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Butea monosperma (Lam.) Taub. an all-terrain Lac host: A Review

Sangita Basrani[1]*, Moni Thomas[2] and Sadhana Kesharwani[3]

[1,3]*Department of Zoology, Government M. H. College of Science and Home Science, Jabalpur, Madhya Pradesh, India*

[2]*Institute of Agri-Business Management, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India*

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***Corresponding author:** Sangita Basrani, Department of Zoology, Government M. H. College of Science and Home Science, Jabalpur - 482 004, Madhya Pradesh, India

Abstract

B.monosperma is an indigenous tree, hardy, widely adaptable with profuse branching. This leguminous tree may be included in afforestation as well as wasteland programmes in India.Lac insect thrives better on *B.monosperma* and produce lac which is a cash crop thus this tree will also be exploited for an economic activity as well as environment conservation.

Keywords: *Butea monosperma*; Lac insect; *Rangeeni*; Lac host; Nutrient management

Introduction

Butea monosperma is a member of family Fabaceae [1-3] and sub-family Faboideae[4]. *B.monosperma* is known by numerous local names such as palash [5,6]bastard teak [7] dhak [8], palsa, chheula and khakar etc.It is widely distributed across forest [9],wasteland [10] marshy land [11] and cultivated fields[12].This slow growing [13] multipurpose tree [14,15] is valuable to the locals and forest dependents [16,17]. *B.monosperma* provides fibre, dye ,thatch and fuel wood for local consumption [18]. It resembles a small bush, reaching a height of 1 to 2 meters with characteristic extensive branching [19]. *B.monosperma* is identified as one of common lac host tree [20-23] for raising *Rangeeni* strain [24,25] of *Kerria lacca* (Kerr), the insect responsible for producing lac [26,27].

Characters of *B. monosperma*

The trifoliate leaves of *B.monosperma* are held with long petioles (10-15 cm) and narrow lance-shaped stipules [28]. The leaflets are thick and leathery; the terminal leaflet is broadly ovate (10-20 cm), while the lateral leaflets are smaller (10-15 × 7.5-10 cm), nearly symmetrical, all with rounded tips [29]. The upper surfaces turn smooth with age, and the undersides remain silky with distinct net-like veins [30]. *B.monosperma* initiates shedding its leaves in winter around December to become completely leafless in March.In the spring new shoot sprouts [31]. *B.monosperma* blooms during March. Flowers are 2 to 4 cm in diameter of bright orange-red colour with large and rigid racemes [32].

The staggering flower clusters often seen from February to April. The flowering period varies from place to place [33]. During summer when *B.monosperma* blooms amidst dry bamboo plants in the forest it appears like a fire from a distance. Thus, the tree got its name "flame of forest" [34-36]. The fruit of *B.monosperma* is a flat, papery legume pod about 15 cm long and 3-5 cm wide. Young pods are covered with soft, velvety hairs, while mature pods hang own. Each pod usually carries one flat seed with an average diameter of 25-40 mm ,15-25 mm width and thickness of 1.5-2 mm. The reddish-brown seed coat is often glossy, and wrinkled, enclosing two large yellowish cotyledons. A hilum is charcterstic feature near the middle of the curved edge of the seed [37]. Bark of tree is ash coloured and secrets red coloured gum when injured [38].

Distribution

B.monosperma a medium-sized deciduous tree is widely distributed across the Indian subcontinent [39,40]. This tree is native to India and commonly found in tropical and subtropical regions [41-43]. The tree thrives in dry deciduous forests [44] scrublands and on the fringes of cultivated areas [45]. It is particularly abundant in the states of Madhya Pradesh, Chhattisgarh, Jharkhand, Odisha, Uttar Pradesh, Bihar, Maharashtra and West Bengal [46]. *B.monosperma* is also reported in neighbouring countries like Nepal, Sri Lanka, Myanmar and Thailand [47,48]. *B.monosperma* is commonly found in drier parts,

often gregarious in forests, open grasslands and wastelands also up to an altitude of 1200 m except in extreme arid regions [49]. It can grow in poor, swampy, drained, waterlogged, or black cotton soil [36]. *B.monosperma* adapts to high saline conditions [50] and low water available conditions [51]. Seedlings thrive best on a rich loamy soil with pH 6-7 under high temperature and relative humidity [52]. The plant can sustain in areas where an annual rainfall ranges from 450 to 4500 mm [53]. Palash is integrated with crops, pasture, and livestock or planted along field edges [54]. It mostly occurs on agriculture bunds, particularly in paddy fields [22].

Species of *Butea*

Koenig was the first to use the genus *Butea* to name the Indian tree called *Palash* or Dhak. The genus name *Butea* was in the honour of Lord Bute, a supporter of botany [55]. The genus *Butea* also shows great variations in their flowers structure, inflorescence, flowers per plant, colour and size of flowers, colour and size of anther, dehiscence of anther, colour and size of stigma and pollen morphology [56]. The specific name *monosperma* means one seeded and refers to the fruit with a single seed near its apex [57].

There are 33 species of *Butea* reported till date i.e. *acuminate*, *B.africana*, *B.affinis*, *B.apoensis*, *B.braamiana*, *B.balansae*, *B.bracteolate*, *B.crassfolia*, *B.cuneiforms*, *B.dubia*, *B.frondosa*, *B.ferruginous*, *B.gyrocarpa*, *B. harmandii*, *B.laotica*, *B.loureirii*, *B.littoralis*, *B.listeria*, *B.minor*, *B.macroptera*,*B. merguensis*, *B. maingayi*, *B.oblonfolia*, *B. parviflora*, *B.pulchra*, *B. purpuea*, *B. riparia*, *B.rosea*, *B.suberecta*,*B.superba*, *B. volubilis* and *B. varians(58)*. Among the recognized species, the four ones are commonly reported: *B.monosperma* (Lam.) Taub. (syn. *B. frondosa* Wall.), *B. superba*, *B.parviflora* and *B.minor* [55],[59]. The genus *Butea* includes *B. monosperma* parviflora, *B.minor* and *B. superba* which are widely distributed throughout India [60].

Description of *B. monosperma*

B. monosperma is a dicot [61] plant. Stem is made of porous, soft wood with a greenish white tint [62]. The tree has short trunk usually crooked and tortuous (elongated and cylindrical) with rough, greyish-brown, fibrous bark showing a reddish exudate, branchlets densely pubescent [63- 65]. The plant attains a girth ranging from 40cm-70cm. It has large irregular low branches with a rather open crown. It adapts remarkably well to various climates, showcasing its extensive geographic spread [66]. *B. monosperma* has a dense canopy with ample branches and leaves, offering a large surface area for the lac insects to colonize [22]. Pruning of host plant is an essential operation for lac production that determines success of lac crop [67]. *B. monosperma* being very good at regenerating or producing new shoots after being cut down. It grows to a medium height of 12 to 15 metres and is upright [68]. The tree is an ideal host for lac production due to its abundant summer foliage that protects lac insects from sun and provides sap, its suitability for both summer and winter lac crops, high resistance to pests and diseases, strong coppicing ability, ease of climbing and pruning, and a short gestation period of just 5-6 months between harvest and re-inoculation [22].

B. monosperma as host of *Kerria lacca* (Kerr.)

B. monosperma is the most widely distributed ecologically dominant among *Butea* species in India. *B. monosperma* is potential lac host tree [69,70]. *B. superba* and *B. parviflora* are woody climbers. *B. parviflora* resembles *B. superba* in vegetative features but is distinguished by its panicled inflorescence bearing smaller and more numerous flowers. *B. minor* is a less common species with limited documentation and differs in certain morphological characteristics that set it apart from the other three species [55].

Strains of lac insect

The lac insect (*K. lacca* Kerr) secretes the commercially valuable resin known as lac [71,72]. These exists in two principal strains: *Kusmi* and *Rangeeni* [73]. Both strains differ significantly on host plant, nutritional requirements, quality of the lac produced, time taken to reach crop maturity and productivity [22], [74 -76]. The *Rangeeni* strain is most commonly reared on *B.monosperma* [77,78] due to its adaptability, shorter life cycle and higher lac yield. Lac is produced through two main crop cycles: the *katki* crop inoculated in June-July and harvested in October-November [79,80] and the *baisakhi* crop inoculated in October-November and harvested in April to May [81- 83]. The resin from *Rangeeni* strain is of a slightly inferior quality being darker [84 - 86]. However, *Rangeeni* lac is favoured for bulk lac production due to the high yield and faster turnover. Out of entire lac productions in India, 80-85 percent is from *Rangeeni* strain which is contributed mainly by *Palash* [87]. *Baisakhi* lac crop contributes 76 percent of the total lac production in India. The share of *katki* is just 19 percent [88].

Lac yield in nutrient managed condition

Nutrient management of host plants of lac insects is an important operation for increasing lac production [89]. The application of a plant growth regulator (Chlormequat chloride 50% SL) resulted in the highest lac yield, with a mean raw lac production of 4.01 kg per plant and 21.57 g per 30 cm sticklac, followed by zinc (3.41 kg/plant,16.88 g/sticklac) and boron (3.24 kg/plant, 15.14 g/sticklac). The Control treatment (water spray) produced the lowest lac yield (2.03 kg/plant and 7.53 g/stick), indicating the superior efficacy of plant growth regulators and micronutrient supplementation in enhancing lac production on *B. monosperma* [90]. Foliar application of nutrients significantly enhanced lac yield on *B. monosperma* the highest mean raw lac yield per plant was recorded in the double spray PGR treatment (1.95 kg), followed by double spray nitrogen (1.82 kg), single spray nitrogen (1.77 kg), single spray PGR (1.73 kg) and the lowest in the Control (0.95 kg). Both single and double applications of chlormequat chloride (50% SL) positively influenced lac yield compared to the Control [77].

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The highest mean raw lac yield was recorded with zinc (2.10 kg/tree), followed by zinc + humic acid (1.82 kg/tree) and boron (1.61 kg/tree), while the Control produced the lowest yield (0.58 kg/tree). These results highlight the positive impact of micronutrient application, especially zinc, on lac production [91]. Pruned twigs and leaves were reused as natural mulch to cover the soil. Among the two lac crops, *baisakhi* lac yield was higher (31.6 kg) compared to *katki* lac (29.2 kg). The mean lac productivity per *B. monosperma* tree was 1.92 kg for the *baisakhi* crop and 1.83 kg for the *katki* crop. Typically, the average lac productivity per *B. monosperma* tree is around 5 kg [69]. Liming increased *rangeeni* lac yield on *B.monosperma* by 71 percent in 6-month-old shoots, with minimal effect on older shoots. Potassium application in the absence of liming enhanced yield up to 2.8 times compared to the Control, while liming without potassium also significantly improved productivity, indicating that both treatments independently contribute to better host nutrition and increased lac secretion [92].

Lac yield in Intercropped condition

The study revealed that integrating lac cultivation on locally available host trees, such as *palash* (*B. monosperma*), along the bunds of rice fields proved to be a profitable approach for enhancing the family income of lac-growing farmers. The net return from rice cultivation combined with lac production on *Palash* trees was ₹11,284 and ₹3804.0 for rice crop. Furthermore, the benefit per rupee of investment was calculated to be ₹2.41 for rice with lac production on *palash* and ₹2.08 for rice crop only [93].

In Central India's drought-prone areas, lac production on *B. monosperma* based agroforestry is very beneficial for livelihood security. A single *B.monosperma* tree may yield1.5-2.5 kg, generating an annual income of ₹700-800 (10-12 US$) [94].

Conclusion

B.monosperma being very hardy, high adaptable and a leguminous multipurpose tree, may be conserved. The tree is ideal suited for afforestation as well as wasteland reclamation programme, atleast in India. *B.monosperma* due to its deep root system survives even arid regions. This should be exploited for Lac production. Lac is a cash crop hence its promotion as a livelihood enterprise will promote both economics and environment in the area.

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