

CHAPTER 4

***Haldina cordifolia* (Roxb.) Ridsdale: A Valuable Tree Species in Indian Traditional Medicine - A Review of its Pharmacognosy, Pharmacology, and Toxicology**

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Abstract: *Haldina cordifolia* is a fascinating tree that holds a place in medicinal and cultural significance. It belongs to the Rubiaceae family, which includes coffee and gardenias. Keeping the importance of this tree in mind, significant information was collected and presented in this chapter. Results revealed that it contains alkaloids, flavonoids, saponins, terpenes, tannins, and carbohydrates. Plant parts are used traditionally for treating rheumatism, stomach-ache, headache, toothache, fever, cold, and conjunctivitis. Plant parts of *H. cordifolia* also possess antidiabetic, anti-inflammatory, anti-amoebic, antiulcer, and antibacterial activity. The chapter highlights the pharmacognosy, pharmacology, and toxicological aspect of *H. cordifolia*.

Keywords: *Haldinia cordifolia*, Rubiaceae, medicinal, cultural, ecological, pharmacological

INTRODUCTION

Since the prehistoric period, humans have relied on plant-based medicines. In fact, most of the pharmacopoeia of modern scientific medicine was developed from traditional herbal knowledge collected in the 20th century (Upton 2022). Many drugs in current use have

botanical origins. Nearly a quarter of all prescriptions filled in the most advanced nation include traditional medicinal plant ingredients. Some are derived from plant extracts, while others are synthetic analogues of these substances. Rubiaceae is an important family in the flowering plants belonging order Gentianales (Davis et al., 2009). Among many plants from the Rubiaceae family, *Haldina cordifolia* is one of them with numerous medicinal, ecological, and cultural values. According to the history of *H. cordifolia* also known as *Adina cordifolia* (synonym), it can be traced a long time back to the Vedas, Puranas, and Samhita. In the Vedic period, the root and branches of the plant was used for dantadhavana. It is mentioned as Nipa in the Panineeya Asthadhyayi, Pathanjali Mahabhashya, Gubhilagruhya sutra, and Shulwa Prathishakhya (Negi et al., 2022). It is also known as Yellow Teak and Saffron Teak (Dash et al., 2019). It is a deciduous tree species native to India and some parts of Southeast Asia (Nayak and Kumar, 2023). It is distributed from the outer ranges of the Himalayas eastwards to Sikkim, Bhutan, and Myanmar; southwards through Central India and South India to Sri Lanka; and China, Vietnam, and Thailand. It can be identified by heart-shaped leaves and small, fragrant yellow flowers. It is found in moist deciduous forests and favors well-drained soil and sunlight. Flowering period June to July and fruiting period November to March (Saxena and Brahmam, 1995). As per ethnomedicinal values claimed by different researchers, the reported plant parts contain bioactive compounds that helps to treat different diseases such as rheumatism, fever, cold, wounds, headache, eczema, toothache, jaundice, and urinary infections (Dalu et al., 2021). The recorded pharmacological activities of *H. cordifolia* are anti-diabetic, anti-inflammatory, antiulcer, antiamoebic, and anti-nociceptive activity. It is a multi-use plant, which includes the use of wood for its durability for making furniture, construction, and flooring (Muthupandiyan et al., 2019). It is also valued in Hindu rituals and ceremonies. In many sacred places, it is one of the most planted species. It also holds a place in traditional medicine for its anti-inflammatory, antidiabetic, and antimicrobial properties (Roshan and Verma, 2021; Muthupandiyan et al., 2019). In addition to commercially accessible pharmacological options such as insulin, sulfonylureas, biguanides, thiazolidinediones, and others due to their fewer side effects and improved acceptance. It also contributes to economic values and plays an important role in agroforestry. Leaves and young twigs are used as fodder, and wood are used for timber and fuelwood (Muthupandiyan et al., 2019). Wood is also used for pencil manufacturing (Warrier et al., 2023).

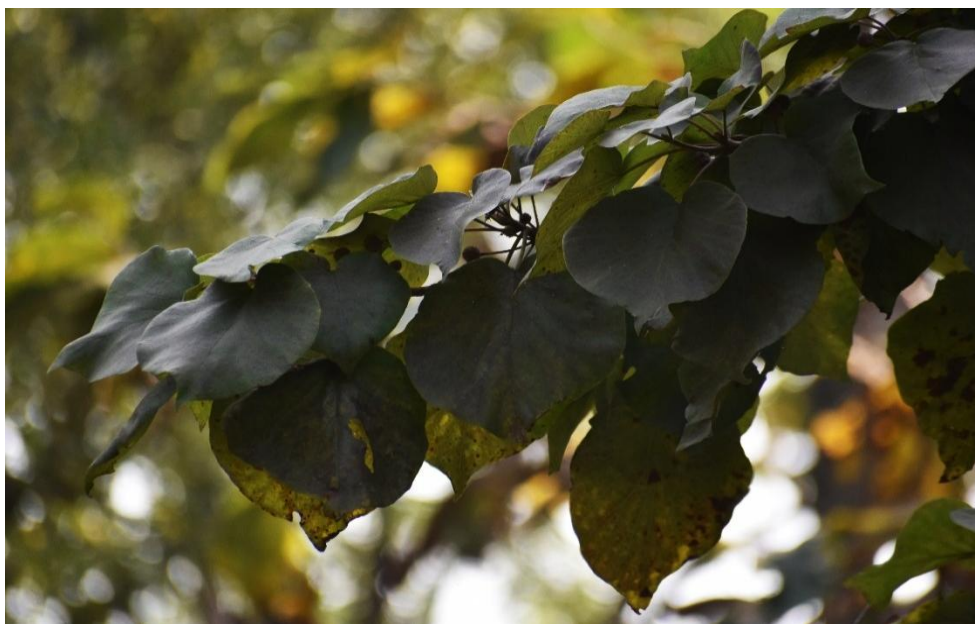


Figure 1: Leaves of *Haldina cordifolia*

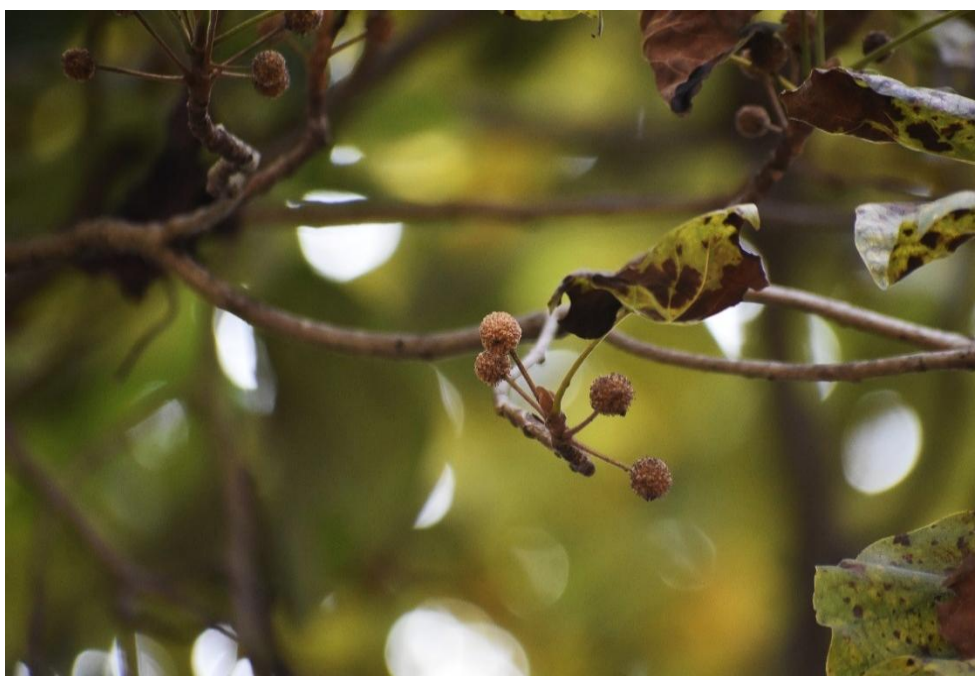


Figure 2: Fruit of *Haldina cordifolia*

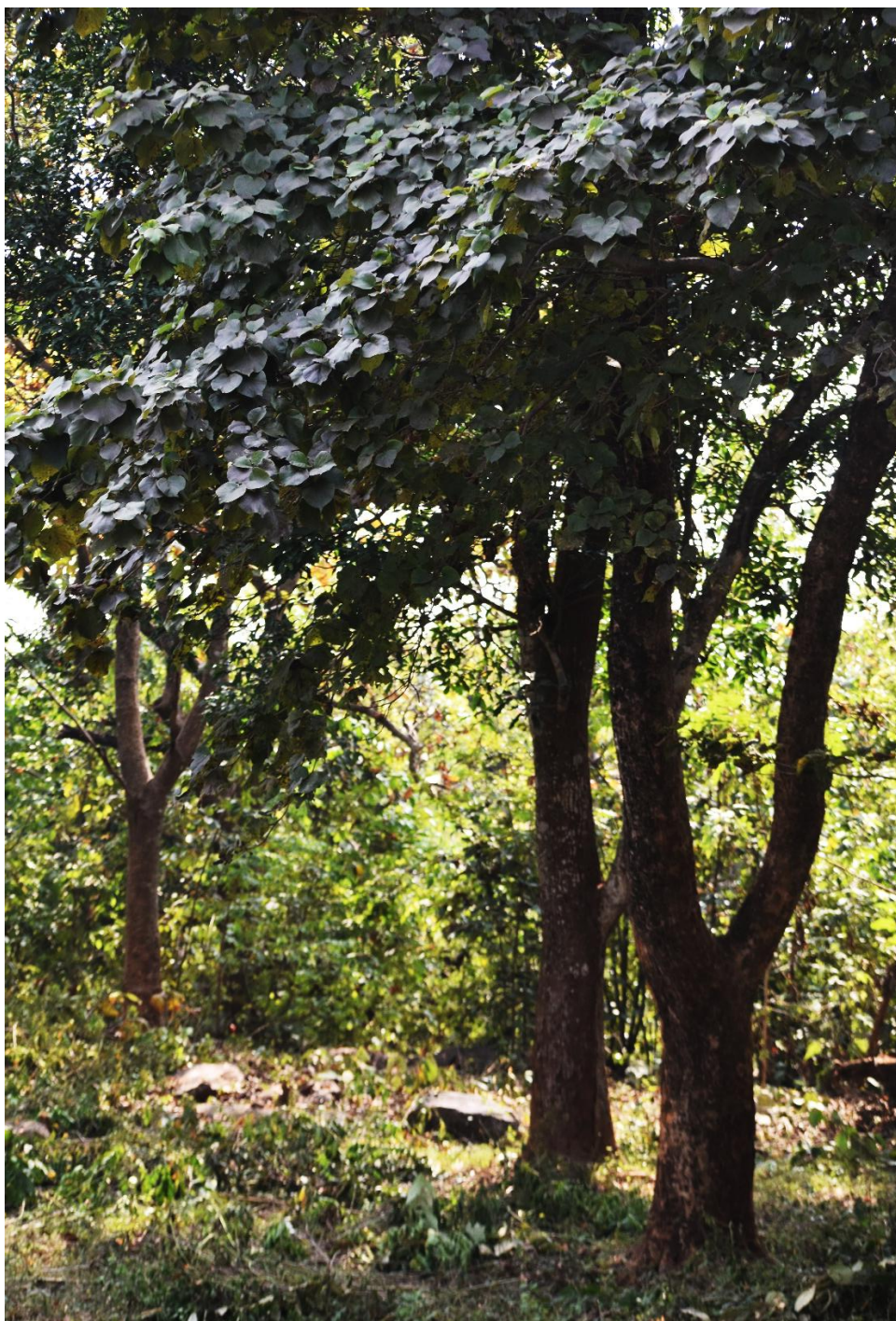


Figure 3: Habit and habitat of *Haldina cordifolia*

METHODOLOGY

The survey was carried out based on field and literature survey. The field survey was carried out to collect photographs of the plant from 2022-2024 in Odisha state. The plant was identified by the authors in field followed by flora book (Saxena and Brahmam, 1995). The literature survey was carried out through websites like PubMed, Scopus, and Web of Science. Relevant articles and published books were selected for the review process.

MORPHOLOGY

It is tree with smooth bark, light coloured, exfoliating in patches. Leaves broadly ovate, shortly abruptly acuminate, glabrescent to minutely pubescent above, pubescent to tomentose beneath; petiole 5-8 cm, glabrescent or tomentose; stipules suborbicular, enclosing the terminal bud. Heads 1.9-2 cm diameter, yellow, axillary, usually in vertical rows of three; peduncles, with 2 small caducous bracts towards the end; bracteoles filiform, hairy and somewhat expanded upward. Calyx -lobes linear. Corolla 5 mm, tube pubescent. Fruiting heads dry, 1-1.5 cm diameter (Saxena and Brahmam, 1995; Figure 1-3).

ETHNOMEDICINAL USES

It is one of the most common yet traditional medicinal tree used by tribal healers and by commoners. It is used to treat chronic cough, jaundice, stomach-ache, appetite, and stomach swelling (Table 1). Root used to treat astringent, constipation, diarrhoea, and dysentery. Bark is used to treat aphrodisiac, tonic, diuretic (Roshan and Verma, 2021).

Table 1: Ethnomedicinal uses of *Haldina cordifolia*

Part uses	Mode of uses	Diseases	Source
Leaves	Juice	Boils and conjunctivitis	Subba et al., (2024)
Flower	Paste	Headaches	Subba et al., (2024)
Stem and Bark	Juice	Rheumatism	Subba et al., (2024)

Bark	Maceration	Stomach-ache	Subba et al., (2024); Rokade and Pawar, (2013)
Leaves	Paste	Wounds and cuts	Subba et al., (2024)
Flowers	Paste	Headache	Singh et al., (2019)
Leaves	Paste	Wounds	Singh et al., (2019)
Bark	Decoction	Eczema	Rokade and Pawar, (2013)
Bark	Decoction	Urinary problems	Rokade and Pawar, (2013)
Latex	Paste	Toothache	Rokade and Pawar, (2013)

PHARMACOGNOSY

Researchers have done work in this aspect using the plant parts of *H. cordifolia* and reported several bioactive compounds (**Roshan and Verma, 2021**). Root and bark consist of oleoresin, essential oil, cellulose, β -sitosterol 13 and sitosterol (**Dash et al., 2019; Roshan et al., 2021**). The leaves of *H. cordifolia* contains glycosides, carbohydrates, proteins, amino acids, sterols, triterpenes, total phenolic compounds, flavonoids, and saponin (**Tiwari and Soni, 2023**). Bark of *H. cordifolia* contains cadambine, triterpenoids. Heartwood contains 3,4,5,7- tetracetyl quercetin. 7- hydroxycoumarin and 7- β -D glucosylcoumarin contains in bark and root. Leaves possess anthocyanins, coumarin, phenol, flavonoid, phytosterol, fatty acid, tannin, saponin, alkaloids, anthaquinone and sugar (**Das et al., 2022**). Heartwood of *H. cordifolia* possess adinin belonging to naphthaquinone groups of pigment. Root bark contains a new coumarin glycoside adicardin, characterized as 7-apiglucoside of umbelliferone (**Singh et al., 2019**).

PHARMACOLOGY

It is a broad field that studies comprise on the interactions of drugs with living organisms, including their actions, mechanisms, and effects. It includes both natural and synthetic drugs. Many researchers reported on its pharmacological values (**Table 2**). It has been used as anti-amoebic, anti-inflammatory, antinociceptive, ant fertility (**Dash et al., 2019; Dalu et al., 2021**). Leaves possess antimicrobial activity (**Dash et al., 2023**). Stem part possesses anticancer and antibacterial activity (**Rao et al., 2020**), antiulcer activities, hepatoprotective effect (**Ravi et al., 2012**), anti-inflammatory effect, antifertility activities, antidiabetic activity (**Chaudhary et al., 2012**), anti-amoebic (**Iqbal et al., 2009**), antinociceptive activity (**Jain et al., 2006**). In 2021, Roshan and Verma reported cytotoxicity activity in the crude extract of bark.

Table 2: Pharmacological activities of *Haldina cordifolia*

Part used	Pharmacological activities	Sources
Leaves	Antimicrobial activity	Dash et al., (2023)
Bark	Antimicrobial	Singh et al., (2019)
Stem	Anticancer and antibacterial activity	Rao et al., (2020)
Leaves	Antioxidant and hepatoprotective activity	Roshan and Verma, (2021); Mishra et al., (2022)
Leaves, bark, root	Antioxidant activity	Roshan and Verma, (2021)
Stem and bark	Hepatoprotective activity	Ravi et al., (2012)
Bark	Anti-inflammatory and analgesic activity	Roshan and Verma, (2021); Jain et al., (2006); Jakaria et al., (2015)

Stem	Anti-ulcer	Roshan and Verma, (2021); Baral et al., (2016)
Leaves	Antidiabetic activity	Chaudhary et al., (2012); Singh et al., (2019)
Root and bark	Antiamoebic activity	Iqbal et al., (2009); Baral et al., (2016)
Leaves	Anti-neoplastic activity	Mishra et al., (2022)
Bark	Anti-nociceptive activity	Jain et al., (2006)
Leaf, bark, and root	Antioxidant activity	Baral et al., (2016)
Stem and bark	Anti-inflammatory and antipyretic activities	Kiran et al., (2011)
Leaves	Anti-fertility	Singh et al., (2019)
Stem bark	Antimalarial	Singh et al., (2019)

TOXICOLOGY

Toxicology is a broader field that examines the adverse effects of chemical, biological, or physical agents on living organisms. The acetone and aqueous extract show hepatoprotective activity against Wister rats with liver damage induced by ethanol at a dose of 500 mg/kg body weight exhibited hepatoprotective effect by lowering the Serum Glutamate Pyruvate Transaminase (SGPT), Serum Glutamate Oxaloacetate Transaminase (SGOT), alkaline

phosphate and total bilirubin to a significant extent and significantly increased the levels of total protein (Sharma et al., 2012). Some studies also include acute toxicity assessments, which involve administering high doses of the plant extract to animals to observe any immediate adverse effects (Warrier et al., 2023).

CONCLUSION

This study heightens the therapeutic potential of *Haldina cordifolia* in different aspects and their constituents in the prevention or treatment of disease. From this study it aimed to attract the attention of researchers seeking new drug formulation from *H. cordifolia* and its chemical constituent.

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