Study of Morpho-anatomial Phytocemical and Ethnobotany of Polyalthia longifolia

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Abstract:
In India's drier regions, *Polyalthia longifolia*, a member of the Annonaceae family, is a native plant known as "Ashoka." Additionally, Southeast Asia, Africa, Australia, and New Zealand all grow it. Other names for Polyalthia longifolia include green Champa, fake Ashoka, graveyard tree, mast tree, and Buddha tree. Anatomical traits change in terms of size, distribution, and dimension is essential for both tree breeding and use, as differences in a plant's physiological processes and other wood qualities, such as The uneven expression of anatomical traits, which in turn influences the quality of the finished product, is the primary cause of features like stomata, cuticular epidermal cells, and distinctive features of leaves of wood species. This article gathers a thorough examination of the information that is currently known about Polyalthia longifolia's morphoanatomical phytochemicals and their ethnobotanical characteristics. There is also discussion of its possible uses in the treatment of various ailments.

Introduction

The tall, attractive Polyalthia longifolia tree is a member of the Annonaceae family. It is available across India and many tropical nations. Due to its ability to significantly reduce noise pollution, it is frequently planted as an aesthetic street tree. Steroids, alkaloids, terpenoids, phenolics, and flavonoids are among the substances found in this plant and are used in traditional medicine to treat fever, skin conditions, diabetes, and heliminthiasis. Significant biological and pharmacological effects of Polyanthia longifolia include anti-fungal, anti-leishmanial, anti-ulcer, anti-inflammatory, anti-cancer, hypotensive, anti-oxidant, anti-bacterial, anti-inflammatory, and termicidal action.False Ashoka, Buddha Tree, Green Champa, Indian mast tree, and Indian fire tree are other names for Polyalthia longifolia. It shows development in symmetrical pyramids. It has long, thin, lanceolate leaves with undulate edges, as well as weeping pendulous branches. The tree is 30 feet tall. Traditional medicine uses it to treat duodenal ulcers using a variety of herbal preparations. The herb is used in traditional medicine to treat helminthiasis, diabetes, hypertension, and a variety of skin conditions. The plant's leaves have a pleasant scent. Typically, they are used for adornment. In India, the bark is used to cure pyrexia and other bleeding diseases. When Polyalthia longifolia was first used, it was reported by Troup RS in 1909 and RN Chopra in 1982. They used it to treat gonorrhoea, as well as snake and scorpion wounds and stings. Blood pressure and pulse rate are decreased by the plant's bark's aqueous extract. Traditional medicine uses a variety of herbal treatments to treat duodenal ulcers. The herb has been used in traditional medicine to treat helmiinthiasis, diabetes, hypertension, and skin conditions as well as fever. From the plant, a variety of physiologically active substances have been identified.

History Distributon

P. longifolia is a native of Sri Lanka and India, and it has now spread to other parts of the Indian subcontinent. The mast tree is a large, symmetrical, evergreen tree with plenty of dark green foliage. In many tropical nations, it is mostly planted for garden design. The plant is mostly grown as a street tree in India, Sri Lanka, and Southeast Asia. The plant is grown in Southern Taiwan for a variety of reasons (Chen CY 2000).

Geographical Distribution

Arunachal Pradesh, Bihar, Punjab, Rajasthan, Maharashtra, Manipur, Mizoram, Tamil Nadu, Gujarat, Jharkhand, Karnataka, Uttar Pradesh, Delhi, Goa, Kerala, Madhya Pradesh, and Sri Lanka are all included in the native geographic distribution. Bhutan, China, Pakistan, and Nigeria, the Philippines, Malaysia, East Africa, Madagascar, Northern Australia, and Melanesia, Bangladesh, and Trinidad and Tobago in the Caribbean Islands are all included in the unusual geographic distribution. natural setting *P. longifolia* requires a tropical or subtropical environment, and it may reach a height of 1,500 m in India.It can survive for up to eight months during dry seasons and naturally grows in sub-humid to humid regions with 800-3,800 mm of yearly rainfall. For growth, it needs frost-free locations with temperatures between 16 and 35 °C. Rich, well-draining clay-loam, loam, sandy-loam, and loamy-sand soils with a pH of around 5.5-7.5 are necessary for *P. longifolia*. It can endure drought conditions and endure the winter outside at temperatures of around 30 to 40 degrees Fahrenheit. For plants to develop, full exposure is necessary.

Varieties of plant

P. longifolia var. pendula and P. longifolia var. angustifolia are the two variants of the plant that are available. Due to its obvious nature, P.longifolia var. pendula draws a lot of attention. Shorter branches and a thin, straight trunk are characteristics of this cultivar. The tree has a thin columnar form as a result of the downward-inclined branches. The bark of P. longifolia var. angustifolia is smooth and grey. The tree's crown is shaped like a pyramid as a result of the wider distribution of its branches.

Morphological Discription

Young plants have weeping pendulous branches and straight stems. The longest branch is observed near the base of the stem and gets shorter towards the end, giving the impression of a conical crown. Long, slender, glossy, dark green leaves. The form of the leaf blade is ovate-oblong. The bowl-shaped abaxial sections and the straight adaxial side are visible in the transfer section of the leaf through the midrib. The walls of the epidermal cells are thin, broad, and polygonal. The walls are either straight or hardly wavered. Six layers of collenchyma cells are seen on either side beneath the epidermal cells. Sclerenchymatous ring surrounds the vascular bundle in the middle of the rib. Flowers have curved petals and are a lovely light green tint. The blooms only bloom for a brief time. Usually, it takes two to three weeks. Oval-triangular is how seals look. Flowers have greenish yellow petals. There are 20–25 carpels in each egg. Sessile stigmas exist. Fruits are borne in clusters of 10-20.It is usually void in shape. Initially fruits are green in colour but later it turns in to purple or black when ripe. Seeds are pale brown in colour and ovoid in shape.

Anatomical Discripton;-

Wood is a complex structure, been the product of trees with individual characteristics especially in hardwood species where the wood is compost of different cellular structures such fibres, vessels, rays and parenchyma cells (Zhang and Zhong 1992). Understanding the variation in anatomical properties wood of this species in terms of size, distribution and dimension is important in tree breeding and wood utilisation, since variations in physiological functions of a standing tree and other wood properties such as strength is mainly the function of differential expression of anatomical properties and hence affecting the end use quality (Zobel and van Buijtenen 1989). Vessels play an active role in the to and fro conduction of water and sap between the roots and the crown while fibres are chiefly responsible for the strength and longitudinal shrinkage of the wood(Panshin and de Zeeuw, 1980). Cell diameter in relation to cell wall thickness and the proportion of thin walled to thick walled cells determine density which is closely correlated to mechanical strength, machining and working properties and yield in pulping (Ocloo and Laing, 2003; Hamid et al., 2011). The mean radial cell proportion showed an increasing trend proportion of some of cells from inner wood to outer wood with values ranged between 11.08% and 11.60% for vessel proportion, 54.31% and 56.99% for fibre proportion and 21.56% to22.52% for rays.The proportion of vessels decreased slightly between the inner wood and middle wood and then increased again towards the bark (Table 2). This pattern of radial variation in the proportion of vessels was earlier reported by Bosman et al, (1994) and was later confirmed by Chowdhury et al, (2011) they attributed the increase in vessel proportion to increase of vessel size and constant vessel frequency from pith to bark this might have an impact on the density and mechanical properties of the wood. The proportion of fibres gradually increased along the radial position.The proportion of rays was almost constant in the inner,middle and outer wood zones, whereas the proportion of axial parenchyma decreased from the inner wood to outer wood. The decrease in the proportion of axial parenchyma caused an increase the proportion of fibres near the bark. This assertion was made by Taylor and Wooten (1973) they observed that an increase in the abundance of one type of cell is associated with a decrease of at least one other cell type.

Phytochemical Studies

Numerous compounds have been reported from different parts of the plant, mainly from leaves, stem bark, seeds, fruits, and roots. The structures of the chemical constituents extracted from the plant.

Chemical constituents extracted from the leaves

Polyanthia longifolia mainly contains diterpenoids, alkaloids, 64 Pharmacognosy Reviews | January-June 2010, tannins, and mucilage. The chief components of the plant are O-methylbulbocapnine-N-oxide, polyfothine, N-methylnandigerine-N-oxide, oliveroline-N-oxide, pendulamine A, N-pendulamine B, 8-oxopolyalthiane, 16-oxo-5, 13-halimadien-15-oic acid, 16-Oxo-3, 13-clerodadien-15-oic acid, 16-hydroxycleroda-3, 13-dien-16, 15-olide. Aporphine and azafluorene alkaloids,

proanthocyanidins, h-sitosterol, and leukocyanidin, clerodane, and ent-helimane,diterpenoids were isolated from the leaves, stem, and stem bark. Carbohydrate was isolated from the seeds. A novel azafluorene alkaloid, polylongine (5-hydroxy-6- methoxy-1-methyl-4-azafluoren-9-ol), and 3 new aporphine N-oxide alkaloids named (+)-O-methylbulbocapnine-β-N-oxide, (+)-O-methylbulbocapnine-α-N-oxide,and(+)-N methylnandigerine-β-N-oxide were isolated from the leaves of P. longifolia (Sonn.) Thwaites (Annonaceae).

Ethnobotanical Description

In the Indian traditional system of medicine, *P. longifolia* is used to treat various disorders, such as hypertension, diabetes, fever, skin diseases, pyrexia bleeding disorders, and helminthiasis. The plant extracts acts as an effective remedy for various ailments, such as rheumatism, scorpion sting, menorrhagia, and various digestive system complications [Dixit, P., Mishra 2014].

Pharmacological studies

Antiulcer activity

The methanolic extract of *P. longifolia* leaves was evaluated for in vivo ulcer-protective function. The experiment involved the use of wistar albino rats, in which ulcers were induced by ethanol and ethanol/HCl. Results showed that the extract possessed a good dose-dependent antiulcer activity [S.Chanda , Y.Baravalia,M.Kaneria 2011]. The aqueous and ethanolic extracts of the plant leaves showed an ability to reduce total acidity, ulcer index, and gastric content and enhance the pH of gastric pylorus ligation ulcer mode.(RK, Sharma,S.Mandal 2011)

Antiplasmodial activity

P. longifolia leaf aqueous extract evaluated for in vivo antimalarial activities in chloroquine-resistant Plasmodium berghei (ANKA) strain. It showed a suppression of parasite multiplication. The ethanolic extract of *P. longifolia* stem bark showed strong antimalarial activities against drug-resistant Plasmodium falciparum infections

Anticancer activity

The methanolic extract of *P. longifolia* leaves possessed a good efficacy toward prostate cancer cells. The extract had the ability to decrease cell growth and block the process in the G1/S phase of the cell cycle. *P.longifolia* induced apoptosis by the activation of the intrinsic apoptotic machinery. Alcohol extract and chloroform fraction of *P. longifolia* leaves had the ability to induce apoptosis in different human cell lines, such as human leukemia HL-60 cells, SF 295 (CNS), and SW-620 (colon).

The inhibition of human lung cancer cell line by the ethanol extract of *P. longifolia* leaves was also reported. Christina et al. studied the anticancer activity of the methanolic extract of *P. longifolia* fruits. The study involved the use of N-nitrosodiethylamine and phenobarbital, which induced hepatocellular carcinoma in male wistar albino rats.

Wound healing property

The wound healing effect of the ethanolic leaf extract of *P. longifolia* was examined using an excision wound model in rats. The study was assessed up to 14 days on the antero-dorsal side of the rats' skin. The extract showed wound healing action by wound contraction upon topical application.The bark extract of *P. longifolia* in different solvents, such as methanolic, n-hexane, and ethyl acetate for the isolation of active compounds, were responsible for the significant wound healing action. It increased the epithelization speed and contraction property of myofibroblasts and exhibited healing activity.

Antimicrobial activity

Gram-positive bacteria, such as Bacillus megaterium, and gram-negative bacterial and fungal strains, such as Proteus mirabilis, Candida tropicalis, and C. albicans resp. Were more susceptible to the methanolic extract of the *P. longifolia* leaves (S.Chanda, Y.Baravalia 2011). *P. longifolia* showed less activity toward gram-negative bacterial strains (S.Chanda, R.Nair 2010). An antibacterial activity against Escherichia coli (E. coli), Staphylococcus aureus (S. aureus), Pseudomonas aeruginosa, and Bacillus cereus microorganisms was exhibited by the ethyl acetate extract of the plant leaves . *P. longifolia* exhibited a marked antibacterial activity against Klebsiella pneumoniae, E. coli, and Bacillus subtilis

The extract of various parts, such as ripe and unripe pericarps and leaves strongly inhibited various fungal strains, such as Pythium aphanidermatum and Fusarium oxysporum [Dileep N, Junaid S 2013]. The seed oil of *P. longifolia* had a strong growth inhibitory potential against S. aureus. Preparative thin layer chromatography isolates of the ethanolic extract of *P. longifolia* showed a significant level of inhibition potential against E. coli, Klebsilla aerogenes, Pseudomonas aerogenes, Salmonella typhi, Shigella flexneri, and S. aureus [Sampath M, Vasanthi M 2013]

Antipyretic activity

K Annan et al. examined the antipyretic activity of the methanol extract of the leaves, stem bark, and roots of the plant by using a lipopolysaccharide-induced antipyretic activity model. The plant extracts showed a significant antipyretic activity, which was typically higher than acetylsalicylic acid. The order of percentage of inhibition was root extract, leaf extract, and stem bark extract, respectively. The dose-dependent antipyretic activity of the plant made it suitable for the treatment of various ailments.

Antioxidant activity

The ethanol extract of the ripe pericarp of *P. longifolia* indicated the presence of high phenolic content; thus, the extract showed significant antioxidant activity [Dileep N, Rakesh KN 2012]. The seed oil showed less antioxidant activity than ascorbic acid, whereas the methanolic extract of the leaves showed more activity than ascorbic acid. Sampath and Vasanthi studied the ethanol extract of the leaves and showed the presence of three flavonoids, namely rutin, chrysin, and daidzein-related isomer, along with an unknown flavonoid. The flavonoids played a significant role in inducing antioxidant activity. A promising antioxidant activity was exhibited due to the 3-O-methyl ellagic acid compound from the stem bark of the plant. The methanolic extract of *P. longifolia* fruits had the potential to scavenge free radicals and showed maximum percentage of inhibition [Rajangam, J., & Christina, A. J. M. (2013).].

Hepatoprotective activity

Jothy and Aziz et al. demonstrated the hepatoprotective action of the plant by using a liver injury model. According to the study, *P. longifolia* had the ability to cure and protect various biochemical and histopathological changes occurring in various organs. In mice, the plant protected oxidative damage possibly by increasing the antioxidant protection mechanism. The methanolic extract of *P. longifolia* fruits had the ability to protect from hepatic injuries and liver damage by decreasing elevated serum enzymes, bilirubin, and lipid peroxidation [Rajangam, J., & Christina, A. J. M. (2013].

Hypoglycemic or antihyperglycemic activity

Lakshmi et al. evaluated the antidiabetic activity by administrating the bark extract of *P. longifolia* for 21 days in alloxan-induced diabetic rats. The study showed that the bark extract exhibited similar effectiveness to that of glipizide in controlling Type 1 diabetes. The bark extract in methanol, ethylacetate, and n-Hexane solvents showed a promising hypoglycemic activity by decreasing insulin levels. The extract also revealed homeostasis in biochemical parameters, such as cholesterol, urea, creatinine, and total protein as well as in enzyme activities . The solvent extract of *P. longifolia* leaves had the ability to lower glucose levels; however it did not modify biochemical parameters. The extract showed an antihyperglycemic effect against sucrose-induced hyperglycemia.[Nair, R., Shukla, V., & Chanda, S. (2007).]The α-amylase and α-glucosidase enzymes catalyzed carbohydrate metabolism and increased plasma glucose level. The ethanol and chloroform extracts of the *P. longifolia* leaves had the ability to inhibit such enzymes. Therefore, the extract had the ability to reduce the rate of glucose absorption, which consequently inhibited a postprandial rise in plasma glucose.

Conclusion

P. longifolia holds a prominent position in the ancient medical system of India. The features of these plant fibres that were examined revealed an upward tendency in correlation with cambial growth. Through anatomical characterization, Polyalthia longifolia has been characterised as a distributed porous wood. From the inner to the outer wood, the length, diameter, and lumen width of the fibres all grew while the thickness of the cell walls decreased. All of the anatomical features examined, with the exception of fibre length, do not alter substantially from the inner to the outer wood, demonstrating wood homogeneity along the radial location in the stem of *Polyalthia longifolia. P. longifolia* holds a prominent position in the ancient medical system of India. According to the thorough literature assessment, P. longifolia is a medicinal plant with a wide range of pharmacological effects. Preclinical trial tests have confirmed its incredible therapeutic efficacy. *P. longifolia* has the ability to treat a wide range of conditions, including liver damage, inflammation, hyperuricemia, diabetes, ulcers, gonorrhoea, and many other infectious disorders. To investigate new areas of plant efficacy, it is vital to use contemporary testing and assessment approaches. therapeutic studies must be conducted in the future, and acceptable plant formulations must be developed with real-world therapeutic use in mind.

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