

# tree talks

E.02  
Plant Pigments  
Sanjeewa Wijesundara

[00:05] In celebration of the Lunuganga gardens 75<sup>th</sup> anniversary, *Tree Talks* podcast explores the lives of flora and ecosystems within the gardens. Bought on the eve of independence in 1948, Lunuganga is Geoffrey Bawa's first and longest running architectural endeavour, join us as we unravel the intricacies of this living archive.

[00:33] All transcripts, translations and supplementary guides for *Tree Talks* podcast episodes are available at the *To Lunuganga* and Geoffrey Bawa websites, links available in the show notes.

[00:49] “the village and surrounding lands is lush and overwhelmingly green, monochromatic but with an infinite variety of greens the dark brown of the earth seldom evident except when the rice fields are tilled and the dark brown beautiful against the green lines of the dividing bunds which separate field from field making elegant geometric man-made patterns.”

Geoffrey Bawa, from his book *Lunuganga*, 2006

[01:20] Colour, and thereby pigment extractions, have been in the centre of human aesthetics and creative pursuits since the earliest records of human history. This episode delves into the nuances of colour and experimentation through extractions of plant pigments with fashion designer and advocate for sustainable fashion practices, Sanjeewa Wijeyesundara.

- [01:47] “Hello! I’m Sanjeewa Wijesundara, a graduate of Fashion Design and Product Development, University of Moratuwa. I study natural pigments and dye because as a designer I have a responsibility to promote sustainable products and practices.”
- [02:07] Plant leaves, flowers, stems, roots, fruits and pods of various species have been hand picked for their ability to be extracted and retain colour throughout history. However, working with nature and understanding its temperaments requires patience and experimentation.
- [02:27] “Say for an example, if we take Hibiscus flower in January, and we boil it and make some pigments and dye some fabric in it can get a certain red and let's say we do the same process, same flower, and same fabric, same temperature in September, or a different tree, we can't achieve the same colour in same way because there so many factors that affect these natural dye extractions and pigments.”
- [03:03] Geoffrey Bawa used natural pigments like Samara and Nil in the buildings at Lunuganga, connecting and extending interior spaces to nature outdoors. Bawa was meticulous about how he interacted with and extracted from the land. Starting in the Field of Jars, is a prime example of his design philosophy.
- [03:25] In the front of the pond at The Field of Jars, beside the well you're met with a tall, magnificent Kumbuk tree, Terminalia arjuna is easily identifiable by its smooth, peeling light grey bark that creates a two toned bole. As evident by the orchids that are latched on to the trunk and the ants racing up and down it, this Kumbuk tree is giving and resourceful.
- [03:45] As Geoffrey Bawa himself fondly recounts in his book 'Lunuganga', Kumbuk trees are often planted beside wells to clarify water. In the case of the abundant well beside this Kumbuk tree, back in Bawa's time, it was used by the entire village during severe droughts.
- [04:19] Traditionally, Kumbuk is used for its medicinal and pigment properties. Its bark extracts predominantly produce shades of cream and beige but owing to the nature of natural dyes; colours are not always consistent but rather exist in a general shade range. However, factors like the material and mordant used can also affect the shade.
- [04:42] “Mordants fix the colour or extract the colour, so the mordant is a very important thing. It works as a fixing agent”
- [04:52] Kumbuk bark contains compounds such as tannins which act as mordants, but also allows it to bind with other mordants such as alum to create dark brown shades on silk, taupe shades on cotton and light brown shades on nylon.
- [05:10] “Kumbuk tree is not listed as endangered, but it needs to be conserved. It produces some great shades but the thing is, it's a very threatened tree. So we can't extract for commercial purposes because it takes 40-50 years to make a good tree.” So I have to encourage not to use Kumbuk barks for extracting dyes even though it produces beautiful hues because when we speak about biodiversity it has a great value”

[05:42] Further, extracting from nature or transforming landscapes is just as much about respect as it is aesthetic sensibility; to interject with responsibility and sensitivity. Geoffrey Bawa propels the principle of cognizant creation by drawing from quirks and kinks in the environment rather than erasing it to a blank slate. Take a final look at the field which Bawa regarded as needing “the most gentle treatment” and note the natural slopes used to place the pond and the reflections of tall slender trees crowning the water.

[06:28] As you climb back up the hill and cut across the hâ-hâ, take some time to further explore mordants, a key element in the natural dyeing process and a monumental discovery for early colourists.

[06:38] “I think in ancient times people had more curiosity and also a lack of resources, so they tried to invent more things than us.”

“So when they dipped the fabric in the water with the dye and took it out, they had to treat it in moonlight. Can't put in directly sunlight, they had to dry it in moonlight for two days and then they used bamboo or areca nuts to boil it again so the colour is fixed. So, I'm exactly not sure how they discovered the alum but there might be some experimenting with those kinds of things because there is something called a mud bath for the cloth. Where they go to the clay spot and pour the water and make it more water soluble and put the fabric in it and they simply wash it. So it fixes certain types of colour and gives durability to the fabric.”

There are two types of chemical bonds in mordants, acidic bonds that derive from tannins like those found in tree barks, vegetable oils or tea and basic bonds derived from minerals like salts, copper and zinc.

[07:55] “So, the interesting thing is there are some plants who produce these types of mordants. For an example, Some Mango trees. There are certain Mango trees who produce what we call a milky sap and it turns to black when it dries. Ancient people have used these milky saps to create more colour fastness because, the main issue in the natural dye is colour retention. They wanted to keep it more durable and more colourful and so they used this mordant as fixing agents.”

[08:29] “So currently, even now, most of the natural dye extracted use simple methods and mordants to extract their colours. So even in the textile industry or it can be paints, they're trying to do many experiments with these natural dyes because the environmental impact is less. So, the issue is there are very limited pigments among the natural extractions and we can't produce the brightest shades. To produce more brighter shades, we have to use more types of chemicals. So there is a problem, if we use a certain artificial chemical with the natural dye it might not be eco friendly.”

[09:25] Veer into the arched walkway of the veranda and past the coloured mural of warriors by Laki Senenayake, to stand under the shade of the gnarly Cashew tree beyond. If you catch the tree during its fruit bearing season, it would be hard to miss the bright red apples with the encased nut hanging low.

- [09:35] The Cashew tree *Anacardium occidentale*, a tree native to Northeastern Brazil and yet widely found in tropical gardens, is prized for its apples and nuts. However, the nut's shell, the waste product of the harvest, can be used in dyeing. Cashew nut shells produce light, earthy shades of brown to darker shades depending on the acidity of the mordants used. However, this limited colour palette amidst a large scope of natural dye extracts can make it a less popular option, even if more sustainable.
- [10:15] "So Cashew contains natural pigments such as tannins, the same as Tamarind also has pigment or compound called flavonoids. which gives them their dyeing properties and this natural dye produces shades from light to dark brown, influenced by the plant and the part of the plant that is used. So simply if we use, for an example, the leaves it's a different colour, if we use the nut it's a different colour."
- [10:44] "However, because it's harder to extract because we can't always find these Cashew nut shells, and I think we can find more Jack roots and Hibiscus flowers rather than Cashew nuts. Yeah, it's a possibility, but there are so many options which is easier to achieve and find."
- [11:03] While the Cashew nut shell may not yet find a popular place in modern natural dyeing practices, some plants have cemented their favour for centuries. One such tree is hard to miss as you walk back towards the gravel path, a jack of many trades beloved by Sri Lankans for its fruit and wood. The aged jackfruit tree with its round, green and ochre leaves, if in season, will carry bulbous rich fruit hanging from its knotted, crackle barked trunk.
- [11:37] Jackfruit bark and root extract has been the main ingredient in dyeing Buddhist monk robes for centuries. The colours produced range from light beige, yellow to rich brown depending on the age of the tree, other plants used, the fabric and the fixing agent. This natural dyeing process is fairly simple and remains relatively unchanged to this day. A clay cauldron is used to boil Jack roots, Mahogany roots, Bamboo leaves, Areca nuts and Sepalika flowers for several hours until the pigments are extracted. The fabric is then dyed in the solution and to stabilise the colours, the dyed fabric is soaked in a second bath of either boiled Bamboo leaves or Areca nuts. Jack root can also be used in combination with Mahogany root and an alum fixing agent in order to produce darker hues.
- [14:51] "So an interesting thing is they have used these pigments for temple paintings and still to this day the colour remains. But the knowledge of these ancient dye extractors are very interesting because even now with these modern technologies we can't extract natural dyes and make it a more simple process"
- [13:04] Jack root or bark extract is rarely used by itself and typically taken from only older, mature trees for the desired dark hues.
- [13:15] "let's say even in the human body when you grow up, the hormones and chemicals are changing, same as the trees. So let's say, in an old tree there is a certain chemical and hormonal changes inside the tree, when it's matured it has a certain stabilisation in pigments and hormones. So

when we cut a certain tree or a certain bark for this type of work, it will produce a certain quality. And any type of pigment is a good pigment, but it's best if we can keep it in a durable way, so that's the reason I think the ancient people used this type of technique”

[13:59] As you head towards the main house and step into the gravel road, you are offered shade by towering trees among which are the monumental Mahogany trees. Approaching the steps there stands a lone Mahogany tree extending through the landing in reach of the sky allowing one to bask in its full magnificence without distraction.

[14:24] Mahogany is part of the Meliaceae family well known for its hardwood but is also used to create pigments in traditional batik practices. The bark, wood and sometimes the leaves are used for extracting colour. Although there are variations in the colours extracted based on the plant part or the mordants used, it is still limited to rich reddish brown shades.

[14:53] “Most of the time, this Mahogany dye extraction is used to create other colours, for an example the raw roots of Mahogany tree and Aralu is used to create black colour. So, most of the time they produce very dark browns and not much lighter browns. And there are some rare situations where the tree produces a certain type of red colour extractions. So the only limitation that I see here is the range of colours”

[15:24] Beyond the few steps is a path wrapping around the main house and leading to the red terrace. The Garden Room or Sandella was formed into the unusual two level position by the lay of the land and framed by these great ironwood and mahogany trees.

[15:33] Approaching the Sandella, you catch a glimpse of the outstanding ochre walls. This colour lends its credit to Samara, a natural extract from a lateritic, kaolin rich clay found in this region. The colour varies with the amounts of iron oxides and hydroxides in the soil. Cutting across the Gravel Terrace you come to the Tamarind tree standing tall over their peers.

[16:14] *Tamarindus indica* has a textured bark, distinctive pinnate leaves and curved, brown pods with edible, sour flesh that can contain up to twelve seeds. It is the seed pods that are used for dyeing. The process of boiling the seeds until the husks are separated is similar as with other plant extracts and can take up to several hours depending on the quality of the seed. Thereafter the dye can be used as is or dehydrated and powdered for later use.

Tamarind can create reddish brown to light brown pigments but unlike most other dyes, that are limited to shades and hues of a colour, it has the ability to change colours. By using iron as a mordant the colour can be changed from brown to yellow. However, Tamarind seed extract can also act as a fixing agent owing to containing tannins within itself. Furthermore, the sticky polysaccharides in Tamarind can be used in sizing and finishing fabrics, lending these seeds useful across the textile industry.

[17:30] “Currently there is a very interesting thing, there are experiments going on the medicinal value of these Tamarind seeds. Tamarind possesses many medicinal values such as antioxidant, anti-inflammatory agents and digestive benefits by considering how to extract these dyes and how

to take this medicinal benefits to textiles we can effectively cure certain ailments in the body. Like skin rashes like what we call the sudu kabara. So there is an experiment for that but it's in the initial stage. What they do is they stitch a garment from this treated fabric and let them wear it. So, there are certain effects like reducing scratches and redness in the skin."

"Even in chemical dye, sometimes the dye can be allergic. So in the same sense we can use these medicinal values to give certain positive effect to our skin, which is gift from nature."

[18:40] Peering around the Tamarind tree you come into view of the Hibiscus tree arch with its eye-catching bright red, five petaled flowers.

[18:48] Many varieties of Hibiscus are a common sight in tropical gardens and Sri Lankan home gardens, despite not being a native species. The red flower can produce vibrant pigments when ground or boiled and was historically used as food colouring and in beauty products. For dyeing fabrics, red, pink and purple colours can be expected depending on the mordant used and the duration of the soak.

[19:17] "The primary pigment responsible for vibrant colours of Hibiscus is Anthocyanin, which means it has a certain water soluble effect. If we want to change these pigments' colour, what we need to do is change the pH level of the water. So, currently, they use either alkaline, something like salt as a fixing agent or something acidic like vinegar to get more colours. So sometimes they also use alum, alum is also a fixing agent. But The thing is in ancient times alum is not something that was very popular so they mostly used both vinegar and salt. So the pH level of the solution or the liquid can significantly affect the colour obtained. With more acidic solution it produces pink shades and more alkaline solution it results in purple. So the substance used can change these colours in Hibiscus, but it is not possible to do with every other plant or tree."

[20:18] "Hibiscus is a very valuable plant to ancient colour extractors or textile makers because of this reason. So after a few times with the experiments the alum was used to boost these colours because in the beginning if we use this pink or the purple colour extracted from Hibiscus for certain textiles or a wall or any product, the colour is very low, the pigment very dull. But with time the ancient colour extractors have experimented and used this alum to boost these colours."

[20:50] "Even in Sri Lanka there are some people using this flower to make their own textiles because it's a very easy and fun thing to do. Pick a flower, Hibiscus flower and crush it or boil it and create this pigment but the colour might not last because of this lack of fixing agent."

[21:15] The complexity of plant based pigments shows us that flora are more than the sum of their parts. Plants may seem passive and still in the moments we appreciate them, but have vigour and intelligence. In the same vein, extracting pigment from plants is as much an art as it is a science.

[21:28] The intricacies of colour lie in the nuances, the shades and the hues and the perception and the interpretation. It is this subtlety that has inspired generations of creators to experiment with and contextualise nature's bounty. Whether it be architectural gardens or coloured fabrics, it is the

vibrancy of trees that bridge the gap of the artistic vision and the experience of the observer. Through sculpture and extraction and the imperceptible hands of nature and time, trees gift us ever evolving art and possibilities.

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## **References**

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