions of Africa, South Asia, and Australia. In India, it commonly occurs in the forests of Madhya Pradesh, Odisha, and Haryana. The plant is also cultivated in various regions for its fruits and as a shade tree. Locally, *G. latifolia* is known by several vernacular names Papra (Hindi), Kalkambi (Kannada), Ghogari (Marathi), Kota rangadamkurdu (Oriya), Kumbay (Tamil), and Peddabikki (Telugu). It can be easily recognized by its large leaves and distinctive greenish-grey bark, which peels off to reveal smooth, concave, rounded depressions. Traditionally, it has been extensively used as both food and medicine in South Asian countries, especially for treating digestive disorders (Alshabi and Shaikh 2022). In India, *G. latifolia* has a long history of medicinal use for treating a variety of ailments, including snake bites, skin diseases, stomach pain, inflammatory conditions, dental caries, and bleeding disorders in humans, as well as ephemeral fevers in livestock. Phytochemical analyses of its stem bark extract have revealed the presence of several bioactive compounds such as flavonoids, saponins, terpenoids, and phenols (Bharti and Sharma 2024). Pharmacological investigations have demonstrated that extracts and isolated compounds of *G. latifolia* exhibit a broad spectrum of biological activities, including antibacterial, antiviral, anti-inflammatory, antileishmanial, antioxidant, antiplasmodial, antitheilerial, hepatoprotective, larvicidal, and cytotoxic effects (Reddy et al. 2021). Despite its extensive traditional and pharmacological importance, further molecular and biochemical investigations are needed to isolate novel bioactive compounds and clarify their precise mechanisms of action. *G. latifolia* is recognized as a significant ethnomedicinal tree of India, supported by rich traditional knowledge and growing scientific evidence of its diverse therapeutic properties. This chapter aims to emphasize the medicinal relevance of this species and highlight the need for its conservation.

MORPHOLOGY

It is a small deciduous tree with a low, bushy crown and grey bark that peels off in flakes. The stem grows about 12–14 ft high and 2–4 ft in girth (Singla and Gupta 2021; Kumar et al. 2022; Figure 1).

Leaves: Leaves are opposite or whorled, large, and broadly ovate to obovate, typically 6–8 inches long and about 3 inches broad. They are smooth, with very short petioles, and possess a small hairy gland in the axils of the veins on the underside. The leaves are generally crowded at the ends of branches.

Flowers: Flowers are solitary, borne at the tips of branches, and fragrant. The calyx forms a bell-shaped cup with irregular segments or teeth. The corolla is salver-shaped, beginning as a narrow tube and expanding abruptly into a flat arrangement of petals. Flowers are white, turning yellow as they fade. The flower tube measures about 2 inches long, and bears 5–9 obliquely obovate petals, each about half the length of the tube. The stigma is club-shaped, thick, fleshy, and bipartite, with bifid segments.

Fruit: The fruit is a globose berry, nearly spherical and 1–2 inches in diameter, with a pubescent surface. It is edible and crowned with the persistent limb of the sepal.

TRADITIONAL MEDICINAL USES

G. latifolia has been extensively used in traditional medicine for centuries due to its diverse therapeutic properties (Figure 2).

Root: The root is traditionally used as a remedy for indigestion in children. It contains gardenins, a group of bioactive compounds with potential pharmacological activity (Ansari et al. 2019).

Bark: The stem bark is used to treat skin diseases, snake bites, dental caries, rheumatism, diarrhea, and dysentery. Crushed and boiled bark extract is applied to affected areas for tooth decay and used externally for skin ailments. It is also employed as a remedy for transient fevers in livestock. The bark contains β-sitosterol, hederagenin, and methyl esters of oleanolic and gypsogenic acids (Ansari et al., 2019). Saponins isolated from the bark have been reported to reduce histamine formation and may have potential in the treatment of asthma. Tribal communities in Bangladesh (Chittagong and Hill Tracts) use a decoction of the bark for treating dental caries (Bharti and Sharma 2024).

Stem: The stem is used in traditional medicine to relieve stomach pain and toothache. The stem and fruit extracts are also employed in the treatment of sores, wounds, and skin infections.

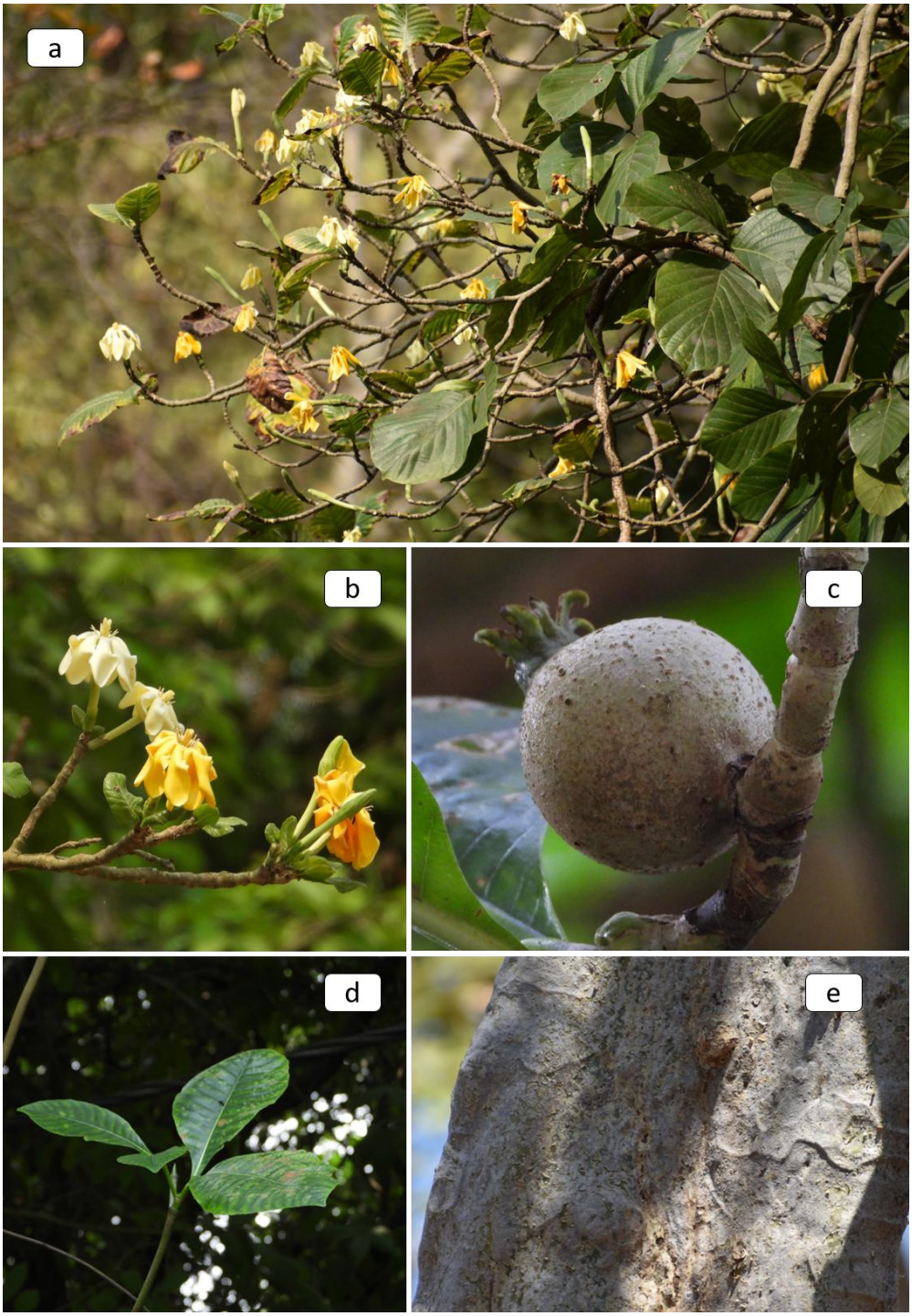


Figure 1: Vegetative parts of *G. latifolia*; a) Canopy, b) Flowers, c) Fruit, d) Leaves, e) Bark

Fruit: The fruit is widely used in folk medicine for treating snake bites, stomach pain, skin diseases, dental caries, wounds, and ulcers of the hands and feet. Pounded pulp of the fruit is applied to the forehead to reduce fever and to the breast for treating mammary gland disorders. The fruit extract acts as an antiseptic and painkiller, promoting wound healing (Bharti and Sharma 2024). It is also used in herbal cosmetic applications, particularly in perfume preparation. Fruits are reported to have been used in haemorrhage, stomach ache, and ephemeral fevers in livestock (Reddy et al. 2021).

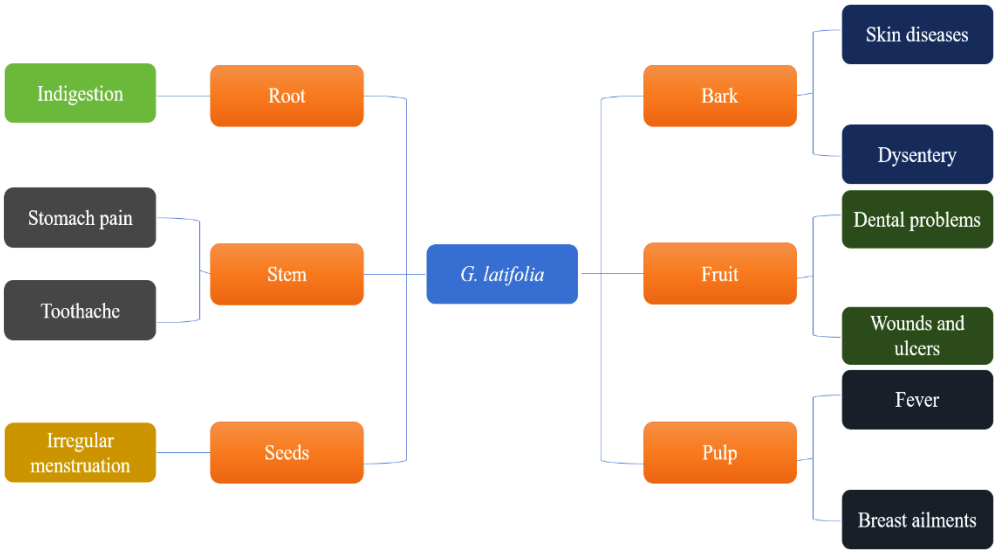


Figure 2: Traditional medicinal uses of *G. latifolia*

Seeds: The Gond tribe of Bhandara district, Maharashtra, consumes powdered seeds mixed with *Piper nigrum* to regulate irregular menstruation (Bharti and Sharma 2024).

Pulp: The pulp of the fruit is crushed and applied externally to treat breast ailments and fevers. It is also used topically for wound healing and inflammatory conditions.

Various tribes in Baragarh district, Odisha, use *G. latifolia* to treat rheumatism. Gond tribes of Maharashtra and tribal communities of Bangladesh employ different plant parts for menstrual disorders, dental ailments, and fever. The species holds a prominent place in traditional medicine across India and neighboring countries due to its broad pharmacological potential.

BIOACTIVE COMPOUNDS

The stem bark of *G. latifolia* contains several bioactive constituents, including hederagenin, D-mannitol, β-sitosterol, siaresinolic acid, episiaresinolic acid, oleanolic acid, and spinosic acid (Ansari et al. 2019). For phytochemical extraction, various solvent systems such as hexane, chloroform, ethyl acetate, and methanol have been evaluated. Among these, the methanolic extract exhibited the richest phytochemical profile, showing the presence of alkaloids, saponins, glycosides, flavonoids, phenols, and terpenoids. In contrast, hexane showed no detectable compounds, chloroform revealed only phenols and flavonoids, and ethyl acetate contained phenols, flavonoids, glycosides, and terpenoids (Mehboob et al. 2024). Studies have demonstrated that phenolics possess a wide spectrum of biological activities, including antioxidant, antibacterial, anti-atherosclerotic, anticancer, antiviral, and anti-inflammatory properties. Diets rich in phenolic compounds have been associated with a reduced risk of cardiovascular diseases. Similarly, flavonoids exhibit diverse pharmacological effects such as anti-allergic, anti-inflammatory, anticancer, antithrombotic, antimicrobial, antiviral, and hepatoprotective activities, primarily due to their strong free radical scavenging capacity. Terpenoids, another major class of bioactive compounds found in *G. latifolia*, are known for their antibiotic, antiseptic, antihelminthic, and insecticidal properties (Reddy et al. 2021).

PHARMACOLOGICAL USES

Antibacterial activity: Extracts of *G. latifolia* have shown significant antibacterial effects against both Gram-positive and Gram-negative bacteria. The presence of phenolic compounds, flavonoids, and terpenoids contributes to this property by disrupting bacterial cell walls and inhibiting microbial growth (Bharti and Sharma 2024; Reddy et al. 2021).

Antiviral activity: Phytochemicals such as flavonoids and phenolics in *G. latifolia* demonstrate antiviral potential, inhibiting viral replication and enhancing host immune responses (Mohamed et al. 2022)

Anti-inflammatory activity: Methanolic extracts of *G. latifolia* exhibit marked anti-inflammatory effects, attributed to the presence of saponins, flavonoids, and triterpenoids, which suppress the release of inflammatory mediators like histamine and prostaglandins (Ansari et al. 2019).

Antioxidant activity: Phenolic and flavonoid-rich extracts of *G. latifolia* show strong antioxidant properties, effectively scavenging free radicals and protecting cells from oxidative damage (Mehboob et al. 2024).

Cytotoxic and anticancer activity: The plant exhibits cytotoxic properties, attributed to its flavonoid and terpenoid content, which induce apoptosis in abnormal cells and inhibit tumor proliferation (Vindhya and Leelavathi 2014).

Hepatoprotective activity: Experimental studies suggest that *G. latifolia* possesses hepatoprotective potential, protecting the liver from toxin-induced damage due to its antioxidant and membrane-stabilizing effects (Abass et al. 2018).

Antiasthmatic activity: Saponins from the bark have been found to reduce histamine formation, suggesting potential antiasthmatic effects and usefulness in respiratory inflammation (Reddy et al. 2021).

Antidiarrheal and gastroprotective activity: Traditional applications of the stem and fruit extracts in stomach pain, diarrhea, and dysentery indicate their gastroprotective and antispasmodic effects, possibly due to the presence of tannins and flavonoids (Ansari et al. 2019).

CONCLUSION

G. latifolia represents an important ethnomedicinal species with significant traditional and scientific relevance. The wide range of bioactive phytoconstituents present in its various parts accounts for its multifaceted therapeutic effects. Modern pharmacological studies have validated many of its traditional uses, revealing strong antibacterial, antioxidant, anti-inflammatory, and hepatoprotective properties. Despite its established ethnobotanical and pharmacological importance, further molecular, pharmacokinetic, and clinical investigations are needed to isolate novel compounds and elucidate their precise mechanisms of action. Conservation and sustainable utilization of this species are equally vital to ensure its continued availability and to facilitate future research aimed at developing plant-based drugs from *G. latifolia*.

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