

Mahua: A Potential Minor Forest Produce of Chhattisgarh

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ABSTRACT

The state of Chhattisgarh sits in the centre of India, and a sizable portion of its people is tribal. Mahua trees and their components hold a great deal of symbolic and social value for the tribal people, who also own a great deal of medical equipment. The indigenous people use Mahua flowers as food because of their nutritional value. Madhuca Longifolia is the scientific name for Mahua, which is a member of the Sapotaceae family plant with origins in various regions of India, Sri Lanka, Myanmar, and Nepal. The Indian subcontinent has five primary species. These species Madhu calongifolia, M. latifolie, M. butyracea, M. neriifolia, and M. bourdillonii, are widely grown almost all over India. The high vitamin C content of Mahua flowers is what gives them their antioxidant powers. Mahua flowers contain a precursor of vitamin A called carotene. Among the health advantages offered by various parts of the mahua plant are those for diabetes, bronchitis, tonsillitis, gum soreness, headache, and other conditions. Every year, the state collects more than five lakh quintals of Mahua flowers, which are valued at roughly Rs 170 crore. The Chhattisgarh State Small Forest Product Cooperative Federation Limited has devised a method to create Mahua flowers that are suitable for human use. This has been done to guarantee that forest residents may profit as much as possible from collecting mahua flowers. Madhya Pradesh is the state with the most impressive mahua development, with an estimated annual production of 45000 million tonnes of mahua flowers and an average trade volume of 5,730 metric tonnes. Jharkhand, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh, Chhattisgarh, Gujarat, Maharashtra, Bihar, West Bengal, and Karnataka are all home to the mahau tree.

Keywords: Mahua, Madhuca longifolia, forest produce, Tribal food, Vitamin C and Sapotaceae.

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INTRODUCTION

Mahau is one of the many diverse plants that nature has provided, acquiring a unique place in the ethnic as well as managing the life of traditional people. These plants are utilized for numerous functions, including decorating, blooming, fruiting, and medicine. Mahua (*Madhuca Longifolia*), a member of the Sapotaceae family with origins in various parts of India, Sri Lanka, Myanmar, and Nepal, satisfies the three basic requirements, high in sugars, and therefore high in vitamins, minerals, proteins, and fats (Pinakin et al., 2018). The Mahua tree is widely known as the butternut tree (Mishra et al., 2013). Mahua tree is medium-sized to large deciduous tree, usually with a large rounded crown and a short trunk (Bisht et al., 2018). Flowers are small and fleshy with dull or pale white in colour (Varies, 1995).

They may be eaten, and many regional recipes like halwa, kheer, puri, and burfi utilize them as sweeteners (Patel & Naik, 2008). Flowers of *Mahua* had to undergo through series of operations to become the final value-added products (Sahay & Singh, 1996). Improvement in storage facilities and processing of flowers after harvesting and drying will enhance the availability of flowers for industrial purposes (Alok & Amta, 2019). However, due to urbanization, a loss of value, new technologies, and shifting dietary tastes, *Mahua* is losing its significance as a means today (Kumari et al., 2018). *Mahua* is believed to be an important source of therapeutic effects for traditional and modern medicine and is generally used for primary healthcare. It has many medical properties such as antibacterial, anticancer, antiulcer, analgesic and hepatoprotective as well (Sinha et al., 2017). Different health benefits occurring by different parts of *the Mahua* plant are Diabetes, Tonsillitis, pain in gums, Headache etc. (Jogelkar et al., 2021). *Mahua* for the rural people, forests are a source of livelihood, providing them with a means of social and cultural existence in addition to an economic one. As a result, forest dwellers defend forests (Patnaha et al., 2020). Alcoholic drinks are

prepared by the fermentation of the flowers (Amia & Ekka, 2014). *Mahua* tree flowers during the sparest season of agriculture, March to April (Sinha et al., 2017). *Mahua* flowers are known to be open-dried in the sun before storage. Due to their hygroscopic nature, flowers easily deteriorate by absorbing atmospheric moisture. The tribe members must sell their items right away, either with little or no value addition. In many parts of the country, only a small quantity of *Mahua* blossoms is eaten raw (Bakhara et al., 2016). Stamens range from 20-30 (usually 24 or); anthers are hispid at the back with stiff hairs (Bhaumik et al., 2014). The sun-dried flowers are dark reddish-brown and shrink in size, resembling raisins (Kuruvilla et al., 1989). A lot of time is spent on the collection of flowers because *Mahua* flowers are collected manually one by one from the ground (Ranjana et al., 2018). India is regarded as a treasure trove of different plant species that have been used for medicinal and aromatic purposes since ancient times. Approximately 65% of people worldwide are using medicinal plants for therapy, according to WHO (2003-2004). The most amazing *Mahua* developing state, Madhya Pradesh, has an average trade volume of 5,730 metric tons. The estimated yearly production of *Mahua* flowers is 45000 million tonnes, with a range of 80 to 320 kg per tree. The raising and gathering of this plant, or self-sowing (Pinakin et al., 2018).

RECOMMENDED DIETARY ALLOWANCE

The product's protein content was more in laddoo, i.e. 5.23, than the Pickle, i.e. 4.04. The fat content of the Pickle was 4.24 and of Ladoo was 7.96, and the calcium content was 130 and 139 mg in Pickle & Ladoo, respectively. Out of the developed product, Ladoo and Pickle meet the 1/3rd requirement of protein and an intake of 100 grams of Ladoo can fulfil about 1/3rd of the RDA of iron. The incorporation of sesame seed in laddoo improves the protein and mineral content (Kumari et al., 2018).

HEALTH BENEFITS

- Bronchitis: Leaves and flowers are expectorant and used in chronic bronchitis.
- Orchitis (Testis inflammation): It is used for relief from orchitis.
- Diabetes: Bark is used for diabetes treatment.
- Pilex: Laxative properties of oil extraction from seeds are helpful in constipation and piles.
- Eczema: Leaves are helpful in skin diseases.
- Tonsillitis: Leaves are used for pain relief in tonsillitis.
- Burns: Ash is produced from burning leaves mixed with ghee and used for the burning.
- Lactation; Flowers of the *Mahua* are used to increase milk production (Sunita & Sarojini, 2013).

VALUE ADDITION OFFLOWER

The creation of sugar syrup from fresh and dry *Mahua* flowers, which may thereafter be utilized as a sweetener, has been proposed in several research investigations. This sweetener can also be used to replace brown sugar in the production of high-quality jams, jellies, sauces, sweets, and confectionery items (Chand & Mahapatra, 1983; Abhyankar & Narayana, 1942; Patel & Naik, 2010). Candy cake ready-to-serve (RTS) toffee, squash, and laddo bar are some value-added products

developed from dry *Mahua* flowers (Dash, 2017). An antioxidant-rich, sugar-free (no added sugar) beverage using *Mahua* flower juice concentrate and amla juice has been developed with high antioxidant activity (Patel et al., 2016). A liquid sweetener developed by using *Mahua* juice concentrate has been used for the preparation of candy, biscuits and cake (Sinha et al., 2017).

AREA OF CULTIVATION AND PRODUCTION

Since it is not grown on a large scale in plantations, information regarding the acreage and production of this fruit in India is not available. However, trees in patches are prevalent in many states' villages and forested areas. It can be seen advancing down highways. India's output is primarily centred in the drier region, and the villagers gather the food to sell in the neighbourhood market. Its production may be expanded to dry and semi-arid regions, areas with limited resources, and wastelands where other crops cannot be successfully produced (Singh et al., 2008).

MARKET POTENTIAL

Global *Mahua* and its commodity sector, which had a 2013 market value of US \$ 1,435.25 billion, will increase at a 4.3% CAGR from 2014 to 2020 to reach US \$ 937, 73 billion *Mahua* product demand is anticipated to increase at a comparable 4.9% CAGR in terms of value (NIFTEM).

COMPOSITION OF MAHUA FLOWER:

| S. No. | Constituents | Fresh Flowers | Dry flower |
|--------|------------------------|-------------------|-------------------|
| 1. | Moisture | 73.6-79.82(% d.b) | 11.61-19.8(% w.b) |
| 2. | Ph | 4.6 | - |
| 3. | Starch(g/100g) | 0.94 | - |
| 4. | Reducing sugars(g/100) | 363-5062 | 28.12 |
| 5. | Protein(%) | 605-637 | 5.26 |
| 6. | Fats(%) | 1.6 | 0.09-0.06 |
| 7. | Fibres(%) | 10.8 | - |
| 8. | Calcium(mg/100g) | 45 | 0.148 |
| 9. | Phosphorus(mg/100g) | 22 | 0.14.2 |
| 10. | Carotene (µg/100g) | 307 | - |
| 11. | Vitamin-C(mg/g) | 40 | 7 |

Source: Gopalan et al. (2007)

SIDE EFFECT OF MAHUA

1. Mahua usage on a regular basis has been linked to infertility in animal studies.
2. Mahua may conflict with anti-diabetic medications due to its hypoglycemic tendency (which lowers blood sugar levels). Mahua is best avoided if you are on such medications or naturally have low blood sugar levels.
3. It has been discovered that mahua seeds contain immunosuppressive qualities (suppresses the function of the immune system). Mahua should not be consumed if you have an autoimmune condition or are using an immune suppressant (Shukla, 2019).

BENEFITS OF MAHUA

1. Fresh juice made from the mahua tree's blooms has been recognized to relieve sinusitis, headaches, pitta dosha, and a burning sensation in the eyes.
2. Mahua leaves have been used traditionally to help breastfeeding women produce more milk.
3. Drinking a 30–40 mL combination of dried mahua flowers cooked with milk will help treat neuromuscular disorders and nerve weakness.
4. When administered in a quantity of 20–25 mL, fresh juice made from mahua tree blossoms helps to relieve hiccups, hypertension, and cough.
5. Mahua flowers, when taken in dosages of 30 ml with sugar-rich milk, can aid with low sperm count, early ejaculation, and improper milk production during lactation. Additionally, the bark powder enhances reproductive vigour and vitality.
6. When administered in a quantity of 30–40 ml, a cold extract made from the flowers or bark of the mahua tree aids in the treatment of burning urination and burning sensations.
7. Irritable bowel syndrome and diarrhoea are both treated with a decoction made from mahua bark that is administered in doses of 30 to 40 ml (Shukla, 2019).

PROCESSING OF FLOWERS

Traditional operations like collection of flowers, drying, stamen removal, storage and marketing are carried out in the post-harvest phase.

Collecting of flowers

Early in the morning, fresh blooms fall to the ground and are collected by hand by primary collectors. On rare occasions, the branches are shaken, and the blossoms are plucked off the tree using a long bamboo staff with an anchoring system. There is grass on the ground below the tree and leaves that have fallen and need to be cleaned away before collecting.

Pre-processing

Fresh flowers can be given a pre-processing treatment that includes washing, hand stamens removal, and blanching with preservatives. Flowers can have their stamen removed mechanically or manually. It is possible to dehydrate flowers by drying them in the shade on trays and on black sheets covered with shade netting (Kumari et al., 2018).

Drying

For drying, collected flowers are distributed equally for 3-4 days at 40-43°C in sunlight (Chandel et al., 2018). The flower is hammered with a wooden plank to separate the stamens once it has properly dried in the sun. Mahua flower gives a bitter taste to the product, which the consumers do not like (Bakhar et al., 2016).

Storage

The dried flowers are kept in the dark, typically poorly ventilated chambers and are packaged in gunny bags. Mahua flowers exhibit hygroscopicity, or a tendency to absorb moisture, particularly during the rainy season, since moisture seeps in from clay floors and roofs at that time (Behera et al., 2012).

MORPHOLOGY

A medium-sized deciduous tree, the mahua can reach heights of 16 to 20 metres. Its 80 cm-diameter trunk is short and robust. The crown has a circular shape and numerous branches. The bark is Gray, vertically fractured, and wrinkly, with thin scales flaking. The alternating leaves are grouped at the tips of branchlets. Simple, oblong-shaped,

inflexible, thick, and hard, woolly at the bottom face, and leaking a milky sap when damaged, the leaf blade measures 10–25 cm long by 6–12 cm wide. Young leaves are reddish-brown or pinkish in colour. Flowers are produced in 12 fragrant, cream-coloured bunches that are either green or pink in colour and hairy. The blossoms barely last one night

before dying and dropping to the ground. Upon pollination, flowers produce a meaty, greenish ovoid fruit containing 1-4 shiny, oily brown seeds. The seeds are 3-5 cm long, elliptical and flattened on one side (Trees India, 2016; FOI, 2016; Fern, 2014; & Orwa et al., 2009).



Figure 1: Mahua Tree



Figure 2: Mahua bud



Figure 3: Dried Mahua Flower



Figure 4: Mahua Seeds

USES OF MAHUA FLOWER

No- Fermented Flower:

1. As a sweetener: *Mahua* flowers used as a sweetener in many dishes like halwa, methi puri, and barfi. Due to the presence of high amounts of sugars (sucrose, fructose, arabinose, maltose, and rhamnose (Patel, 2008)
2. Preparation of cake: It is made from *mahua* flowers, rice, or other cereals or root crops. Pre-soaked rice and mahua flowers are mixed and ground; paste is covered with sal leaves and burned on fire to make the cake (Behera et al., 2016).
3. As a substitute for staple grains: It is generally used by poor tribal people. Sundried flowers are boiled with seeds of tamarind and Sal and stored (Amia & Akka, 2014).
4. As a cattle feed: Spent flowers are fed to cattle, reported improved cattle health and

increased milk production (Sinha et al., 2017).

Fermented Flowers:

1. Preparation of “*mahua daaru*”: Produced from dried *mahua* flowers by tribal people, Alcohol content of “*mahua daaru*” ranges from 20-40% (Kumari et al., 2016).
2. “*Mahuli*” preparation: Traditionally made by local people of Orissa. Alcohol content of “*mahuli*” is reported between 30-40% (Kumari et al., 2016, & Behera et al., 2016).

PROCESSING OF MAHUA JAM

Cleaning

The dried flower is brought to the factory, where raw materials are brought to the cleaning division. Cleaning is often done manually. During this procedure, all the dirt and other foreign stuff are eliminated.

Washing and soaking

The raw material is cleansed with water and then immersed in clean water for 4 to 5 hours.

Pulping

The wet flowers are put into a pulper machine and processed into the necessary pulp.

Heating and addition of sugar

The pulp is combined with the sweetener, water, and citric acid during heating. Steam temperature is used to heat the pulp concurrently, and either the same vessel or a different one is used for the final boiling. Boiling concentrates the mahua pulp and sugar while reducing the quantity of water present in the combination. Total Soluble Solids (TSS) (also known as "Degrees Brix" or "endpoint of the jam") should make up 65 to 68 per cent of a jam's ultimate composition. There are several methods for determining when boiling stops.

The most precise method to determine the total sugar content is to use a refract metre. Remove the jam from the heat after you have reached the goal to prevent overheating and overcooking.

Filling and packaging

Pour the jam into the hot, sterilized jars after cooling it to around 85°C. Around 9/10ths of their capacity, fill the jars. After loosely fastening the clean lids to the jars, invert them to sterilize them with the hot jam.

Storage

When jams and jellies are prepared using the right recipe, they will last for a long time. Compared to jams packaged in plastic bottles, jams preserved in glass jars will have a longer shelf life (up to 12 months) (up to 4 months). For the longest possible shelf life, jam should be kept out of direct sunlight in a cold, dry location (NIFTEM).



(a) Dried Mahua



(b) Soaked Mahua



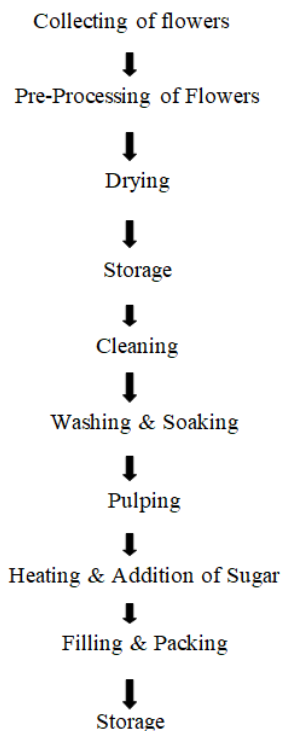
(c) Mahua Pulp



(d) Mahua Jam

Figure 5: Mahua Jam

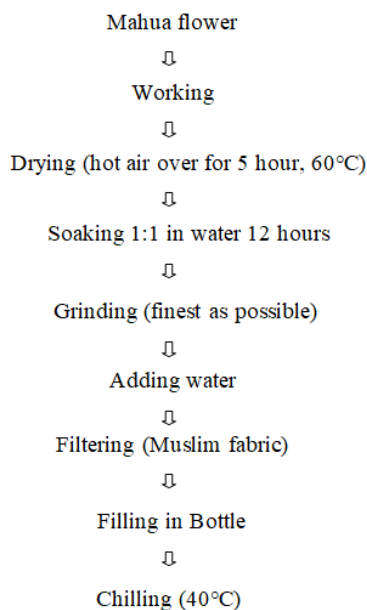
FLOW CHART OF MAHUA JAM



MAHUA JUICE

The *Mahua* flowers were washed and dried in a hot air oven for 5 hours at a temperature of 60°C. To stop the growth of further pollutants, 1 kg of *Mahua* flowers were soaked for 12 hours in 1 L of distilled water containing 1.5 g of Potassium Meta bisulphite (KMS). More water was added to the recipe to make the

simple grinding of the flowers' juice possible. The mixture was mashed with an electric mixer and filtered through muslin fabric before being put into screw-top bottles and chilled to 4°C. The juice produced from 1kg of dried *Mahua* flowers has total soluble solids (TSS) of 20°Brix, a pH of 5.3, and a volume of roughly 3.5 L. (Singh et al., 2013).



FLOW CHART OF MAHUA JUICE



(a) Dried Mahua



(b) Soaked Mahua



(c) Grinded and Extracted Mahua



(d) Mahua Juice

Figure 6: Mahua Juice

CONCLUSION

The dry *mahua* is one of the most significant Indian tropical tree products in the world, *Mahua* includes textural characteristics, aroma, volatile compounds, flavour, total soluble solids, titratable acidity, and colour; the *mahua* develops a wide range of fermented and non-fermented food products. *Mahua* flowers are used in India by various populations, especially tribal communities, as their primary food source and as a means of commerce. It is utilized for its therapeutic benefits in traditional medicine and is effective in treating skin conditions, arthritis, headaches, constipation, haemorrhoids, fever, itching, diarrhoea, cough, and is occasionally used as a supplement to help breastfeeding moms and lactating pets produce more milk. It was discovered that *mahua* is utilized as medicine among these investigated tribal people to treat and heal stomach, teeth, and eyes, as well as to guard from snakes, scorpions, insects, and mites, etc. *Mahua* flower was chosen because, in contrast to grains and millet, it was discovered to be high in carbs, protein, fat, calcium, iron, and phosphorus. *Mahua* is a nutrient-rich tree with qualities that include analgesic, antimicrobial, anticancer, hepatoprotective, and anti-hyperglycemic.

Mahua's flower, fruit, and seed have all been the subject of extensive research highlighting its medical benefits, but its use as a food or food additive has received far less attention.

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Conflict of Interest:

There is no such evidence of conflict of interest.

Author Contribution

All authors have participated in critically revising of the entire manuscript and approval of the final manuscript.

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