



REVIEW ON MEDICINAL PROPERTIES, WOOD CHARACTERISTICS AND ITS POTENTIAL UTILIZATION OF *ADINA CORDIFOLIA* (ROXB.) BRANDIS

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ABSTRACT

Adina cordifolia is a multipurpose tree species spread over moist deciduous tree native to the Indian subcontinent and parts of Southeast Asia that can grow well over 20 metres High flowering plant in the family Rubiaceae, commonly known as the Haldu. It is revered for its cultural significance with extensive traditional medicinal uses for ailments like chronic cough, jaundice, diarrhea, ulcer, malaria and abdominal disorders, and various skin diseases since ancient era. Though many phyto-chemicals and pharmacological compounds have been identified from this tree species Bark is described as bitter, astringent, refrigerant, vulnerary, and diuretic and used for skin diseases, wounds, fever, and as an aphrodisiac and tonic, while its roots are astringent and used for diarrhea and dysentery. Flowers are used to relieve headaches, buds are used to counteract snake venom, and leaves are used as an antiseptic to heal boils and sores. It has excellent wood quality, making it

appropriate for building projects, railroad cars, flooring, and paneling. The Haldu tree has several uses, but overexploitation and habitat loss are facing problems. Sustainable management and conservation efforts are essential to protect this valuable species and ensure its continued contributions to society and the environment. This Paper described about the potential uses of wood, its qualities, and its medical qualities.

KEYWORDS: *Adina cordifolia*, Haldu, Manjakadambai, *Haldina cordifolia*, Multipurpose tree, Wood Quality, Medicinal Uses, Pharmacological.

INTRODUCTION

Ailments are persistent companions throughout one's life. The pursuit to relieve these ailments, along with the aspiration for vitality and longevity, drove early humans to explore their natural surroundings. In this endeavor, herbs became the initial forms of medicine. Notably, around 80% of the global population still relies on traditional medicine. The World Health Organization supports traditional remedies because of their cost-effectiveness, broad accessibility, and relatively low occurrence of side effects. A variety of medicinal herbs and spices are integrated into everyday life, with many acting as herbal treatments. Minor ailments, such as the common cold and cough, can frequently be effectively addressed with herbal remedies that harness the medicinal qualities of these spices. The effectiveness of these herbal solutions has generated interest in researching these vital plants, which offer a diverse array of therapeutic advantages and present researchers with opportunities for future investigation.

Adina cordifolia (Roxb.) Brandis is flowering plants belong to Rubiaceae family. It is also referred to as Manjakadambai in Tamil and Bahuphala in Sanskrit. Common names for it include Haldu, Yellow teak, Saffron teak and turmeric wood (CSIR, 1985).

Synonyms

- *Haldina cordifolia* (Roxb.) Ridsdale
- *Nauclea cordifolia* Roxb.
- *Nauclea sterculiifolia* A.Rich. ex DC. (eFloraofIndia, 2020).

Common name: Haldu

Vernacular name

Assamese: Lampatia, Tarak chapa

Bengali: Keli-kadam, Dakom, Petpuria

Burmese: Hnaw

Garo (Meghalaya, Assam, and Tripura): Sandang

Gujarati: Haladwan

Guji (Ethiopia): Haladwan, Holdarvo

Hindi: Hardu, Haldu, Karam

Kannada: Kadambe, Anavu, Arsintega, Yettega

Khashi (Meghalaya): Thieng-phalo-tarong, Dieng-thing-phala,

Kuki (Sino-Tibetan): Ting-khop-thing

Kutchi (Kutch region of India and Sindh region of Pakistan): Bagting-Phang

Malayalam: Manjakadamba

Marathi: Heddi, Heddu Honangi Kalamb

Nepali: Karam

Punjabi: Haldu

Tamil: Manjakadambai, Pumpadari, Parasamaram, Poonthecku

Telugu: Bandaru, Dodaga, Dadduga, Rudradanapa, Patchi Kamba Chettu, Pasupu ganapa, Pasupu kadamba, Rudra ganapa, Bandari, (Soundararajan, 2023)

Oriya: Holonda, Bandaru, Pedda kamba, Keli kadamba gacha Maldu, Koim, Kurum, Halanda, Mandi, Kurnn

Sanskrit: Bahuphala, Haridru

Malayalam: Barakuram, Katamba, Manjakadambu, Malamkadambu (Gamble, 1922; Purkayastha, 1982; CSIR, 1985; Sujatha and Shashikala, 2012; Sankara Rao., 2019).

Indonesia: Lasi

Malaysia (Islands): Meraga

Myanmar: Hnaw

Philippines: Adina

Sri Lanka: Kolon, Manjakadambai

Thailand: Kwao

Vietnam: Gao-Vang (tropix.cirad.fr, 2012)

Adina cordifolia is native to southern Asia and it's distributed in India, China, Vietnam, Srilanka, Bangladesh, Nepal, Thailand, Bhutan, Vietnam, Myanmar, Cambodia, Laos and Malaysia (en.wikipedia.org; tropical.theferns.info; Sankara Rao, 2019). It is found scattered population in deciduous forests throughout the greater part of India (except in arid regions of Rajasthan) ascending to an altitude of 900 m in the sub-Himalayan tract. It is also widespread in South Indian forests (Iqbal *et al.*, 2009). In India, *Adina cordifolia* distributed in Andhra Pradesh: Kurnool district, Nellore district, Kadapa district, East Godavari district, Srikakulam district, West Godavari district, Vishakapatnam district; Karnataka: Bengaluru district, Ballari district, Chikkamagaluru district, Dakshina Kannada district, Davanagare district,

Hassan district, Kolar district, Mysuru district, Shivamogga district, Tumakuru district, Udupi district, Uttara Kannada district; Kerala: Kasaragod district, Kannur district, Wayanad district, Kozhikode district, Malappuram district, Palakkad district, Thrissur district, Ernakulam district, Idukki district, Pathanamthitta district, Kollam district, Thiruvananthapuram district; Odisha: Mayurbhanj district, Koraput district; Tamil Nadu: Madurai district, Salem district, Tiruvannamalai district, Dharmapuri district, Dindigul district (Sankara Rao., 2019); West Bengal: Occurs throughout the plains (Pandey, 2016; Soundararajan, 2023).

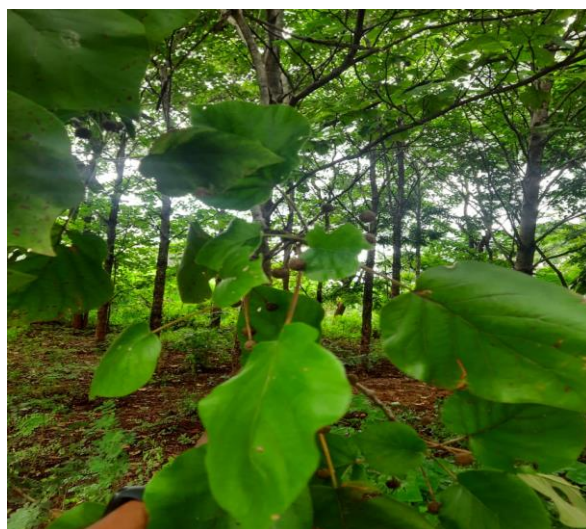
Adina cordifolia's tree is grows in various geological formations such as granite, gneiss, schist, quartzite, trap and laterite up to an elevation of 1,000 metres (Kundu, 2018; Muthupandiyar *et al.*, 2019) and it grows on a wide range of soils, prefers a pH in the range between 5.5 - 6.5, and will tolerate soils with high pH values, up to 8.3. It is susceptible to frost damage and to fires. The tree has a massive root system in proportion to its size, which makes it very resistant to drought and Succeeds in most soils, growing best in deep, fairly fertile conditions. Prefers a moist but well-drained soil (nbrienvs.nic.in, 2011; tropical.theferns.info). It grows best in areas where annual temperature is within the range of 25°C-35°C, but can tolerate 5°C - 47°C. It can be killed by temperatures of -1°C or lower. It prefers a mean annual rainfall in the range 1,000 - 2,000mm, but tolerates 800 - 4,500mm (tropical.theferns.info; Tntreepedia, 2018).

Adina cordifolia is a large deciduous important timber tree, under good conditions grows, over 30 m., but is normally about 14 - 20 m tall, leaves up to 25 cm or more across, broadly oval or circular in shape, acute at the apex, heart-shaped at the base, slightly hairy especially when young, green or tinged with red or pink; nerves a strong one running from the base to the tip of the leaf and 5 - 6 pairs of lateral ones, which unite in a wavy line near the margin of the leaf. Leaves come out in pairs, one on either side of a branch, their stalks connected by a pair of stipules. These are two leaf-like structures, up to 2.5 cm. long, enclosing and protecting the very young leaves and shoot apex; when the stipules fall away, they leave two clear lines, each encircling half of the branch. Leaf stalks are 5-10 cm, long (Cooke, 1901; Roy and Bhaskar, 1992; Yogesh Rokade and Sunil P. Pawar., 2013).

Adina cordifolia Flowers are insignificant individually, being very small; but they come out in balls 2-3 cm. across; the tiny flowers are yellow or yellowish in color, often tinged with pink. When the little flowers open out, the most prominent parts are the styles, which form a

sort of halo round the floral ball (Cooke, 1901; Roy and Bhaskar, 1992; Yogesh Rokade and Sunil P. Pawar., 2013). Flowers are bisexual, in axillary globose heads 3-4 mm long, mixed with many filiform bracteoles; hypanthium 1-2 mm long, densely hairy; calyx cupular, 1.5-2 mm long, tube short, lobes 5, 1.3-1.8 mm long; corolla 7-9 mm long, 5-ridged, densely finely hairy outside, lobes 5, oblong, 1-2 mm long, densely hairy; stamens 5, exserted; filaments 0.5 mm; anthers 1-2 mm long, oblong; ovary 2-celled, inferior; ovules many on a pendulous placenta; style filiform; stigma globose (keralaplants.in).

Adina cordifolia Fruits are minute, forming an almost solid ball, which when ripe is black or nearly black. Fruit a capsule, 2-3 mm long, of 2 dehiscent cocci, turbinate, brown; seeds many with tail at one end and a bifid wing other end. Leaves are shed about February, and the tree remains leafless until about May-June; the stipules covering the buds are than very conspicuous. Flower balls are at their best from June to August. After the fruit proper has been shed at about the beginning of June of the following year, the fruit-heads appear black and are about 12 mm. across: the rains of the monsoon may bring them down and prepare the tree for the new flower balls (Cooke, 1901; Roy and Bhaskar, 1992; Yogesh Rokade and Sunil P. Pawar., 2013; keralaplants.in).



Young plantation of *Adina cordifolia* (Photo Courtesy Dr. A. Muthu Kumar).

The fruit's color and moisture content can be used to determine the maturity index of seeds, which disappear between April and June. When the fruit reaches maturity, its color will shift from light green to light brown, and its moisture content will range from 38 to 46% (Jeena *et al.*, 2012). Spread the tarpaulin beneath the trees when it's time to gather seeds, and then pluck or lop the branches to gather the fruits. For optimal germination, the harvested seed

should be sun-dried for seven to ten days and have its moisture content reduced to five to six percent (Kundu, 2018; (Muthupandiyan *et al.*, 2019).



Stem of *Adina cordifolia* (Photo Courtesy Dr. A. Muthu Kumar).

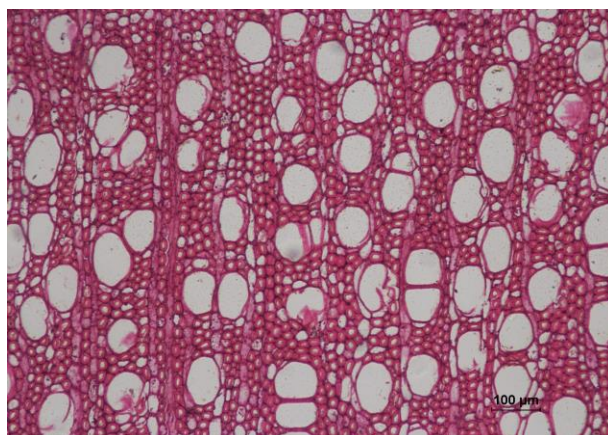
The seeds of *Adina cordifolia* are shed from April to June and are frequently transported by the wind across considerable distances. The seed must fall on bare terrain, such as landslips, alluvial soil near rivers, and abandoned farming, in order to effectively establish itself. It germinates early in the rainy season. Due to their tiny size, the young seedlings are susceptible to being battered down or washed away by rain. The seedlings grow extremely slowly in the first year, frequently reaching a height of barely 2.5 cm; in the second year, however, development picks up speed, and the seedlings develop thick taproots. Although the young seedlings seem to benefit from shade, if this keeps up, development will be limited until the canopy is opened to let in more light. Young trees want to be in mild to moderate shade, but as they become older, they need more light (nbrienvic.nic.in; tropical.theferns.info).



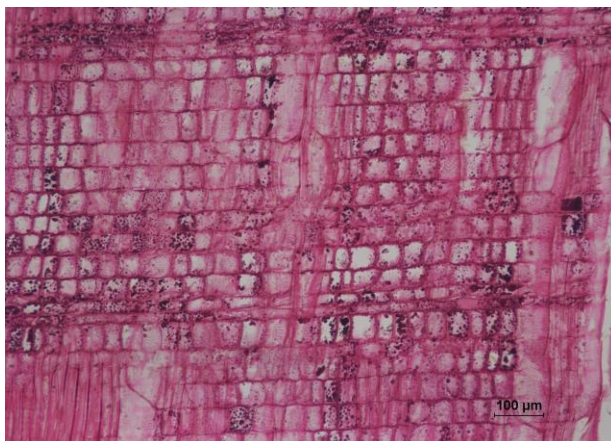
Tree of *Adina cordifolia* (autumn season) (Photo Courtesy Dr. A. Muthu Kumar).

The poly-potted seedlings that have been kept in the nursery for five to six months should be field planted. Without causing any harm to the seedlings' root system, remove the polythene cover and plant them in a hole that is 30 cm by 30 cm by 30 cm. The seedlings should be placed such that the flat soil surrounding them provides little terracing to prevent water stagnation. Approximately 70% of seedlings planted in the field will make it through the first three months. For field-planted seedlings to survive, protection against drought is crucial. After eight months in the field, seedlings will reach a height of 16.7 cm (Nair *et al.*, 2004; Muthupandiyan *et al.*, 2019).

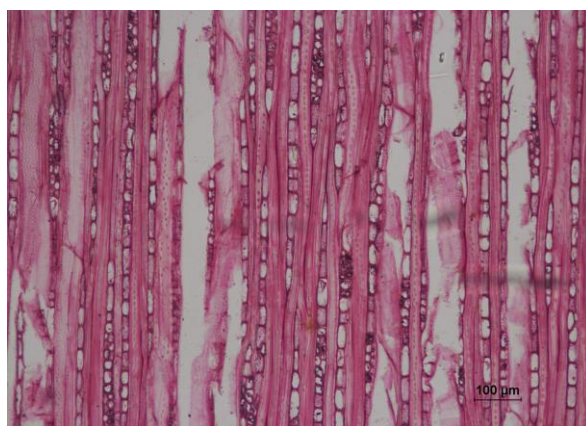
Structure of the Wood



Cross Section (Photo Courtesy: Dr. M. Sujatha).



Radial Section (Photo Courtesy: Dr. M. Sujatha).



Tangential section (Photo Courtesy: Dr. M. Sujatha).

Growth rings generally present but inconspicuous, faintly delimited by smaller and less numerous vessels and denser fibrous tissues toward the outer margin, 5-11 per inch. Vessels small to very small, the orifices appearing quite small with a hand-lens and more or less angular at higher magnifications, largest through the central Portion of the ring, smallest at the beginning of the ring but exhibiting no great or abrupt variation in size within a growth increment, open, with contiguous rays on one and frequently on both sides, forming fine inconspicuous vessel lines along the grain, solitary and in short radial rows 2-5 (mostly 2-3) between the narrow, close rays, quite evenly distributed, 50-66 per mm²; vessel segments long (400-1,235μ), medium thin-walled, truncate or abruptly or gradually tailed on one or both ends, the largest 100-115μ in diameter; perforations simple, nearly horizontal to oblique; inter-vessel pits numerous, small, orbicular to oval or somewhat Polygonal through crowding, with wide boarder and lenticular horizontal orifice, the maximum diameter 4-6μ ; pits leading to contiguous rays numerous to each ray cell, orbicular to oval, with broad semi-border and

lenticular horizontal orifice reaching nearly to the margin of the pit cavity, the maximum diameter 3-5 μ ; tyloses wanting; gummy inclusions not observed (Pearson and Brown, 1932).

Parenchyma paratracheal and metatracheal, in cam biform rows of 3-12 (mostly 7-9) units along the grain; (a) Parenchyma paratracheal extremely sparse, restricted to occasional cells contiguous to the tangential walls of the vessels and Wholly wanting from 40-50 μ ; (b) metatracheal paratracheal relatively abundant, scattered and in short tangential lines spanning the narrow interval between adjacent wood rays, occasionally extending across several rays but never forming a definite reticulum; cells generally flattened in the tangential plane, with maximum diameter of 30-40 μ , the largest 120 plus μ height along the grain; infiltration spares, pale yellow; crystals wanting; starch deposits Very numerous, filling many of cells (Pearson and Brown, 1932).

Fibers non-libriform, coarse, angled in the transverse section and aligned in radial rows which are frequently interrupted by parenchyma cells, medium thick-walled and fairly wide lumened, generally somewhat thicker-walled and fattened toward the outer margin of the ring, frequently contiguous to the tangential walls of the vessels, non-gelatinous, non-separate, 865-2,360 μ long, with tapering ends, 35-42 μ in diameter; walls 5-7 μ thick; inter-fiber pits numerous, somewhat more abundant on the tangential walls, boarded, with round or elliptical, vertically orientated court and short, linear-lenticular, steeply oblique orifice; infiltration not observed (Pearson and Brown, 1932).

Rays not distinct with the naked eye, very fine, very close (14-16 per mm.), separated by 1-4 (often 1-2) fibers, frequently contiguous to the vessels, of the same colour as the background forming an inconspicuous fleck on the radial surface, 1-3 seriate, heterogonous, divisible on the basis of size and composition into two sorts; (a) narrow rays consisting wholly of 'upright' cells, uniseriate or occasionally in part biseriate, approximately as numerous as the wider rays, 1-12 plus cells and 570 plus μ in height ; (b) wide rays 2-3 seriate and with maximum width of 40-47 μ and consisting wholly of 'Horizontal' cells through thickened portion, vertical uniseriate extensions of 'upright' cells from one or both margins which resemble the 'a' rays and not infrequently unite along the grain, forming compound rays; maximum height of 'b' rays (where not compound) 15 plus cells and 670 μ ; height of thickened 2-3 seriate portion 70-140 μ ; pits leading to contiguous vessels numerous to each ray cell, orbicular to oval, with broad semi-boarder and lenticular horizontal orifice reaching nearly to the margin of the pit cavity, the maximum diameter 3-5 μ ; infiltration spares in the ray cells, pale yellow;

crystals not observed; starch deposits very numerous, filling many of the ray cells (Pearson and Brown, 1932).

Wood properties

The yellowish wood is found to be uniformly fine texture and straight grained. Basic Density range between 503.0 kg/m³ to 663.5 kg/m³. Average density at breast height level was 596.7 kg/m³ (Nair *et al.*, 1991). Sapwood is pale yellowish or yellowish white. Heart wood is deep yellow turning reddish or brownish on exposure. Parenchyma is sparse and indistinct to the naked eye. Rays are fine, numerous and closely spaced. Vessels are small, solitary and in radial multiples of two to three (Anoop and Pasha 2005). Various other wood properties worked out were: Specific gravity: 0.70 at 12% moisture content. Co-efficient of volumetric shrinkage: 0.45%, total tangential shrinkage (TS): 6.8%, total radial shrinkage (RS): 3.4%, TS/RS ratio is: 2.0, crushing strength: 55MPa (1MPa=1 N/mm²), static bending strength: 90 MPa, modulus of elasticity: 12770 MPa (Anon, 2012). Air dry weight is 40- 42lb per cubic ft (CSIR, 1948; Muthupandiyan *et al.*, 2019).

General properties: Sap wood pale yellow or yellowish – white, merging into the heartwood. Heartwood deep yellow when fresh, turning, brownish or reddish – yellow on exposure. Wood moderately heavy, average weight 695 Kg/m³ (43 lb/ft) at 12 percent moisture content; fine-textured with straight grain (Purkayastha, 1982; Ramesh Rao and Juneja, 1992).

Gross structure: A diffuse-porous wood. Growth rings usually indistinct. Pores small to very small, not visible to the eye, distinct under the lens, moderately numerous to numerous, mostly solitary and in short radial multiplies of 2-3, evenly distributed, open; vessel lines indistinct. Soft tissues indistinct to the unaided eye, but just visible under the lens, diffuse to diffuse-in-aggregates. Rays fine, not visible to the eye, but distinct under the lens as very fine, light-coloured, numerous, closely-spaced lines (Purkayastha, 1982; Ramesh Rao and Juneja, 1992).

Strength: It is a moderately strong wood and is about 10% harder than teak. The comparative strength co-efficient expressed as a percentage of strength co-efficient of teak are, for constructional purpose – 80, for furniture and cabinet making- 95, for heavy packing cases – 105 (ISI, 1964; Purkayastha, 1982).

Seasoning: It is moderately refractory wood (ISI, 1973), but can be seasoned with very little degrade, even when stacked in the open provided it is protected against direct sun. Experiments conducted at Dehra Dun in the beginning of April with 2.5 cm thick planks having an initial moisture content of 40-50 percent, showed that timber was fully seasoned (Kapur, 1934). About 100cm thick planks were also found to air – season without any appreciable degrade except for opening out of original heart shakes (Kapur, 1934). The chief seasoning defeats are liability to surface cracking and splitting along the original defects. End splits continue to increase generally during period of seasoning, if once start in the log use of suitable end – coating of logs, therefore has been strongly recommended (Purkayastha, 1982).

It Kiln – seasons remarkably well. Freshly felled Kiln – seasoned stock retains its brightness better than air – seasoned timber. According to Rehaman's schedule V (Rehman, 1956) 2.5 cm thick planks takes about 13 to 16 days to season. Kin's states that as the timber is susceptible to climatic variations, provisions for shrinkage and swelling should be made in the manufacture of this timber into framed – up articles. He has recommended a clearance of 2.5 per cent for Kiln – seasoned stock (Purkayastha., 1982).

Natural durability: Haldu is not durable in contact with the ground or in exposed conditions but durable under cover. 'Grave Yard' tests carried out with three consignments of the timber at this Institute gave an average life of 30 to 35 months with a minimum of 22 to 28 and a maximum of 39 to 50 months (ISI, (1967; Purkayastha, 1982).

Insect and fungus attack: Freshly converted and seasoned timber does not stain or discolor. Adults and larvae of powder post ambrosia beetles (Platypodidae and Scolytidae) bore in dead wood. It is also damaged by the dry wood bores (Purkayastha, 1982).

Preservative treatment: The heartwood is easy to treat but the uses, to which the timber is currently put, do not necessitate preservative treatment (Purkayastha, 1982).

Working qualities: It is a very easy timber to saw and work with hand or machine. The working quality index as compared to teak is 108 (Rawat, and Rajput, 1975). it is one of the best woods for turnery. The cost of sawing and machining according to kinns in about 65 percent of that for teak. Trotter states it cannot be dovetailed in the dovetailing machine, because it breaks away. It finishes well but as the grain is liable to rise, damping off the surface is recommended before final sand papering for polishing or vanishing. It polishes

well but if polished with ordinary commercial lac – sprit French polish, it is liable to darken in colour. To retain the natural colour and texture of the timber, polish made of white shellac is advisable (Kinns, 1925). The timber also absorbs colour uniformly and can be stained to any color. It is also suitable for veneering (Purkayastha., 1982).

Utilization

Adina cordifolia is one of the best turnery and carving wood and is largely used for class I ply wood and folding chairs and camp furniture and house hold fitments (Deore *et al.*, 2020). The freshly cut wood is yellowish, though later it turns reddish brown. The wood is moderately strong and takes a good polish. It is used for interior use but not suitable for external work. It is used for canoes, packing cases, cigar boxes, furniture, toys, handles for brushes, agricultural implements, carving, picture frames etc. It has a great demand for making good quality combs and bobbins. It is also one of the best timbers for flooring and paneling (Pandey, 2016).

Adina cordifolia is largely used for structural work. It is one of the best Indian timbers suitable for flooring, paneling and for railway carriages (CSIR, 1948). It is also suitable for pulp and paper, construction, window frames, furniture, bobbins, piano keys and rulers (Chandel *et al.*, 2018). Wood is also used for pencil manufacturing (Trotter, 1959). Other uses are canoes and dugouts, planking of river boats, packing cases, cigar boxes, grain-measures, sieve frames, snuff boxes, furniture, yokes combs toys gunstocks, carving and turnery work, brush- backs and drums (Muthupandiyan *et al.*, 2019).





Door and Windows.

Haldu is used for variety of purpose. It is one of the best turnery carving wood and is largely used for toys, pen – holders, combs, rulers, metric, scales (ISI, 1970), handles and ordinary grade mathematical instruments (ISI, 1973), reels of cotton and other yarns, carom draughts (ISI, 1967), chess pieces (ISI, 1973), cricket stumps and bails (ISI, 1972), footwear lasts, grain measures, ornamental caskets and picture frames. It is a special field timber machines (ISI., 1955), flyer bobbins (ISI., 1965), jute spool centers for jute winding machines (ISI., 1955), flyer bobbins (ISI., 1966), weft pirns for shuttles (ISI., (1971), dobby barrels (ISI., 1967), and pirns for woolen and worsted plain blooms (ISI., 1969), wooden warp bobbins of rabbit spindles (ISI., 1971), slubbing and rover tubes and skewers (ISI., 1967), It is one of the commonest timber for various types of brush backs (ISI., 1963; 1964; 1964; 1964; 1964; 1967;1967; 1968; 1969; 1969; 1970; 1971; 1971; 1974; 1974; 1976). It is also specified for handlers for cuttings and shaping tools such as chisels, files, saws, augers, screw drivers, sickles etc. (ISI., 1975; Sekhar, and Bharathari, 1964), caulking and tin battens for plywood cases, plywood cases for packing tobacco for export, packing cases and crates (ISI., 1964; 1965; 1967; 1976), pent top cases (ISI., 1966), frame, core and cross band of flush door shutters (ISI., 1973), block boards and ballies (ISI., 1973) for general purposes (ISI., 1965; 1969) and mine work (ISI., 1967). It is also used for light furniture, paneling household

fitments, ceiling boards, door and window frames and shutters and nail – jointed timber construction (Purkayastha., 1982).

Medicinal Uses

There are many biologically active plants that symbolize a rich source of drugs, either alone or in combination, that have been proposed for various therapeutic uses to treat various diseases. *Adina cordifolia* is native to India, Ceylon, Thailand and Burma; it is widely distributed in the deciduous forests by traditional healers for the treatment of chronic cough and for use in jaundice, stomach pain, diarrhea and swelling of the stomach (Ribeiro and Maria, 2010). The bark is acrid, bitter, astringent, refrigerant, vulnerary, diuretic, demulcent, aphrodisiac and tonic. It is useful in vitiated conditions of pitta, wounds and ulcers, skin disease, gastropathy, fever and burning sensation. In the literature, *Adina cordifolia* is described as to have wide range of medicinal applications. It has been used as anti-amoebic, anti-inflammatory, anti-nociceptive, ant fertility (Rajput and Yadav, 2000; Pragyandip Parthasarathi Dash *et.al.*, 2019).

Its leaves, seeds, bark, and roots are used in traditional Indian medicine. Leaves and bark are used for cholera, cold cough, fever, headache, scars and skin blemishes and urinary complaints. Paste of stem bark and leaves are used for curing deep wounds, jaundice, stomachache and swelling in stomach (Jain *et al.*, 2005). Stem bark is used for the treatment of malarial fever, abdominal disorders, inflammation, wound and ulcer (Narayan and Singh, 2017). It acts as a good antibacterial, antiseptic, anti-bilious, anti-diabetic and febrifuge agent (Rokade and Pawar, 2013; Muthupandiyar *et al.*, 2019).

Leaf, Bark and root of *Adina Cordifolia* have been reported Antioxidant Activity from the methanolic solvent extract (Surveswaran *et al.*, 2007; Dai and Mumperm, 2010; Baral *et al.*, 2016; Kumari *et al.*, 2017; Aishwarya *et al.*, 2021). Leaf and stem of *Adina Cordifolia* have been reported Anti-cancer Activity from the Silver Nitrate solvent extracts (Sangameswaran and Saluja, 2012; Dubey *et al.*, 2020; Rao *et al.*, 2020; Aishwarya *et al.*, 2021). Leaf and stem of *Adina Cordifolia* have been reported Antibacterial activity from the Silver Nitrate solvent extracts (Hossan *et al.*, 2009; Mohan *et al.*, 2014; Sayeed and Ali *et al.*, 2015; Muthupandiyar *et al.*, 2019; Aishwarya *et al.*, 2021). Leaves of *Adina Cordifolia* have been reported Anti-Diabetes activity from the Hydro-alcoholic solvent extracts (Campus and Bhimber, 2016; Sijad, 2017; Nag, 2017; Aishwarya *et al.*, 2021). Bark extract of *Adina Cordifolia* have been reported Hepatoprotective activity from Acetone (AEAC) solvent

(Medjahed *et al.*, 2016; Singh *et al.*, 2018; Aishwarya *et al.*, 2021). Bark extract of *Adina Cordifolia* have been reported Cytotoxic activity from Crude methanol solvent (Rashid *et al.*, 2016; Nordin *et al.*, 2016; Raypa, 2021; Aishwarya *et al.*, 2021). Root and Bark of *Adina Cordifolia* have been reported Antiamoebic activity from Benzene and ethyl acetate solvent extracts (Iqbal *et al.*, 2009; Baral *et al.*, 2016; Ahmed *et al.*, 2016; Seshian *et al.*, 2020; Aishwarya *et al.*, 2021). Root barks of *Adina Cordifolia* have been reported Anti-inflammatory and Analgesic activity from Petroleum ether and ethyl solvent extracts (Jain *et al.*, 2006; Asif, 2015; Thant, 2019; Aishwarya *et al.*, 2021). Stem of *Adina Cordifolia* have been reported Anti-ulcer activity from Chloroform solvent extracts (Kasinadhuni *et al.*, 1999; Aishwarya *et al.*, 2021)

CONCLUSION

Adina Cordifolia has historically a high demand due to its medicinal properties and therapeutic value. *Adina Cordifolia* has constituents in disease prevention and treatment. It is required to promote the commercial plantation in allover India. Paste from stem bark or leaves of the leaves of the plant is useful for dysentery, heel pain, jaundice, stomach pain, malaria fever, stomach swelling and low-viability direct sowing of *Adina cordifolia*.

Following a comprehensive review of the existing literature, it was found that there has been tremendous scope for more research to be conducted on this species, particularly on its pharmacological activities. *Adina cordifolia* has traditionally been in high demand due to its medicinal attributes. The isolated constituents of *Adina cordifolia* may potentially be utilized in future clinical assessments and its better pharmacological applications, as well as serve as adjuvants to current medications. This article may give an insight to the enthusiastic researchers, students and others in various directions, assisting them in recognizing and harnessing the therapeutic potential of these plants for the benefit of public health.

Due to the destructive nature of the harvest, the genus endemic species *Adina cordifolia* is classified as a harmful organism. Protestant martyrdom is therefore necessary to save the plant from extinction.

Abbreviation

cm- Centimetre; Kg/m³ - kilogram per cubic meter; mm- millimeter; MPa- Megapascal; N/mm² - Newtons/square millimeter; % - percentage

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