

# Gardenwise



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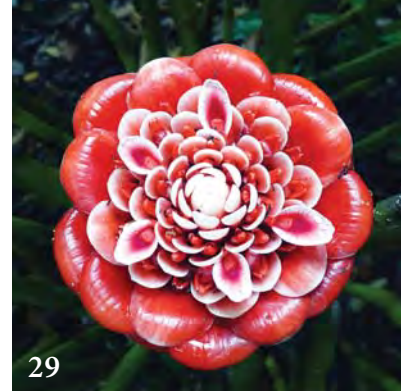


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A young participant practicing her photography skills during an educational workshop for children in March.

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# Message from the Director



Images from a childhood visit to the Gardens with my sibling and a cousin: (left) at the Sundial Garden, and (right) possibly at the current Lawn B, which used to hold the gymnosperm collection. (Photos courtesy of Dr Tan Puay Yok)

**Two** of the most significant events of the past half year must be the full opening of the Gallop Extension and the Tropical Montane Orchidetum at the National Orchid Garden. Both projects were progressively opened to the public over the last two years, starting with the Mingxin Foundation Rambler's Ridge and OCBC Arboretum at the Gallop Extension, and the Neram forest section of the Tropical Montane Orchidetum. The newly enhanced VIP Orchid Garden was also opened at the National Orchid Garden.

It has taken a good three years for the Gallop Extension, and four years for the Tropical Montane Orchidetum to be completed, all amidst the challenges of work disruption and worker shortfall due to COVID-19, uncertainties in plants and construction supplies because of disruption in global logistics, and challenging site conditions. The Gardens' Facilities, Development and Living Collections teams have done very well to

bring these two major projects to a successful completion, which culminated in the official opening of the Gallop Extension by Deputy Prime Minister and Coordinating Minister for Economic Policies Mr Heng Swee Keat on 13 March 2021, and the Tropical Montane Orchidetum by Prime Minister Mr Lee Hsien Loong on 3 April 2021. With the addition of the Gallop Extension, the Gardens has grown to 82 ha, the largest in its history, and when completed in a year's time, the HPL Bridge will link the Gallop Extension to the Learning Forest and make the Gardens seamlessly connected for the convenience of our visitors. These two development projects are significant milestones, not only because they have expanded our footprint and added to the attractions for our visitors, but because they are intimately linked to the mission of the Gardens. I share a few perspectives on why these two additions mean so much to the Gardens.

First, the Gallop Extension has strengthened the Gardens as a

cultural landscape of Singapore. Most parts of Singapore have been developed and redeveloped several times, and many of us miss the sights, sounds and even smells of lost landscapes that were part of our memories. The Gardens is perhaps unique in preserving a part of the landscape of Singapore that has remained largely unchanged over the past 161 years. Many of our visitors have fond recollections of spending time in the Gardens with their families and loved ones, myself included. We now add to this collective memory the cultural landscape of the Tanglin area that the Gardens is part of. The Tanglin area during our colonial history was occupied mostly by European settlers, and although much of the land was cleared of its original primary forest cover, first for betel nut, nutmeg, and gambier and pepper plantations, and then for settlements, much of the terrain has remained unchanged, judging from the contour lines that we see in historical maps. The open, rolling hill landscape, in fact, is also connected to the origin of

‘Tanglin’, a Teochew term for ‘great east hill peaks’. Such a landscape is rare in Singapore now. Maintaining this character of the Gallop Extension was a principal consideration in its development, and it guided how we incorporated our plant collections into the terrain and vistas of the site. And now, for the first time in more than 100 years, this open landscape is made accessible to the public to use and appreciate. It is such a delight to see children rolling or sliding down the grassed slopes, and families having picnics on the lawn between the two majestic, conserved buildings which house the Botanical Art Gallery and Forest Discovery Centre @ OCBC Arboretum.

Second, the Gallop Extension and Tropical Montane Orchidatum further enrich our education and outreach efforts to engage our visitors with the botanical world. Key among our efforts is introducing our visitors to the world of botanical illustration and art. The Gardens has a sizeable collection of botanical illustrations and art, some of the oldest being by brothers James and Charles de Alwis. In the days before photography, during the age of scientific exploration, botanical illustration was a principle method to document plants, and was in fact, instrumental to the development of botany as a scientific discipline. Charles de Alwis was first employed by then-Director of the Gardens, Henry Ridley, in 1890, followed by James de Alwis in 1893, to produce illustrations and drawings of plants for the *Flora of the Malay Peninsula* project. The de Alwis brothers produced more than 260 works in total, many of which were of new species discovered by Ridley. These precious drawings and illustrations, together with many others in the Gardens’ collection, as well as rare books

and correspondence, were previously not accessible to the public. With the opening of the Botanical Art Gallery, many of the Gardens’ archived materials are now on display to the public for the very first time in our history.

But is this just another opportunity to appreciate the history of the Gardens? I submit that it is most certainly not. Despite the advances in digital photography, many botanists still prefer to refer to botanical drawings and illustrations to see the fine details of plants, as captured through the eyes of the botanical artist. The role of botanical illustration in the study of botany will continue, and in fact, it has been said that botanical art is currently thriving. The situation in Singapore perhaps reflects this, with the recent formation of the Botanical Art Society (Singapore) in 2019 (see [www.botanicalartsocietysingapore.com/home](http://www.botanicalartsocietysingapore.com/home)). The Society now has around 60 members. Through thoughtful curation and interpretation of our exhibited materials, as well as outreach and education programmes that bring the world of botanical illustration and drawing to our visitors, the Botanical Art Gallery can play a catalytic role to cultivate a new generation of botanical artists, so that this medium can continue to thrive, for both science and art.

Third, a growing plant collection in these two areas will mean that our horticulturists need to continue to hone their plant growing skills and knowledge to manage the new additions. This could not be more apparent than the growing of cool region orchids in the Sembcorp Cool House in the Tropical Montane Orchidatum. The dizzying display of orchids that can be seen up close and personal have left our visitors in awe of their diversity and beauty,

and we also hope that they will appreciate the role of the Gardens in conserving these plants, many of which are threatened in their native habitats. Some must also be asking how we get them to bloom for visitors’ enjoyment. This is indeed the task set for our horticulturists who are among the best growers of tropical orchids in the country. Growing cool region orchids is, however, largely a new frontier for us, and the Sembcorp Cool House, together with our ancillary nursery facilities, provides the resources and opportunities for us to continue developing our horticultural excellence in growing orchids from cool regions. This is of course, not just about increasing horticulture skills alone – the skills we develop will have large implications on our operational costs, the displays we put up, and ultimately, our ability to conserve orchid species as well.

Thus, the Gallop Extension and the Tropical Montane Orchidatum are not just new additions to the Gardens for the enjoyment of our visitors. This is, of course, part of our mission, but in delivering this mission, the Gardens must also see to it that our roles in conserving cultural heritage, providing education and outreach, and advancing horticulture excellence and botanical knowledge have to be at the heart of what it means to be a botanic garden.

**Tan Puay Yok**  
*Group Director*  
*Singapore Botanic Gardens*



# The new Tropical Montane Orchidetum

**The** Tropical Montane Orchidetum is the latest attraction at the National Orchid Garden. Officially opened by Prime Minister Lee Hsien Loong on 3 April 2021, the orchidetum features new and enhanced spaces to display orchids and other flora, and also provides facilities and areas for the *ex-situ* conservation of rare and threatened plant species.

The orchidetum comprises two outdoor features – the Lowland Habitat Trail and Secret Ravine – as well as three display houses – the Yuen Peng McNeice Bromeliad Collection, the Tan Hoon Siang Mist House and the Sembcorp Cool House. Each display area exhibits landscapes and flora unique to various habitat types that can be found at low, mid- and high elevations of tropical mountains.

## Lowland habitat displays

The first feature that visitors to the orchidetum will encounter is the refreshed **Lowland Habitat Trail**. The displays along this trail emulate the Neram forests that can be found in the lowlands of Peninsular Malaysia, where large Neram trees (*Dipterocarpus oblongifolius*) cantilever over streams. In the wild, these trees support a rich diversity of epiphytes, with as many as 20 species having been observed on mature individual trees.



The Neram forest area along the Lowland Habitat Trail.



The Tropical Montane Orchidetum, with the Sembcorp Cool House shown on the left and the Tan Hoon Siang Mist House on the top right.



*Papilionanthe hookeriana* can often be found growing near waterbodies in nature.



The trail features a waterfall that provides the humidity required for riverine orchids to thrive. Surrounding this waterfall is a collection of *Papilionanthe* species and hybrids which includes our national flower, the Vanda Miss Joaquim, and its parents, *Papilionanthe teres* and *Papilionanthe hookeriana*. A collection of *Renanthera* species and hybrids from Southeast Asia can also be found near the waterfall. Further down the trail, a meandering boardwalk takes visitors past lowland plants from the island of Borneo. A highlight of this area is a collection of *Tristaniopsis* trees and leafless orchids. (See *Gardenwise* volume 55, pages 16 to 19 for more information on the orchid collections that can be found along the Lowland Habitat Trail.)



The bark of *Tristaniopsis* trees is smooth, and depending on the species, can have different colouration.



Reed orchids or Epidendrums are robust plants that produce clusters of bright orange, yellow or red flowers at the tip of the stems.

## Mid-elevation habitat displays

The **Yuen Peng McNeice Bromeliad Collection** features mid-elevation bromeliads, orchids and other plants from tropical regions of the Americas. Nestled within the enhanced enclosure are more than a hundred bromeliad species. A relatively diverse family of monocots, the Bromeliaceae comprises around 70 genera, some of the more prominent being *Ananas*, *Dyckia*, *Neoregelia*, *Pitcairnia*, *Vriesea* and *Tillandsia*. Species and hybrids of orchids from the neotropics such as *Brassavola*, *Cattleya*, *Epidendrum* and *Oncidium* are also showcased in this collection.



*Cattleya forbesii*. Cattleyas have large and showy flowers and are commonly known as corsage orchids.



*Oncidesa* Gower Ramsey is known as a dancing lady orchid as its highly modified ruffled labellum resembles a dancer's skirt. *Oncidesa* is a hybrid genus between *Gomesa* and *Oncidium*.



Mid-elevation plant species can also be found in the **Tan Hoon Siang Mist House**. This enclosure is named after the late Mr Tan Hoon Siang, who was a rubber plantation owner and avid orchid grower. His son, Mr Tan Jiew Hoe, president of the Singapore Gardening Society, has supported the redevelopment of the old Tan Hoon Siang Mist House and also donated many rare plants to the Gardens. These include species of *Ardisia*, *Begonia* and *Medinilla*, along with more than 50 other species of herbaceous plants. The orchids featured here are part of the Gardens' collections of award-winning species and cultivars, outstanding hybrids from our orchid hybridisation programme, as well as fragrant orchids.



The newly upgraded Tan Hoon Siang Mist House.

Past the mist house, a meandering path leads visitors down into the **Secret Ravine**. Modelled on habitats that can be found in deep, narrow valleys of tropical mountains, the Secret Ravine features plants such as *Arundina graminifolia*, *Ficus villosa*, *Ficus pseudopalma* and *Ficus dammaropsis*.



The path winding through the Secret Ravine.

## High elevation habitat displays

The **Sembcorp Cool House** contains the Gardens' collection of high elevation montane species. It is an expansion and upgrade of the original Cool House and was made possible by a generous sponsorship from Sembcorp Industries. The new 1,100 square metre facility houses more than 1,000 cool-climate orchid species and hybrids, and around 100 species of other herbaceous plants. Tropical montane habitats are some of the most threatened in the world, and the Sembcorp Cool House allows us to conserve and study species that require the specialised climates of these habitats to thrive. The state-of-the-art facility was also built with sustainability in mind, and features such as spectrally selective glass panels to reduce heat intake, solar panels to offset energy requirements, and a high efficiency cooling system mean that we are able to achieve our conservation and educational goals without incurring a high environmental cost.

The Sembcorp Cool House is organised into five zones that represent key global orchid biodiversity hotspots: Malesia, Australasia, continental Southeast Asia and South Asia, the Afrotropics and the Neotropics. Each zone features orchids and other herbaceous plants that can only be found within their respective biogeographical region. At the entrance to the Cool House is a majestic pool surrounded by towering dicksonias, a mass display of unique lady slipper orchids, specimens from the oncidium alliance, and cascading inflorescences of *Phalaenopsis* hybrids. It is a picturesque spot which epitomises the theme of 'where Old World and New World orchids meet.'



The Sembcorp Cool House.



The plants in the **Malesian zone** include *Paphiopedium* species and hybrids. Affectionately known as lady slipper orchids, they have a modified labellum which has evolved into a pouch that aids in pollination. This zone also showcases *Dendrobiums* from the section *Formosae*, such as *Dendrobium tobaense*, which has orange markings on the labellum and bears flowers along the stem. Also on display here are *Phalaenopsis* species with mottled leaves, such as *Phalaenopsis philippinensis*, *Phalaenopsis sanderiana* and *Phalaenopsis schilleriana*, which are endemic to the Philippines and have branching inflorescences with stunning lilac pink flowers. These species are responsible for many of the large standard flower *Phalaenopsis* hybrids that can be found in commercial nurseries. *Cyathea contaminans*, a tree fern from the Cameron Highlands, is also featured in this zone.

Beautiful Latouria *Dendrobiums* dominate the landscape in the **Australasian zone**. Some of the species on display here hail from New Guinea and produce bizarre and often hairy flowers, such as *Dendrobium macrophyllum*, while *Dendrobium cuthbertsonii* grows in mossy forests and produces flowers that vary in colour from shades of pink to orange to yellow. This zone also includes a Wollemi Pine (*Wollemia nobilis*) that was gifted by then-President of Australia Mr Tony Abbott during his visit to the Singapore Botanic Gardens in 2015. This species was only discovered in 1994; prior to that it was known only from fossil records.

In the **continental Southeast Asia and South Asia zone**, visitors are greeted by a plethora of colours from Nobile-type *Dendrobiums* and Densiflorum *Dendrobiums*. Nobile-type *Dendrobiums* produce brightly coloured blooms that range from pinks to purples to whites and have yellow hues at the nodes. Densiflorum *Dendrobiums* have pendulous inflorescences that look like pinecones. Representatives of both sections can be found growing in the Himalayas, Myanmar, Laos and Vietnam. Hybrids of *Phalaenopsis* with white and pastel pink flowers



(Left) *Paphiopedilum* Lynleigh Koopowitz, and (right) *Dendrobium* Jiaho Delight from the section *Formosae*.



(Left) *Dendrobium macrophyllum* and (right) *Dendrobium cuthbertsonii*.

borne on long and cascading inflorescences are also displayed here. These *Phalaenopsis* have been extensively bred in Taiwan and China and show an exemplary display of almost perfectly round flowers. Amongst the orchids in this zone are *Rhododendron* species and hybrids from the section *Vireya*. Found in the highlands of Southeast Asia, some of these species grow on trees as epiphytes.



A *Rhododendron* *jasminiflorum* hybrid.



The **Afrotropics zone** features orchids from tropical Africa, including the island of Madagascar. These include genera such as *Aeranthes*, *Angraecum* and *Jumellea*, most species of which have an elongated spur that extends out from the back of the flowers. One of the most notable species is *Angraecum germinyanum*, a reliable bloomer that produces cream coloured and long-lasting jasmine-scented flowers.



*Angraecum germinyanum*. (Photo credit: David Lim)

The species-rich **Neotropics zone** showcases a myriad of genera including *Maxillaria* and *Phragmipedium*. Maxillarias are a diverse group of orchids that generally have rampant growth. On display here is *Maxillaria tenuifolia*, a species with attractive red flowers that produce a strong coconut scent. *Phragmipedium* is another spectacular genus from the New World, with some species such as *Phragmipedium caudatum* having very long lateral petals. A related species also showcased in this zone is *Phragmipedium lindenii*, which lacks a labellum or 'pouch', and instead has a long petal that appears similar to the lateral petals.



*Phragmipedium caudatum*.

With the completion of the enhancements and opening of the Tropical Montane Orchidarium, the collection of orchid species and hybrids in the National Orchid Garden has more than doubled. In addition, the total display area has increased by 5,000 square metres. We are proud that the enhancements and new features will ensure that the National Orchid Garden continues to be a world-class attraction for the public to enjoy for years to come.

**Mark Choo**  
**Whang Lay Keng**  
*National Orchid Garden*

*The authors would like to thank Ooi Zong Yu and Goh Seh Nang for their input on this article.*

*All photos by Mark Choo unless otherwise stated*

# New attractions in the Gallop Extension

Following the launch of the Mingxin Foundation Rambler's Ridge and OCBC Arboretum in 2019, the Gallop Extension is now fully open to the public. The newest features in the extension, including the Botanical Art Gallery, Forest Discovery Centre @ OCBC Arboretum, Eco Zone, COMO Adventure Grove and Gallop Valley, were officially launched on 13 March 2021 by Deputy Prime Minister and Coordinating Minister for Economic Policies Mr Heng Swee Keat. The 8-hectare Gallop Extension, along with the adjoining Learning Forest, forms the Tyersall-Gallop Core which is dedicated to the Gardens' educational and scientific work in forest conservation.

## Land use history and site development

The Gallop Extension, with its hilly terrain, open lawns and surrounding forest, is part of the cultural landscape of Singapore. Such landscapes are not commonly seen in Singapore, other than in the Gardens and other parts of the Tanglin District, and are conserved here for posterity as part of our national heritage. The site had gone through several land use changes since the 1800s, from a nutmeg and fruit tree plantation to a residential area in the 1900s. It has essentially been preserved for the past 100 years as it was largely untouched during this period. The site was allocated to NParks in 2015.

Developing the Gallop Extension proved to be challenging on several fronts. For

instance, the two conservation houses, built around the turn of the 20th century, not only had to be restored but refurbished into modern galleries complete with climate control and security systems to protect rare artefacts. Construction progress was also impeded by the COVID-19 pandemic. Due to the rich diversity of wildlife present in the area and the site's proximity to residential units, several considerations were made to reduce environmental impacts during construction. For example, working hours were shortened and special equipment such as silent piledrivers were deployed to reduce noise pollution. Also, environmental impact surveys were conducted during the initial phase, which led to the discovery and conservation of a natural freshwater stream running parallel to today's COMO Adventure Grove and the adjacent Eco Zone.



(Left) A 2021 map showing the location of the Gallop Extension within the Gardens; together with the Learning Forest and Rain Forest it makes up the Gardens' nature area. (Right) An area map of the Gallop Extension showing the locations of its major features.



The uneven terrain of the site, often with a steep gradient, coupled with the need to provide universal access for visitors, presented its own set of challenges. Gently sloping footpaths were integrated into the landscape and around existing conserved mature trees. A number of slope stabilisation methods were incorporated throughout the site, such as retaining walls in areas with steeper slopes, and the use of environmentally friendly geobags wherever possible to reduce the amount of hardscape in the natural environment. Several areas were marked out as tree protection zones, limiting access for both construction and landscaping works. Trees had to be transferred from main access points

to their targeted planting locations with 100-tonne lorry cranes, while materials were carried in manually as much as possible to limit machinery usage. Major construction works concluded in 2021. The final phase of the project will be the completion of the HPL Canopy Link, targeted in 2022. When open, this 200-metre bridge will provide a seamless connection from the Gallop Extension to the rest of the Gardens.

### Gallop Road Conservation Houses

Two major features of the Gallop Extension are the turn of the century

conservation houses set amongst colonial gardens characteristic of the Gallop estate's past. They were designed by well-known architect Regent Alfred John Bidwell, who also designed Raffles Hotel and the Goodwood Park Hotel. These houses represent the earliest remaining examples in Singapore of the distinctive black and white architectural style, known as such because of their white-washed exterior walls and black wooden beams or trim. Their unique architecture reflects elements of the Tudorbethan style that was very popular in late 19th century in England, combined with features from traditional Malay architecture during the *kampung* days when homes



House 5 at Gallop Road is now home to the Forest Discovery Centre @ OCBC Arboretum.



Two of the galleries in the Forest Discovery Centre @ OCBC Arboretum. (Left) Singapore's Living Forests, and (right) the Forest Conservation Gallery. (Photo credits: NParks)



were elevated off the ground to protect against elements of nature such as flash floods.

The house at 5 Gallop Road was built in 1898, and is the oldest known black-and-white bungalow that is still standing in Singapore. The house was named Atbara after a river in the Sudan where the British won a historic battle the year the house was completed. It was originally owned by John Burkinshaw, who was a founding partner of one of Singapore's oldest law firms. In 1903, this house and its surrounding lands were sold to Charles MacArthur, one of the earlier chairmen of the Straits

Trading Company Ltd, who then built the house at 7 Gallop Road, which was completed in 1906 and called Inverturret.

The historical landscape of the houses is preserved with open lawns, a feature reminiscent of the English Landscape Movement tied to the Gardens' heritage. From 1939 to 1999, 5 and 7 Gallop Road were the addresses of the French embassy and the French ambassador's residence, respectively. The house at 5 Gallop Road is now home to the Forest Discovery Centre @ OCBC Arboretum, whereas the house at 7 Gallop Road is now the Botanical Art Gallery.

## Forest Discovery Centre @ OCBC Arboretum

Created as a hub and launchpad for many of the programmes under the umbrella of NParks' Community in Nature initiative, the home-like setting of the Forest Discovery Centre @ OCBC Arboretum creates a warm and welcoming environment for visitors of all ages. Within the centre are four main galleries, called the Atbara Foyer, Singapore's Living Forests, Forest Conservation Gallery and the Nature Explorer Zone. The displays in each area are designed to complement the architecture of the house.



House 7 at Gallop Road is home to the Botanical Art Gallery. (Photo credit: NParks)



The inside of the Botanical Art Gallery. (Left) One of the exhibition rooms on the second floor, and (right) the landing area on the second floor, leading into rooms showcasing some of the Gardens' collection of botanical artworks.





The earthen path leading through the Eco Zone. The stream runs alongside the left side of the path. (Photo credit: NParks)



The freshwater stream in the Eco Zone dotted with *Ficus ischnopoda*, a riparian species native to Malesia. (Photo credit: Lai Simin)



The COMO Adventure Grove. (Photo credit: NParks)

The Atbara Foyer gives a brief introduction to the history of Atbara House and links into Singapore's Living Forests, where visitors are treated to sprawling views of the Gallop estate, with the room accentuated by a glass installation of seven notable tree species in Singapore. On the walls, current species tallies of Singapore's native fauna and flora give a summary of our rich biodiversity and provide an introduction to the adjacent Forest Conservation Gallery.

The Forest Conservation Gallery was conceptualised as an interactive experience that introduces visitors to Singapore's three main forest types: coastal forests, swamp forests and tropical rainforests. Making use of translucent overlays and acrylic sheets, the gallery is designed to allow visitors to view plants in each station together with animals silhouetted from behind to mimic how they would be seen in natural forest environments. The space features tactile panels for children to learn about nature through play. Complementing the Forest Conservation Gallery are two living exhibits, called the Lowland Forest Terrarium and the Swamp Forest Paludarium. These exhibits reflect the species featured within the gallery and give visitors a glimpse into our amazing habitats.

The Nature Explorer Zone and accompanying Pangolin Room are the heart and soul of the house. These areas serve as a launchpad for programmes under the Community in Nature initiative and facilitate community engagement events, school programmes and workshops for all ages.

### The Botanical Art Gallery

The Botanical Art Gallery aims to highlight the vital role that art plays in the scientific documentation of plant diversity in Singapore and the region as well as to inspire renewed appreciation of the natural world through art. The gallery presents a unique opportunity for visitors to see original pieces from the Gardens' own botanical art collection, started by Henry Nicholas Ridley in 1890. The collection now includes more than 2,000 botanical paintings, as well as hundreds of sketches, line drawings and photographs which have rarely been shown to the public. The individual





Some of the plants that can be found in the COMO Adventure Grove. (From left to right) *Artocarpus anisophyllus*, *Artocarpus elasticus*, *Ficus crassiramea* and *Ficus stricta*. (Photo credits: Jolene Lim)

paintings showcased in the gallery will be regularly rotated to limit light exposure and to vary the displays.

On the first level of the gallery are two rooms dedicated to temporary exhibitions on botanical art. The current exhibition, *Plants in Print*, includes a selection of rare illustrated publications from the Gardens' Library of Botany and Horticulture, ranging from *Hortus Malabaricus*, a book dating to the 17th century, to various floras and magazines from the 19th century. These are complemented by contemporary works by local artists made in response to the artefacts on display.

A representative selection of artworks is exhibited on the second level of the building and spread over four

rooms. One room showcases a historical overview of the collection, including watercolours by early artists James and Charles de Alwis, botanists Ridley and E.J.H. Corner, and Juraimi bin Samsuri, the last artist on the Gardens' staff. The species represented in this room range from native plants to mushrooms and ornamentals, and exemplify the shift in research focus of the Gardens over the years. Another room is dedicated to paintings of native species, many of which continue to be found in our nature reserves or nature parks, while others have become locally endangered or lost altogether. This room also showcases paintings of orchids, reflecting the Gardens' orchid cultivation and breeding heritage, including the VIP Orchid Naming Programme. The Botanical Art Gallery

also includes interactive screens, two projections and an activity room where younger visitors can learn more about botanical art and create their own botanical artwork.

### New outdoor features

As part of the Gardens' nature area, around half of the Gallop Extension is an *ex-situ* conservation site for plants native to the Malaysian floristic region. Sourcing for these plants took more than four years, and led the Living Collections team to plant nurseries and wet markets in Peninsular Malaysia and Borneo. Visits were also made to national parks in Sarawak to observe these species *in-situ*. Locally, native species salvaged by the Native Plant Centre and Plant Resource Centre were propagated for introduction into the extension. More than 300 threatened plant species from this region are currently conserved on site, many of which can be spotted in the newest outdoor features comprising the Eco Zone, COMO Adventure Grove and Gallop Valley.

With a natural freshwater stream running alongside it, the **Eco Zone** is designated as a nature trail. Special care has been taken to conserve the stream and restore the fragile habitat surrounding it. The exotic species that once covered this area has been cleared for native riparian species. Set against a forested backdrop adjacent to the Eco Zone is the **COMO Adventure Grove**. It is designed to introduce and instil a love for nature in children through



Gallop Valley, with the existing grove of Tembusu trees on both sides of the winding trail. (Photo credit: NParks)



play. The central and largest play area is inspired by the spreading branches and aerial roots of a banyan tree, with the Saga and Cempedak play areas on either side. More than 30 species from the Moraceae (*Artocarpus* and *Ficus* spp.) and Fabaceae families were curated for the COMO Adventure Grove and surround the play features.

Set amidst a grove of mature Tembusu trees, the plants in **Gallop Valley** have been laid out to showcase their uses for culinary purposes and in fragrances.

Adjacent to Gallop Valley is one of two water retention ponds that can be found at the Gallop Extension, the other being behind the OCBC Arboretum. These ponds retain water from rainfall and surface flows during storms, and are planted with species that assist in biofiltration. The water is then used for irrigation. The walk continues through Gallop Valley, ending at the Woollerton Gate at the northwestern extent of the Gallop Extension, where the paths meander through a reforested area planted with lowland Dipterocarp species.

Since the Gallop Extension was completed, it has fast become a hotspot for fauna. The diversity of plants introduced into the landscape and the undisturbed secondary forest from adjacent sites provide a refuge for numerous birds and other wildlife. The top of the staircase at the COMO Adventure Grove is one of the best lookout points for the endangered Grey-headed Fish Eagle (*Ichthyophaga ichthyaeetus*) which roosts among the tall trees beyond the Eco Zone, while the Common Birdwing (*Troides helena cerberus*) and Common Mormon (*Papilio polytes romulus*) butterflies are frequently found in the Eco Zone and around the Gallop Houses. Earlier in the year, the grove of Tembusus (*Cyrtophyllum fragrans*) in Gallop Valley attracted a family of Spotted Wood Owls (*Strix seloputo*) and we were able to observe their nesting behaviour thanks to the assistance of the National Biodiversity Centre in setting up camera traps.

The Gallop Extension is a treasure trove of biodiversity, botanical art and cultural heritage that can be enjoyed by people all ages. Together, its range of features strengthen the Gardens' efforts in tropical plant conservation and environmental education while helping to connect our visitors with nature. Through the dedication and hard work of our staff, we hope that this reforested land will flourish for generations into the future.

**Joey Lim**  
**Jolene Lim**  
**Lai Simin**  
**Ooi Zong Yu**  
*Living Collections*

**Sabrina Tang**  
**Sheryl Koh**  
**Dillen Ng**  
*National Biodiversity Centre*

**Michele Rodda**  
*Herbarium*



The Tembusus in Gallop Valley were home to a family of Spotted Wood Owls in February 2021. Camera traps were set up to observe their nesting behaviour, and astonishingly, the footage revealed the owls defending their nest against a Clouded Monitor Lizard (*Varanus nebulosus*).



One of the Spotted Wood Owls in its nest. (Photo credit: Seow Pheng Heong)



# Conserving the Woolly Frogsmouth, a native wetland species

**In** January 2021, our colleagues from the Herbarium and the National Biodiversity Centre reported the sighting of a small population of *Philydrum lanuginosum*. Commonly known as the Woolly Frogsmouth, this native aquatic macrophyte was thought to have been extinct in Singapore since it was last recorded in 1894 by H.N. Ridley. The population was found on a patch of waterlogged scrubland in the Kranji area, and consisted of only three plants, one of which was flowering. Given that this was the sole population known in Singapore, the team relocated the flowering individual (assessed as having the greatest chance of surviving relocation) to the Native Plant Centre to try to propagate it for conservation.

While we attempted to leave the inflorescence on the plant intact in the hope of obtaining viable seeds from the ripening capsules, we also monitored the specimen daily for signs of decline from transplant shock. As it turned out, rapid senescence of leaves on the lead and lateral shoots was observed within a few days after transplantation, and the inflorescence along with its developing seed pods was removed to give the plant a better chance of survival. Thankfully, we had earlier hedged against the risk of losing all of the propagules by attempting *in-vitro* germination of seeds that were salvaged from a single semi-mature seed pod. Fortunately, this species is prolific in seed production and we were able to germinate more than 300 seeds from the capsule.

The seeds were germinated using a diluted Murashige and Skoog agar medium in the Gardens'



**The recently rediscovered *Philydrum lanuginosum* growing in a waterlogged scrubland in the Kranji area. (Inset) The tip of the inflorescence with two opened flowers.**  
(Photo credits: Lua Hock Keong)

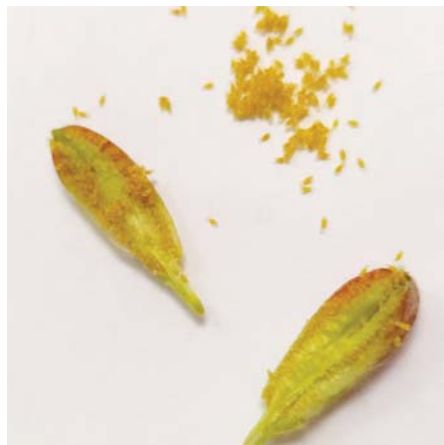
micropropagation laboratory. Sporadic germination was observed after three weeks, and more than 60% of the seedlings had emerged by about five weeks after sowing. The growth of the seedlings under *in-vitro* conditions was rather rapid; at about three weeks into germination, the seedlings, at barely 1 cm tall, were transferred into individual flasks. They then entered into a growth spurt, with many reaching 10 to 12 cm in height within a month. The

micropropagation lab has managed to raise more than 300 plants from that single seed pod, and 60 of these were planted into containers in the Native Plant Centre in April 2021.

Although this species usually grows semi-submerged in marshes and freshwater bodies throughout its native range (subtropical East Asia, throughout Southeast Asia and southwards to Australasia and Micronesia), it can also be found in disturbed areas that experience



Close-up of an opened flower.  
The plant is commonly known  
as the Woolly Frogmouth as the  
flower in full bloom is said to  
resemble the gaping mouth of a  
frog. (Photo credit: Lily Chen)



A six-week-old seedling ready for planting.  
(Photo credit: Chin Li Li)

(Top left) The semi-mature seed pod of *Philydrium lanuginosum* that was salvaged from the transplanted specimen, together with a leaf. (Top right) The surface-sterilised seed pod with seeds removed in preparation for *in-vitro* germination. (Bottom) Seedlings on agar medium, at approximately two weeks after germination. (Photo credits: Chin Li Li)





**Seedlings at around five months old in the Native Plant Centre; those with pink tags are large enough to subdivide for propagation.**

*(Photo credit: Cherish Yong)*

periods of drought, such as paddy fields. To assess whether the species can be grown in our local parks, the seedlings are being cultivated in different environmental conditions in the Native Plant Centre using two types of media – a standard soil mix, and a modified seedling establishment mix that retains more moisture. Currently, we are tracking the progress of the seedlings to determine which medium and set of environmental conditions will best support their growth and development, and will make adjustments as we go along based on our observations. The data collected will also be used to gauge which areas should be selected for reintroduction efforts.

Some of the seedlings growing in the Native Plant Centre have already reached about 30 cm in height, which is approximately three-quarters the size of the adult plant that was collected from the scrubland. Some of these will be sent to the Gardens, various parks, nature areas and nature reserves for planting, while others will be reintroduced to the Kranji area. We will also continue to propagate this species for the next phase of our reintroduction efforts. At the time of writing, one of the plants in the Native Plant Centre was already in flower. If it sets seed, it will be the national record holder for the fastest seed-raised reintroduction that has completed its entire life cycle!

**Chin Li Li**  
**Koh Teng Seah**  
*Micropropagation Lab*

**Cherish Yong**  
*Native Plant Centre*

**Lua Hock Keong**  
*National Biodiversity Centre*

**Ho Boon Chuan**  
**Lily Chen**  
*Herbarium*



**A seed-raised flowering plant at approximately 4 ½ months old.**  
*(Photo credit: Ng Yi Chun)*



# The diversity and ethnobotany of the Mango tree family

**The** mango is one of the world's top five most significant tropical fruits in production and export volumes, according to the Food and Agriculture Organization (FAO). Cultivation of the common Indian Mango

(*Mangifera indica*) is estimated to have begun on the Indian subcontinent about 4,000 years ago. It is thought that Buddhist monks travelling to Southeast Asia in the 4th and 5th centuries were the first to have spread the mango beyond its original range.

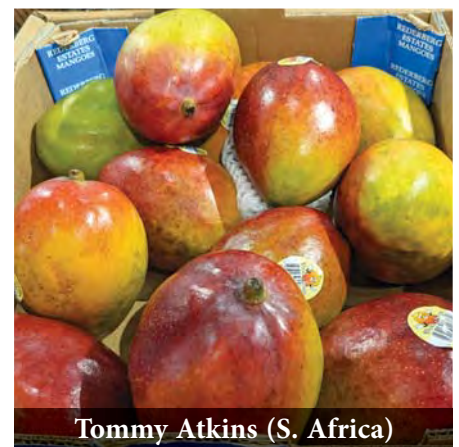
Today, it is cultivated throughout the tropics and there are more than 1,000 known cultivars. There are two main groups of mango cultivars, the Indian group and the Indochinese group, and fruits from both of these are found in local markets in Singapore.



R2E2 (Australia)



Keitt (Australia)



Tommy Atkins (S. Africa)



Osteen (Spain)



Alphonso (India)



Harumanis (Indonesia)



Honey (Thailand)



Rainbow (Thailand)



Parrot (Thailand)

A selection of mango cultivars sold in Singapore's markets. The first five are from the Indian cultivar group, and the last four are from the Indochinese group. (Photo credits: Louise Neo and S.K. Ganesan)



The mango is an inextricable part of society and culture in India, where it is considered to represent many good qualities ranging from wisdom to love and fertility. Mango leaves and flowers are regarded as auspicious and sacred; they are placed over the entrances of homes and used in religious and other ceremonies. The mango also has a prominent place in art. The fruit is thought to have a historical connection to the paisley pattern, a design featuring repeated teardrop-shaped motifs. This pattern still features prominently in Indian and Pakistani textiles today, and the names for it in the languages of these countries are related to the word for mango. For instance, in Tamil, the design is known as *mankolam* (mango pattern) and it is common on Kanchipuram silk sarees.

There are fine specimens of several mango species on the grounds of the Singapore Botanic Gardens. These include *Mangifera caesia*, *M. foetida*, *M. gedebe*, *M. griffithii*, *M. magnifica*, *M. pentandra*, *M. quadrifida*, *M. pajang* and *M. odorata*. One of these, a large Machang tree (*Mangifera foetida*) in the Ethnobotany Garden, flowered spectacularly recently and we were able to photograph the flowers using a telephoto lens. In his *Wayside Trees of Malaya*, Prof. E.J.H. Corner described the Machang as, “in flower, the most beautiful of our mangoes”. Corner was interested in *Mangifera* species and used *berok* monkeys to collect botanical specimens from tall trees. The Machang is a big tree that grows up to about 40 m tall. The fruit is edible, but the flesh is very fibrous and the sap can be an irritant. This tree occurs naturally in mixed dipterocarp forests in Southern Thailand and Malesia (Peninsular Malaysia, Singapore, Sumatra, Borneo and Java) and is also widely cultivated and naturalised. In Singapore, this species is found in the wild in the Central Catchment Nature Reserve.

Another notable mango specimen from the Gardens’ collections is a Kuini tree (*Mangifera odorata*) on the grounds of the Centre for Ethnobotany. Like the Machang, the Kuini is spectacular when in



Inflorescences of a Kuini tree near the Centre for Ethnobotany. (Photo credit: S.K. Ganesan)



A selection of leaves of Singapore mangoes. (Photo credit: Louise Neo)

flower. Indeed, molecular work has suggested that the Kuini is a hybrid between the Machang and the common Indian Mango. The Kuini is a smaller tree in stature than the Machang. It grows up to 25 m tall and is mainly found cultivated in Peninsular Malaysia, Singapore, Sumatra, Borneo and Java. In Singapore it can sometimes be encountered on formerly cultivated land. The ripe fruits are edible and occasionally available in local markets; however, the sweet pulp is fibrous and considered inferior to that of the common Indian Mango. The fruits are also used in curries and made into pickles.

In total, there are about 12 species of mango that occur in the wild in Singapore. Many of these are rare and restricted to primary forest patches in the Bukit Timah and Central Catchment Nature Reserves. Recent botanical exploration related to the *Flora of Singapore* project has resulted in *Mangifera quadrifida* (Asam Kumbang) being recorded for the first time for Singapore, while *Mangifera magnifica* (Machang Pulasan), formerly only known from St John’s Island, has now been found to occur also in Bukit Timah Nature Reserve and on Pulau Tekong. Also, a new species of mango, *Mangifera paludosa*, has been described.





This sari was woven at the ancient city of Banarasi on the banks of the river Ganges in India. Banarasi is one of the major centres for the weaving of saris in India. Banarasi silk saris are known for their elaborate embroidery in gold and silver threads on a base of finely woven silk. The mango motif is considered auspicious and serves both as this are worn for auspicious events such as weddings and house-warming parties.

**Silk sari exhibited at the Centre for Ethnobotany displaying mango motifs.** (Photo credit: Louise Neo)



**Inflorescences from a large Machang tree on the grounds of the Ethnobotany Garden.** (Photo credit: S.K. Ganesan)

**The crown and bark of a Machang tree in the Central Catchment Nature Reserve.**  
(Photo credit: S.K. Ganesan)







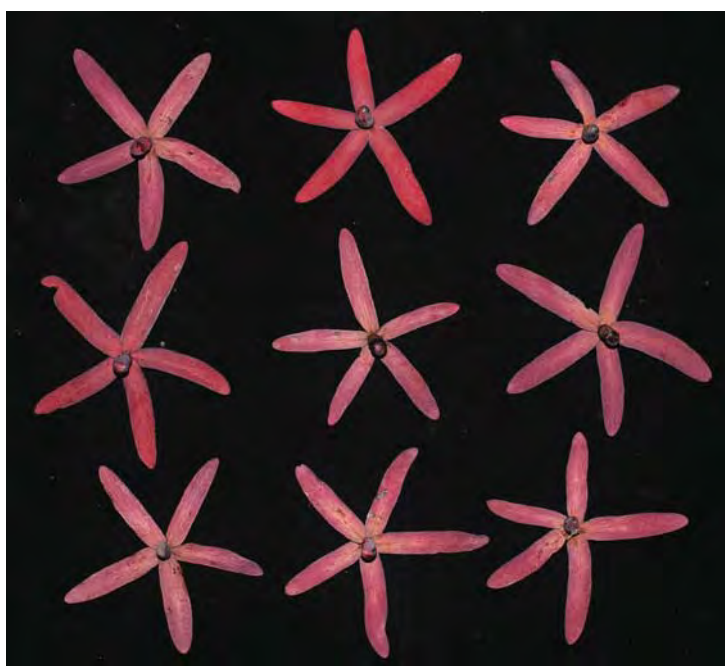
*Mangifera decandra*, commonly known as the Barun, flowering in Brunei.  
(Photo credit: S.K. Ganesan)



*Mangifera pajang*, or the Bambangan, in fruit in Sabah.  
(Photo credit: S.K. Ganesan)



Cashew nut fruit with reddish enlarged pedicel, from a planted tree at East Coast Park.  
(Photo credit: Evonne Tay-Koh)



Winged fruits of a rengas (*Gluta wallichii*), collected from the Nee Soon Freshwater Swamp Forest. (Photo credit: X.Y. Ng)



Plum mango fruits, with characteristically purple seeds, purchased at the Geylang Serai Market. (Photo credit: S.K. Ganesan)





(Left) Close-up of flowers and (right) fruits of the Sparrow's Mango, from a planting along Napier Road.  
(Photo credits: S.K. Ganesan)

A Pelong tree, from a planting along Ang Mo Kio Street 22.  
(Photo credit: S.K. Ganesan)



Other members of the Anacardiaceae can also be found locally, such as the trees that are collectively called *rengas* in Malay. For those who access the forests of our region, it is useful or even essential to be able to recognise and avoid *rengas* trees. This is because they produce a typically black sap that can cause contact dermatitis, including rashes and blisters. However, the *rengas* trees in Singapore are confined to primary forest habitats, and even within these habitats, they are rare. There is

little chance of encountering these species along our forest trails, although sometimes one can come across the curious winged fruits of our most common *rengas*, *Gluta wallichii*.

Besides mangoes, other members of the Anacardiaceae produce edible fruits. These include cashew nuts, which are the embryo of *Anacardium occidentale*; pistachios, which are the roasted endocarp and embryo of *Pistacia vera*; and plum mangoes, produced

by *Bouea* spp. and sometimes sold in local fruit markets. Another use of Anacardiaceae in Singapore is for urban forestry. The common Indian Mango is frequently planted for shade in the urban environment, including in parks, gardens and along roadsides. More recently, the Pelong (*Pentaspadon motleyi*) has been widely planted as an ornamental in streetscapes because of its attractive form, while the Sparrow's Mango, also known as Otak Udang (*Buchanania arborescens*) has been incorporated into ecological corridors along roads, known as nature ways, as its prolific small fruits are a source of food for smaller native birds.

More information about the diversity and ethnobotany of the Mango tree family can be found in an ongoing exhibition in the Centre for Ethnobotany. The exhibition showcases some of the members of the family that are used as sources of food and material by people in Singapore and other parts of the region. Other topics covered include dispersal of mangoes, poisonous Anacardiaceae and their use as lacquer, as well as the rarer Anacardiaceae found in Singapore's forests. This exhibition on the diversity and ethnobotany of the Mango tree family will be on at the Centre for Ethnobotany until the end of October 2021. The Centre is open daily from 9 am to 6 pm, except for the last Wednesday of every month. Admission is free, so do stop by on your next visit to the Gardens.

S.K. Ganesan  
Louise Neo  
Herbarium



# A landscape architecture collaboration with Singapore Polytechnic

**In** a collaboration between the Gardens and the School of Architecture and the Built Environment at Singapore Polytechnic (SP), first-year students pursuing a Diploma in Landscape Architecture were tasked to design and propose landscape plans for our Healing Garden. This marks the second year of partnership, as the previous batch of first-year students had worked on the Gardens' Corner House in the 2019/2020 academic year.

This collaboration was part of the students' year-end projects and called for them to revamp the landscape of the existing area as an academic exercise. The aim was to offer alternative ways for visitors to interact with the planting spaces, while ensuring that the area continues to serve as a place for healing and contemplation. Apart from allowing the students to put what they had learnt into practice, the six-month-long project enabled them to have the experience of working with clients. The project, which took place between September 2020 and February 2021, was divided into three phases: site analysis, conceptual development, and design documentation.

As the students were unable to go on a site walk with Gardens' staff due to COVID-19 restrictions, they were instead introduced to the site through a virtual tour. The students were split up into several groups to analyse the site conditions and constraints presented in the virtual tour, then worked on producing an initial concept for the site. Following this, the students built upon their group work to come up with individual landscape design plans, with guidance from their SP lecturers. Their plans included a hardscape plan and proposed plant palette, complete with technical drawings of their designs.

To mark the end of the project, a joint critique session was held at SP on 16 February 2021. During the session, the students presented their landscape design proposals to a panel, on which



One of the students presenting the plant palette for her landscape design plan to Jerome and Wan Xin.



Close-up of a model prepared as part of one of the landscape proposals for the Healing Garden.

we were invited to sit and provide comments. The students prepared board journals, intricate models and even a video tour to present their design plans to the panel.

It was an enriching and rewarding experience for both Gardens' staff and the SP students. We were able to gain inspiration from the fresh and exciting design ideas of the students, while the students gained valuable insight into operational concerns that need to be considered while designing landscapes. As one of the students said of the Gardens' staff, "they explained how I could improve my design by choosing more suitable plants, and also provided us with a lot of information on plants that allowed me to learn and expand my knowledge".

This collaboration was fruitful for the Gardens as some of the students' ideas will be further evaluated for incorporating into the Healing Garden, such as the possibility of dividing the space into separate zones for relaxation and interaction, and the use of suggested plants in the landscape. We certainly hope that the collaboration has benefited the students as well, and will contribute towards growing the next generation of landscape architecture talent in Singapore.

**Tan Wan Xin**  
**Jerome Koh**  
*Living Collections*

*All photos by Singapore Polytechnic*





# Conservation Assessments

The pages of *Gardenwise*, along with those of newspapers, social media posts, and many and varied other news and information sources, frequently carry items on conservation that focus on good-news stories of species brought back from the brink of extinction or bad-news stories of species that were not saved or of habitats under threat. Scientists are only human and we too can be swept up in the big news stories of the day, rejoicing or commiserating as the case may be. But we also have a role to play in the background to tip the balance in favour of conservation by providing the tools policy makers need to make informed decisions. On a day-to-day basis, all of the work of the Singapore Botanic Gardens and the wider National Parks Board is founded on advocating for and protection of Singapore's natural heritage. In this article, however, I want to focus on how the Gardens' researchers utilise criteria developed by the International Union for the Conservation of Nature (IUCN) to assign objective conservation assessments to plant species. These assessments can then be used in developing policy, environmental impact assessments and conservation action plans, and when prioritising resources.

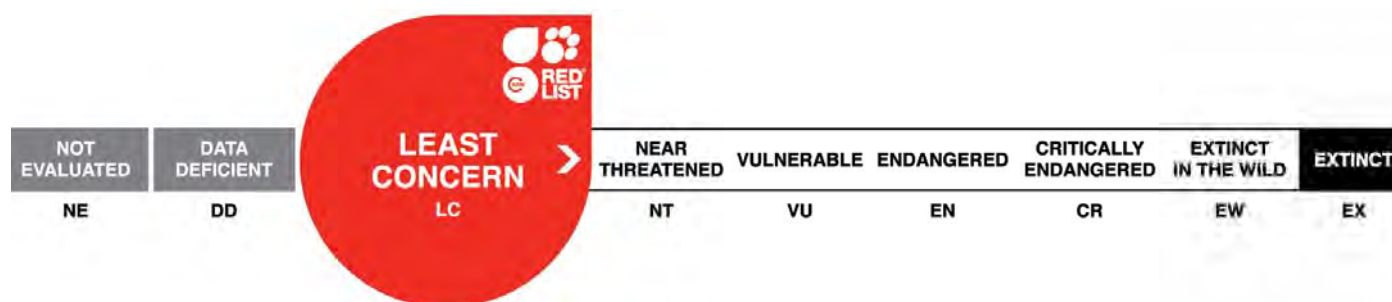
Researchers in the Singapore Botanic Gardens contribute to the conservation of plant diversity in Singapore and the wider region primarily by ensuring that we

better understand the natural world around us. What species are there, how are they related to each other, where do they occur (and also where do they not occur), how are they pollinated and dispersed, how can they be identified, can they be propagated and possibly reintroduced to places they no longer occur, and can their seeds be 'banked' for the long term so as to propagate them in the future? Answers to these questions and many more can set the context for preservation of habitats and species. Ultimately, all of these questions can only be effectively communicated about species if they have names that are accepted and understood.

A stable system of naming and identifying species is the starting point for any conservation actions, including for the system devised by the IUCN to provide an objective measure of the likelihood that a species may go extinct. This is called the IUCN Red List of Threatened Species which covers all groups of organisms. So far only about 1.5% of the estimated 8.7 million species of animals, plants and other organisms that exist on the earth have been assessed, although this is equivalent to about 6% of the estimated more than 2 million species that have already been formally described, a precondition of inclusion on the IUCN Red List. Of these, some 28% are threatened with extinction although it should be noted that, as the overall percentage of assessed species is

low, including for plants, much of the attention has so far been paid to groups of organisms known to be under threat. For plants this includes tree-ferns, cycads and cacti, many of which have been or are still being unsustainably harvested to supply horticultural demand, and many tropical lowland tree species, which are under threat from forest clearance for timber, agriculture and urban expansion.

The IUCN system places all assessed species into a number of categories based on the possibility of the species being driven to extinction. A species' placement in a category is calculated using a complex system of quantitative criteria, called the IUCN Red List Criteria. Criterion A is based on a measure of population decline: past, present and/or projected into the future. These declines are measured over time and/or in relation to the generation time of the species in order to assess how likely it is to go extinct if the decline continues. Criterion B is based on the distribution of a species using two separate measures of range: the Extent of Occurrence (EOO), and the Area of Occupancy (AOO). The EOO is a measure of the total area within the greatest spread of occurrences of a species, including any areas where the species does not occur. The AOO, on the other hand, is the sum of all of the actual areas in which the species occurs within the wider EOO. Criterion B is calculated from a measure of



A display from the IUCN Red List to show the status of *Cyrtophyllum fragrans*, the Tembusu, as Least Concern (LC).





*Hanguana triangulata* is both globally and nationally Critically Endangered (CR) as it is endemic to Singapore and the same IUCN criteria apply to both assessments.

(Photo credit: Jana Leong-Škorničková)

EOO and/or AOO combined with the number of populations and real or potential threats to those populations (e.g., logging, land use change, unsustainable harvest, etc.). Criterion C is based on knowing that there are already very few individuals left of a species and the extent of any further decline, especially if all of the individuals are in very few remaining populations. Criterion D is based on there simply being extremely few individuals at all, regardless of whether they are in decline or not, or on the species occupying such a small area that a catastrophic event could wipe it

out regardless of how healthy that population is now. Criterion E is based on calculating a likelihood of extinction based on modelling known data.

In theory, all of the criteria can apply equally to plants, animals or fungi, but in reality different groups of organisms tend to be assessed using the criteria most appropriate to that lifeform. Plants are most commonly assessed under Criterion B because it is generally more difficult to assess population size and reduction rates and the length of a generation for plants

than it is for animals. For plants it is mostly more straightforward to look at distribution patterns and ascertain what threats (both natural and anthropogenic) there may be to populations across that distribution. If the number of individuals of a plant species is extremely small or very restricted, it may be possible to assess a species under Criterion D. More than one criterion can be used to assess any one species, after which the precautionary principle should be applied, meaning that the assessment that is applied to the species is the highest threat category found.

The most severe category is Extinct (EX). Establishing that a species really is extinct is not necessarily straightforward and must be established over time and only after exhaustive surveys. There are many famous cases of extinctions in animals, not least the dodo, but far fewer in plants. It is not that extinction in plants is any less likely, more that they have been less well documented over time so historical extinctions were unrecorded. The next category is Extinct in the Wild (EW) where a species is known to persist but only in captivity or cultivation.

The three principal threat categories in the IUCN system are Vulnerable (VU), Endangered (EN) and Critically Endangered (CR), with the likelihood of a species becoming extinct increasing from Vulnerable to Critically Endangered. The language used by the IUCN for a species assessed as Critically Endangered is that the species is “...facing an extremely high risk of extinction in the wild”. The category of Near Threatened (NT) is applied when a species doesn’t quite qualify for an actual threat category but the weight of evidence suggests that it is likely to do so in the near future.

Most species are not threatened with extinction but should nevertheless be assessed in the same way using the same IUCN criteria as species under threat. When a species has been assessed and has been found not to be at risk of extinction, it is placed in the category of Least



Concern (LC). A species can be assessed as Least Concern even if it is rare as long as it is not so rare that it qualifies under Criterion D. Some species are naturally rare because they occupy extremely specialised habitats or because their resource requirements mean that only very few individuals can be accommodated within populations. If there are no threats to the species such that it can continue to exist in these small numbers with a low likelihood of it becoming extinct, it can be assessed as Least Concern.

There are also categories of Data Deficient (DD) and Not Evaluated (NE). The latter speaks for itself. The category of Data Deficient may be applied for various reasons. Sometimes it is applied because there is insufficient agreement on the taxonomic status of a species, for example whether it really is a distinct species at all or should be included within a species that may be common and widespread. It may also be applied when a species has not been sufficiently surveyed to know its distribution, population size and potential threats. For example, a single plant of a species may have been collected decades ago and it may be tempting to assess it as extinct or in a high threat category based on a presumption of very narrow distribution or extremely small population but if nobody has been back to the collection site since, the parameters to make the assessment are actually unknown and the species should be assessed as Data Deficient.

The assessment of species under the IUCN criteria can be done globally or at a national or subnational level. Although the system was devised for global assessments, it can be adapted for national or local assessments. Many countries, including Singapore, have, therefore, produced their own national Red Lists which are often referred to as Red Data Books. If a species is endemic within the territory covered by a national or local Red List, then the assessment will be the same as the global assessment. But this case is extremely rare in Singapore and many national assessments differ



*Kopsia singapurensis* is assessed as Vulnerable (VU) globally and as Critically Endangered (CR) in the wild in Singapore but is now also widely cultivated. (Photo credit: Zaki Jamil)

from the global assessments. In particular, there are many species in Singapore assessed to be in one or other of the threat categories but for which the global assessment is Least Concern. This is mostly because a species may be very widespread and not under any great threat globally but in Singapore is known from very few remaining individuals. Despite being Least Concern globally, these species are conservation priorities for Singapore because they each constitute a unique element of our natural heritage and each is a vital link in the complex ecological web that forms Singapore's habitats. By objectively assessing each species using the IUCN criteria, we are able to identify those species most critically in need of conservation actions, such as by including the species in NParks' Species Recovery Programme.

The process of conducting taxonomic research on plants necessarily includes compiling much of the data needed to critically assess species using the IUCN criteria. It has, therefore, become increasingly common for taxonomists to include

conservation assessments in their taxonomic outputs and provide the data for inclusion in the IUCN Red List. When the Gardens launched the *Flora of Singapore* project, it was decided that global and national conservation assessments would be included for all species. These data will also be summarised in a forthcoming new Checklist of Singapore's plants and will inform the next edition of Singapore's national Red Data Book, which is a collaborative project between NParks, the universities and the nature societies. With ongoing research and these resources, Singapore will be well placed to make informed decisions to protect the most threatened species in the country.

**David Middleton**  
*Herbarium*



# International researchers working on the *Flora of Singapore* project



(Photo credit: Dr Jareansak Sawei)

**Chatchaba Promma** is a postdoctoral researcher from East China Normal University, Shanghai. She works on liverworts, focusing on the genera *Radula* and *Frullania*. She visited the SING Herbarium from 8 to 16 October 2018 and is contributing to the family Radulaceae for the *Flora of Singapore*.



(Photo credit: Serena Lee)

**Daniele Cicuzza** is an Italian researcher currently residing in Brunei. He is an assistant professor in the Faculty of Science, Universiti Brunei Darussalam. He visits Singapore regularly and has prepared a taxonomic revision of Gnetaceae for the *Flora of Singapore*. Ferns are his true passion and while he mainly conducts research on fern ecology, taxonomy and conservation, one of his recent projects focuses on fern biomechanics and bioinspiration.



(Photo courtesy of the New York Botanical Garden)

**Sir Ghilleen Prance FRS** was the Director of the Royal Botanic Gardens, Kew, from 1988 to 1999. He started his career with the New York Botanical Garden as a research assistant, conducting extensive fieldwork in the Amazon rainforest and publishing numerous papers covering topics such as plant systematics, ethnobotany and conservation. Though retired, Ghilleen is actively involved in conservation efforts and serves as a trustee for the

Eden Project (UK) and the Amazon Charitable Trust. For the *Flora of Singapore* project, he has contributed to the families Chrysobalanaceae and Lecythidaceae.



(Photo courtesy of Len Ellis)

**Len Ellis** is the Senior Curator of the bryophyte herbarium at the Natural History Museum in London. With special interest in bryological nomenclature and the taxonomy of the tropical moss family Calymperaceae, Len is also a nomenclatural editor and column editor for the *Journal of Bryology*. Len is revising

the genera *Calymperes*, *Exostratum*, *Mitthyridum* and *Syrrophodon* for the treatment of Calymperaceae for the *Flora of Singapore*, the largest moss family present here with around 40 species.



(Photo courtesy of Phiangphak Sukkharak)

**Phiangphak Sukkharak** is an associate professor of botany at the Department of Biology at Burapha University in Thailand, following the completion of a PhD in Germany on the monograph of the liverwort genus *Thysananthus* with Professor Dr Stephan Robbert Gradstein. Since intermediate taxa between *Thysananthus*

and *Mastigolejeunea* were found, she, in collaboration with Gradstein, wrote a monograph on *Mastigolejeunea* leading to its treatment as a subgenus of *Thysananthus* based on morphological and molecular evidence. Phiangphak is working on the liverwort genera *Thysananthus* and *Frullania* for the *Flora of Singapore*.

**Bazilah Ibrahim**  
**Ho Boon Chuan**  
**Serena Lee**  
*Herbarium*



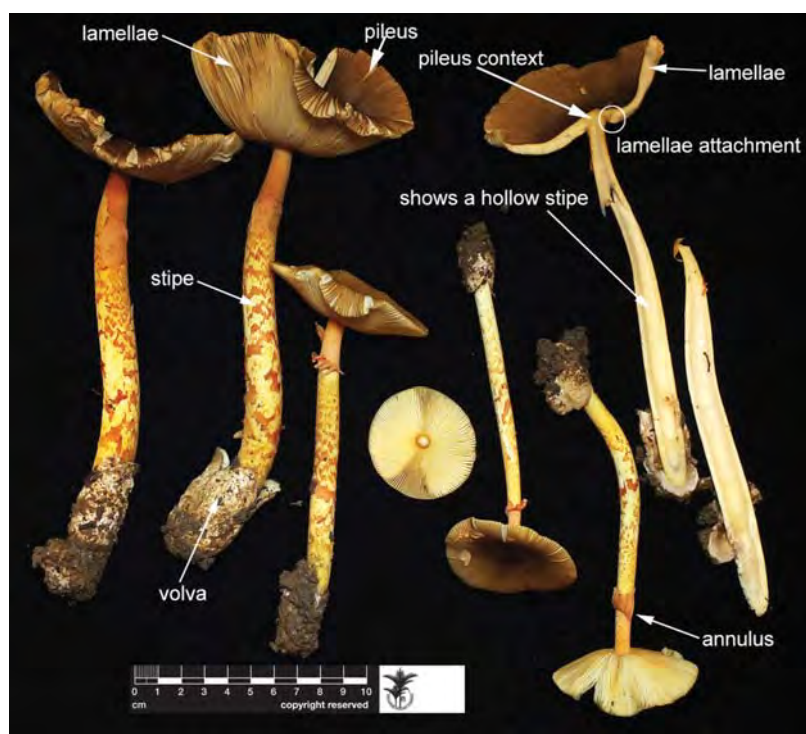


# The sum of its parts

**M**acro fungi can be separated into two large groups, basidiomycetes and ascomycetes. Which of these orders a fungus belongs to can be determined based on a single observable feature – whether the spores are borne in a basidium or contained within a sac-like structure known as an ascus. (Note however that there are other ways to distinguish these groups, such as by differences in their life cycles.) While these structures can vary in shape and form across different taxonomic groups within these orders, they cannot be used on their own to determine the genus or even the family that a species may belong to. Determining its identity requires observation of a number of other microscopic features as well, which must be considered alongside a host of macroscopic characters.

The growth habit of the fruiting body, such as whether individuals are solitary, scattered, gregarious, caespitose, connate, etc., is important to note when trying to identify an unknown fungus. If there is a mushroom cap, then characters of the pileus (the top of the cap) can also be informative, such as the width, shape, colour, margin, surface, flesh and sap. The hymenium, or fertile layer, may have gills (lamellae), pores or teeth and alongside this its general colouration is also important to consider. Characters of the stipe (mushroom stalk) to look at include its height and width; whether its attachment to the pileus is central, off-centre or sessile; its shape, surface, colour and if there are colour changes when bruised; the consistency of the flesh, such as whether it is hollow, firm, stuffed (having the centre softer than the outer part), laddered, brittle, etc.; and the presence or absence of an annulus, which is a ring-like structure remaining from a partial veil that would have once covered the fertile area.

Many of the identifying features of a macro fungus, however, can only be observed under a microscope. These include the hyphae, and important characters to note include if they are septate (have a partition separating two chambers) or not, if they are thin or thick-walled, coloured, have branches and/or are inflated. The presence of pigmentation in any of the microscopic structures is also important, and sometimes the use of chemicals like Melzer's reagent will give a reaction because of the interaction with compounds that are found in certain groups of fungi, such as the Russulales. Certain groups may have sterile cell structures known as cystidia, and if present, their size, shape and colour are important to consider. Some groups may have unique microscopic features on the pellis, or cuticle (the 'skin' of the



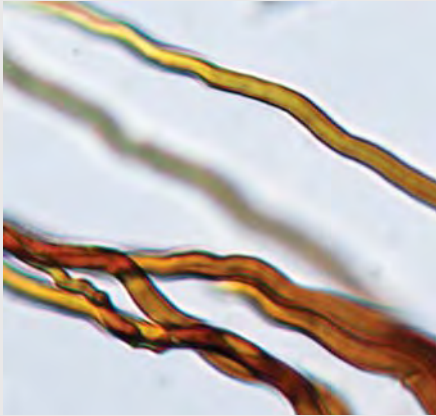
Macroscopic features of a basidiomycete (*Amanita hemibapha* subsp. *similis*).



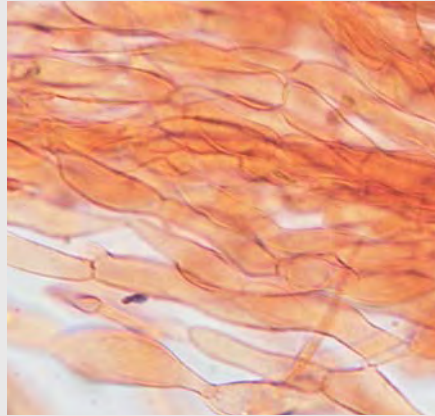
Macroscopic features of an ascomycete, the cup fungus *Cookeina speciosa*. In cup fungi, the hymenium is found on the inside of the cup.

fruiting body), and their presence will lead you straight to certain taxa like species of *Marasmius*. Spore shape and size may be informative as well; for example, members of the genus *Entoloma* have uniquely angled spores which can help to distinguish different species – provided however that they have already been described and are known to science!





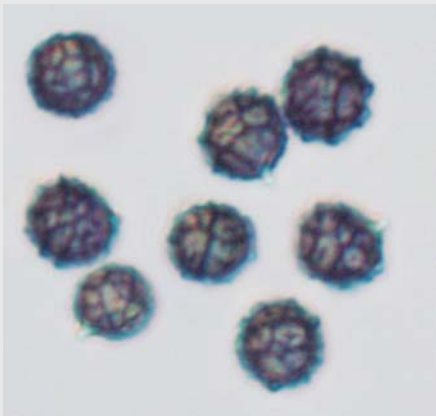
Thick-walled, unbranching hyphae in a species of *Ganoderma* (a basidiomycete). Thickened hyphal walls are notably found in bracket fungi.



Thin-walled, septate hyphae in a species of *Hygrocybe* (a basidiomycete).



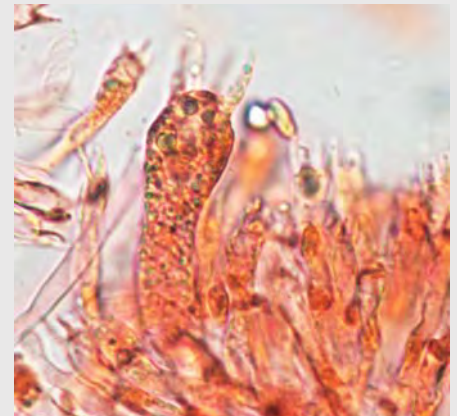
Pigmentation found in basidia and cystidia of a species of *Boletus* (a basidiomycete). Pleuro-cystidia are a type of cystidia found on the vertical surfaces of the hymenium; in contrast, cheilo-cystidia are found on the edge of the gills or pores of the hymenium.



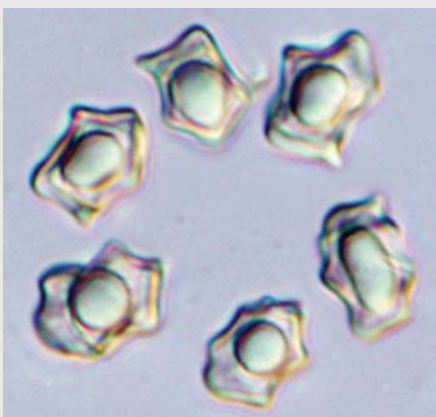
Spores of a species of *Russula* (a basidiomycete), with reticulate ornamentation; they have turned blue from an amyloid reaction with the application of Melzer's reaction. This is a trait of fungi in the Russulales group.



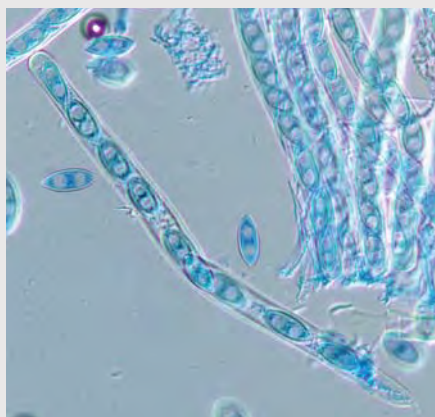
Cellular elements found in the pileus cuticle of a species of *Marasmius* (a basidiomycete). Their presence is a tell-tale feature of certain sections in the *Marasmius* group.



Dimorphic basidia in a species of *Hygrocybe* (a basidiomycete). Dimorphic basidia, with one type being normal in size and the other type relatively very large, are an interesting feature that only occurs within one section of the *Hygrocybe* group.



Irregularly angled spores of an *Entoloma* species (a basidiomycete).



Spores in an ascus of *Cookeina tricholoma* (an ascomycete).



Dark coloured spores of a *Xylaria* species (an ascomycete).

As you can see, it is crucial to take note of as many features that can be both seen and unseen with the naked eye, as the identity of a fungus lies in the sum of its parts. While identifying macro fungi may seem daunting because of this, with experience it does become easier.

**Serena Lee**  
*Herbarium*

*All photos by Serena Lee*





# *Etlingera corneri* – ‘rose’ of the tropics



*Etlingera corneri*.

**The** ginger research collections at the Singapore Botanic Gardens, with almost 1,800 accessions, are among the largest in the world. These collections were acquired over several decades through fieldwork in collaboration with various institutions across Southeast Asia, exchanges with botanical gardens around the world, purchases from reputable plant nurseries and occasional donations by members of the public. While some plants can be identified to the species level straight away, others are unknown until they exhibit characters that allow us to make a positive identification. Until then, they are labelled in our collections as ‘Unknown Zingiberaceae’, or with the possible genus followed by a question mark.

A couple of years back, one such mysterious plant was donated to us

by Mr Tan Jiew Hoe, President of the Singapore Gardening Society, patron of the Gardens and avid plant collector. Based on its leafy shoots, we could only place the plant into the subfamily Alpinioideae, and guessed that it might belong to *Alpinia*, *Etlingera* or *Hornstedtia*. It was obvious that the plant would be large, so we planted it in the ground behind one of our research nurseries in the Potting Yard. The plant grew and grew! In the beginning of April 2021, the first signs of inflorescences appeared. Around 15 long, spear-like peduncles with reddish swollen apices appeared, somewhat similar to those of a Torch Ginger (*Etlingera elatior*). This eliminated the genus *Alpinia*, but for a precise determination we still had to wait for the inflorescences to mature, bracts to open and flowers to appear. After one month of daily impatient checking, and just in time

for Mother’s Day, the plant revealed its full beauty and with it – its identity! Bright-red bracts in a rose-like arrangement left no doubt that we had a fine living specimen of the Rose Ginger, scientifically known as *Etlingera corneri*.

The Rose Ginger is indeed a close relative of the much more widespread and better-known Torch Ginger, also known locally as Kantan, the unopened budding inflorescences of which are used as a condiment. The young inflorescences of the Rose Ginger have a nearly identical smell and flavour, so much so that they could undeniably be used for the same purpose.

*Etlingera corneri* was named in honour of E.J.H Corner, Assistant Director of the Gardens from 1929 to 1942 and subsequently a civil internee at the Gardens until the end





*Etlingera corneri* in the Potting Yard.



(Left to right) *Etlingera corneri* in the Potting Yard, *E. elatior* in the Ginger Garden, and *E. venusta* in the Cameron Highlands, Malaysia.

of the Japanese Occupation. Corner was the first to collect this species, on 11 May 1937 from near Mawai in Johor, but it was not at first recognised as a new species because it was confused with another, equally stunning ginger, *Etlingera venusta*. It took over 60 years to realise that *Etlingera corneri* is a distinct species and was finally described as new to science in 2000. The Torch Ginger can be differentiated from the other two closely related species by its nearly smooth leaves and inflorescences which are raised on top, as both *Etlingera corneri* and *E. venusta* have corrugated leaf blades

and flat-topped inflorescences. Both species occur in Peninsular Malaysia; however, *Etlingera venusta* thrives in higher altitudes in Selangor, Pahang and Perak, while *E. corneri* is a lowland species known to occur on the eastern side of Peninsular Malaysia from Johor to Terengganu and extending to the Satun province in Thailand.

Behind the scenes, we have propagated several plants of *Etlingera corneri*, by rhizome cuttings. We hope to be able to transfer them into the grounds of the Gardens for visitors to enjoy by early next year.

In the meantime, young plants of the cool-loving *Etlingera venusta* have been released from the research nursery and incorporated into the new Sembcorp Cool House in the Tropical Montane Orchidatum. With a bit of ginger luck, both species will produce their beautiful inflorescences and bring smiles to plant lovers in a year or two.

**Jana Leong-Škorničková**  
*Herbarium*

*All photos by Jana Leong-Škorničková*





# How to grow leafy vegetables

**In** Singapore, we consume a wide variety of leafy greens. Asian greens are particularly popular, and they include plants like Pak Choi and its related cultivars (*Brassica rapa*, Pak Choi Group), Chinese Kale (*Brassica oleracea*, Alboglabra Group), Chinese Spinach (*Amaranthus* species) and Kangkong (*Ipomoea aquatica*). This article shares about the process of growing these leafy vegetables from seed to harvest.

## Seed germination

There are two main ways to sow seeds, the broadcast method and the seed tray method. Broadcasting involves scattering seeds on a seed tray or directly into a planter bed. However, with this method it can be difficult to control spacing and the seedlings often end up being crowded, requiring thinning out or transplanting which may result in growth set-back or death of the transplanted individuals. Though convenient, this method tends to use up more seeds and results in a less uniform crop, making it not ideal for many leafy vegetables. However, it is suitable for Chinese Spinach and Kangkong. This is because their leaves are held on a long stem and the plants can benefit from being grown close together, around 10 cm apart. As the plants grow, they provide shade for one another and the stems are encouraged to reach up toward the light. This leads to the development of a long and tender stem, which is usually the desired result when growing these edibles.

For vegetables with a large spread, like Pak Choi and Chinese Kale, which tend to grow as a rosette and can reach 15 to 20 cm in diameter by harvest time, it is recommended to germinate them in a seed tray. As the seedlings grow, their roots will fill the cell and hold on to the medium. Each plantlet can then be taken out of its cell rather easily as a 'plug' and replanted in its final



Sowing seeds into a seed tray.



Seedlings ready for transplant.

growing location while minimising transplant shock. The plugs can be spaced out evenly during planting, depending on the expected maturation size of the plants. With ample space and light exposure, they will tend to grow more uniformly.

To sow seeds using the seed tray method, depending on the number of seedlings required you can use a recycled plastic egg tray. In this case, a hole should be made at the base of each cell for drainage. If you plan to grow larger numbers of seedlings, seed trays may be more suitable; they are available for sale in most garden nurseries. Fill the cells to the brim with the seed-raising mix and tamp it down slightly, taking care to avoid compacting it. Moisten the mix and proceed to make one or two holes about 1 cm deep in each cell. Drop a seed or two into each hole and cover them. The growing medium should be kept moist until the seeds germinate, which should be around a week if they are fresh and of good quality. Once the seedlings



A seedling plug.

emerge, the seed tray should be moved to a location where they can be exposed to at least four hours per day of direct sunlight. They should be protected from heavy rain which could wash them away.

Whether using the broadcast or seed tray method, it is best to use a moisture-retaining, sterile and aerated medium to grow leafy vegetable seedlings. A mix consisting of equal parts of peat moss, vermiculite and perlite has been found to be optimal. If you are using a peat moss-based substrate that has been fortified with nutrients, then there is no need to feed your seedlings with fertiliser. Otherwise, a diluted, water-soluble fertiliser can be applied when they are about a week old. They will produce up to two sets of true leaves about two to three weeks after germination, and at this stage, the roots should have filled the cell. This is when they can be transplanted to their final growing location, whether a planter box or a garden bed.





**Right after transplant.**



**One week after transplant.**



**Two weeks after transplant.**



**Three weeks after transplant.**

## Soil preparation and planting

The soil in the planter box or garden bed needs to be prepared prior to transplanting any seedling plugs. Leafy vegetables do not have very deep roots, so a soil depth of about 15 to 20 cm is sufficient. The soil used should be well draining, moisture retaining, and rich in organic matter. Soil preparation involves loosening the soil and incorporating an organic fertiliser rich in nitrogen, such as processed chicken manure or bone meal. An application rate of 1 kg of organic fertiliser per square metre of planting area is recommended.

Ensure that the soil surface is relatively even, and then create planting holes spaced 15 to 20 cm apart. Place the transplanted seedlings into the planting holes, taking care not to bury them too deeply. Transplanting is best done in the early morning when the environment is still cool. Water the seedlings once transplanting is completed.

## Growing the seedlings

Leafy vegetables demand good light to grow and at this stage need to be in a location with at least six hours of direct sunlight. Leafy vegetables generally grow at a slower rate and tend to become etiolated if they do not receive sufficient sunlight. Depending on environmental conditions, they should be watered at least once daily to ensure they do not dry out. One week after transplanting, a side dressing of organic fertiliser can be applied around the base of the plants. Once the seedlings enter their rapid



**A netted structure to protect seedlings from pests.**

growth phase, this can be repeated on a weekly basis to provide them with sufficient nutrients.

## Harvesting vegetables

The time till harvest depends on the variety of leafy vegetable being grown and the growing conditions. In optimal conditions, Pak Choi and its relatives are generally ready for harvest about two to three weeks after transplant. Chinese Kale grows at a slower rate and is usually ready to harvest about four to six weeks after transplant. Chinese Spinach and Kangkong are ready to harvest about 30 days after seed sowing.

It is best to harvest leafy vegetables early in the morning when they are turgid. They can be cut at the base and stored in the refrigerator immediately to reduce heat stress and rate of respiration. There should not be any water on the leaves during storage. They can be stored in a sealable plastic bag to retain moisture to prevent wilting. Leafy vegetables should be washed before cooking.

## Important tip

Leafy vegetables are prone to attacks by chewing and rasping pests such as snails, slugs, moth caterpillars and flea beetles when grown in an outdoor garden. To reduce damage by such pests, it is recommended to grow your leafy vegetables inside a netted enclosure which serves as a physical barrier. The netting used should be white in colour to allow the full spectrum of light to pass through. If you are growing your plants during the rainy period, it may be necessary to put a clear plastic sheet over the enclosure. This will protect the seedlings from damage, waterlogging and disease.

**Wilson Wong**  
*Jurong Lake Gardens*

*All photos by Dr Wilson Wong*





# Framing nature through photography and botanical art

**In** March this year, the Gardens' education team held two art-based workshops to help connect people to nature. Focusing on photography and botanical art, they were aimed at guiding participants to appreciate nature by seeing it through a different perspective.

## Discovering Nature through a Lens

This photography workshop for children was held on 15 March 2021, during the school holidays. Participants were introduced to a brief history of photography as a medium and taught how to use basic functions of a digital camera such as

adjusting focus, aperture and shutter speed. They were also given tips on how to photograph subjects by using techniques such as the rule of thirds and framing their shots from different perspectives and angles.

After a short theory and practice session in the classroom, the children ventured out into the Gardens to apply their newfound skills. During this educational photo walk, participants learnt about the Gardens and were encouraged to appreciate and capture images of its landscapes, flora, fauna and heritage landmarks through different angles and perspectives. They enthusiastically scoured each area for interesting subjects in nature to photograph.

Following the productive photo walk, the children returned to the classroom to select and print their favourite images. They also created nature journals to feature their printed photographs and included observations beside each image as a reminder of what they learnt during their walk. The children enjoyed putting their photographs into a nature journal to bring home, and many of the participants shared that they wish to visit the Gardens again in the future. On the education team's part, we felt that the workshop was successful in enabling the children to more confidently use the functions and features of a digital camera to add value to their creative work.



(Left) Kay Yee teaching a participant how to adjust aperture settings on a digital camera to photograph a close object. (Right) Steffi and Taufiq showing the children how to use different camera functions.



(Left) Participants photographing two monitor lizards that they spotted high up in a *Hopea* tree. (Right) Participants using different aperture values to take close-up photographs of flowers.





Some of the photos taken by participants of the workshop. (Clockwise from top left) A monitor lizard by Uriana, age 11; mushrooms by Ishan, age 7; a dragonfly by Sofia, age 12; and a tree canopy by Elsa, age 10.



Decorating and incorporating photographs into nature journals.





Leaf of the day, *Calathea* 'Beauty Star'.



A participant adding the finishing touches to his work.



Members of the Botanical Art Society (Singapore) providing pointers to the participants.

### Painting Foliage with Watercolours

On 6 March 2021, a group of adults joined us at the Gardens for our first botanical art workshop, *Painting Foliage with Watercolours*. The trainer, Ms Debbie Teo from the Botanical Art Society (Singapore), introduced participants to the concept of botanical art and its

history, as well as some basic watercolour techniques. Inhabiting the realms of both science and art, botanical art depicts plants in a scientifically accurate manner that is also often aesthetically pleasing. Used by botanists for describing and identifying plant species, they are intended to be true representations of plants and their distinguishing traits.

After a short practice session, participants were guided step-by-step on how to paint the leaf of a *Calathea* 'Beauty Star'. This leaf was chosen for its suitability for beginners, as its relatively large surface area meant that anyone not used to wielding paintbrushes would not be overly worried about precision. The leaf itself is aesthetically pleasing as some specimens have bright pink lines arising from the midrib which contrast beautifully with the darker green colour elsewhere on the leaf. At the end of the session, participants were able to take their artwork home with them, along with painting materials to continue practising their watercolour techniques.

This workshop was conducted in collaboration with the Botanical Art Society (Singapore). Special thanks to Ms Carrie-Ann Lee, Ms Kelly Bassett and Ms Debbie Teo from the Botanical Art Society (Singapore) for their help in making the programme a success.

**Muhammad Taufiq Jumal**

**Steffi Loe**

**Tan Hui Min**

*Education Branch*

*All photos courtesy of the Education Branch*





# Heralding new openings with blooms

**The** months of March and April are usually a good time to see many plants flowering in the Gardens. Not surprisingly, again this year, following periods of hot spells and downpours in preceding months, many plants were triggered to bloom. It so happened that this flowering spell coincided with the opening of the Gardens' newest attractions at the Gallop Extension in March, and the Tropical Montane Orchidethum in April.

In the Gallop Extension, the most prolific and striking plant blooming at the time was *Ixora nigricans*. This medium sized shrub peppers the edges of the path from the Gallop Extension Visitor Counter to the Forest Discovery Centre @ OCBC Arboretum and Botanical Art Gallery. Belonging to the Coffee family, Rubiaceae, the genus *Ixora* has over 560 different species and varieties. *Ixoras* are some of Singapore's most common flowering shrubs and they come in a variety of colours, shapes and sizes. Hence, it can be difficult to identify this *Ixora* without close scrutiny. The generic epithet *Ixora* is derived from the name of the Indian deity Ishwara, whereas the species' epithet, *nigricans*, means almost black and alludes to the very dark reddish-brown stems of the inflorescences.

Commonly known as the Black *Ixora*, this fairly large shrub can reach up to 5 m in height. Like most other *Ixoras* and members of its family, it has a simple opposite leaf arrangement. The leaves are large, between 6 and 10 cm long. When in full bloom, the shrub has numerous corymbs which hold a multitude of flowers at different stages of opening. The flowers are white and tinged with pink, tubular in shape with four reflexed petals, and highly scented, especially in the evenings. The fruits are pea-sized globose drupes that contain two seeds each.

The distribution of the Black *Ixora* ranges from the Western Ghats of India to Myanmar, where it



Close-up of the delicate fragrant flowers of the Black *Ixora*, *Ixora nigricans*.

commonly grows in evergreen to semi-evergreen forests at elevations of up to 800 m. It thrives under full sun or in partial shade and likes fertile, well-draining moist soils that are rich in humus. In India, this shrub is highly valued by tribal communities for use in traditional medicines. Various parts of the plant are used to treat many ailments, including diarrhoea, dysentery, stomach disorders and paralysis. In recent years, researchers have been investigating the efficacy of

phytochemicals found in this plant for their anti-inflammatory and anti-oxidative properties.

A few weeks after the attractions opened in the Gallop Extension, the much-awaited launch of the Tropical Montane Orchidethum occurred on the 3rd of April. As expected, orchids in various colours and forms were on display, ranging from those that thrive from the lowlands right up to high elevation montane regions. Not to be outdone,





A handsome Black Ixora heavily laden with flowers.



The Ortigon, *Coccoloba rugosa*, with its long crimson inflorescence and large crinkly leaves.



Close-up view of the striking red flowers of the Ortigon.

the non-orchid plants also showed off their beauty at every turn along the paths. One outstanding and strange looking plant blooming at the time was *Coccoloba rugosa*. Belonging to the Knotweed or Buckwheat family, Polygonaceae, the genus *Coccoloba* is estimated to have 176 species that are native to the Neotropics. Commonly known as the Red-flowered Sea Grape or Ortigon, *Coccoloba rugosa* is related to the widely grown *C. uvifera* or Sea Grape that is usually found along coastal beaches in the tropics.

The Ortigon is a small evergreen tree with a skinny trunk, only around 12 cm in diameter, but is able to reach 10 m in height. It only branches from the base, and the green stems are stout and slightly flattened with longitudinal ridges. This tree has huge and beautiful stalkless wrinkled leaves that are alternately arranged, measuring up to 60 cm long with recurved margins. The conspicuous young leaves unfurl and change colour from a dark red or maroon to a

deep green colour as they mature. The leaves are stiff and thick like illustration board, which is one of the striking features of the tree. The other is its very long terminal inflorescences, which measure up to 75 cm long and bear numerous crimson flowers. The fruits are about 1 cm long, reddish and ovoid in shape, and contain a single brown and pointed three-angled seed. Unlike those of the common Sea Grape, the fruits of this species are not known to be eaten. The Ortigon is important within its natural distribution but is becoming endangered due to habitat loss. Its heartwood, which is purplish, fine-grained, hard, heavy and strong, has been used in construction and for cabinet making.

The next time you visit our new attractions, remember to look out for the Black Ixora with its fragrant flowers in the Gallop Extension, and the bizarre-looking Red-flowered Sea Grape amongst the lush greenery and orchids in the Tropical Montane Orchidarium.

**Nura Abdul Karim**  
*Research and Conservation*

*All photos by Dr Nura Abdul Karim*





# The *Human x Nature* exhibition, a collaboration with the National Library Board

**In** July 2020, a team from the National Library Board contacted the Gardens' Library of Botany and Horticulture to discuss a collaboration for an exhibition highlighting 200 years of Singapore's biodiversity use and conservation. Called *Human x Nature: Environmental Histories of Singapore*, the exhibition was officially launched on 9 April in the level 10 gallery of the National Library Building and will be on until 26 September 2021. On display are loans of various artefacts from the Gardens and other key custodians of our heritage, namely the National Archives Singapore, the Urban Redevelopment Authority of Singapore and the Lee Kong Chian Natural History Museum.

The *Human x Nature* exhibition focuses on the history of the relationships between Singapore's inhabitants and the natural world through the display of land use records and maps, as well as documents of cultural understanding and scientific studies. It also highlights the evolution of approaches towards rehabilitation, restoration and conservation of our biodiversity over time. The exhibition is laid out according to three categories: understanding nature, consuming nature and remaking nature.

This exhibition was gladly supported by the Gardens' library as it allowed us to share some of our rarely seen illustrations and other artefacts with the public. On display are original drawings and paintings of fragile tropical mushrooms by E.J.H. Corner, Assistant Director of the Gardens from 1929 to 1942 and then a civil internee until the end of the Japanese Occupation. Corner was



Entrance to the *Human x Nature* exhibition in the National Library Building at Victoria Street.



One of the elegantly designed sections in the exhibition.

a fascinating botanist and highly regarded mycologist of his time who spearheaded the study of tropical fungi in the region. The exhibited mushroom illustrations by Corner are the originals that were reproduced in his book, *Boletus in Malaysia*

(1972). The scientific work of other key directors and curators of the Gardens' past, including reports on plants, botanical explorations and food production among other topics, also form part of the exhibition and enrich the story conveyed.

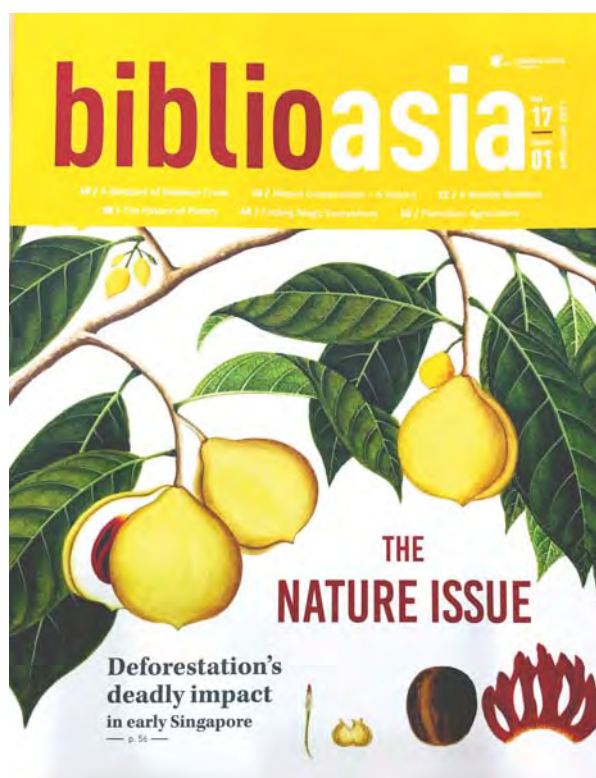




A selection of original botanical drawings by E.J.H. Corner, and his book *Boletus in Malaysia* (1972), where these images were reproduced.



Herbarium specimens of useful plants on loan from the Gardens.



The National Library Board issued a special edition of their quarterly magazine, *BiblioAsia*, to complement the *Human x Nature* exhibition. The issue features a number of interesting articles and is well worth a read.

*Human x Nature* also attempts to bring to light the work of unsung contributors to the scientific knowledge of our flora and fauna during the colonial period. Exhibited are botanical drawings by Ethel Burkill and Barbara Everard, two of only a handful of female botanical artists working in the tropics at the time, the former also being the wife of prominent British botanist and Director of the Gardens, I.H. Burkill. Also showcased are amazingly precise and beautiful illustrations by self-taught local Malay artist Juraimi bin Samsuri, who was the first local-born staff member of the Gardens to be employed officially as an artist. Another example on display is the paper 'Malay Village Medicine: Prescriptions Collected', published in the *Gardens' Bulletin*, volume 6 (1930). While many publications dating to the colonial period that document the region's natural history were written without acknowledging the contributions of local and indigenous people, alongside I.H. Burkill this paper is attributed to Mohamed Haniff, a local Malay naturalist employed by the Gardens at the time.

It is well worth visiting this special exhibition before it ends in September. It offers a wonderful opportunity to learn about how our relationship with and understanding of nature has transformed over time, and to view first-hand rarely seen natural history artefacts from the Gardens' archives and other organisations.

**Nura Abdul Karim**  
*Research and Conservation*

*All images courtesy of the National Library Board, Singapore*





# Retirement of a long-time staff member, Zakiah binte Agil

**A**fter 33 years of service with the Singapore Botanic Gardens, Zakiah binte Agil, one of our most trusted and devoted library assistants, retired at the end of April. Staff and members of the public who frequent our library will miss her friendly smile, witty comments and most importantly her breadth of knowledge about the library's collections and artefacts.

A *kampung* girl born in 1963 to Mr Agil bin Abdul Hamid and Madam Zainah binte Abdul Rahim, Zakiah is the second youngest of nine siblings. She grew up in Kampung Melayu, the Jalan Eunus Malay Settlement that was later renamed Kampung Eunus. The *kampung* eventually gave way to the construction of the Pan Island Expressway, and in 1985, Zakiah and her family relocated to an HDB (Housing and Development Board) flat in Tampines.

In June 1981, at the age of 18 and upon completion of her GCE O-level examination, Zakiah joined the civil service as a clerical assistant with the Ministry of Education. When an opportunity arose for a position as a library assistant with the National Library Board, she jumped at it and was successful in her application. Zakiah began her journey as a library assistant in September 1984 at the National Library Building located then at 91 Stamford Road. Four years later, Zakiah was seconded to the Parks and Recreation Department (which later became part of the National Parks Board after its establishment in 1990). In July 1988, she joined the Gardens' library staff, where she stayed until her retirement. In 2007, after 25 years of public service, her contributions were recognised by receiving the Pingat Bakti Setia (Long Service Award) from the Ministry of National Development.



**Reporting for duty. Zakiah (centre) with long-time friend and colleague Sufiah binte Mohd Salleh (left, from NParks' Lifestyle and Business team) together with Herbarium staff Bazilah Ibrahim at the Singapore Garden Festival 2016. (Photo credit: Sufiah binte Mohd Salleh)**



**Mission accomplished! Zakiah with the last box returned to the library following renovation works in 2018. (Photo credit: Zakiah binte Agil)**

Before retiring, Zakiah shared that she never regretted her decision to remain with the Gardens throughout her career. She enjoyed her 33 years here, working alongside the late Christina Soh in helping to manage the library. She was not just a wonderful resource for members of the public and colleagues from the Gardens, she provided invaluable support for staff throughout NParks including in managing sales of our various book publications.

We would like to express our sincere thanks and appreciation to Zakiah for her contributions and long service to the Gardens and NParks. The atmosphere in the library will not be the same without her.

**Low Yee Wen**  
**Bazilah Ibrahim**  
*Herbarium*

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# An award-winning orchid hybrid named for our City in Nature



*Papilionanthe* National Parks Board 'SBG City in Nature'. (Photo credit: Whang Lay Keng)

**T**his beautiful orchid hybrid whose name references our City in Nature vision is a cross between *Papilionanthe* Snowdon and *Papilionanthe* Miss Joaquim 'Douglas'. It was awarded a First Class Certificate by the Orchid Society of South East Asia during the Singapore Botanic Gardens' Heritage Festival last year, which was held in conjunction with the Community Garden Festival from 24 October to 1 November 2020. It is a robust and free-flowering orchid hybrid that produces strong and upright sprays of flowers. Each large and showy flower measures about 7.5 cm across and has an attractive pinkish purple lip.

**Whang Lay Keng**  
National Orchid Garden





# Plant illustrations in black ink

**L**ine drawings, also known as pen and ink drawings, are the typical illustrations associated with scientific papers. In contrast with photographs, line drawings do not focus on colours or the effects of light and shade on surfaces. Line drawings clearly and objectively present the morphology of a plant, are drawn to scale, and include all the features needed

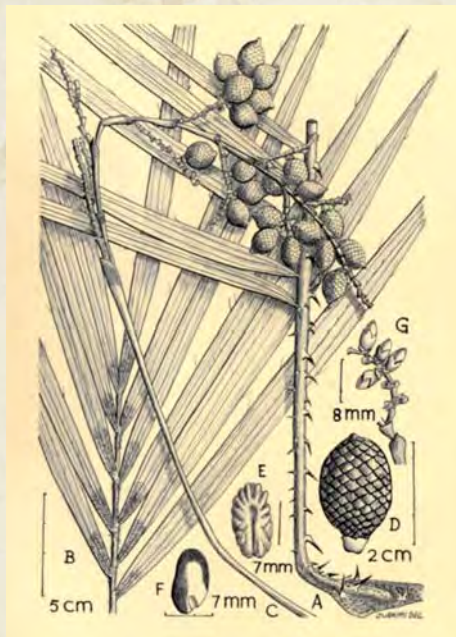
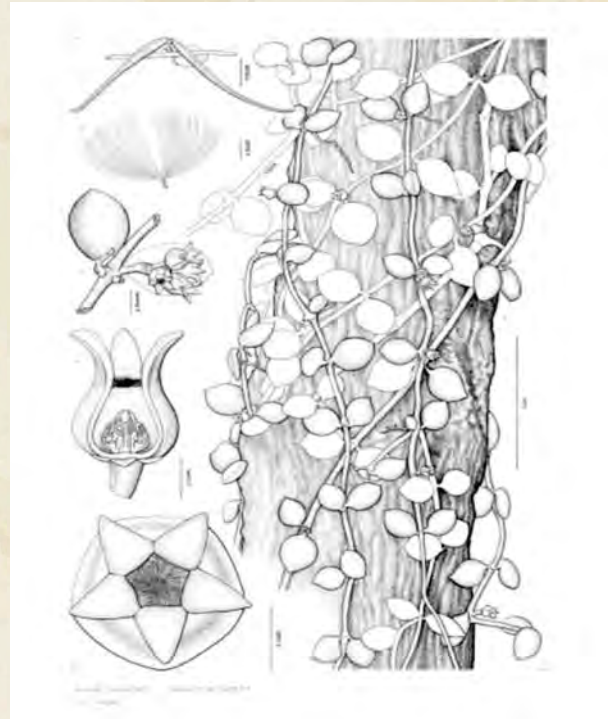


Illustration of *Calamus dachangensis* (now *Calamus gibbsianus*) by Juraimi bin Samsuri, likely unpublished.



A much-magnified cross section of the fruiting body of the fungus *Nectria egens*, a new species described and drawn by Corner and published in the *Gardens' Bulletin*, volume 8 (1935).



*Dischidia nummularia*, drawn by Loh Xiang Yun and published in *Flora of Singapore*, volume 13 (2019).

for identification and discrimination between similar species. These features are often very minute and can be represented greatly magnified.

Nowadays photographs are also commonly used in scientific journals; however, photographs of rare species may not always be available, and detailed drawings may still be needed to complement photographs. Therefore, in recent years the Gardens has engaged and trained new artists to make line drawings for the *Flora of Singapore*, as well as to illustrate rare and new plants for scientific papers.

The recent drawings will join the large collection of historical line drawings already present in the Gardens' archives and dating from the 1930s to the 1970s. Since 2020 efforts have been made to study and catalogue this invaluable collection. More than 3,000 individual items have been inventoried, including pencil sketches, finished drawings and printing proofs. The collection includes the work of artists formerly employed by the Gardens such as Chan York Chye and Juraimi bin Samsuri, as well as by botanists E.J.H. Corner and Murray Ross Henderson.

**Michele Rodda**  
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