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## MADHUCA INDICA: A POTENTIAL SPECIES FOR LIVELIHOOD SUPPORT OF RURAL POPULATION IN CENTRAL BASTAR REGION OF CHHATTISGARH, INDIA

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### ABSTRACT

The Genus *Madhuca* (Family- Sapotaceae), commonly known as Mahua, is a tropical tree found largely in the central and north Indian plains forests and grassland in scattered form. Mahua tree play a key role in the life and economy of communities living in and around forests at Bastar region of Chhattisgarh. It is a fast-growing tree species that grows approximately 20 meters in height. The tree is the most beneficial for the tribal & rural population due to supply as food & vegetable and income through different other produce of Mahua in meagre agriculture. It is of economic value at village level, especially for forest-fringed areas, providing a significant source of income to the whole year. This paper examines the role of Mahua tree for livelihood supports of people in Bastar and the factors influencing the extent of their dependence on forest. Mahua tree have a tremendous potential to create large scale employment opportunity thereby helping in reducing poverty and increasing empowerment particularly tribal and poor people of the poorest and backward area of Bastar region of Chhattisgarh. With this view, a study was undertaken predominantly in rural area of Bastar to determine the role of Mahua in augmenting the income of rural and tribal family. This study was carried out for 20 random sampled villages of Kondagaon district which revealed that the farmer who has 1 to 2 Mahua tree in their home yard/field/nearest area having economic worth of an average of Rs. 40,000 to 50,000/- annual and household earn income of Rs. 10,000-20,000/- in a normal year of Mahua flowering, but villagers are not interested in brewing while in a village of 150-300 households, almost 10-15 households are engaged in brewing reason behind it, because of it is a time taking process and more fuel used in this process. Apart from providing cash income, it also plays an essential role in food security during the lean period.

**Keywords :** Collectors, Brew, Liquor, *Madhuca indica*, Middleman, Tribal and Economy etc.

### Introduction

Forests in India offer to mankind, in addition to timber, many valuable forest products like leaves of commercial importance; bamboos and canes; gums, resin and oleo-resin; oil seeds; essential oils, drugs and spices; fiber and flosses; tans and dyes; animal products and edible products. These are collectively known as Non-Wood Forest Products (NWFP) which is derived from about 15,000 plants species out of which nearly 3000 species of plants growing in forests of India (Kumar, 2015). In the recent years, NWFPs have attracted considerable global interest. This is due to the increasing recognition of the fact that NWFPs can provide important community needs for improved rural livelihood; contribute to household food security and nutrition; help to generate additional employment and income; offer opportunities for NWFP based enterprises; contribute to foreign exchange earnings; and support biodiversity and other conservation objectives (FAO, 1995).

*Madhuca indica* J.F.Gmelin belongs to the family Sapotaceae and locally known as Mahua. It is a medium-sized deciduous tree found throughout the more significant part of India. This tree is usually has a short and sizeable

rounded crown with multiple branches. Mahua is a multipurpose tree of economic importance because; it yields country liquor, edible succulent corollas and oil from the seed. It is indigenous to the forests of central provinces but cultivated in all parts of India. *Madhuca indica* is useful for getting two important NWFPs namely Mahua flowers and Mahua seeds or Tora locally known for oil. This species is found mostly in the parts of the Northern hill of Sarguja agro climatic zone and Southern Bastar plateau agro climatic zone of Chhattisgarh and scattered form availability in plain Chhattisgarh along with farming land or agriculture field as well as grass area of the state. Mahua flowers are largely used in the preparation of the liquors and oil from Mahua is also used for different purposes.

Mahua tree starts flowering at the age of 10-15 years and flower starts falling from the third week of February and continues until the first week of May. Awasthi, (1971) reported that the average flowering season of Mahua tree is about five weeks. According to an experimental trial conducted by State Forest Research Institute, Jabalpur, the average yield per tree varies from 11.33 kg to 76.79 kg/tree depending upon the size of the tree (Prasad and Bhatnagar, 1991).

The tree, known under the name of Mahua, produces edible flowers and fruits. Mahua flowers are well known for their high reducing sugar and nutrient content (Jayasree *et al.*, 1998). Flowers are a rich source of sugar, vitamins and minerals are eaten by the tribal in various forms (Belavady and Balasubramanian, 1959; Srivastava *et al.*, 1970; Awasthi, 1971; Chand and Mahapatra, 1983; Prasad, 1991; Jayashree *et al.*, 1998). However, despite being a rich source of nutrition, a significant portion of the dried flowers is being used to prepare country liquor. So the value addition to these flowers at the local level for food product preparation will help direct and indirect employment generation especially in the Bastar region of Chhattisgarh state.

Apart from this, Mahua also has social importance; it is used as an essential drink at various social and cultural events in the village to serve the tribal on social and cultural occasions such as festivals, birthdays, weddings, inaugurations and other occasions and is often served instead of tea when guests arrive in home. However, maximum production goes into brewing beverages. The central Bastar region has numerous villages where Mahua liquor manufacturers are being done on a large scale for the selling purpose and achieve economic benefits mainly rural and tribal people.

Singh *et al.* (2013) reported that the Mahua flowers are rich in sugar (68-72%) and several minerals and one of the most important raw materials for alcohol fermentation and investigated for the development of a non-distilled alcoholic beverage from Mahua flowers. The fermented non-distilled alcoholic beverage contained total sugar (8.83 mg/ml), reducing sugar (0.82 mg/ml), total soluble solids (6.37°Brix) titrable acidity (0.65 %), and volatile acidity (0.086%). The developed fermented alcoholic beverage had the characteristic flavour and aroma of Mahua flowers with about 7 to 9% alcohol. In India, it is estimated that 80 % of the forest dwellers in Orissa, Bihar, Madhya Pradesh, and Himachal Pradesh depend on forests for 25-50 % of their annual food requirements (CSE, 1985). As per Mishra and Pradhan, (2013) of particular importance are *Shorea robusta* seeds boiled with Mahua-*Bassia latifolia* flowers as a substitute for grain staples. People in rural areas also use Mahua flowers as food; mainly, food is made from Mahua flowers and Ghee. Fresh Mahua flowers are used in milk boiled and consumed similarly; the paste of presoaked flowers is used with wheat flour to make dough used in making sweet poori (Singh *et al.*, 2018). Apart from this, the outer part of Mahua fruit green in color used as a vegetable in the Bastar area, this fact was reported during the study.

Mishra and Pradhan, (2013) Mahua flowers are also used as an exchanger in tribal and rural areas for food and other life supporting goods. Mahua seeds are rich in edible fats, so they have economic importance. Mahua fruits are used as a vegetable and widely consumed by the tribes of western Odisha. *Madhuca longifolia* is also considered a medicinal herb and is useful for external application in treating skin diseases, rheumatism, headache, chronic constipation, piles, haemorrhoids and is sometimes used as an emetic and galactagogue. Mahua oil is used to

manufacture laundry soaps and detergent and is also used as cooking oil in various tribal regions of India. Almost similar findings were also reported during the study in Bastar region of Chhattisgarh state.

According to Kirtikar and Basu (2001) in Diarrhea, a cup of infusion of the bark is taken orally twice a day by the tribal. Besides this, in chronic tonsillitis, leprosy and fever, the stem bark is used. It is commonly used to treat snakebite as an antidote in the southern part of Tamil Nadu, India. In skin disease and Hydrocoele, the Decoction of stem bark is used to cure. For the treatment of scabies, powdered bark is used. Leaves are expectorant and used for chronic bronchitis and Cushing's disease. The leaves are applied as a poultice to relieve eczema. Therefore, the present investigation was carried out to study *Madhuca indica*: a potential species for livelihood support of rural population in central Bastar Region of Chhattisgarh.

### Materials and Methods

Kondagaon is a newly formed district of central Bastar region of Chhattisgarh, and it came into existence on 1<sup>st</sup> January, 2012. It is situated in the southeastern part of the State in Central India. Kondagaon is the third-largest city of Bastar division. District Dhamtari and Kanker surround in north, district Narayanpur in the west and district Bastar in the south and east and south east by Koraput district of neighboring state Odisha.

Kondagaon is located at 19.59° N 81.65° E. It has an average elevation of 593 mts from the sea level. As of the 2011 India census, Kondagaon has an average literacy rate of 64%, higher than the national average of 59.5%: male literacy is 73%, and female literacy is 55%. Along with large tribal population dominates in the district. Of the total population, more than 70 % are tribal people like Gond, Maria, Muria, Dhruva, Bhatra, and Halba Tribe etc. Here the forests area spread over 18% of its geographical area, (State Forest Report, 2019) in which *Shorea robusta* is the dominant tree species, followed by *Madhuca indica*, *Buchanania lanzan*, *Diospyros melanoxylon*, *Schleichera oleosa*, *Syzygium cumini* and *Mangifera indica* etc.

The present study was conducted in six villages (Bangaon, Mohalai, Charkai, Palli, Stali, and Chilputi etc.) of Kondagaon district, Chhattisgarh. These villages are forest-fringed and villager's livelihood partially depends upon the collection of NWFPs and by sale in local weekly markets or hat/ bazaar of surrounding area. The study area was surveyed and data were collected through household survey with the help of a well-prepared questionnaire.

To fulfill the objective of the research study, select two-block randomly from the Kondagaon district. After that, three villages from each block were chosen randomly and finally, ten respondents (Tribal and NWFPs collectors) were selected randomly from each of that selected villages. Thus 60 respondents were selected from the desired district/state to assess the economy, and each farmer in these villages was interviewed personally and information was collected to present the results.

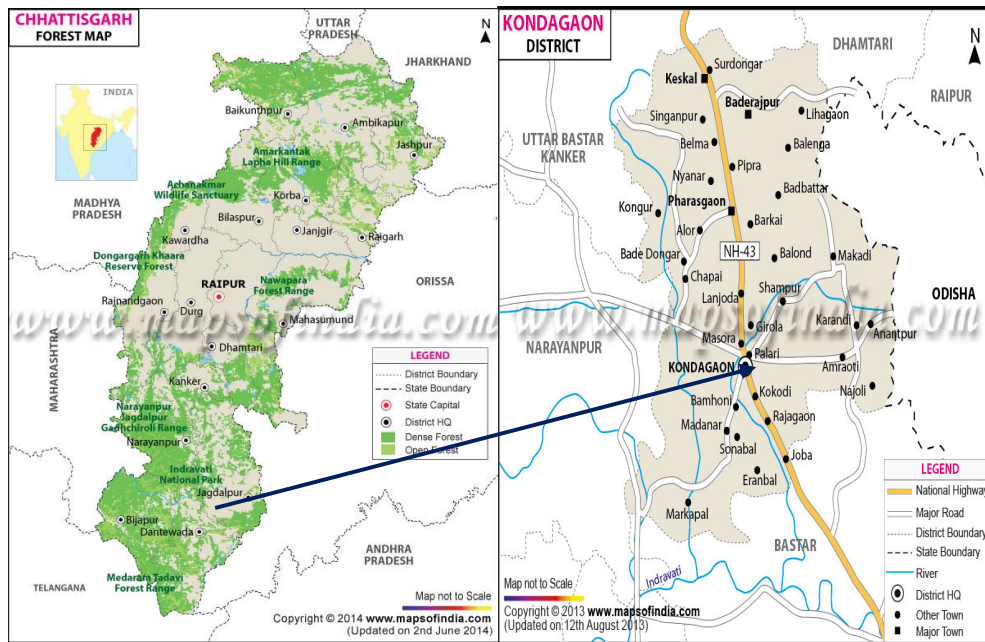


Fig. 1: Map of study area Kondagaon district of Chhattisgarh

## Results and Discussion

### Collection of Mahua flowers in Study area

Mahua is a large evergreen or semi-evergreen tree with numerous branches. It flowers from the end of February to April. The fleshy cream-coloured, sweet petals fall soon after the flowers open out. During the flowering season, large petals are collected by tribal. The average production of Mahua flower annually, depends on the site condition and climatic condition of the particular area. During the study we found that a Mahua tree start yield on the age of 8-10 years and reached on the full bloom at middle age, the average yield annually by a Mahua tree at the age of 20-25 years. The fruits ripen from June to August of the year. The season for collecting Mahua flowers is too short and a considerable part of the crop is lost during monsoons due to a lack of well-organized harvesting whereas Dhyani *et al.* (2015) reported that flower appears from Feb-April and it takes 20-30 days from flower initiation to anthesis. Heavy flower and young fruit drops are observed and only 8-13 % of set fruits reach maturity. Fruits are harvested by the 3<sup>rd</sup> week of May to the 3<sup>rd</sup> week of June and flower yield varies from 100-150 kg/tree/year and kernel 60-80 kg/tree/year but as per Patel *et al.* (2011) the yield of Mahua flowers varies from 80-320 kg for every tree. Singh *et al.* (2018) reveals that during the period from mid of March till the end of April, when flowers fall on the ground, people start collecting them early in the morning, which can go anywhere from about 5:00 AM to 10:00 or 11:00 AM depending on the number of trees covered. This process is repeated daily during the falling period and collected by all family members, usually men, women, or children.

After collection of Mahua flower, the flowers were kept for sun drying for 5-6 days in the open area inside the house or the front of home yard depending upon the sunlight. Sun-drying may be followed by shade drying before it is finally stored. Each day's collections are dried separately from the previous collection, so that there is no moisture transfer from one lot to another. Cloudy weather at times poses a significant problem with the Mahua flower not being dried properly. It loses its colour, turns black, and is prone to insect

infestation. Large amounts of Mahua are kept in Bamboo Baskets known as Dholgi and covered by Paddy straw with mud soil to protect from insects and pests and also avoid moisture losses in old practice and recently Mahua flowers are also kept in plastic sacks showed in Fig. No. 2.



Fig. 2: Storage of Mahua in Bamboo Basket (Dholgi)

Collectors of Mahua flower in Bastar region sell a major chunk of it, apart from their self-usage for making country liquor and for animals feed, because its flowering occurs around March and start falling in the 2<sup>nd</sup> or 3<sup>rd</sup> week of March; it may vary depending on the region. Still, this period may get affected due to the weather condition, which affects the flowering duration and quantum. As this period is of summer, during which agricultural activities remain limited to water availability, it acts as an income generation source for the local communities of Bastar. During the study information collected from various respondents and household show that the Mahua tree has vast potential to fulfill basic needs of these rural and tribal communities of study area. We also recorded data of socio-cultural aspect of tribal society from study area, Mahua tree intermingled with various cultural, religious and social part of tribal life starting from birth to death thus Mahua tree have vast potential with regard to economy of tribal and rural population of Bastar .

### Processing of Mahua flowers fruits and seeds in Study area

During the study about processing of mahua flower in Bastar region we found that the local communities follows at three stages for mahua flower processing; after the collection, collectors dry the flower before they sell in the market, and then traders stock in cold storages to prevent further damage from insects or moisture and brewing of liquors household/ big factory/ large brewer level or country Bhatti.

After collecting of flower, collectors bring it back to their house for the drying process. The reason for drying is because of sugar and its high moisture content. So Mahua flower is dried under the sunlight else, it would get spoiled by microbial activity. The usual practice is spreading the collected flower over a flat surface, either cemented floor or roof of the house, where it can get proper sunlight. This process is repeated for 3-5 days, so that its moisture level comes around 15-16%, based on the value identified using the moisture analyzer of dried Mahua flower taken from the collectors (Singh, 2018) whereas due to the lack of proper scientific investigation and post-harvest processing technologies, they are collected and subjected to open yard sun-drying till about 80% moisture is lost before storage (Patel and Naik, 2008). In spite of being a rich source of nutrient and easy availability in the study areas Mahua flowers are not very popular as food. Only a small quantity of flowers is consumed raw, cooked or fried in different part of the Bastar region. Similar result also reported by the many authors for different part of the India.

Mishra and Pradhan (2013) reported that Mahua seeds contain about 40% pale yellow semi-solid fat. The seed oil is commonly known as "Mahua Butter". Fresh Mahua oil from properly stored seeds is yellow with an unpleasant taste. The oil content of the seed varied from 33 to 43% weight of the kernel. Whereas, Kumar, (2017) reveals that the seed kernel of Mahua contain 51% oil and is used for manufacturing laundry soaps. There are several reports on preparation of sugar syrup from dry Mahua flowers (Abhyankar & Narayana, 1942; Sutaria & Magar, 1955; Shrivastava *et al.*, 1970; Chand & Mahapatra, 1983). Dried Mahua flowers are an attractive source of fermented products due to the high sugar content. Further experiments were carried out to find the utility of the developed concentrate. Excellent bakery and confectionary goods (candy, biscuits and cake) were prepared using the Mahua concentrate as a liquid sweetener (Patel & Nayak, 2009). Mahua jam and jelly were also prepared using fresh flower by many researchers in the study area and according to the findings of hedonic test all the developed Mahua products were found to be highly acceptable.

### Livelihood support and tribal dependency on Mahua tree in Study area

The information about the collection, marketing and uses of Mahua tree products by the tribal of the surveyed site of Kondagaon district, Chhattisgarh, gathered information through prescribed questionnaire as well as personnel interview of the respondent. It was found that the drying process of Mahua flower is done immediately after collection, so that prevent further spoilage from moisture and insects; it is rarely seen that the flower is sold without drying for quick returns by collectors. After that, for household use, the tribal brew, it at home traditionally and on a large scale to

retain its colour and quality Mahua flower is kept long time in cold storage, big traders or wholesalers do it.

During the study we observed Mahua is a potential NWFPs tree is an essential source of income through collection, processing and selling the flowers, fruits and seeds of plant in Bastar region specially study area which are dominated by tribal population; they collect other different types of NWFPs from the surrounding forests and also from nearby farm land. Mainly collection process of Mahua flower engaged by women and 10 to 13 years young children play a unique role. Present research also revealed the role of man is essential in managing and bringing the product at home and selling it, whereas women engagement is most common especially in the household industry of country liquor manufacturing and selling in village level. During the study we also reported major quantity of flowers is used in the preparation of distilled liquors. They freshly prepared liquor has a strong, smoky foetid odour, which disappears on ageing. It reported to excite gastric irritation and produce other unpleasant effects. The flower of Mahua tree is very rich in sugar content and after drying the collected flowers under the shade become more concentrated, and this concentrated dried flower is further used as the sources of sugar in making alcoholic products by the following fermentation procedure in the study area. In fermentation, the microorganisms use this glucose as their energy source and breakdown sugar into ethanol and carbon dioxide. This is one of the most adopted methods and source of economy for the rural and tribal people in India especially in northern (Bastar region) and southern (Sarguja region) part of the Chhattisgarh state, Odisha, Madhya Pradesh and some part of the Maharashtra etc. The products obtained after distillation process are wine, brandy, ethanol, acetone and acids reported also reported by Patel *et al.*, 2017; Singh *et al.*, 2013; Pinakin *et al.*, 2018; Jha *et al.*, 2013.

The seed is of great importance and rich in oil content so the tribal people used to collect the seed after the ending the flower season (Deep *et al.*, 2016) and sell it to the local market similar results also found in the present study area. Some people take seeds to the oil extractor and they collect the oil called locally Tori oil. This oil is very useful in many medicinal, non medicinal economic purposes to Bastar tribal population especially it is believed that the oil is equal importance to the cow ghee during the festival of Diwali for lightning of Diya.

### Traditional method of brewing in Study area

Every household in a village of study area does not seem interested in brewing, while in a village of 150-300 households, barely 10-15 households are engaged in brewing, reason behind it; in Chhattisgarh state, large scale brewing by licensed Bhattis is not permitted freely. Consequently, in the tribal area, brewing is a household industry and a major portion of dried Mahua flowers are being used in the preparation of country liquor (Patel and Naik, 2006). First of all, dried Mahua flowers are washed thoroughly with tap water to remove impurities of tiny particles of soil and sand and then put in the earthen pots filled with water 2-3 days before it goes into brewing (Fig. 3). After that, the bubbles are seen on the top of the pot; that flower pot is suitable for further processing in the furnace and then transferred to the brewing brass pot on the bottom. Then another pot placed near the hearthstone (Fig No.4) is directly connected to the

brew pot with a pipe; this process often takes four to five hours a day. Women are mostly do the manufacturing of Mahua liquor or country liquor to get the returns expected.



**Fig 3: Fermentation process of Mahua Flower**



**Fig 4: Traditional method of brewing**

Singh (2018), most Mahua flower goes into liquor making, apart from consuming it, as it is or making the sweet dish and other value added products. Since liquor made out of flowers are consumed traditionally on different occasions like festivals or marriage, liquor making remains a major product made out of it. Some people use the three-tier container mechanism in which the middle one contains escaping vapor into the external container. The top layer contains the water, which is changed from time to time to condense the vapor generated in the middle layer. The bottom one contains the soaked Mahua flower, which is kept over Chulha.

**Table 1 : Mahua tree present in farmer’s field of the study area**

SN	Frequency of Mahua tree	Number of farmer’s where Mahua tree is exist	Percentage of Farmer’s (%)
1	1-2	25	41.6
2	3-4	18	30
3	5-6	12	20
4	7-8	9	15
5	9-10	0	0
6	11-12	1	1.6
7	13-14	2	3.3

The analyses of the collected data from surveyed villages of studied areas were presented in the table No.1; the result revealed that maximum number of farmer’s where Mahua tree is existed was reported 25 farmer’s (41.6%) had 1-2 trees followed by 18 farmer’s (30%) had 3-4 trees, 12 farmer’s (20%) had 5-6 trees, 9 farmer’s (15%) had 7-8 trees, 2 farmer’s (3.3%) had 13-14 trees, 1 farmer’s (1.6%) had 11-12 trees, whereas minimum farmer’s where tree existed 9-10 were reported zero (0%) farmer. Those farmers which have no Mahua tree in own farmyard they collect the Mahua flower and seeds from the field of outside and also from the forests and get income through selling in local market of dry Mahua or through liquor distillation.

**Table 2 : Income of farmer by Mahua liquor manufacturing in the study area**

SN	Income group (Rs/year)	No. of farmer’s	Percentage (%)
1	10,000-20,000	18	30
2	21,000-30,000	9	15
3	31,000-40,000	12	20
4	41,000-50,000	5	8.3
5	51,000-60,000	1	1.6
6	61,000-70,000	1	1.6

Table No. 2 showed that the farmers engagement in the manufacturing of Mahua liquor or country liquor in different villages of the study area. It is clear that after the analysis of observation, result was found that maximum of 30% of farmers gathered income Rs. 10,000- 20,000/- year/tree followed by 20 % farmers gathered income Rs 31,000-40,000/-year/tree, 15 % farmers gathered income 21,000-30,000/-year/tree, 8.3 % farmers gathered income 41,000-50,000/-year/tree. Whereas, 1.6 % farmers gathered the income of 51,000-70,000/year/tree and also 61,000-71,000/-year/tree income gathered farmers was 1.6% by the Mahua flower. They sell Mahua liquor in own home and also in local markets of nearby villages at the rate of Rs. 60/-per bottle (750 ml). Study also revealed that the average annual income from the sale of Mahua liquor is Rs 40,000-50,000/-per year/tree found in the study area. So we can say Mahua tree is very important to enhance the tribal economy at Kondagaon district of Bastar region of Chhattisgarh state.

**Table 3 : Maximum consumption of Mahua liquor on the different occasion in Study area**

SN	Occasion/event	Consumption in liters/bottle	Earning/occasion
1	Wedding ceremony	75	4,500.00
2	Festival	85	5,100.00
3	Social and cultural	70	4,200.00
4	Death occasion	54	3,240.00
<b>Grand total</b>		<b>284</b>	<b>17,040.00</b>

Mahua liquor is consumed mostly in the festival in tribal & rural areas of whole Bastar region as it is a time of happiness in which everyone joins together. Similarly, all the wedding ceremonies are celebrated by using Mahua liquor. Apart from this, it is also used on death occasions social and cultural programs. In this study, the results showed (Table No. 3) that the maximum consumption of Mahua liquor per festival is 85 liters, due to which they earn about 51,00/-per day at that time, followed by 75 liters consumption in

marriage ceremony per day and they earn 45,00/- in a day and during the social & cultural occasion Mahua liquor consumption was 70 liters/day of Rs. 42,00/- reported, Whereas in death occasion in the study area average of 54 liters Mahua liquor were consumed by local population.

Mahua (*Madhuca longifolia*) is one of the ecologically and economically important species found in the study area. The seeds and flowers have commercial valued and utilize various end products (Hegde *et al.*, 2017). Interestingly, natural regeneration was recorded to be affected in disturbed sites of Mahua and resulted in poor regeneration. In contrast, in undisturbed sites, the regeneration of Mahua was quite excellent, and Experimental results showed that disturbance level does not significantly affect the tree density, dominance, and importance value index. However, disturbance levels greatly affected the representation of juvenile trees and natural regeneration in the Mahua population (Hegde *et al.*, 2018). According to the study, the regeneration rate is moderately high in the study site, but the regeneration percentage is meager near the village.

### Conclusions

Based on prescribed questionnaires and interviews made of tribal people about the importance of the Mahua tree in their life, the following conclusion has been derived. The farmer with 1 to 2 Mahua trees in their field earns an average of Rs 40,000-50,000 annually. Some farmers used this plant as for beverage for their use and sale in the market. Thus we can conclude that Mahua trees have traditional value in the tribal society in the Kondagaon district of Bastar region. Its brew manufacture, storage, as well as its sale and consumption helps in improving socio-economic status and enhance overall upliftment of livelihoods. So promoting and giving the proper knowledge of Mahua tree products helps upgrade the rural livelihood and the environment of the Kondagaon district of Bastar region of Chhattisgarh state.

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