REMOKABLE TREES ON NII CAMPUS

6. Calabash Tree

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Common name: Calabash Tree, Beggar’s Bowl

Botanical Name: *Crescentia cujete* L.

Family: Bignoniaceae (Jacaranda Family)

Where to Find: In the triangle between the old animal house, generator substation & the A/C cooling tower, and the road leading to the back gate

The Calabash tree, with its flowers and fruits appearing directly on older parts of the trunk, would be arrestingly remarkable in any setting, but here on our campus it is more so as there are just two of them facing one another. How and from where they got here is a mystery I have not been able to solve! This is indeed a very rare tree in Delhi: other than our specimens, there are said to be only four more [one near the

1 Unless otherwise acknowledged, the photographs/illustrations are mine.
Talkatora swimming pool, a second in the garden at the CSIR-National Institute of Science Communication and Information Services, and a pair of trees opposite the emus in the Delhi Zoo (Krishen 2006²).

These are the two calabash trees on NII campus, both located in the triangle bordered by the animal house, cooling tower and the main road leading to the back entrance. The tree on the left is immediately adjacent to the cooling tower. The one on the right is closer to the main road. Both of our trees lack a clear bole, but several trunks emerge from the ground. In that sense, they are more like shrubs than trees. Note the abundance of fruits on the trunks in the image on the left.

The calabash (derivative of the French word 'calebasse') tree is native to the tropical and subtropical regions of America. Its place of origin is uncertain because the species has been cultivated in the Yucatan Peninsula³ since pre-Hispanic times (see Box 1). The species grows naturally on the Caribbean islands and from Mexico through Central America to northern regions of South America. It has been introduced into India from South America. Today it is cultivated as a backyard tree in several countries across the world.

The genus Crescentia has seven species. Of these, two viz., C. alata Kunth and C. cujete L. have been introduced and cultivated in several states of India because of their ornamental

² Krishen P 2006. Trees of Delhi. Pp. 360. Dorling Kindersley (India) Pvt Ltd. The author was probably not aware of the two trees in NII. I have also discovered a young tree in the Garden of Five Senses, taking the tally of Delhi plants to seven. Whereas Krishen treats the trees as C. alata, he recognizes that at least three specimens could belong to C. cujete. It is possible that there is cross-breeding between these species giving rise to hybrids. However, more studies are required.

³ peninsula in south east Mexico, lying between the Gulf of Mexico and the Caribbean Sea.
Box1. The Calabash Tree and Mayan Legend

In the mid-1850s a Latin-translated version of a long-forgotten Mayan manuscript known as *Popol Vuh* (= ‘Book of the Community’, ‘Book of the Council’ or ‘Book of the People’) was discovered in the archives of the University of San Carlos, in Guatemala City. The *Popol Vuh* was written by anonymous members of the Quiché-Maya nobility, a branch of the Maya that dominated the highlands of western Guatemala prior to the arrival of Spanish conquerors in 1524. Their present population is something over half a million, spread thinly through the modern Guatemalan states of Quiché, Totonicapán, and Quetzaltenango. The *Popol Vuh* encompasses a range of subjects that includes creation, ancestry, history and cosmology and contains the oldest Maya myth to have been preserved in its entirety. The calabash tree, known as *luch* in Mayan, was considered sacred, as it personified the god of creation who fathered the progenitors of the Mayan royal family.

According to one legend described in *Popol Vuh*, Hun Hunahpu, the earthly god was playing ball with his brother. The gods of Xibalba, the underworld felt disturbed. They cunningly invited the brothers to play a game with them, and defeated them through deceit. They then beheaded Hun Hunahpu and suspended his head on the branches of a calabash tree. The tree immediately produced fruits that looked like Hunahpu’s head. Until this time the tree had never borne fruits. Seeing this, the gods of the underworld were so fearful of the power of the tree that they forbade anyone from cutting its fruit or going near it.

Intrigued by the head on the tree, an underworld maiden, daughter of one of the Xibalban lords approached the tree and started a conversation with the head. When she came close enough, Hun Hunahpu spat into her hand, magically impregnating her. When the dark lords discovered that she was carrying the child of an unknown father, they banished her to the surface of the earth where she gave birth to twins. The twins grew up on earth; they learnt that their true father was Hun Hunahpu, also the true lord of the earth. In due course they defeated the lords of the underworld and recovered the remains of their father and father’s brother, but could not resuscitate them.


The generic name *Crescentia* was coined by the Swedish botanist Carolus Linnaeus in honour of Pietro de' Crescenzi (or Petrus de Crescentius in Latin), a 14th century Italian

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4 Madhukar VK, Srivastava SK, Dubey NK 2013. Revision of Genus *Crescentia* L. (Bignoniaceae) in India. Amer. J. Plant sci. 4: 1164-68
jurist and author of *Ruralium Commodorum*, a book on horticulture and agriculture. The specific epithet 'cujete' is the Brazilian vernacular name for the gourd⁵ (fruit) of this plant (see Box 2).

Leaves are usually arranged in alternate clusters of 3-6 on the branches (above left) or directly on the trunk (above). They are simple (lamina undivided); however, an occasional leaf in a cluster may be 2-or-3-lobed (left). Leaf shape is described as obovate – the basal portion being narrower than the apical. The leaf tip is rounded with a shallow notch at the tip (arrows in the picture on the left).

Box 2. The calabash and the Haitian currency

The Haitian currency is called gourde. Do you know how it got its name? Gourds had so much importance for the Haitian people that King Henry Christophe (1767-1820) declared that all gourds would henceforth become the property of the state. Piled high on farm carts, 227,000 gourds were rounded up for the treasury by the king’s soldiers. Declaring them national currency, Christophe placed a value of a franc on each of them. He asked the farmers to grow coffee, and purchased it by paying them with – you guessed it – gourds! The coffee was sold to foreign nations in exchange for gold, thus ushering in a stable economy. And thus, a currency system based on gold was also established.

Even today, Haiti’s currency is called gourde and it is divided into 100 centimes. At today’s exchange rate, US$ 1 = 43.798 gourde.

What is still unclear is whether the original cumbersome currency came from gourds produced by vine gourds of the pumpkin family or from the calabash trees that grow naturally in the Caribbean islands. Some argue that both types of gourds were brought to the treasury. Be that as it may, thank god that it was only a temporary arrangement. Otherwise you would have needed a truckload of gourds for your trip to Haiti!

⁵ The term ‘gourd’ is also applied to the fruit of the bottle gourd *Lagenaria siceraria* Standl., an annual vine of the Family Cucurbitaceae (pumpkin family). Often, gourds of both the species are put to similar use.
A very striking feature of the calabash tree is the presence of flowers (and fruits) on the trunks and older parts of branches. You simply cannot miss the flowers scattered on the bare dark trunk. This feature - which it shares with more than a hundred other species - is known as 'cauliflory'. The flowers are pollinated by bats in their native habitat. How is pollination effected in Delhi, so far away from their home?

The calabash is a small, evergreen tree growing up to 10 m (30') with a straight trunk and open crown. The bark is light gray and relatively smooth. Leaves may also occur directly on the older parts of the trunk. The leaves in each cluster could be 12-18 cm long and 2.5-5.5 cm wide, bright green and sessile (without a petiole). The lamina is entire, occasionally two- or three-lobed. It is narrow at the base, flaring toward the apex. The tip is rounded with a shallow notch. The midrib is prominently raised on the underside; secondary veins are 6-20 pairs.

Flowers are drab, greenish-purple with purple veins. There is a prominent notch towards the base of the corolla tube (left). A portion of the corolla tube has been removed (middle) to expose the interior. There are two pairs of arrow-like stamens, the arrowhead known as the ‘anther’ and the long handle known as the ‘filament’. One of the pairs is longer than the other and all of them along with a sterile stamen (staminode) - not seen here - are attached to the base of the corolla tube. Note that the anthers have not yet dehisced (split along the ‘seam’) to release the pollen grains. The pistil (middle and right) comprises the ovary mounted on a disc, a long style that projects above the anthers and a flat, broad bi-lobed stigma. The calyx remains even after the corolla has fallen off.
Flowers are stalked, tubular, greenish purple and open at night. They are borne throughout the year solitarily or in clusters on older parts of the trunk or larger branches; this phenomenon is known as ‘cauliflory’ (see Box 3). The calyx is cup-like, split into two halves till the base, and dark green. The corolla is tubular, purple with yellowish-brown veins ~4-6 cm long and up to 4 cm wide and fleshy. There are five triangular lobes, the tips of which are extended into long narrow points. Stamens are in two pairs attached to the corolla tube, one pair being shorter than the other. There is also a sterile stamen (or staminode) on the side opposite to the notch. The pistil is 4.5-6 cm long with a long style and flat broad bi-lobed stigma. Bats are reported to pollinate these flowers (see Box 4).

The corolla tube falls off from the rest of the flower the same night after the flower blooms. Post-pollination, it also turns a lighter shade (left). Note the difference between the anthers in this picture and the previous one: here the pollen grains have been released. What remains on the tree trunk comprises the persistent calyx cup protecting the ovary mounted on the prominent disc (right). The disc is a nectary that continues to secrete nectar for some time. The nectar attracts ants that supposedly ward off herbivores.

The fruit is an eye-catching hard-shelled berry arranged on the woody part of the tree trunk. If you cut it open (believe me it is a tough job!), you will see the white pulp in which are embedded a number of brown seeds. The fruits, also known as ‘calabash’ or ‘gourd’ are highly valued.
The fruit - also referred to as gourds (see foot note 5), is a spherical or ovoid-elliptic indehiscent berry of 8-20 cm diameter. The pericarp is smooth, green and hard with a white pulp inside in which numerous brownish seeds are embedded. The fruits appear very attractive as they mature slowly, remaining on the tree for up to seven months. When ripe the pericarp changes colour from green to greenish-yellow-to-brown. Ripe fruits fall to the ground and rot in due course. They were probably dispersed by large extinct herbivores.

Box 3. Cauliflory: Blooming of Flowers (and Hence Fruits) on Woody Trunks

In the majority of woody flowering plants, flowers usually arise on young leafy stems. The term ‘cauliflory’ (Latin caulon = stem; flos = flower) refers to flowers and inflorescences that develop directly from the trunks, limbs and main branches of woody plants. In such instances, flowers originate from axillary buds which have become engulfed by the stem tissues during secondary growth. By the way, the cauliflower has nothing to do with cauliflory, and is essentially a dense cluster of unopened flower buds arising from a main flower stalk.

Why is cauliflory remarkable? Well, we may say it is a striking botanical sight to see a tree trunk with flowers or fruits. Even a single flower will stand out on a stark woody background. While rare in temperate climates, this phenomenon seems fairly common in tropical forests. More than 100 species including cannon ball, jack fruit, cocoa trees; and fig are known to exhibit this trait (see illustrations below).

How did cauliflory evolve in parallel in so many unrelated species? While it is difficult to generalize, it may be safely assumed that most species do not prefer self-pollination (and hence self-fertilization) as it minimizes genetic variation. One of the 'clever' strategies they have hit upon to ensure cross fertilization is to make animals carry out pollination services for them. It is a well-known fact that in tropical forests pollinators (insects, birds, bats etc.) are distributed in horizontal layers at various heights above the ground. Many of the cauliflorous species have capitalized on fauna that inhabit the ground level. Equally important, the generally large fruits of these species are easily accessible to the animals that feed on them and disperse them eventually.

Above (left to right): cannon ball tree; jack fruit tree; cocoa or chocolate tree; and fig.

Picture credit: [Planet Oddity](http://planetoddity.com/dangerous-cannonball-tree/); [Civil Society Online](http://www.civilsocietyonline.com/Archive/aug11/aug116.htm); [Starr](http://upload.wikimedia.org/wikipedia/commons/9/97/Starr_070321-6113_Theobroma_cacao.jpg); [Sunday Farmer](http://sundayfarmer.wordpress.com/2011/02/21/biblical-fig-tree-in-kerala)

The gourds are used as storage containers, bowls, scoops, ladles, ornament boxes, musical instruments (see Box 5), and even help trap food. The Taíno people of the Caribbean would hollow a calabash, cutting ‘eye holes’ into it. Wearing the calabash on their head they waded into the rivers or the ocean. Apparently these floating gourds did not frighten the birds. Thus, the camouflaged hunters were able to catch the unsuspecting birds by grabbing them by their legs without disturbing the flock.
Box 4. How is the Calabash Tree Pollinated in its natural home? In Delhi?

In its native habitat the calabash is pollinated by Palla's long-tongued bat (*Glossophaga soricina*). This tiny Central and South American mammal with a body no bigger than your thumb (length 5 cm; weight just 9g) is a nocturnal forager for nectar and pollen. Calabash flowers, by virtue of being cauliflorous (see Box 3) are prominently displayed facilitating their detection and recognition by pollinators. They also open at night to coincide with their pollinators’ visits and emit a sulphurous smell that bats recognize.

Even so how do bats unerringly home in on these flowers in the dead of the night? While their sense of smell and vision is excellent, bats’ orientation is mainly guided by a highly developed system of echolocation. Using high frequency sound as a tool, they emit calls out to the environment and listen to the echoes of these calls that return from various objects near them. The echoes are used to locate and identify the objects, both for navigation and foraging. It is now known that calabash flowers generate complex but predictable echoes owing to their specific shape and texture.

Once the flower is located, Palla’s long-tongued bat (much like a hummingbird) hovers for a few seconds over the flower, dips its muzzle into the tube, then inserts its long tongue to slurp up the nectar. With the need to soak up as much nectar as possible in the shortest time, the bat’s tongue is covered with tiny hairs. When the tongue is tucked inside the mouth the hairs lie flat on its surface. When extended to the maximum into the flower, the hairs become erect through supply of blood, a unique feature not seen anywhere else. When that happens, space is created between each of the rows of hairs into which nectar gets loaded. In other words, the tongue acts like a very efficient mop (you can watch a video of this at the following web link: http://blogs.scientificamerican.com/running-ponies/2013/05/06/bats-use-blood-to-reshape-their-tongues-for-better-feeding/). When the bat inserts its muzzle into the flower, the pollen adheres to the fur on its head. Eventually, some of this pollen will get transferred to the stigma of the next flower the bat visits, thus effecting pollination.

Since hovering takes up a great deal of energy the bat has to visit many flowers in a single night. In order to maintain very high metabolic rates the animal has to rely on the sugary nectar it ingested mere minutes ago to almost exclusively fuel its hovering. In Palla’s long-tongued bat, 78% of the energy needed for hovering is provided by the processing of the recently ingested sugar. Hummingbirds can fuel 95% of their hovering flights in the same way. Comparatively, humans and other mammals are able to burn a meagre 25-30% of dietary sugars as they rely heavily on other types of fuel such as glycogen and triglyceride.

So how does pollination take place in the calabash plants growing in Delhi (or in other Indian cities) in the absence of their natural pollinator? The trees set fruits in abundance suggests that pollination is taking place; however, we do not have enough studies on bat pollination in India. Based on studies carried out in the 1930s, six species of Indian flower bats and some 25 species of bat-pollinated plants were recognized. I am sure this list will expand as more work is carried out. At least three species of flower- visiting bats viz., short-nosed fruit bat (*Cynopterus sphinx*), Leschenault’s Rousette (*Rousettus leschenaultii*) and the Indian flying fox (*Pteropus giganteus*) are known to occur in Delhi. Do they visit our trees? Or is pollination effected by other agents, e.g., honey bees, humble bees or moths? Alternately, are these flowers self-fertile? Clearly, in depth work is needed here.


Picture credit: http://ngm.nationalgeographic.com/2014/03/bat-echo/meagher-text
Box 5. The versatile calabash

In contrast with most perennial plant species that have been domesticated for edible fruits, *Crescentia cujete* has been exclusively used by the ancient Mayans of the Yucatan Province, Mexico for preparing bowls or containers commonly known as *luch* in Maya and *jícaras* in Spanish. Even today, Mayan people in the Yucatan region make diverse uses of bowls as linked to their life and culture - from everyday uses to specialized practices associated with religious and agricultural rituals. Chiefly, bowls are used: (a) in households for daily consumption of *pozol* - a maize-based beverage cooked in plain water, with lime added; (b) for religious rituals associated with offering food and drinks (e.g., liquid chocolate) to the souls of the departed on the Day of the Dead - small bowls for children and larger ones for adults that have passed away; and (c) for agricultural rites such as the *ch'a chaak* ceremony (rain petition), *bahlí kol*, *wahi kol* or *primicia* (first-fruit ceremony) etc. In these ceremonies, *saká* (beverage made from maize cooked in plain water and sometimes sweetened with honey) and *balché* (mildly intoxicating fermented beverage made from the bark of a legume *Lonchocarpus* spp soaked in water with honey) are served in the *jícaras*. Other uses include children' school parade when *jícaras* are hit with one another to produce a rhythmic sound, and the "Dance of the Pig's Head" where they are used as rattles to fulfil a vow to a saint.

For preparing the bowls, mature fruits are collected when the pericarp is hard and woody. After the stalk is cut off, the two halves are marked with a knife point. A clean cut is then made with a fine-toothed saw along the line mark. After the pulp is extracted and thrown away, the halves are boiled in water with lime (calcium hydroxide) for 5-20 minutes until the remaining pulp attached to the pericarp turns soft and can be scraped off. Each bowl is then washed with clean water and left to dry upside down for a couple of days in the sun. At this stage, it is ready for daily use. For ornamental use it has to be treated further depending on intended use. With age, the calabash darkens naturally, but may be stained in other colours such as rose or indigo. They may be elaborately carved (illustration above, a), painted, or polished bowls or boxes (b, c) and made into a variety of other objects such as lady's purses (d) or simple percussion instruments known as *maracas* usually played in pairs (e). Maracas are made of a dried gourd filled with seeds or dried beans. They are generally used in pairs. I had the fruit cut into the shape of a *kamandal* (see photograph on right). You could use your own imagination!

Box 6. The Gourd

The calabash (gourd) has also been the subject of several poems. Here is a beautiful one titled ‘Gourd’ written by Paul Laurence Dunbar.

Paul Laurence Dunbar (1872-1906) was the first African-American poet to garner national critical acclaim. Born in Dayton, Ohio, Dunbar penned a large body of dialect poems, standard English poems, essays, novels and short stories before he died at the age of 33. His work often addressed the difficulties encountered by members of his race and the efforts of African-Americans to achieve equality in America. He was praised both by the prominent literary critics of his time and his literary contemporaries.

The Gourd

In the heavy earth the miner
Toiled and laboured day by day,
Wrenching from the miser mountain
Brilliant treasure where it lay.
And the artist worn and weary
Wrought with labour manifold
That the king might drink his nectar
From a goblet made of gold.

On the prince's groaning table
Mid the silver gleaming bright
Mirroring the happy faces
Giving back the flaming light,
Shine the cups of priceless crystal
Chased with many a lovely line,
Glowing now with warmer colour,
Crimsoned by the ruby wine.

In a valley sweet with sunlight,
Fertile with the dew and rain,
Without miner's daily labour,
Without artist's nightly pain,
There there grows the cup I drink from,
Summer's sweetness in it stored,
And my lips pronounce a blessing
As they touch an old brown gourd.

Why, the miracle at Cana
In the land of Galilee,
Tho' it puzzles all the scholars,
Is no longer strange to me.
For the poorest and the humblest
Could a priceless wine afford,
If they'd only dip up water
With a sunlight-seasoned gourd.

So a health to my old comrade,
And a song of praise to sing
When he rests inviting kisses
In his place beside the spring.
Give the king his golden goblets,
Give the prince his crystal hoard;
But for me the sparkling water
From a brown and brimming gourd!

(Link: http://allpoetry.com/poem/8462475-The-Gourd-by-Paul-Laurence-Dunbar)

Young fruits are pickled like walnuts. Seeds are cooked and made into a drink known as semilla de jicaro in Nicaragua. The fruit pulp is used in folk medicine for respiratory problems such as asthma, as a laxative, expectorant, anthelmintic, analgesic and anti-inflammatory.
**Box 7. Paintings of the calabash tree**

*Calabash Tree-I*

by Juliet Thorburn

https://www.behance.net/gallery/11744643/Tree-Scapes-II

Juliet Thorburn-McIntosh is a Wilmington-based contemporary artist with colourful and distinguished Caribbean roots. Her work ranges from watercolours to oils, from realism to a special version of the abstract she calls her ‘Etherreals’ and ‘Jewelled Etherreals’.

*Jamaican Orchids growing on a branch of the Calabash tree (Painting III)*

by Marianne North

http://prints.kew.org/art/469775/III_Jamaica_Orchids_growing_on_a_branch_of_the_Calabash_tree

Plants: Orchids *Dendrophyllax funalis,* and *Oncidium triquetrum,* Calabash tree, *Crescentia cujete*

Marianne North (1830-1890) devoted her life to travelling the world and painting plants. The Marianne North Gallery at the Royal Botanic Garden, Kew, UK houses 833 of her paintings.
**Box 8. Postage stamps on the calabash tree**

Images taken from the Internet

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