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BAKULA—A REPUTED DRUG OF ĀYURVEDA, ITS HISTORY, USES IN INDIAN MEDICINE

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The drug *Bakula* has been in use in the indigenous system of medicine since antiquity. It is also regarded as a sacred plant among Hindus, as a symbol of love and beauty due to its fragrant flowers in ancient Sanskrit literature. In the Āyurvedic texts as well as in various books on medicinal plants, Sanskrit name *Bakula* has been equated with the botanical name *Mimusops elengi* Linn. belonging to the family Sapotaceae. It is a beautiful evergreen tree and is planted for its ornamental foliage and fragrant flowers. The present communication deals with the ancient history of the plant, its application in classic Sanskrit literature along with its distribution, uses in the indigenous system of medicine. The salient important characters regarding the pharmacognosy and chemistry have also been discussed.

The drug *Bakula* has been in use in the indigenous system of medicine since antiquity as a specific cure for the diseases of gum and teeth. It is used to fix loose teeth and as a gargle. The drug has been reported to be bitter, astringent, tonic, febrifuge, and as a cure for chronic dysentery and constipation.

Bakula is considered as a sacred plant among Hindus and has obtained an important place in religious texts as well as in ancient Sanskrit literature. Its fragrant flowers are celebrated in the *Purāṇas* and even placed amongst the flowers of the Hindu paradise. Kṛṣṇa is said to have fascinated the milkmaids of Brindābana on the banks of Yamunā by playing on his flute beneath a *Bakula* tree[1,2].

Aiyer[3] (1956) in his book "The antiquity of some field and forest flora of India" stated that *Bakula* is recorded as a flowering tree growing in the *Gandhamadana* forest (in *Rāmāyaṇa*) and also among the trees planted near Indraprastha (in *Mahābhārata*). Joshi[4] (1973) has recorded that in *Vālmiki*

Rāmāyaṇa, the name *Bakula* has been mentioned several times. It has been reported to be growing in the Pampaser forests (ki 1/78), Aśoka Vana of Laṅkā (Su 14/43, 15/44), in the garden of Sahyagiri (yu/4/79) on the way to the forest with *Ṛṣi* Viśwāmitra (*Ba* 24/15), and for building the bridge (*Yu* 22/59).

Kālidāsa has also included in his classical Sanskrit literature *Bakula* flowers as symbol of love and beauty. He has beautifully described in *Raghuvamśa* (Act IX : 30) that the odour of the flowers of *Bakula* somewhat resembles that of a wine and the fragrance of flowers is often likened to that of the breath of young woman. (*Raghuvaṃśa*, canto VII : 64). It is supposed that the tree puts forth maximum efforescence , if a mouthful of wine is sprinkled on it by a beautiful young damsel.

Similarly in *Abhijñāna Śakuntalā* (act V), he has written that the flowers even when dried in the sun do not lose their fragrance, which lasts for a long time.[5] In *Kumārasambhava* and *Ṛtusaṃhāra* of Kālidāsa, *Bakula* flowers have been referred under the name '*Keśara*' (*Kumāra*, 8/25, 3/55, *Ṛtusaṃhāra* 2/20 loccit. Uniyal 1975[6]).

In *Bṛhat Saṃhitā* too *Bakula* has been found mentioned as a sacred tree planted near houses, temples and religious places[8].

Its mention for economic use has been made in Kauṭilya's *Arthaśāstra*, wherein it is observed that the fibre from this was used in making garments. (See reference 3).

Bakula of Āyurveda has been equated with the plant *Mimusops elengi* Linn. of family Sapotaceae in all the Āyurvedic texts and books on Medicinal plants.

Correct Botanical Nomenclature

In view of the taxonomic studies carried out by Lam (1925, 1927, 1932) and Van Royen (1952) on the genus *Mimusops* Linn., the correct nomenclature of *Mimusops elengi* Linn. has been discussed by Oza (1975)[7]. The synonym in detail is as follows : *Mimusops elengi* Linn. Sp. Pl. 1753, Lam in Bull. Jard. Bot. Bzg. Ser 3, 7 : 234, 1925 : Ser. 3, 8 : 479-480, and Nova Guina 14, 4 : 568, 1972 : Van Royen in Blumea 6 (3) 594, 1952 ; *Mimusops elengi* Linn. var. *typica* (*elengi*) var. *parviflora* (R. Br.) Lam. var. *brevifolia* Lam and *Mimusops elengi* Linn. var. *typica* (*elengi*) form *longepedunculata* (Blume in Burek) Lam. in *Bull. Jard. Bot. Bzg.* Ser 3, 7 : 235-238, 1925.

Common Names

Different names have been mentioned for *Bakula* in various Āyurvedic *nighaṇṭus* and text books on medicinal plants: It is known as *Bramarananda, Strī-mukhamadhu, Anaṅkaṇṭha, Madhuparijara* in Sanskrit. It is referred in various regional languages as follows :

Bengali	:	*Bakul*
Bombay	:	*Dorsali*
Assamese	:	*Gokul*
Gujarati	:	*Bolsari, barsoli*
Hindi	:	*Maulseri, molchari, maulsiri* and *bakula*
Kannad	:	*Karak, bakula, pagade*
Malayalam	:	*Elengi, ilanni, ilenji*
Marathi	:	*Bakula, barsoli, avalli*
Oriya	:	*Kaudkudi, bokulo, baula*
Punjabi	:	*Molsari*
Tamil	:	*Alagu, kesaram, magilam, mogadam, nakum*
Telugu	:	*Kesari, pogada, vagula, magadam, barzi*
Urdu	:	*Molsari.*

It is known as 'Surinam medlar,' 'Spanish cherry' in English and '*Munnamal,*' '*Muhula,*' '*Muhuma*' in Sinhalese and *Khaya* in Burmese. In Trade, it is mentioned as 'Bulletwood'.

Botanical Description

Mimusops elengi Linn. is a small or large evergreen tree generally characterized by very rough trunk. Leaves are very glossy and are dark green when old. The new leaves mostly appear in February when the trees often appear bright vivid green. The shining rather narrow pointed leaves are closely scattered along the branches and with somewhat short stalks. Leaves are variable, elliptic, oblong or oblanceolate, short or long acuminate, margin undulate, closely but faintly veined.

The dull white scented flowers grow in small clusters or solitarily in the form of a flat star. Pedicels are pubescent and buds ovoid. Fruit is an ovoid, yellow berry when ripe, usually one seeded. Flowering and fruiting are from March-April.

Distribution

The tree is native of Western Peninsula and is found in South India, in dry evergreen forests from the river Krishna southwards occurring in the hills upto 1200m, along western coast and lower ghats in moist evergreen

forests. Roxburgh, however, observed that he found it in wild state on the mountain of the Rajamundry district. Drury (1873)[8] also reported the occurrence of this plant on the mountains of the Rajamundry district. It is also reported in Andaman, Burma, Martaban, Tannasserim and Sri Lanka. The tree attains large dimensions in the moist evergreen forests of the Western Ghats, in the Eastern Ghats it is found in dry areas, often on laterite and is comparatively smaller in size. In Andamans it attains a height upto 30m.

Bailey[9] 1953 : Brandis[10] 1971 : Bamber[11] 1916 : Burmann[12], Cooke[13] 1958 : Gamble[14] 1957 : Haines[15,16] 1916, 1922 : Hooker[17] 1882 Parker[18] 1973 : Rama Rao[19] 1914 : Stewart[20] 1972 : Talbot[21], 1949 : Trimen[22], 1974.

Cultivation and Collection

The tree is extensively cultivated and commonly planted in gardens for ornamental foliage and fragrant flowers. It is also grown as an avenue or shade tree throughout the greater part of India[23-28].

It is best propagated by sowing seeds singly in baskets and planting out seedlings in the field, usually after two years in the rainy season. The rate of growth is slow.

The *Bakula* flowers from March to July and bears fruit during the hot season and rains. But Benthall[24] (1935) mentioned that two trees planted some years ago outside the main gate of Royal Agri-Horticultural Society's gardens at Alipore (Calcutta) behaved in a curious way. The young trees were taken at random, after sometime differences in the foliage and the manner of growth began to appear, one tree becoming apparently more robust than the other. In 1942 the trees were about 6m high and both bore flowers at various times of the year.

Properties and uses in Indian Medicine

From time immemorial, the drug *Bakula* has been in use against many diseases. The triad scholars of Āyurveda, viz. Caraka, Suśruta and Vāgbhaṭa have mentioned this drug in their respective Āyurvedic treatises, i.e. *Caraka Saṃhitā*, *Suśruta Saṃhitā* and *Aṣṭāṅga Hṛdaya*[29-32]. Mention about this drug has also been made in various *nighaṇṭus* like *Bhāvaprakāśa*[33], *Dhanvantari*[34], *Śāligrāma* and others[35-38]. Various properties and uses have been vividly depicted in different *'ślokas'*, *saṃhitās*, and *nighaṇṭus*.

According to the Āyurveda the drug is acrid, sweet, cooling, astringent and tonic. It has been reported to be anthelmintic and cures biliousness,

chronic dysentery, constipation and fever. Being a very important drug of Āyurvedic Materia Medica, *Bakula* has been used by the Hindu physicians as a specific cure for toothache from very ancient times.

In *Bhāvaprakāśa*[38] it has been described as astringent, cooling, destroys *kapha, pitta*, as anthelmintic and useful in diseases of gum and teeth. According to *Raj Nighaṇṭu*[39] *Bakula* is cooling, cardiotonic, sweet, astringent. Cakradatta mentions the astringent properties of the unripe fruit and recommends it to be chewed for the purpose of fixing loose teeth. He also mentions decoction of the bark as a useful gargle in diseases of gum and teeth.

The water distilled from the flower is said to be beneficial in melancholy madness.

Drury (1873) (See Reference 8) mentioned that the bark forms a good gargle in salivation. A liquid distilled from the flower is used by the natives in Southern India, both as stimulant medicine and as a perfume.

In modern indigenous practice also, the drug is valued as sweet, cooling, astringent, expectorant and used for the diseases of gum and teeth. Dymock *et al*[40]. (1891) in his '*Pharmacographica Indica*' reported the different properties of the drug and mentioned that the decoction of the bark is useful in discharges from the mucous membrane of the bladder and urethra, also as a gargle for relaxation of the gums. The powdered flowers induce a copious defluxion from the nose. In Konkan, the fruits and flowers along with other astringents are used to prepare a lotion for sores and wounds. The ripe fruit powdered and mixed with water is given to promote delivery in child birth.

Later the drug was mentioned by Butterworth[41] (1911), Haines, (references 15 and 16) and Kramer[42] (1916). King[43] (1922) also described its astringent properties and its uses in the diseases of gums and teeth. Roberts[44] (1931) too described it as a useful gargle in weak and spongy gums, pyorrhoea, alveolaris, stomatitis and ulcerated throat. He mentioned about two preparations namely : *Extractum mimusops elengi* and *Corticis liquidum*, which are employed. Later Kirtikar and Basu[45] 1933), Bhandari[46], Biswas and Ghosh[47] (1951), Nadkarni 954), Chopra[49,50] *et al.* (1956, 1958), Anon[51] (1962) also gave a detailed account of the properties and uses of the drug. The bark, flowers and fruits are strongly astringent, tonic and are used in diarrhoea and dysentery. A decoction of the bark is useful as a gargle in salivation in weak and spongy gums, pyorrhoea ; stomatitis and ulcerated throat. Compound powder made of the bark is recommended as tooth powder

in cases of spongy gums. An infusion of the leaves is used as a cold compress for headache.

The flowers and fruits are sweet, acrid, cooling, astringent and expectorant and are used in various ailments. The snuff made from the dried powder of flowers is prescribed to relieve feverish cold. A mouth-wash and a gargle is prepared from the flowers and also fruits.

The fruits and the seeds are sweet, astringent, aphrodisiac, diuretic. The unripe fruits are recommended to be chewed for the purpose of fixing loose teeth. Pounded seeds are pasted with oil or ghee and used as suppositories in case of obstinate constipation, especially for children[45-49].

According to Unani System of medicine, flowers of this drug are considered as expectorant, cure biliousness, liver complaints, diseases of nose, headache, and their smoke is considered good for asthma. The fruit and seeds are sweet, sour, aphrodisiac, diuretic and astringent to the bowels[71].

Dosage

The decoction of the bark is taken at the dose of 5-10 gm, flower in the form of powder at the dose of 1-2 drachms.

Other Economic Uses

The tree is planted in gardens and along the sides for its ornamental appearance. Its fragrant flowers are sometimes valued for stuffing pillow and *attar* distilled from them is esteemed as perfume. From the seeds a fixed oil is obtained, which is used for culinary purposes and for burning. The ripe fruit is edible and is sometimes used for making preserves and pickles.

The bark contains tannin and is used in some parts of India for dyeing and tanning purposes. The wood is very hard and close and even grained. It is useful for building purposes, carts, furniture. making boats oars, rice pounders, crushers and oil mills [51-53].

Watt (1891) reported that the ripe fruit, which has sweetish pulp, is sometimes eaten by the poor natives and the oil yielded by the seed is employed for culinary purposes.

Modern Researches

It is worthwhile to mention some of the latest work that has been done on this drug.

The bark and flowers are reported to contain a saponin and an alkaloid. Fresh flowers on water distillation yield 0.01% of the otto. The seed kernels

yield 16.25% of fatty oil. Bahl *et al.*[54] (1968) have done the chemical analysis of bark, stem, wood, leaf and flowers. The crude oil has a reddish brown colour with an unpleasant odour and is more or less tasteless. The refined oil is almost colourless, odourless but acquires a yellow tinge on exposure to air. The constants of the oil are $D^{28^\circ}_{28^\circ}$, 0.9113, $n_D^{30^\circ}$ 1·4655, acid value 12.0, Iod. value 82.2, sap val. 188.0, acet. val. 12.0, and unsapon matter 1.30%. The composition of the total fatty acids of the oil is as follows: Palmitic, 10.97, stearic, 10.10, behenic, 0.46, oleic 63.98, and linoleic 14.49%. Saponin has been isolated from the fat free seed meal in a yield of 2.4% a saponin, which on hydrolysis yields rhamnose, arabinose and glucose (Anon. 1962[51]). The bark contains 3.7% tannin, some caoutchoc, wax, colouring matter, starch and ash. Seed contains a fixed fatty oil. Pulp of the fruit contains a large proportion of sugar and saponin (*Chem. Abstract* 1940, 34.6636, 1930, 24.836, Anon. 1962 *loc. cit.*).

Mitra and Misra[55,56] (1965), (1967) and Misra and Mitra[57,58] (1968) (1969) carried out investigations on the constituents of fruit and seed of *Mimusops hexandra, Mimusops elengi* and *Mimusops manilkara.* Recently Misra *et al.*[59,60] (1974) (1975) investigated three well known species of the genus *Mimusops*, which support the chemotaxonomic intergenus and intragenus relationship among the plants of Sapotaceae family. The fruit pulps of *Mimusops hexandra* and *Mimusops manilkara* showed the presence of fatty acid esters of common terterpene alcohol, while that of *M. elengi* yields the free tritepenoids. Identical constituents are present in the seed coat and kernel of the three species. Another group of workers [61] reported appreciable amount of saponin giving both neutral and acidic triterpenoids from *M. elengi* bark. But Misra and Nigam[60] (1975) when investigated the bark, could not isolate any saponin. They concluded that such vast differences in the constituents might be due to ecological changes.

Bhargava *et al.*[62] (1971) have studied the anti-inflammatory activity of saponins and other natural products obtained from a number of plants including *Mimusops elengi.* The anti-inflammatory activity of some natural products of known chemical structures was studied against the exudative and proliferative phase of the inflammatory reaction in albino rats. The saponins of *Mimusops manilkara* were active against carrageenin induced oedema with hydrocortisone as standard and formaldehyde induced arthritis. Saponins of *M. elengi* and *M. hexandra* were found inactive.

The methanol and benzene extracts when administered orally showed anti-pyretic activity. But none of these extracts possessed any significant diuretic or anti-inflammatory activity (*Annual Report*, CCRIMH 1976-77, New Delhi).

Pharmacognosy

In view of the importance of this drug pharmacognostic investigations on the bark[63], leaf, flower[64] and fruit and seed[65] have been carried out by Mitra and Mehrotra[66] (1976) and Mitra and Yadav[67,68] (1978). Market samples were also procured from different parts of the country and when compared with the authenticated samples, these were all found to be originated from *Mimusops elengi.*

Salient Pharmacognostic Characters of the Different Parts of the Drug

Bark occurs in flat or slightly curved pieces, externally dark grey and internally red or reddish brown, rough, due to the presence of vertical lenticels, cracks and longitudinal fissures. Fracture short, taste bitter, astringent and mucilaginous.

Microscopically it shows parenchyma consisting of thick rhytidome, wide zone of secondary phloem, composed of stratified layers of ceratanchyma alternating with fibres. Solitary crystals of calcium ovalate are present. The powder is brown. Microscopically it shows tannin cells. Powder treated with nitrocellulose in amylacetate emits black fluorescence under uv light. Preliminary phytochemical investigation shows the presence of reducing sugar, tannin and saponin.

Leaf. Leaves are alternate, petiolate, lamina lanceolate, elliptic, oblong or oblanceolate, shortly acuminate, base acute or rounded, margin undulate, very glossy, dark green, when old, paler beneath, odour is characteristic, brittle when dry, taste is astringent.

Microscopically leaf shows a dorsiventral structure, stomata present on the lower surface and are ranunculaceous or rubiaceous. Hypodermal cells are thickwalled. Calcium oxalate crystals, tannin and brownish contents are present. Stomatal index is 10.362, palisade ratio is 5, vein islet and vein termination numbers are 10 and 11 respectively. Powder treated with conc. HNO_3 turns orange. Powder treated with 1 N NaOH and nitrocellulose in amyl acetate emits blackish green fluorescence under uv light.

Flowers. The flowers arise in pairs of fascicles in the axil of the leaf. They are bracteate, tetramerous, bisexual and rusty tomentose. There are 8 sepals arranged in 2 whorls of each. Each lobe out of 8 consisting a gamopetalous corolla, bears two dorsal appendages.

The androecium comprises of an outer whorl of alternisepalous stamens and 2 inner whorls of 8 alternipetalous, petaliferous and hairy staminodes. Both stamens and staminodes are epipetalous. The ovary is pubescent, superior and octalocular. Each locule has a single basal ovule. The entire flower (except

corolla) is covered by thickwalled, 2 armed hairs. The anther wall comprises epidermis, fibrous endothecium, 3-4 ephemeral middle layers and secretory polyploid tapetum. Anomocytic stomata are found on the anther. The pollen grains are bi-tri-tetracolporate. The ovules are anatropous, unitegmia and terminucellate. The archesporium is single celled and functions directly as the megaspore mother cell. The development of the embryo sac conforms to the polygonum type. The synergids have a distinct filiform apparatus. The chalazal end of the embryo sac develops into a finger like projection. The endosperm is nuclear. The primary endosperm nucleus divides before the division of zygote. The embryo has a massive multicellular suspensor. The cells are of various sizes, cotyledons are foliaceous and show reticulate venation. The testa is completely sclerified, the sclereids have tannin deposited in the lumen[63].

Fruit and Seed. The fruit is a berry, 2.5-3 cm. long and 1-1.5 cm. broad, green when unripe and yellow or orange when ripe, one seeded, ovoid or ellipsoid often bearing at the apex a short bristle, the other end being attached to the persistent calyx,having five free sepals. Seeds are compressed, testa hard, greyish brown or dark brown in colour, shining and crustaceous. Hilum is small. Cotyledons are broad, flat and embedded in fleshy albumen.

Microscopically the fruit shows pericarp, which is composed of exocarp, mesocarp and a hard endocarp ; presence of secretory canals lined with 5-7 epithelial cells is a characteristic. The mesocarp consists of a broad parenchymatous zone, most of the cells of which are filled with masses of rubber like substances. Numerous vascular bundles are scattered in the mesocarp region. The endocarp cells are thickwalled.

The seed lies enclosed within the endocarp. The testa is 1-1.5 mm thick and is distinguished into five distinct concentric regions. A thin perisperm separates the testa from endosperm. The endosperm and cotyledonous cells are thinwalled.

The powdered fruit and seeds on treatment with ferric chloride turns black. Treated with NaOH in water and observed, it gives black with greenish tinged fluorescence. Total ash values for fruits and seeds are 3.416, 2.247 respectively and acid insoluble ash values are 0.795 and 0.6425 respectively. The drug shows the presence of tannin, redueing sugar, saponin, sterol and resin.

CONCLUSION

In the conclusion it can be said that nearly all parts of *Bakula* are employed or administered for various medicinal purposes. The bark and fruits including seeds are sold in the market under different names in different parts of the country and used for a number of physical ailments specifically for the diseases of gum and teeth and for other economic purposes. Thus, it is understandable

that *Bakula* has been regarded a sacred plant by Hindus who assigned for it an exalted position among the plants of the paradise. Besides mythology, this gifted plant has occupied an important place in religious texts and ancient Sanskrit literature. *Bakula* along with its fragrant flowers has served the poet as an emblem of love, a symbol of bliss, beauty and elegance.

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