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Mahua's Medicinal Marvels: Bridging Traditional Knowledge and Ethnomedicine

Ashish Kumar Yadav*, Darshita Rawat, Kumud Dubey
ICFRE- Eco- Rehabilitation Centre, Prayagraj (U.P.) India

****Corresponding Author***
Email- ashishbotanist1995@gmail.com

ABSTRACT

Madhuca longifolia, commonly known as Mahua, holds significant ethnomedicinal value in various indigenous communities. Traditionally, different parts of the Mahua plant, such as flowers, seeds, and bark, have been utilized for therapeutic purposes. The flowers are well-known for their role in formulating medicinal tonics, believed to alleviate conditions such as cough, cold, and fever. Additionally, the seeds are traditionally employed for their potential antipyretic and anti-inflammatory properties. The bark of Mahua is often used in decoctions to address gastrointestinal disorders. Scientific investigations have identified bioactive compounds in Mahua, including flavonoids, saponins, and terpenoids, which contribute to its pharmacological activities. Research on Mahua's ethnomedicinal uses aligns with traditional knowledge, revealing its potential as an antimicrobial, antioxidant, and anti-inflammatory agent. Additionally, the seeds are valued for their emollient and anti-inflammatory properties, often used topically to alleviate skin conditions such as eczema and dermatitis. The integration of ethnobotanical wisdom with scientific exploration highlights the promising pharmacological prospects of Mahua in the realm of traditional medicine. By bridging the gap between traditional wisdom and scientific validation, this review underscores mahua as a valuable resource in the pursuit of holistic healthcare solutions. Indigenous traditional knowledge was acquired through a questionnaire-based survey conducted among local and tribal communities residing in a selected region, primarily focusing on the utilization of Mahua (Madhuca longifolia) flowers. These communities, situated near riverbanks, engage in the collection of Mahua flowers to produce country liquor, and participate in commercial activities by selling both flowers and seeds at local markets. The study incorporated diverse documentation methods, including video recordings and photographs, to capture utilization-based practices, storage techniques for flowers and seeds, and information pertaining to economic enhancement. Additionally, the documentation of Indigenous Traditional Knowledge (ITK) encompasses the multifaceted applications of Mahua, ranging from medicinal purposes to the preparation of traditional foods such as halwa, meethi puri, kheer, burfi, mahua flakes, lapsi, pudding, and pickle. Notably, Mahua flowers also serve as a nutritious feed for livestock, contributing to improved animal health. In times of scarcity, a concoction of Mahua flowers and sal seeds is prepared, serving as a grain-free substitute.

***Keywords**: Madhuca longifolia, ethnomedicinal value, Indigenous Traditional Knowledge (ITK), Tribal livelihood.*

INTRODUCTION

Since the age of Ayurveda, herbal remedies have stood resilient as the cornerstone of traditional medicine, revered for their robust pharmacological impact, and hailed as promising avenues for novel drug development (Grover et al. 2002). Embraced for their potent effects, these botanical wonders continue to be the bedrock of healing traditions. Jha and Mazumder, 2018 highlighted

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that over 75% of the populace in developing nations relies steadfastly on the therapeutic prowess of traditional medicines. Through scientific exploration, it has become evident that compounds derived from plants showcase a remarkable spectrum of efficacy and safety, boasting a distinct advantage of inducing fewer side effects in comparison to their synthetic counterparts. The profound linkage between age-old wisdom and contemporary scientific validation serves to accentuate the enduring importance of herbal medicines in fostering well-being and resilience across diverse populations.

In this context, *Madhuca longifolia*, a tree renowned for its myriad medicinal qualities, stands as a noteworthy example. The integration of traditional knowledge with empirical scientific evidence highlights the potential therapeutic value embedded in this botanical resource, further emphasizing its role in contributing to the health and vitality of varied communities (Yadav et al. 2022). Mahua is a plant that is gaining prominence in both the cultural and economic spheres of traditional communities. Tribals worship Mahua because they believe all parts of the plant contribute to human well-being, considering it sacred and integral to their culture, where the belief in the tree's spiritual significance also includes its ability to absorb water. It is a multipurpose tree which fulfils three fundamental needs of tribal individuals i.e. Food, Fodder and Fuel (Patel et al. 2011, Yadav et al. 2023).

The Mahua tree stands at around 20 meters tall and features foliage that is either evergreen or semi-evergreen, as noted by Tengenakai (2013). The Mahua tree's leaves contain saponin, an alkaloid glucoside, while its seeds have been discovered to contain sapogenin and other fundamental acids. Mahua flowers are renowned for their elevated levels of reducing sugars and nutrients, making them edible. The corolla, often referred to as Mahua flowers, is abundant in sugar and contains significant amounts of vitamins and minerals, according to Singh and Singh (2005), Singh and Singh (2005).

Traditionally, the flowers have served various purposes including as astringent, chronic tonsillitis, demulcent, cooling agent, tonic, aphrodisiac, and for treating helminth infections, pharyngitis, acute and bronchitis. *Madhuca longifolia* leaves possess expectorant properties and are utilized in the management of chronic bronchitis and Cushing's disease.

Taxonomy & Description

Botanical Name : *Madhuca longifolia*
Family: Sapotaceae
Subfamily: Caesalpinioideae
Tribes: Caesalpinieae
Genus: *Madhuca*
Species: *longifolia*
Order: Ericaleae

Madhuca longifolia, commonly known as Mahua, is a deciduous tree indigenous to the Indian subcontinent and prevalent in tropical and subtropical areas. The tree reaches maturity and begins bearing fruit between 8 to 15 years of age, with fruit production continuing for up to 60 years. It typically attains a height of around 20 meters, characterized by a wide-spreading canopy and a straight trunk. The leaves are arranged alternately, elliptical in shape, and possess a glossy green appearance, with lengths ranging from 7 to 15 centimeters.

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Fig 1: Parts of Madhuca longifolia (Mahua)

Mahua trees exhibit blooming of fragrant, creamy-white flowers in clustered panicles during the spring season, attracting diverse pollinators. The fruits are spherical or oval-shaped drupes, approximately 2 to 3 centimeters in diameter, housing a single large seed enveloped by fibrous pulp. The flowers are petite and succulent, exhibiting a dull or pale white hue, clustered in defined fascicles near the branch tips. The corolla is tubular, possessing a fresh, pale-yellow color, emitting a fragrant aroma, and ephemeral in nature (Varier and Vaidyarathanam 1995). Mahua is esteemed for its multifaceted utility, with its various components serving culinary, medicinal, and economic purposes among indigenous populations.

Synonyms of Mahua

English	Indian butter tree
Hindi	Mahua, Mohwa, mauwa
Bengali	Mahwa, Maul, Mahwla
Marathi	Mahwa, Mohwra
Gujrati	Madhuda
Telgu	Ippa
Tamil	Illupei, Ewpa
Kannad	Tuppe
Malyalam	Poonam, Ilupa
Oriya	Mahula, Moha, Madgn

Distribution and Habitat

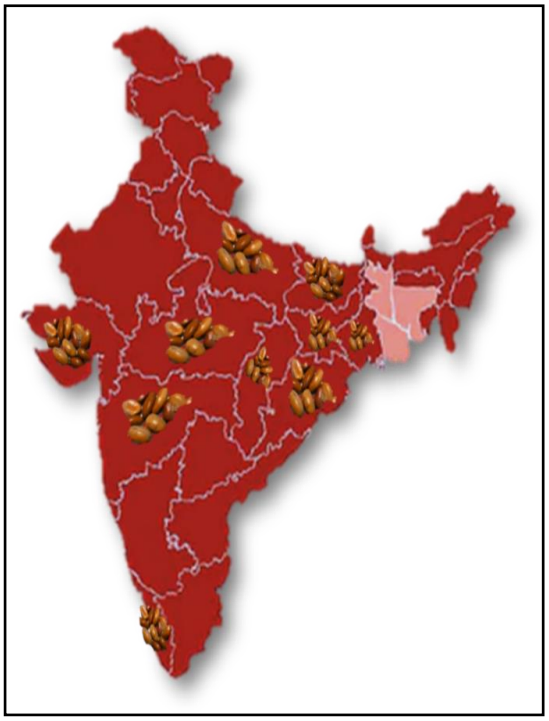

Fig 2: Distribution of Mahua in India

It is adjusted to arid environments, being a prominent tree in tropical mixed deciduous forests in India in the states of West Bengal, Chhattisgarh, Jharkhand, Uttar Pradesh, Bihar, Maharashtra, Madhya Pradesh, Kerala, Gujarat and Odissa (Fig 2). The tree, *Madhuca longifolia*, exhibits adaptability to a diverse range of soils, with optimal growth observed in sandy soil conditions. It can also thrive in shallow, boulder-strewn, clayey, and calcareous soils. Found at altitudes up to 1200 meters, its habitat typically experiences mean annual maximum temperatures ranging from 28 to 50°C and minimum temperatures of 2 to 12°C. Annual rainfall in its habitat ranges from 550 to 1500 mm (Sinha et al. 2017). This species demonstrates resilience to drought conditions, has a high requirement for sunlight, and is susceptible to suppression under shade.

Material and Methods

Ethno-botanical survey of Mahua: A study was undertaken within the natural forest stands of Mahua in Uttar Pradesh. Initially, a survey was conducted across various forests within the tribal locality in Vindhyan and Bundelkhand regions. Fifty people were interviewed in each

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region. Total 100 people were interviewed. These forests were categorized into disturbed and undisturbed Mahua populations based on criteria related to protection measures and anthropogenic factors. The survey involved the participation of local and tribal communities, employing indigenous traditional knowledge to explore the medicinal and ethnomedicinal significance of Mahua through a questionnaire-based methodology. In this survey, we conducted a comprehensive investigation into the utilization of various parts of the Mahua tree by local and tribal communities for the treatment of ailments affecting different regions of the human body. Through rigorous scientific inquiry, we explored the traditional knowledge and practices surrounding the medicinal applications of Mahua, elucidating its efficacy in addressing diverse health issues across a spectrum of bodily systems and organs. Literature on ethnobotany of Mahua was also collected from available sources.

Bio-Chemical Analysis of Mahua Flower: Biochemical composition (Total Sugar and Protein) of Mahua flower was analyzed by using methods described by Sadasivam and Manickam, 1996.

Oil Extraction from Seed: The seeds of Mahua (*Madhuca longifolia*) are recognized as the most extensively utilized part of the plant. To extract oil from these seeds, a common method employed is the Soxhlet extraction technique (Azmir et al. 2013). In this method, the seeds are initially ground into a fine powder. This powder is then packed into a thimble, which is placed in a Soxhlet extractor setup. A suitable solvent, often hexane, is continuously circulated through the extraction chamber. As the solvent passes through the thimble containing the seed powder, it dissolves the oil constituents, thereby extracting them from the seeds. The solvent-oil mixture is then collected in a separate flask, and the solvent is subsequently evaporated, leaving behind the extracted Mahua oil. This oil can undergo further processing and refinement steps to enhance its quality and purity, making it suitable for various industrial and commercial applications, including food, pharmaceuticals, and biofuel production. The oil yield from Soxhlet method (Munasinghe & Wansapala 2016) was calculated as follows:

% Crude oil content in the sample = $\frac{X-F}{W} \times 100$

X - Weight of the flask with oil and chips
F - Weight of the flask and the chips
W - Weight of the kernels

RESULTS & DISCUSSION

As per biochemical analysis, the total sugar of Mahua flower was 51.35 g/100gram of fresh flower weight and Protein was 5.8 % of fresh flower weight. Oil content was ranging from 42 % to 49% of seed weight.

Ragi, Agaria, Khond are major tribal population reside in Vidhyan region of Uttar Pradesh. Sahariya, Gond, Chero Kol and Mawasi tribe reside in Bundelkhand region of Uttar Pradesh. Medicinal usages of Mahua by these tribal was studied and summarized and depicted in figure 3. From survey it was informed by 80 percentages of respondents that the young and soft twigs are being used for cleaning teeth by tribal people of area. The paste or decoction of mahua bark is used for dental disease and dental ach treatment. Bark is also used as Astringent and about 63 percentage of respondents reported that the using its bark for this purpose. The paste of Mahua Bark is used for itching, reported by 47 percentage of respondents.

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About 67 percentage of people informed that the mahua Bark decoction is used for fever and fatigue treatment. The reported that leaf of Mahua is known for enhancing the lactation in their Livestock. About 75 percentage of responded informed that they used to feed their livestock with Mahua leaves after delivery. About Leaf paste for wound healing 67 percentage respondents reported that they are using leaf and bark paste for Rheumatism treatment. It is well known fact that Mahua flower is used for liquor production and is a major source of their livelihood. Mahua Flower is given to lactating women for enhancing milk production and about 78 percentage of respondent informed regarding this fact.

Dried Mahua Flower with milk is taken as food supplement for strength. Mahua fresh flower juice is taken for cough treatment. This is due to its high Vitamin C content (Dave *et. al*., 2018). Seed oil of Mahua is used for Skin Disease treatment. Seed oil is also used for Gout in Massage, and about 70 percentage of respondents reported this. Seed oil is also used for cooking and they use oil to exchange it for other necessary products like soap and required goods in 'Barter' system. The 80 percentage of people accepted it. Seed oil is also for hair growth. About 48 percentage people is used seed oil in skin treatments like itching, drying etc.

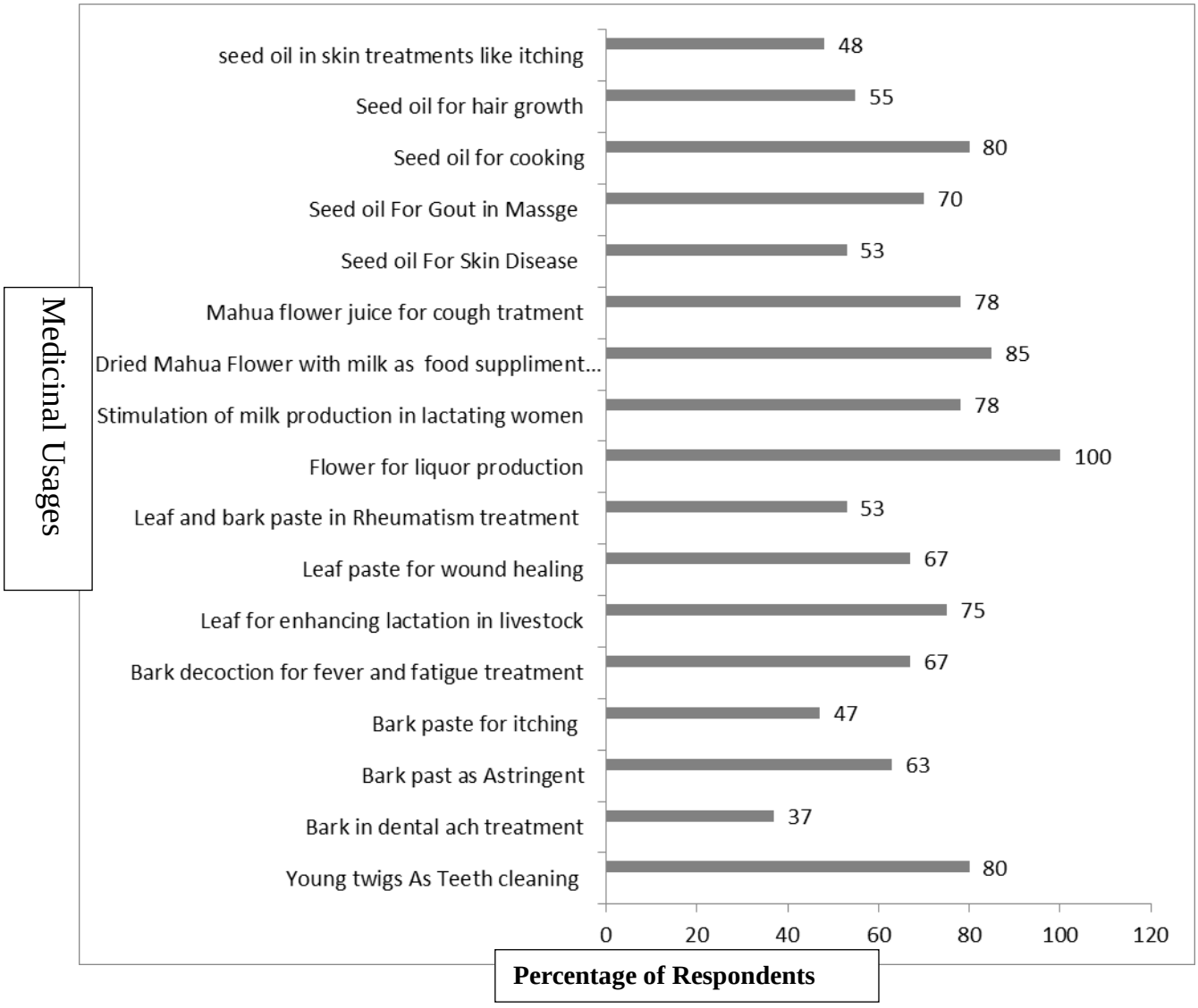

Figure 3: Different Medicinal Usages of Mahua by tribals

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From literature, it was observed that in Ayurveda, *mahua* is very important plant (Dave *et. al*., 2018) and it supported above survey findings. Its flower is known cooling agent and carminative, to avoid gas problem in the gastrointestinal tract. It is also known for lactation inducer property. It is also considered to have astringent property i.e. it shrinks or constricts body tissues and stop bleedings from cut (Sinha *et al*, 2017). It is also advantageous in heart, skin, and eye diseases (Amia and Ekka, 2014).

Mahua flowers are used traditionally as a remedy of many diseases by tribal people of the study area (Dave *et. al*., 2018). Mishra and Pradhan (2013) mentioned that tribal people give raw flowers to mothers after delivery for enhancing their milk. Roasted flowers are consumed to cure cough and bronchitis by tribals (Palani *et al*, 2010). Acharya and Srivastava, (2008) studied that *madhuca* flowers can treat impotency and general weakness when consumed with milk. Flowers fried in ghee act as a cooling agent and help to cure piles.5 Table 4 provides brief description of utilization of *mahua* flower as remedy for various diseases by traditional people.

The literature investigation highlights the myriad health, nutritional, and economic advantages conferred by *Madhuca longifolia*. Utilizing a questionnaire-based survey approach, the study has yielded a thorough comprehension of the varied applications attributed to distinct parts of the Mahua tree (table 1), which have been comprehensively expounded upon and analyzed below:

Table 1: Parts wise use of *Madhuca longifolia*

Parts of Plant	Medicinal Properties
Bark	Gum ailments, Tonsillitis, Diabetes, Stomach discomfort, Anti-venom treatment for snake bites, as well as its astringent, emollient, fracture-healing, and anti- itch properties.
Leaf	Enzymatic processes, wound healing, anti-burn treatments, bone fracture remedies, emollient formulations, skin disease management, rheumatism alleviation, and headache relief.
Flower	Refrigeration, liquor production, jelly making, preparation of sweet syrup, expectorant properties, stimulation of milk production in lactating women, diuretic effects, anthelmintic activity, management of strangury, treatment of verminosis, hepatoprotective effects, and alleviation of Gastropathy.
Oil	Efficacy in laxative properties, as well as in the treatment of piles, hemorrhoids, and as an emetic agent. Additionally, it exhibits anti-earthworm activity.

Source- (Wealth of India, 2007, Seshagiri and Gaikwad, 2007)

The findings of our research underscore the remarkable therapeutic potential inherent in Mahua, revealing its multifaceted role in addressing a spectrum of health concerns within indigenous communities. Through the systematic exploration of indigenous practices and beliefs, we have unveiled the rich pharmacological repertoire of Mahua, bridging the gap between traditional wisdom and modern scientific inquiry. The questionnaire-based approach has enabled a nuanced exploration of Mahua's medicinal marvels, shedding light on its efficacy in treating ailments ranging from respiratory disorders to inflammatory conditions. Moreover,

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our study underscores the cultural significance of Mahua as a revered botanical resource deeply ingrained in the social fabric of tribal societies. By integrating traditional knowledge with scientific investigation, we pave the way for the validation and documentation of Mahua's therapeutic properties, offering insights into its potential applications in modern healthcare.

This convergence of traditional wisdom and contemporary research represents a promising pathway towards the advancement of ethnomedicine (Table 2) and the preservation of indigenous healing traditions (Mishra and Poonia , 2019).

Table 2. Products prepared from mahua flowers

Traditional products from flowers	Value- Added products from flowers
Fermented products: • Local liquorCountry (made from dried flowers) • Mahuli **Non - Fermented products:** • Cake prepared with mahua flowers and cereals or root crops • Sweetener in dishes like puri, gulgula, halwa etc • Staple grain substitute • Cattle feed (spent flowers)	**Fermented products:** • Mahua Vermouth • Mahua wine • Brandy • Citric acid • Lactic acid • Citric acid • Acetone **Non- Fermented products:** • Beverages • Sweets (ladoo, barfi, kheer, lapsi) • Confectionary (candy,toffees) • Mahua jan, jelly, marmalade • Glazed flowers, candied flowers • Juice concentrates • Purees • Sauces

Through the implementation of a questionnaire-based survey methodology, this study has facilitated a comprehensive understanding of the diverse applications associated with different components of the Mahua tree beyond its medicinal properties. In addition to its medicinal value, Mahua possesses numerous other attributes that have been elucidated through this research endeavor. Tribals have also prepared some value added products. For example they used to prepare Mahua Flower Flakes which may be taken with milk and can be stored for longer duration. Its juice is used as sweetener also. The fruit is used for making pickles and vegetable. Mahua leaf is also used for making plate and bowl for local uses. The leaf is also used for storing betel leaves for longer duration.

CONCLUSION

In conclusion, the questionnaire-based survey conducted among local communities elucidated the multifaceted uses and benefits associated with different parts of the Mahua tree. The findings underscore the importance of Mahua in traditional medicine, nutrition, and economic livelihoods of indigenous populations. Further research and conservation efforts are warranted to harness the full potential of Mahua for human well-being and sustainable development. This highlights the importance of further research endeavors and conservation initiatives aimed at optimizing the holistic potential of Mahua for promoting human health and fostering sustainable development in these communities. Such endeavors hold promise for enhancing our

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understanding of Mahua's pharmacological properties and ecological significance, thereby facilitating its integration into broader health and economic strategies for the betterment of society. The integration of Mahua into ethnomedical practices demonstrates its cultural significance and longstanding use as a natural remedy among diverse communities. Within the geographical expanse of the Gangetic plain, Vindhyan, and Bundelkhand regions, the conservation of Mahua forests is imperative for the preservation of traditional knowledge and ethnomedicinal practices deeply rooted within tribal communities. These forest ecosystems serve as repositories of invaluable botanical resources, including Mahua trees, which have long been integral to indigenous healing traditions. By safeguarding the biodiversity of Mahua forests, we not only protect the ecological integrity of these regions but also uphold the cultural heritage and medicinal heritage of local tribal populations. The intricate interplay between biodiversity conservation and the preservation of traditional knowledge underscores the importance of holistic approaches to forest management. Furthermore, the conservation of Mahua forests offers opportunities for interdisciplinary research collaborations, facilitating the documentation and validation of traditional medicinal practices. Through scientific inquiry and ethnobotanical studies, we can deepen our understanding of the therapeutic properties of Mahua and its potential applications in modern medicine.

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