REMARKABLE TREES ON NII CAMPUS

11. Red Silk Cotton Tree

S. Natesh
Consultant Advisor, NII, New Delhi

Common name: Red silk cotton tree, Semal, Shālmalī

Botanical name: Bombax ceiba L. [= Bombax malabaricum DC, Salmalia malabarica (DC) Schott & Endl. ]

Family: Bombacaceae (Baobab Family). Some taxonomists place it under Malvaceae (Hibiscus Family)

Where to see: Along the eastern, western, and southern borders outside NII

Illustration of Bombax ceiba (as Bombax heptaphyllum) from Roxburgh W, Plants of the coast of Coromandel, vol. 3: t. 247 (1819). Illustration contributed by: Missouri Botanical Garden, St. Louis, U.S.A.
http://plantillustrations.org/illustration.php?id_illustration=61458

1Unless otherwise acknowledged, illustrations and art work are mine
The Red silk cotton tree, when in bloom, must surely rank as one of the most enchantingly beautiful natural sights. It is huge and imposing, capable of reaching 20-40 metres in height. With its large, cup-shaped scarlet, maroon or orange flowers it lights up the skyline, all the more so because the tree is practically leafless at the time of flowering. The nectar-rich flowers are a huge draw for insects and birds throughout March and April in Delhi. The tree is believed to have originated in southern China and Indo-Malaysia and is widely cultivated in Vietnam, Malaysia, Indonesia, China and Taiwan as well as parts of Australia and Africa. In India its habitat is along the banks of rivers and streams but grows in dry as well as mixed deciduous or moist forest and mixed evergreen forests. It is also cultivated in parks and roadsides for its beautiful flowers.

2Sometimes it is vaguely known as silk cotton or Kapok, both of which names could also refer to a cousin Ceiba pentandra (with smaller white flowers).
The genus *Bombax* is the largest within the family and has about 60 species. Currently only seven species are accepted and others are treated as synonyms or are under assessment. Apart from *B. ceiba* only one other species, namely *B. insigne*, is reported from India (others are treated as synonyms). The earlier name of the silk cotton tree was *Salmalia*, derived from its Sanskrit name 'Shālmali'. The Swedish naturalist Carolus Linnaeus described and named this species in 1753 in his seminal work *Species Plantarum*. The generic name *Bombax* is derived from the Greek *Bombyx* meaning things of silk or cotton (also Latin *Bombyx*, meaning silk and silkworm) and refers to the silky/cottony floss produced by the fruit wall. The specific epithet *ceiba* is a Spanish derivative of a Tino or other Arawakan (South American indigenous languages) name used for a group of large, tropical trees related to *Bombax*, many of which also produce floss.

The trunk of the red silk cotton tree at different ages: **Left** – a comparatively young tree with the characteristic sharp conical prickles. **Middle** – As new bark is formed following secondary growth, the number of prickles becomes considerably less. **Right** – In older trees there are no prickles; the bark is smooth with irregular vertical striations. The prickles are employed for treating acne and pimples by several tribal communities (see Box 5).
The leaf is described as palmately compound and resembles the human hand (or a duck’s foot). Five-to-seven leaflets radiate from a common point at the apex of the long petiole which is swollen at the base (left). The central leaflet is the longest and the peripheral leaflets are progressively shorter. Each leaflet is lens shaped with the tip drawn into a long point. The margins are smooth and the texture is smooth. The ventral surface is glossy and the dorsal surface is not (right).

The bole (unbranched part of the trunk) is straight, and covered short, stout, straight and conical prickles up to 1.2 cm long when young, but these are sloughed off in older parts of trees. The bark is pale ashy to silver grey in younger and middle aged trees but becomes rough with irregular vertical cracks in older trees. In older trees the trunk produces buttresses to anchor the tree.

The leaves are palmately compound (look like the palm of the human hand), and 15-30 cm long. Each leaf comprises five-to-seven leaflets, measuring 10-15 cm long and 7-10 cm wide, and arranged like the fingers of the hand, and radiating from a common petiole up to 20 cm long. The central leaflets are usually longer than those on the periphery. Each leaflet is shaped like a lens (lanceolate), tapering to a point (acuminate), and smooth and glossy (glabrous).

Flowering occurs profusely between February and March during which bright scarlet, maroon or orange flowers are conspicuous on the leafless trees. Flowers occur singly or in
Box 1. Red Silk Cotton: Facts, Myths, Legends and Folklore

- The Red silk cotton tree is known as Shālmalī in Sanskrit and Semal in Hindi. Shālmalī finds mention in the Kishkindha Kānda of the Hindu Epic Ramāyana. In the Purānic literature cosmography, the earth is divided into seven concentric islands (Saptadweepa) separated by seven encircling seas. The islands— or dveepas in Sanskrit— are all named after plants with one exception, which is named after a bird. At the core of the concentric islands is Jambudweera (on which India is located), named after the Indian blackberry or jamun (Syzygium cumini). The third island is Shālmalidweera, named after the Shālmalī tree (Bombax ceiba).
- Those born under the birth star (janna nakshatra) of Jyeshtha (the 18th nakshatra or lunar mansion in Vedic Astrology) are enjoined to plant saplings of Semal tree in order to obtain happiness and prosperity.
- According to Chinese historical record, Zjao Tuo, the king of Nam Yuet (today’s southern China and northern Vietnam), gifted a red silk cotton tree to the Emperor of Han dynasty in 2nd Century BC.
- A 727-year-old tree of B. ceiba (Gao in Vietnamese) in Mo Pagoda, Nghi Duong Hamlet, Ngu Phuc Commune in Vietnam was given the status of heritage tree of Vietnam in March 2011.
- Semal tree is mentioned in Guru Granth Sahib, the holy book of the Sikhs with the following commentary:

> “The semal tree is tall and stiff as an arrow
> But birds that visit it hopelessly depart disappointed.
> For its fruits are tasteless and flowers nauseating,
> Only humility and sweetness, O Nanak, bear virtue and goodness.”

Considering how many bird species draw nectar and nourishment from the semal flowers (see Box 3), one cannot help feeling that this is a bit too harsh on the tree.
- Semal is considered as a tree of the infernal region (hence one of its Sanskrit names Yamadruma (Tree of Yama, the Lord of death)).
- Because it has prickles on its stem it has earned the name Kantakadruma (prickly tree). It is also considered inauspicious in the Dungarpur district of Rajasthan due to the hooting of owls that make the tree their home.
- The festival of Holi (also the festival of colours) is celebrated in the month of Phalgun. The Bhāgavata Purāṇa has an interesting story on the tradition of Holi. Hiranyakashipu, the demon king committed austerities to propitiate god Vishnu and obtained a boon. Believing that he was invincible, and no less than god, Hiranyakashipu forced everyone to worship him. However, his own son Prahlad refused to comply, devoting himself to the worship of lord Vishnu. The demon king subjected Prahlad to the most gruesome punishments, but was nevertheless unable to convert him. An enraged Hiranyakashipu enlisted the services of his sister Holika to get rid of Prahlad. Holika had a magical cloak that protected her from being harmed by fire. She tricked young Prahlad into sitting on her lap on a bonfire (see image on right; downloaded from http://www.astrosoage.com/2013/festival/holashatak2013.asp). As the flames engulfed them the garment flew from Holika and enveloped Prahlad. Holika was burnt away while Prahlad came out unharmed. Lord Vishnu killed Hiranyakashipu shortly thereafter, bringing much-needed succour to the suffering subjects.

In many parts of India, especially the northern region, the burning of Holika is symbolically re-enacted on the eve of the Holi festival. The demoness Holika is represented by a pole – usually of the Semal tree – that is set fire to, celebrating the triumph of good over evil. Obviously, this ecologically unsustainable practice is very detrimental to the survival of Semal tree. In Udaipur city alone 1500-2000 trees and twigs are traditionally burnt by Bhil, Garasia and Damor tribes. Since the district of Udaipur has 2,351 villages, more than 2,500 Semal branches/poles are sacrificed during Holi without any plan for conservation and regeneration being put in place.

3 Ref: Wickipedia
4 These islands are, from the core outwards, Jambudweera, Plakshadweera, Shālmalidweera, Kushadweera, Krunachadweepra, Shākadweepra, and Pushkanadweepra
6 http://www.thelovelyplants.com/bombax-ceiba-cotton-tree/
Box 2. The Useful Semal

Semal (*Bombax ceiba*) has many recorded uses, with almost all the body parts being economically valuable.

- The timber is used to make cheap furniture. The wood being light (10-12 kg/cubic foot) it is durable under water. Hence it is popular for making canoes, and light duty boats, and/or other structures required under water. It is also used in the manufacturing of plywood, matchboxes and sticks, scabbards, patterns and moulds.
- Aborigines in Australia make dugout canoes from the wood.
- The floss produced by the fruit is utilized to fill mattresses, cushions, pillows and quilts.
- The young leaf, petiole and seed cake make an excellent cattle feed.
- The fallen ovaries are dried and used to flavour 'biryani' in Andhra Pradesh and Tamil Nadu.
- The dry cores of the flower are an essential ingredient of the nam ngiao spicy noodle soup and kaeng khiai curry of the cuisine of the Shan State in Myanmar and Northern Thailand.
- The Munda and the Oraon tribes of north-eastern India consume the roots, calyx and flowers as food. The immature calyx known as *Semargulla* is eaten as a vegetable in Uttar Pradesh. According to the Wealth of India, the raw calyx compares favourably with carrot, radish, turnip, cabbage and pumpkin in terms of protein and phosphorus.
- A paste of semal petals mixed with breast milk when externally applied, is reported to cure 'red eye'.
- Young prickles on the trunk are used as a substitute for betel nut.
- The gum ('Moch ras') oozing from young bark is edible, and is reputed to be a cure for dysentery and diarrhoea. The gum from older bark is used for book binding.

Clusters, large (7-12 cm across), bisexual, open, and cup-shaped, fleshy and filled with nectar. Pollination is carried out by bees, birds and bats (see Box). Older flowers (actually they comprise the calyx cup, the corolla and the stamens) wither and fall on the ground, making a soft and slushy red carpet.

Calyx is cup-shaped with three lobes and 3-5 cm in diameter. Petals are 8-12 cm long, scarlet or sometimes maroon or orange (rarely yellowish), and fleshy. The stamens are of three types: (a) a ring of peripheral stamens arranged in five bundles of 10 stamens each; their filaments are fused at the base into a short tube attached to the bases of the succulent petals. (b) a central column of five stamens enveloping the style; and (c) a second column of
Flowers are very prominent on the tree as, at the time of flowering, the trees are leafless (indeed, new leaves appear soon after flowering). They are large, and could be red (picture on top), orange (bottom left) or maroon (bottom right) in colour. The calyx is green and leathery with five sepals. The petals are tough but fleshy. Stamens are many and appear in (a) peripheral ring of five bundles of 10 stamens each and (b) a core of two concentric rings of five stamens each, the outer ones being shorter than the inner. The style is 5-fid and protrudes through the inner ring of stamens.
Box 3. How is the Red Silk Cotton Flower Pollinated?

There are two scientific studies on the pollination mechanism in the Red silk cotton tree. Mature buds of *Bombax ceiba* open at midnight and the anthers dehisce immediately thereafter. The stigma becomes receptive and remains so until late evening the following day. Estimates of pollen grains per anther vary greatly from 6,308 to 88,630 (and hence per flower from 5,04,640 to 88,63,000). Nectar is produced from the time the flower is open and functional, and continues to be secreted until about 0500 hr. Each flower secretes about 258±3.5 μl of nectar mainly composed of sucrose, glucose and fructose. The sugar concentration varies from 19-25% through the day.

Fruit set is possible only when the stigma is pollinated by pollen from a flower produced on another plant (xenogamy). Thus *B. ceiba* is an obligate outcrosser.

Fruits take about four weeks to mature, and each fruit generally produces about 330 black, smooth, light seeds surrounded by white floss. Red silk cotton flowers are visited by bees, birds and bats. The latter include the large bat known as the flying squirrel or the great Indian fruit bat (*Pteropus giganteus*) and two smaller bats, the greater short-nosed fruit bat (*Cynopterus sphinx*), and the long-winged tomb bat (*Taphozous longimanus*). These visit the flowers to drink nectar from 1900 hr to until 0400 hr, and while doing so invariably contact the style and the stigma thus effecting pollination. A variety of birds are reported to visit the flowers during daytime between 0600 hr and 1800 hr: the Black Drongo (*Dicrurus adsimilis*), Bank Myna (*Acridotheres ginningianus*), Indian Myna (*A. tristis*, see picture on the right), Jungle Myna (*A. fuscus*), Jungle Crow (*Corvus macrorhynchos*), House Crow (*C. splendens*), Tree Pie (*Dendrocitta vagabunda*), Red Whiskered Bulbul (*Picronotus javensis*), White Eye (*Zosterops palpebrosa*), Common Babbler (*Turdoides caudatus*), Coppersmith Barbet (*Megalaima haemacephala*), and Golden-backed Woodpecker (*Dinopium benghalense*). The most common visitor is the Indian Myna (*Acridotheres tristis*) as may be seen in the picture above. While probing flowers for nectar, the beak, head and body of the birds invariably come in contact with the stamens and stigma, facilitating pollination.

Among the bees, the Asiatic honeybee (*Apis cerana*) and the dwarf honeybee (*A. florea*) are regular visitors and the carpenter bee (*Xylocopa latipes*) an occasional visitor. *Apis* bees collect both nectar and pollen, foraging mostly on a single tree. As the red silk cotton is not self-pollinating, their flower visits are considered of little significance. *Xylocopa* bees, on the other hand, collect only nectar, but move between trees of the same species nearby, hence their foraging behaviour results in cross pollination.

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10. Image Credit: https://comnatura0708.files.wordpress.com/2008/06/398px-psittacula_krameri_karkala.jpg
five stamens enclosing the central column, with slightly shorter filaments than those of the inner five. Thus there are 60 stamens in each flower. The filaments are 3-7 cm long, anthers reniform. The ovary is five chambered and reported to contain about ~600 ovules. It is 15-20 mm long and embedded in silky hairs, continuing into a 50-60 mm long style that divides into five spreading branches, each terminating into a light red stigma. Fruit is a capsule,
oblong to ovoid, about 10-15 cm long, narrowed at both ends five-valved, light green when young, turning brown at maturity. The inner epidermis of the fruit wall produces the floss. At maturity, the seeds get surrounded by the white floss. The seeds are obovoid, smooth and 6-9 mm long. The surrounding floss helps them easily float in the air currents and get dispersed. The seeds yield pale yellow oil, used for soap making, sometimes as a substitute for cotton seed oil.

**Box 4. Painting of *Bombax ceiba* by Vera Scarth-Johnson**

Vera Scarth-Johnson's (1912-1999) passion for plants began in her early childhood, in Yorkshire, and lasted throughout her life. She studied art and agriculture, and during World War II had her own market garden. She arrived in Australia in 1947, settled near Bundaberg and became Queensland’s first licensed female sugar-cane farmer. Wherever she went exploring, Vera collected and painted specimens for botanic gardens and museums around the world.

Her keen botanical interest eventually brought her to Cooktown and Cape York Peninsula. She began what she termed her “life work”, collecting and illustrating the flowering plants of the Endeavour River Valley. In 1990 she gave her Endeavour River series of 156 illustrations to the people of Cooktown.

In recognition of her contribution to the region, Nature’s Power House, was purpose-built in the Cooktown Botanic Gardens to display Vera’s original illustrations. Here is her illustration of *Bombax ceiba* (Image credit: [http://www.naturespowerhouse.com.au/gallery](http://www.naturespowerhouse.com.au/gallery)).
Box 5: Red Silk Cotton Tree in Tribal and Folk Medicine

Almost all parts of the red silk cotton tree are used in tribal and folk medicine. Most uses are for the treatment of gastrointestinal and skin diseases, gynaecological and urogenital problems, general debility, diabetes and impotence. For further information see\textsuperscript{11,12,13,14}.

**Diabetes** – Tribal communities of the Siran Valley and Hazara region of Pakistan, Madhya Pradesh, Uttara Pradesh, Odisha, Chattisgarh, Bihar, Jharkhand and Tamil Nadu use various parts of the plant (root, stem, heartwood, fruit and seeds) to treat clinical symptoms suggestive of diabetes. A hypoglycemic (blood sugar lowering) compound mangiferin (earlier known as shaminin) has been isolated from the leaves and flowers of the red silk cotton. Mangiferin reduces blood sugar significantly in treated rats. Roots and flowers also show hypoglycemic activity. Claims on other plant parts are yet to be validated.

**Sexual Disorders** – Young roots (known as semal musli or semal kanda) have been traditionally used as an aphrodisiac and for the treatment of impotence and spermatorrhoea (involuntary discharge of semen without orgasm). Investigations on rats have corroborated these claims.

**Bladder and Kidney Stones (Urolithiasis)** – Young fruits find use in the treatment of urolithiasis. Aqueous and ethanolic extracts of the fruit have shown significant urinary oxalate reducing activity in rats. Both these extracts also possess diuretic (causing increased passing of urine) effect, confirming the folk claim of treating urinary stones with fruits.

**Acne** – Acne (medically known as Acne vulgaris) is a common skin disease characterized by pimples on the face, chest and back. Many tribal communities have utilized the prickles on the stem and young trunks of the red silk cotton tree to treat acne and pimples. Alcoholic extract of leaves, bark and prickles have been shown to possess very good anti-acne potential compared to the standard drug clindamycin in treating Propionibacterium acnes-induced granulomatous inflammation in rat ear. Interestingly, bark and prickle extracts were quite comparable to the standard drug. Prickles of *Bombax ceiba* are now an important ingredient in Himalaya’s ‘Acne-n-Pimple-Cream’ (http://www.himalayastore.com/acne-n-pimple-cream.htm).

**Liver Disorders** – Aqueous extract of stem bark and root is capable of reducing hepatotoxicity induced by carbon tetrachloride in rats and hepatoprotective effect on liver fat degeneration and cell necrosis. Although there are no ethnomedical claims on the treatment of liver-related problems, scientific studies have demonstrated its hepatoprotective potential.

**Others** – There is now sufficient evidence to point towards several other useful properties including anti-inflammatory, antisyneretic, antidiarrhoeal, analgesic (pain relieving), restorative and tonic, anti-microbial, and oxytocic (hastening or facilitating child birth, especially stimulating contractions of the uterus) activities, all demonstrated on laboratory rats. Other activities include antipyretic, anti-angiogenic, cytotoxic, anthelmintic, larvical and many more. These and others mentioned above, need to be investigated further and it is still a long way yet from resulting in actual drugs for specific problems. However, prima facie, there is enough to excite in the results found so far.

\begin{itemize}
  \item \textsuperscript{11} Jain V, Verma SK. 2014. Assessment of Credibility of some folk medicinal claims on *Bombax ceiba* L. Indian J Trad Knowledge 13: 87-94.
  \item \textsuperscript{12} Bharati KA, Kumar M. 2014. Traditional drugs sold by healers in Haridwar, India. Indian J Trad Knowledge 13: 600-605.
  \item \textsuperscript{13} Chaudhary PH, Rai PD, Deore SI, Khabdadi SS. 2014. Pharmacognostical and phytochemical studies on roots of *Bombax ceiba* Linn. J Pharmacy & Pharmacognosy Res. 2: 172-182.
  \item \textsuperscript{14} Biswas S, Pandita N. 2015. Evaluation of phytochemical constituents and chromatographic screening of alcoholic extract of *Bombax ceiba* Linn. Pharmanest 6: 2797-2806
\end{itemize}
Box 6. Postage stamps on *Bombax ceiba*

Here are four stamps I could find on *Bombax ceiba* on the internet. Are you aware of any other?

![Postage stamps](image-url)

Image credits (clockwise, from above left):

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