

Gardenwise



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Warszewiczia coccinea growing in Pará state, Amazonia, Brazil, January 2017, see pages 14–15.
(Photo credit: Daniela Zappi)

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Opposite page
New Guinea Creeper (*Mucuna bennettii*), Fabaceae, flowering on the third floor of Botany Centre.
(Photo credits: Nigel Taylor)

Group Direction



Dear Readers, in this issue of *Gardenwise* there is a strong flavour of learning. Staff of the Botanic Gardens regularly enjoy training experiences, whether at home or abroad, and we are often host to and educators of our partners from overseas, especially those from the Southeast Asian region, as well as local school groups. No less than seven of the Regular Features in this issue describe such learning experiences (see pages 20, 22–29, 32), the most significant of which was the collaboration between the Singapore Botanic Gardens and Royal Botanic Gardens, Kew in delivering the Tropical Plant Identification Course, held during October and November 2016 at the Gardens (pages 22–24). Building capacity for our botanical partners overseas is an important role for the Gardens, bearing in mind that learning opportunities focused on plant morphology and taxonomy have become a rarity amongst the world's universities at the undergraduate

level, and so it falls to botanic gardens to provide this vital area of basic knowledge without which our appreciation of Nature would be much the poorer.

Creating a desire for understanding of the natural world is easily achieved in a fine garden like ours. Without the need for technical knowledge we can get excited about new plant introductions (pages 14–15) and be reminded that gardens and gardening have been a key part of our culture for generations – witnessed by the fact that the Singapore Gardening Society celebrated its 80th birthday at the Gardens in November, when it was honoured by a new orchid hybrid (page 3). Our researchers continue to push back the boundaries of our botanical knowledge in the mega-diverse island of Borneo (pages 8–11), while also occasionally indulging in a bit of plant-based fun that definitely qualifies as art (pages 4–7). As always no issue of *Gardenwise* can be without something on orchids

and here we learn about the successful reintroduction of the supposedly extinct *Bulbophyllum pulchellum* (pages 12–13) and the forerunner of our National Orchid Garden, the now almost forgotten Orchid Enclosure (see rear cover).

2017 promises to be another eventful year for the Botanic Gardens, with parts of our Learning Forest opening to the public at the close of March and various other developments in the pipeline to be detailed in future editions of this magazine. We look forward to seeing you regularly in the Gardens as it enters its 158th year!

Nigel P. Taylor
Group Director
Singapore Botanic Gardens

Dr Benito Ching Tan (1946–2016)

Keeper of the Singapore Botanic Gardens' Herbarium (SING) (2007–2010)

It was with great sadness and shock that we received the heart-breaking news of the passing of our dear mentor and friend, Dr Benito C. Tan, at the age of 70. He was diagnosed with cancer in August 2016, and passed away on the morning of 23 December 2016 in Los Angeles, California (USA). It was already Christmas Eve in Singapore when we learnt about his death because of the 16-hour time difference.

We first heard of and knew you as the world's authority on mosses who was coming to the National University of Singapore (NUS) from Harvard University. When asked what made you take up bryophytes, you said with a smile that it was because they could all fit in your pocket! You admired those little green organisms that most hardly see, hidden wonders that so many overlook. Always smiling and full of cheer, there was not a mean bone in you. When the going was tough you shrugged it off as a fact of life and carried on.

We remember back at NUS you had an electric bike, and you would ride it to school every day until you got into an accident and stopped. Those were the days when an e-bike was relatively uncommon everywhere and we thought you rather contemporary and funky. Once, when you slipped and fractured your ankle in the Gardens, thinking it was just a sprain, you went to a traditional Chinese medicine practitioner to get a rub-down. Finally when the pain did not go away, and your foot ballooned and turned black and blue, you went to get



A photograph from our colleague Paul Leong, who recalls trying to capture Benito pushing the boat on camera. When caught unawares, he quickly leapt back in with a cheeky grin.



Benito with his namesake plant, *Hoya benitotanii* Kloppenb. (Photo credit: Paul Leong)

an x-ray and told us you were chastised by the doctor that you as a Professor should have known better! You were so humble and funny! You were a wonderful boss for us at SING, so mild in temperament and always welcomed us in for a word.

Thank you for your generosity and guidance while we were students. You were genuinely interested not just in the progress of our research projects but also in our welfare and future. You were our mentor and a somewhat fatherly figure to us.

Oh Prof., you were taken way too soon! But isn't there a saying the good die young? You will be dearly remembered and sorely missed, teacher, mentor, friend, and Coca-Cola lover. Our Prof. Ben.

Ho Boon Chuan
Serena Lee
SING Herbarium

Michelle Goh Wee Kee
Corning Singapore Holdings Pte Ltd

Boon Chuan, Serena and Wee Kee are former labmates of the NUS cryptogram laboratory (1998–2006)

The Singapore Gardening Society celebrates 80 years



On the afternoon of 18 November 2016, the Singapore Botanic Gardens hosted a special 80th anniversary celebration for one of its longest-serving partners, the Singapore Gardening Society (SGS). This was an entirely appropriate thing for the Gardens to do, because in June 1936 the Gardening Society was founded by two former members of our staff, Director Eric Holttum and horticulturist John Nauen. John Tan Jiew Hoe, the current President of SGS, asked the undersigned to give a short presentation on the establishment of the Society to the assembled audience of SGS members and invited NParks staff at our Function Hall. The drivers for its establishment in 1936 seem to have been the prior existence of

gardening societies in Kuala Lumpur and Malacca, and the desire to have a better organisation of the annual flower shows that were regularly held in Singapore in the 1930s. John Nauen was the catalyst in improving these shows and the first held under the Society's auspices was a success in 1938. The war intervened in 1941 and SGS and its shows were only reconvened some years after the Japanese occupation had ended. Sadly, the inspirational John Nauen, together with other staff of the Botanic Gardens, lost his life during the war after being taken prisoner and assigned to work on the notorious Burma-Siam railway. My brief account of the Society's formation concluded with some images taken from its 50th anniversary publication entitled *Golden Gardening* (1986), including an amusing photograph of a very youthful John Tan as a committee member.

For its 80th anniversary SGS was honoured by the naming of a new orchid hybrid, *Renantanda* Singapore Gardening Society, bred by the Gardens' very own How Wai Ron. SGS members had been invited to vote for one of three contrasting hybrids offered to the Society by the Gardens and the *Renantanda* won by a clear margin. John Tan received the orchid in a ceremony conducted by Dr Leong

Chee Chiew, Commissioner for Parks and Deputy Chief Executive Officer of the National Parks Board (NParks), and in the presence of NParks' Adviser, former CEO and former Director of the Gardens, Dr Kiat Tan (CEO of Gardens by the Bay). After the applause had died down, John presented various tokens of gratitude to the senior NParks staff present, including some very unusual plants for our living collections from his private garden, not least amongst which was a spectacular botanically un-described *Syzygium* with giant leaves and a rarely cultivated, tall-growing Ecuadorian gesneriad, *Drymonia chiribogana*, plus two special Hoyas (one being *H. jiewhoeana*, named after John himself).

At the conclusion of the formal proceedings of the afternoon all present retired to the corridor outside the Function Hall where a delicious meal was served and many enjoyable conversations ensued. Now we can look forward to the Gardening Society's 100th anniversary in 2036!

Nigel P. Taylor
Group Director
Singapore Botanic Gardens

Photos courtesy of the Singapore Gardening Society

Nature printing, the art, craft and science of making leaf prints



Silene acaulis, a tiny alpine plant nature printed by Perini in Italy.

The representation of an object is always influenced by the skill of the artist as well as his or her interpretation of the subject, despite efforts to be as objective as possible. Even modern photography can easily manipulate the way a subject is captured. But this is not the case with nature printing.

Nature printing is the art of transferring the image of a natural object directly onto a printing surface. Through this process, the true size and shape of the object are replicated. Textural elements such as long hairs and intricate venation can also be captured and appear sharp in nature prints. Leaves make particularly good subjects for nature printing because they are naturally bi-

dimensional, but flowers and fruits may also be used.

In its most simple form, nature printing involves the inking of an object and then pressing it against a surface to produce an image. Handprints found in cave paintings from 20,000 years ago can be considered the earliest examples of nature prints. For the 500 years or so leading up to the early 19th century, rudimentary forms of nature printing were frequently used, mostly for ornamental purposes. But since then, numerous techniques have been perfected to obtain more accurate and detailed prints that can be used for scientific purposes.

Ideally, plant scientists are able to use fresh specimens for their work. These

can also be pressed and dried to make herbarium specimens that are useful for years to come, but some plant parts do not preserve well or break easily, such as petals or stamens. To document these characters, sometimes artists are called in to make drawings of fresh plants before drying. This also allows their colours to be recorded. However, botanical artists (particularly unskilled ones) sometimes misinterpret the morphological characters and their illustrations can end up being inaccurate or misleading.

Because of the delicate nature of herbarium specimens, they are shared between scientific institutions only when absolutely necessary. Nowadays, scientists exchange photographs of herbarium specimens with their



Leaf prints of cherry trees from a Japanese nursery catalogue, likely made in 1920 using the hectographic process, which involves the transfer of an inked object onto gelatin, from which prints on paper are subsequently made.

early 19th century benefited greatly from nature printing. Enormous quantities of specimens were collected, including 60,000 or so plants. Keeping them dry and pest free during the trip was almost impossible and many were printed while still in the forest to have a better record of their morphology.

In the 19th century, techniques were developed in Europe to allow the mass production of nature prints. Plant specimens were first impressed onto a malleable lead plate and then an electrotype made in copper would be obtained which could be printed over and over again. The beautiful prints made with this technique were used to lavishly illustrate numerous books, including *The Ferns of Great Britain* by Bradbury, *Physiotypia plantarum austriacarum* (Nature prints of Austrian plants) by Ettingshausen & Pokorny and *Flora dell'Italia Settentrionale...* (Flora of Northern Italy) by Perini.

In Asia nature printing was widely used by American botanist Thomas Horsfield, who collected throughout Southeast Asia for almost 20 years. In India, Henry Smith printed large numbers of plants using a letter press, and were collected in *Nature Printing from Unprepared Plants*, published in 1857, a very rare book with few copies printed. Johann Jakob Hunziker and Hugh Cleghorn also adopted the same printing technique.

In Japan, nature printing was used for a rather different purpose. Numerous plants were used in traditional

colleagues, but for a long time simple nature printing techniques were used to duplicate specimens that could be shared. Nature printing was a particularly valuable tool during long expeditions to tropical places, where the hot and humid climate posed a

challenge to preserving dried plants. Bringing an artist along on a long expedition was also not an easy option as it could be very expensive and rarely afforded. For example, the Alexander von Humboldt and Aimé Bonpland expedition to South America in the



Gunnera manicata growing at the Royal Botanic Garden Edinburgh.
(Photo credit: Michele Rodda)



Henry Noltie with the freshly harvested *Gunnera* leaves.
(Photo credit: Michele Rodda)



Michele Rodda inking the *Gunnera* leaf prior to printing. (Photo credit: A.D. Poulsen)

medicine, and often Chinese medical books were used as references. However, the use of Chinese texts, often illustrated with crude woodblock illustrations, led to errors in plant identification and sometimes mistaking toxic plants for medicinal ones. In the 19th century, Japanese botanists such as Prof. Ito Keisuke started to document plants through the process of nature printing. These prints were much more accurate than woodblock illustrations, not only representing the shape of the plant part but also its actual size, reducing the possibility of misidentification. It is interesting to note that the Japanese term currently used for a photograph, *shashin*, was applied to nature prints long before cameras were invented.

A contemporary development of nature printing is popular in Singapore and involves pressing large leaves onto freshly cast concrete.



Likely the largest leaf print ever made, representing a c. 2 m wide leaf of *Gunnera manicata*. (Photo credit: Michele Rodda)



A modern print of a juvenile leaf of *Sterculia macrophylla*, made in Singapore using a hydraulic press. (Made and photographed by Michele Rodda)



A modern print of a decayed leaf of teak, made in Singapore using a hydraulic press. (Made and photographed by Michele Rodda)

Once the concrete sets an embossed image of the leaf is permanently formed on the pavement. Excellent examples of this technique can be observed in the Gardens on the ground level of Botany Centre and just outside of Tanglin Gate.

The making of a colossal nature print

The largest known nature print was produced by Ito Keisuke in 1883 in Japan, and it is now preserved at the Royal Botanic Gardens, Kew. It represents an entire leaf and two partial leaves of *Petasites japonicus* subsp. *giganteus* and is printed on a piece of handmade paper 1.698 m × 0.863 m in size.

During the Flora Malesiana Symposium held at the Royal Botanic Garden Edinburgh (UK) in July 2016 (see pages 30–31 of this issue of *Gardenwise*), Dr Henry Noltie and I had the idea to attempt producing a much larger nature print. The obvious subject was a *Gunnera manicata* leaf, one of the largest entire leaves in the world. This plant is naturally found in the mountains of Southern Brazil, but grows lushly in large clumps in Edinburgh's cool and wet climate, with leaves as big as 3 m across. Unfortunately we were limited by paper size and so we selected a medium sized leaf for our print.

The printing process involved collecting the fresh leaf, flattening it slightly overnight, inking it as evenly as possible with printmaking ink and pressing it onto a piece of Japanese paper 1.8 m × 2.5 m. The leaf alone is around 2 m at its widest point and the print is more than three times the size of Ito Keisuke's print held at Kew. For comparison, we also printed leaves of three tiny *Gunnera* species, *G. cordifolia* from Tasmania, and *G. hamiltonii* and *G. dentata* from New Zealand. In total we made three prints, one of which will be framed and permanently displayed in the conference room of the Royal Botanic Garden Edinburgh.

Michele Rodda
Herbarium

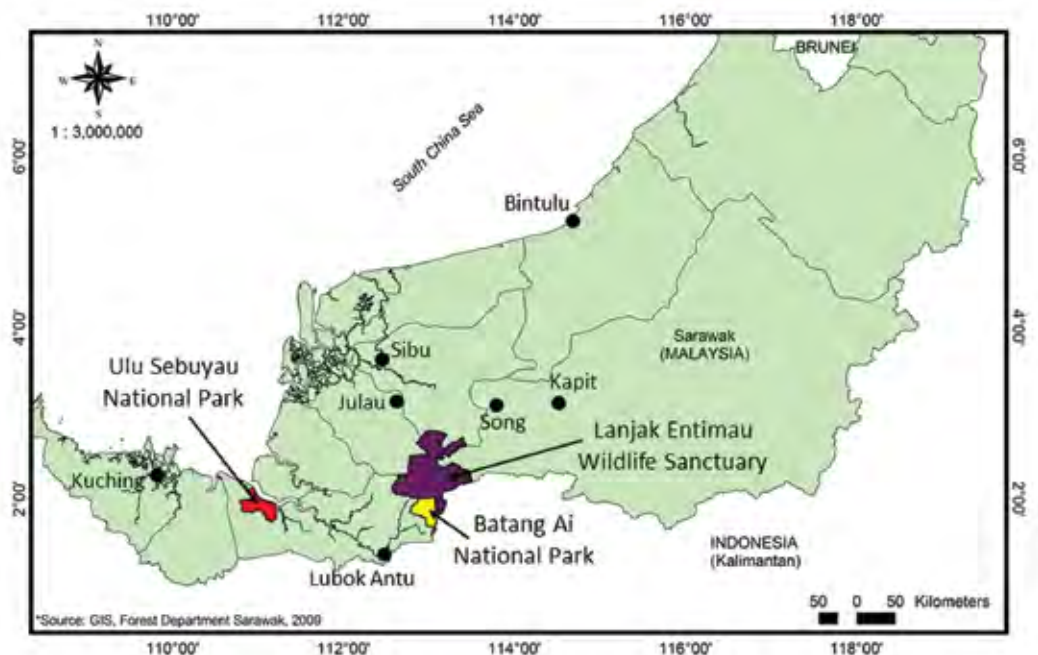
Further reading

Cave, R. (2010). *Impressions of Nature, a History of Nature Printing*. The British Library, London, 191 pp.

A preliminary forest survey of the Lanjak-Entimau Wildlife Sanctuary and Batang Ai National Park in Sarawak

On 8 March 2016, we set out for a two-week field expedition organised by the Sarawak Forestry Corporation as part of the RIMBA (Research for Intensified Management of Bio-Rich Areas of Sarawak) project. The purpose was a reconnaissance for renewed botanical assessments of the forests in the Lanjak-Entimau Wildlife Sanctuary and Batang Ai National Park. Past taxonomic surveys had been done in the early to mid-1990s by ITTO (the International Tropical Timber Organization) for the purpose of improving the management of the forest, and to support sustainable livelihoods amongst the indigenous people living on its periphery. Those initial efforts were primarily focused on tree species identification, as the published results indicate that shrubs, herbs, epiphytes and climbers were generally not covered. Thus, for this initial 'recce', we focused our efforts on these previously under-studied groups of plants.

The Lanjak-Entimau Wildlife Sanctuary (LEWS) lies in the south-western part of Sarawak, about 180 km



Map showing the location of LEWS and BANP. (Courtesy of Ling Chea Ying, Sarawak Forestry Corporation)

east of the capital Kuching, and was gazetted as a Totally Protected Area in 1983. About 1,830 square km in size, it adjoins the 240-square-km Batang Ai National Park (BANP) which was gazetted in 1991. By 2002, together with the forests of Betung Kerihun

National Park in West Kalimantan (Indonesia), a contiguous forested area of about 10,000 square km was designated as the region's first trans-boundary biodiversity conservation area. This huge cross-boundary reserve contributes significantly to the



Collecting in a bouldered streamside forest. (Photo credit: Roslina Ragai)



Navigating the boat through the rapids. (Photo credit: Roslina Ragai)



Pressing specimens. (Photo credit: Paul Leong)



Botanising a hilly mixed dipterocarp forest. (Photo credit: Roslina Ragai)

conservation of rare, threatened and endangered flora and fauna, some of which could be new to science.

We began our trip with a four hour drive from Kuching to Lubok Antu, a town lying at the lower end of the Batang Ai Reservoir. There, we joined some of the local people in their traditional longboats powered by small outboard motors. Five hours through the serpentine course of the Engkari River, we reached Nanga Talong, a traditional Iban long house, where we were welcomed warmly and stopped to rest for the night. Our intention was to reach the LEWS field research station at Nanga Segerak the next day, ordinarily an hour's journey by boat from Nanga Talong, but that proved impossible because of heavy rain that caused a subsequent rush of turbulent water in the river, which, even at the best of times is intersected by thunderous rapids capable of capsizing a boat. In the end, we were much more partial to a three hour hike to the field station, collecting *en route*.

For this exploratory trip, our agenda was to botanise the forests within a day's reach of the field station, and to return each evening to process all the collected samples. The survey areas would be accessed on foot or via short rides in a longboat. After five days of botanising in the forests of LEWS, we shifted our base camp to the Nanga

Lubang Baya Field Station at BANP, where we spent an additional three and a half days studying the flora.

We travelled through a great diversity of mixed dipterocarp, secondary and riparian forests on our trip, although there is a submontane forest deep inside LEWS that we weren't able to reach. That will have to wait until our next expedition scheduled for February 2017, when we shall be camping out deep in the forest. The terrain in LEWS is hilly, even rugged in certain areas, with Bukit Lanjak being the highest peak at about 1,285 m in elevation. The forests that we traversed in LEWS are mostly primary with patches of old secondary growth, evidence of Iban settlement long ago. In contrast, much of the vegetation of BANP, particularly of the lower or southern parts, is secondary, containing regenerating remnants of formerly cultivated land and old burial sites.

The mixed dipterocarp forests occur from almost sea level to about 750 m in elevation with huge emergent trees rising above the main canopy, which is dominated by species from the family Dipterocarpaceae as well as *Koompassia malaccensis* from the Fabaceae. Other large trees belong to the Fagaceae, Moraceae and Myristicaceae, while smaller tree species are from the Ebenaceae and Meliaceae. Understorey shrubs,

herbs and climbers are mainly from the Rubiaceae, Melastomataceae and Araceae. Members of the Ginger family were also frequently seen, from larger plants of the genera *Amomum* and *Alpinia* to smaller denizens such as *Globba* and *Haplochorema*. Also in the understorey, we encountered many herbs and shrubs from the Gesneriaceae and Acanthaceae, two of the least studied plant families in Borneo. We found many ferns and palms, including *Eugeissona utilis*, a palm common in the forests of both LEWS and BANP. This palm produces an impressive upright infructescence which can extend more than four metres above the crown and hold more than 50 fruits, each measuring 12 cm by 5 cm in size.

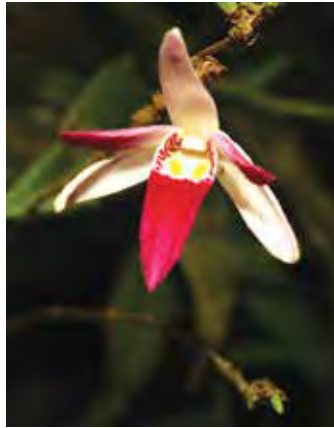
As they exit the sharp valleys of the hill forest, a multitude of trickling streams gather momentum until they cascade over rocky terrain strewn with boulders (some as large as cars) and into the river system below. These rocky areas support plants that thrive in pockets of sandy clay soil and include trees such as *Tabernaemontana macrocarpa* (Apocynaceae) and *Chisocheton macranthus* (Meliaceae), many rubiaceous shrubs and some *Cyrtandra* species (Gesneriaceae). One common climber, *Poikilospermum suaveolens* creeps vigorously over both other shrubs and boulders, while several *Elatostema* species



Eugeissona utilis, a ubiquitous palm with an upright infructescence rising 4 m above its crown. (Photo credit: Michele Rodda)



Begonia celata, one of the incredible nine new species of begonias discovered on our trip. (Photo credit: Julia Sang)



An undescribed species of *Dendrobium* orchid. (Photo credit: Michele Rodda)

from the same family (Urticaceae) grow as lithophytes on rock surfaces perpetually moist from the cascading water. Along one wall of an earthen bank slightly away from the water's edge, we were delighted to discover the fern *Tectaria inopinata* (Tectariaceae), a species previously only known from the Type specimen that was collected in 1980. Nestled within the jumble of boulders are highly localised niches which support species found only there and nowhere else in the area. This is especially true of begonias, such as *Begonia rubrotepala*, which only occupies earth banks above the flooded zone, *B. addrinii* that grows only on shaded rocky banks, and *B. jambilahanuiana* which inhabits the dry, shady ridges and slopes. Both LEWS and BANP are enormously rich in begonias, and we encountered a total of 19 species.

At the interface between the mixed

dipterocarp forest and the river are riparian areas which experience periodic flooding. In fact, several weeks prior to our arrival, heavy rain caused the river to rise several metres, resulting in damage to the riverbank, riverbed and adjacent vegetation, and also caused landslides that felled trees and blocked off transportation along the river. From our longboat several weeks later, we could still see the accumulation of forest debris and fallen tree trunks along portions of the river. Plants that can endure these potentially turbulent episodes of periodic inundation are termed rheophytic, and develop special features such as strongly anchored roots, tough stems, and branches with narrowed leaves. Some of the trees that we routinely encountered along the river were *Dipterocarpus oblongifolius* (Dipterocarpaceae), *Pometia pinnata* (Sapindaceae) and *Syzygium rejangense* (Myrtaceae) as well as the abundant

Sandoricum borneensis (Meliaceae) which was gregariously fruiting at the time. The foliage of these trees tends to overhang the river, and because of the high humidity many will host epiphytes on their trunk and branches. Among the community of epiphytes was a stunning array of orchids, including a beautiful and as yet undescribed species of *Dendrobium* with burgundy tinted flowers, as well as *Hoya glabra* from the Apocynaceae and a diverse assortment of ferns. Smaller trees and shrubs included *Syzygium pycnanthum* (Myrtaceae), *Utania stenophylla* (Gentianaceae) and the striking *Myrmeconaulcea strigosa* (Rubiaceae) that could undoubtedly become a horticultural gem. Of the ferns, two of those encountered were the widespread *Dipteris lobbiana* (Dipteridaceae) and an atypical tree fern *Cyathea moluccana* (Cyatheaceae) that congregates along the river banks, sometimes accompanied in this



Myrmeconuclea strigosa, a very pretty rheophytic shrub that could have horticultural potential. (Photo credit: Paul Leong)



An orangutan's nest, some 5 m up a tree. (Photo credit: Roslina Ragai)

special environment by an interesting diminutive palm, *Pinanga tenella*, which is no more than a metre high.

The secondary vegetation was found to be much less diverse, and certain patches have been rampantly colonised by the exotic *Bellucia pentamera*, a small Neotropical tree from the Melastomataceae. Other trees we encountered included *Archidendron clyperia* (Fabaceae) and *Brookea dasyantha* (Plantaginaceae). There were also numerous sun loving shrubs in the Dilleniaceae and Moraceae, which were accompanied by herbs such as *Lycopodiella cernua* and a common climber, *Adenia macrophylla* (Passifloraceae).

All in all, we collected 371 specimens, each with as many as four sets of duplicates for distribution to colleagues in other herbaria, and all with preserved flowering and/or fruiting samples which are so critical to achieve precise species determinations. Thus far, we have discovered that at least 14 species are new to science, including an incredible nine (!) species of *Begonia* (published in the latest issue of the *Gardens' Bulletin, Singapore* 68 (2), 2016). Also making the list of new species are two from *Alpinia* (Zingiberaceae), a *Homalomena* (Araceae), a *Stachyphrynium* (Marantaceae) and a *Dendrobium* (Orchidaceae). Even so, the taxonomic status has not yet been determined for some of the collected specimens, and others are still waiting to be properly evaluated. The collection could easily

yield more species new to science. The families most represented in our botanical collection, by percent of the total number of specimens collected, are the Begoniaceae (14%), Rubiaceae (12%), Gesneriaceae (9%), Urticaceae (6%), Melastomataceae (5%), Zingiberaceae (5%), and finally, the Araceae (4%).

In contrast to the luxuriant flora in LEWS and BANP, sightings of fauna there are not so easy. Certainly, there were tell-tale signs during our visit, including droppings, paw prints and claw marks, but the most conspicuous indication of animals was the myriad calls and songs which we heard day and night. In LEWS, we heard the territorial Bornean Gibbon (*Hylobates muelleri*) singing passionately in family choruses during the early mornings. Several species of hornbills also call frequently in LEWS, and we were treated to the sight and uniquely haunting call of the majestic Helmeted Hornbill (*Buceros vigil*), now Critically Endangered in Borneo. Unfortunately, the casque that enables the male birds to produce their remarkably resonant call is also being relentlessly sought by poachers. The Great Argus Pheasant (*Argusianus argus*) is common in both LEWS and BANP, and we could hear its resounding and lengthy calls arising from courting grounds, usually located on the ridges. In fact, we spotted a male near the riverbank at BANP, but it darted out of sight before we could reach for a camera!

In BANP, nests of the Bornean

Orangutan (*Pongo pygmaeus*) were frequently spotted in the tree tops along the trails, often in proximity to fruiting trees. However, because of a history of poaching and harassment by humans, orangutans could not be directly observed on our trip. The Bearded Pig (*Sus barbatus*), whose meat is eaten by the local longhouse communities, was frequently seen in LEWS and BANP foraging in the forests, and its wallows were encountered along the forest trails. We also noted claw marks from a Sun Bear (*Helarctos malayanus*). On our last day at the field station in BANP, we observed a mass migration of mayflies moving upstream along the Batang Ai River. These primitive soft-bodied insects live only a few hours as adults, mating while in flight and leaving the females to lay their eggs in the river to create the next cycle of life. The swarm, consisting of trillions of insects, each about 2 cm long, took hours to pass by and extended along the river in both directions as far as the eye could see. Our boats were bombarded by the swarm, but we felt pleased to have the opportunity to witness this spectacular display of nature up close, only one of many remarkable sights in the Lanjak-Entimau Wildlife Sanctuary and Batang Ai National Park!

Paul Leong
Michele Rodda
Herbarium

Julia Sang
Roslina Ragai
Sarawak Forestry Corporation

Conservation and reintroduction of *Bulbophyllum pulchellum* – an orchid thought to be extinct in Singapore for more than fifty years

During a tree flora survey in 2010 at Nee Soon Freshwater Swamp, we rediscovered a very beautiful native orchid, *Bulbophyllum pulchellum*. At the time, it was thought to be locally extinct, as it had last been documented in Singapore more than 50 years prior, according to the 2008 edition of the Singapore Red Data Book.

The Nee Soon Freshwater Swamp is a wet-forest area of around 80 ha, consisting of a mixture of old secondary and primary forests with the Nee Soon Stream running through it. The area we surveyed is about 10 m above sea level and generally flat with thick leaf litter, but surface water was visible within gaps in the root mat. Most of the trees within the area had trunk girths of around 30 to 60 cm and an average height of around 27 m. About 30% of the canopy was open, mostly due to tree-fall gaps. There were a few big trees belonging to the Sapotaceae, such as *Palaquium xanthochymum*, with trunk girths of around 2 to 3 m and magnificent stilt roots. There were also many climbers, some belonging to the genera *Pandanus* and *Korthalsia* that are typical of primary wet-forest flora.

According to records from the Singapore Herbarium, at one time, *Bulbophyllum pulchellum* appeared to be quite widespread in swampy areas of Singapore, although it was not considered common. Our earliest herbarium record of this species is dated 1889, and was collected by J.S. Goodenough in the area that used to be known as Chan Chu Kang. H.N. Ridley, the Gardens' first Director, also made collections of this species in Chan Chu Kang, as well as in Kranji and Seletar, between 1890 and 1891,



Bulbophyllum pulchellum in its native habitat at Nee Soon Freshwater Swamp.

and our second Director Henry Burkill collected a specimen from the Jurong area in 1916. It was also collected at Mandai in 1931 by E.J.H. Corner, the Gardens' Assistant Director at the time. The most recent herbarium specimen prior to our recent discovery was a collection made by J. Sinclair on 20 August 1955, on a "road leading to Number 1 Rifle Range, in Nee Soon", where it was growing on *Knema malayana*. This location is very close to the site where the species was rediscovered.

Bulbophyllum pulchellum is an epiphyte characterised by small flowers that are produced on a short inflorescence. The scape measures 5 to 7 cm in length and bears up to about 10 flowers like an opened fan. The sepals and petals are very attractive; they are light yellow and densely spotted with red. The lip is reddish purple with a yellow tip. The dorsal sepal is concave, measures 5 mm long by 2.5 mm wide, and has a sharp tip and finely fringed edge. The lateral sepals are about 1.3 cm long by 2.5 mm wide, widening slightly from the base to a point beyond the middle; their upper

edges are fused together from near the base to the apex, and the ends are bluntly pointed and curved backwards slightly. The petals are shorter than the sepals, and gradually narrowed to a sharp apex. The pseudobulbs are 1.5 cm long, ovoid in shape, and about 2 cm apart. The leaves are almost without stalks, bluntly pointed at the apex and narrow at the base. They vary in size, with the larger leaves around 16 cm long by 2.5 cm wide.

Not common anywhere within its range, outside of Singapore this epiphyte can be found in Thailand, Borneo, the lowlands of the southern part of Peninsular Malaysia, and also near Bukit Fraser and at Penarek, Terengganu. The pollinator is unknown. According to Dutch botanist Dr Jaap Vermeulen, who specialises in the genus *Bulbophyllum*, *B. pulchellum* is very similar in appearance to *B. acuminatum*, which also occurs in Singapore. It can be distinguished by its wider leaves and shorter inflorescence. The flowers are not really much different, yet we have two distinct species here without a doubt.



The flowers of *Bulbophyllum pulchellum*.



Some of the individuals planted at Upper Peirce Reservoir flowered in September 2016.



Seed capsules of *Bulbophyllum pulchellum*.

Following its rediscovery, a few plants were collected for propagation and eventual reintroduction into suitable locations around Singapore. The plants were divided and grown in the nursery of the National Orchid Garden. Each cutting consisted of two

mature stems and a new shoot, and was mounted on fern bark covered by a layer of sphagnum moss. They were placed under semi-shade (about 50% shade) and watered twice a day for about two years before we attempted reintroduction.

There are several factors that we considered as part of our reintroduction efforts:

- **Size and vigour of plantlets**
Native epiphytic orchids are able to establish themselves quickly if they start off with sufficient shoots and a good root system, which allows them to quickly become attached to their host tree and able to absorb water and nutrients directly from the environment.
- **Time of reintroduction**
The best time for planting *Bulbophyllum pulchellum* is before or during the rainy season. In Singapore, the rainy season starts around October and lasts until January.
- **Suitable microhabitat and microclimate**
Trees that support more epiphytes tend to be better hosts than those with fewer epiphytes. Also, it has been observed that if conditions are suitable for other epiphytes, they are more appropriate for epiphytic orchids too.

Textured bark is generally better able to support epiphytes than fine bark, as its cracks and crevices catch dead leaves and other organic matter that falls down from the canopy above. This material decays and the resulting humus not only holds water but also provides nutrients for the epiphytes. These pockets of organic matter also create suitable habitats for the germination of orchid seeds dispersed by the wind and the subsequent development of seedlings.

The best locations for epiphytes to thrive are the forks of main branches, as this is where water accumulates as it flows down from the top of the tree to the ground.

Ten plantlets, each with about 10 shoots and a good root system, were selected for reintroduction. They were planted at Upper Peirce Reservoir in November 2013. Of all of the individuals planted, we observed that those in semi-shaded conditions with high relative humidity fared the best. As with our other orchid reintroductions, we did not carry out any routine post-planting maintenance. When planted in the right conditions, native orchids should be able to thrive on their own, and in fact, the reintroduced plants survived even through the severe drought that Singapore experienced in 2014. Likewise, no fertilizer was given to the plants because, if planted correctly, they should be able to obtain nutrients from the environment.

We were very happy to see the first flowering of four of the reintroduced plants in September 2016, some of which produced several inflorescences. Besides propagation from cuttings, we have also cross-pollinated some of the plants. The seedlings are growing well and they will be ready to be moved into the nursery in 2017. In two years' time, more individuals of this beautiful species will be planted into nature areas, parks and roadside trees across Singapore!

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All photos by Yam Tim Wing

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New to cultivation in Singapore

There are always some new and interesting plants becoming available in Singapore, whether by means of the growers' stalls at the monthly Gardeners' Day Out events held at HortPark or via visits to the plant markets around Bangkok in Thailand. Three recently introduced species are discussed and illustrated here as they seem to be worthy additions to horticulture.

Phyllanthus mirabilis

Phyllanthus is a large and complex genus of trees, shrubs and herbs that were at one time referred to the Euphorbia family, but are nowadays classified in their own family, the Phyllanthaceae. Well-known trees belonging here are the Indian Gooseberry (*P. emblica*) and the similar Melaka or Laka Laka (*P. pectinatus*), of which the Singapore Botanic Gardens has a fine specimen accorded the status of a Heritage Tree. These become sizeable trees, but the

curious species illustrated here is of smaller stature and is most attractive when young. *P. mirabilis*, the Latin epithet meaning "remarkable" or "extraordinary", is indeed an out-of-the-ordinary plant. First, as a young specimen, the base of the stem is greatly enlarged into a corky-barked water-storing caudex, giving it the appearance of a baobab in miniature. This swollen structure rapidly narrows into a knobbly stem bearing an apical rosette of horizontal lateral branches with densely arranged leaves, which are a most attractive coppery colour when actively growing. As the daylight begins to fade each evening the plant performs a trick that has to be seen to be believed. The lateral stems fold up their leaves very tightly so that the upper surfaces are pressed together and held vertically. The following morning, long before the first hint of daylight, the leaves return to their daytime position and how the plant knows that the dawn is coming is a mystery. This spectacular behaviour is

known as nyctinastic movement and can be observed elsewhere, such as in the so-called prayer plants belonging to the Maranta family, whose leaves similarly take on a vertical position at night and resemble praying hands. This should not be confused with the sensitive leaves of *Mimosa pudica* and its relatives, which react to touch.

According to advice available on the internet, *Phyllanthus mirabilis* is best grown rather "hard", i.e. not watered or fertilized too generously, because it is said that if its growing conditions are very favourable it will lose the caudiciform habit and become a regular-looking tree. It is found naturally in Thailand and Laos in a variety of habitats, including rather humid environments as well as on rocks, and its appearance apparently changes markedly depending on the conditions in a given location. It needs fairly strong light to thrive and will happily grow in full sun. It is propagated from seed.



The leaves (left) and swollen caudex (right) of *Phyllanthus mirabilis*. (Photo credits: Nigel Taylor)



Pereskia portulacifolia. (Photo credit: Nigel Taylor)

Pereskia portulacifolia

The genus *Pereskia* is already familiar to gardeners in Singapore as the uncharacteristically leafy cacti, especially the commonly seen South American *P. bleo* and *P. grandifolia*, sometimes known as Wax Rose or Rose Cactus. Both species become large shrubs, but will flower in a pot if space is limited. Newly introduced

is *P. portulacifolia*, with *Portulaca*-like leaves and which is native to the Caribbean island of Hispaniola (Haiti and the Dominican Republic). This is very different in appearance, having very small neat leaves of the brightest green and spectacular magenta flowers much larger than the leaves and expanding to as much as 6 cm in diameter. If cuttings are taken from a parent plant that is already of

flowering size, the plant can be grown and flowered in a relatively small pot, though in time it will become a small tree if given enough room. Unlike its larger-leaved cousins, this species is very drought-resistant and can survive prolonged water shortages by means of its tuberous roots. It may thus have the potential to be used rather like the dwarf *Bougainvillea* cultivars that are commonly planted on overhead road bridges in Singapore and will not need to be watered once established. The plants that have been recently introduced from Thailand are all clones of a male since this species is dioecious, as are three closely related Caribbean species. In Thailand it has been misidentified as *P. zinniiflora*, a similar species with smaller flowers. As with other *Pereskia* species it is easily propagated by stem cuttings which can be rooted in a few days if placed in shallow water. This seems like a strange way of propagating a cactus, but is very effective!

Warszewiczia coccinea

This spectacular small tree or shrub with opposite (paired) leaves was recently planted in the National Orchid Garden (NOG), in the bed just beyond the Golden Arches as you head away from the NOG entrance. It bears terminal compound inflorescences in which the densely arranged flowers have large leaf-like sepal appendages of the most brilliant scarlet imaginable. It belongs to the Coffee family (Rubiaceae), one of the most important and pervasive of plant families in the tropics. The genus includes six species and comes from the New World Tropics, ranging from Mexico to Bolivia, with four species in Brazil. *Warszewiczia coccinea* is the most widespread of these, occurring in lowland Amazônia as well as in the adjacent Andes of Peru and Bolivia at elevations of up to 2,000 m, so it has a wide ecological tolerance. There are few plants in NOG that distract your gaze from the orchids, but this is certainly one of them!



Warszewiczia coccinea. (Photo credits: Benjamin Aw)

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Describing new plant species

It has been estimated that there are around 70,000 plant species that have never been given a scientific name. Around 2,000 of these are described as new species each year, including large numbers from Southeast Asia. The Singapore Botanic Gardens plays an active role in the taxonomic research necessary to describe these new species.

In any discussion on the description of new species an extremely important point has to first be made: the job of the taxonomist is not merely to describe new species but to understand what species there are in the world and where they occur. This may lead to the description of new species but frequently it does not. It is just as common for taxonomic research to lead to the affirmation of species already known or to lead to a reassessment of the distinctions between existing ones, possibly resulting in fewer species. These results are as critical for our understanding of plant diversity in the world as are the description of species previously unknown to science.

The description of new species does, however, capture the imagination.

What was formerly unknown is now known and that is exciting. Taxonomists are not immune from these human emotions and most find deep satisfaction in uncovering species previously unknown to science. The process of describing new species begins with botanists getting out into the field and collecting plants. These plants are pressed and processed and eventually incorporated into the herbaria of the world. Today, the vast majority of new species are no longer freshly 'found' in the field, but discovered through careful research in herbaria. What this means is that at the time they were collected, most were not recognised as belonging to undescribed species. Their status as new species only became apparent later, often much later, when a botanist made a specialised study of the group.

In a paper from 2010 it was noted that only 16% of new species were published within five years of the date of collection of the specimens on which they are based. Nearly a quarter of new species were described from collections made more than 50 years earlier! They conclude that this suggests that more than half of the as-yet undescribed species have

already been collected and are awaiting study in the herbaria of the world. This includes the Herbarium of the Singapore Botanic Gardens. They note that there are currently too few taxonomists in the world to describe these many new species in a more timely fashion. And, of course, almost half of expected new species have never even yet been collected and some may never be known due to habitat loss. So, even though there are large numbers of undescribed species in our herbaria, there is still an imperative to collect before it is too late.

New species discovery can come about in various ways. Sometimes it is due to dedicated study of herbarium material, possibly along with field studies, and a reassessment of widespread and variable species. In the past, taxonomists made the best decisions they could, based on possibly inadequate material they had available. In the years since, collectors will have added new collections for study and the fresh researcher can make better informed decisions. With more evidence available, formerly variable species may be split into better defined species, for example, the new species of *Hanguana* from Singapore discussed



A new species of *Saurauia* yet to be described. (Photo credit: Joel Dawat)



Hoya isabelchanae, described in 2016. (Photo credit: Michele Rodda)



***Melastoma tanjiewhoei*, described in 2016.**
(Photo credit: Steven Bosuang)



***Microchirita personata*, described in 2016.** (Photo credit: Preecha Karaket)



***Newmania sessilantha*, described in 2015.**
(Photo credit: Luu Hong Truong)

in *Gardenwise* 45 (August 2015, pages 24–29). A similar issue may be when the name of a species in one area is applied to plants from another area because they appear similar even though they are not actually the same species. Often the use of the name in the new area will not be challenged until the plants are studied in more detail. This may be a very long time later, leading to a situation similar to the one above of a widespread and very variable species, but one which nobody really consciously defined as so variable. Dedicated study can discover that the name of the original species should never have applied to the plants from the other areas and that these plants still have no name of their own. This has frequently been the

case for the names applied by foresters to tree species in Borneo which were often given the name of similar trees in Peninsular Malaysia. Projects such as *Flora Malesiana* and the *Tree Flora of Sabah and Sarawak* have been clarifying such past misapplications.

Often new species are not clarified out of the morass of variable or misapplied earlier names but because new or old collections are of species that were previously entirely unknown. The study of poorly known plant groups or plants from poorly collected regions can lead to the discovery of new species. This is particularly the case for herbaceous plant groups, understory trees and shrubs, and epiphytes, and for the study of collections from Borneo and continental Southeast Asia, for all of which the Gardens has considerable expertise.

Possibly the rarest situation of all is when a botanist recognises that a species is new even whilst it is still growing in its native habitat. It can be quite thrilling when this occurs and new species of *Microchirita* in the Gesneriaceae published in 2016 are a case in point. Two new and very distinct species were found growing at the same site only a few metres apart on the first day of a collecting trip to western Thailand in 2014 with collaborators from the Forest Herbarium Bangkok.

Just since the beginning of 2015 staff members from the Gardens have described around 100 species of plants as new to science. These

new species are from Brunei, China, Indonesia, Laos, Malaysia, Nepal, Thailand, Vietnam and Singapore. Particularly large numbers of new species have been described in the families Apocynaceae, Gesneriaceae, Melastomataceae and Zingiberaceae. The staff of the Gardens will continue to describe new species as and when necessary but we shall never reach the huge numbers of species described by H.N. Ridley, the Gardens first Director (1888–1912). Over his career he described about 4,000 new species, of which over 1,500 species were described whilst he was in Singapore and very many of the rest were described from specimens he collected whilst he was here. During his time very little was known of the Malayan flora and he was a prolific collector in the region. Inevitably, a very high percentage of the plants he collected in areas never before explored by a botanist were new.

So what other new species are on the horizon from the Singapore Botanic Gardens? Already in the publication pipeline are a number of new species of *Hoya* from Papua New Guinea, new Gesneriaceae from Thailand, new understory trees from Borneo, and a new parasitic shrub from Brunei. As we continue our work, there will, undoubtedly, be more to discover.

David Middleton
Herbarium



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Partnership with schools: Tanglin Secondary School and the Singapore Botanic Gardens

A new Heritage Garden was unveiled by the Botanic Gardens on 28 May 2016 (see *Gardenwise* 47: 18–20, 2016). This garden commemorates Singapore's greening journey and proudly showcases more than 80 different types of plants which have been introduced to Singapore's streets and green spaces over the past five decades.

In our effort to engage schools and the community, the Gardens partnered with Tanglin Secondary School, through the Ministry of Education's Applied Learning Programme, to train students to conduct guided tours at the Heritage Garden. Ten lower secondary students underwent intensive training to become guides, and showed the guest-of-honour and invited guests around the Heritage Garden on the day of its launch.

The student guides shared information on iconic trees – in particular, pointing out a Pink Mempat (*Cratoxylum*



The student guides from Tanglin Secondary School together with Mrs Ng-Leong Kai Leng, Head of Humanities at the school. (Photo credit: Winnie Wong)



A photo of the students with Minister Lawrence Wong, the guest-of-honour at the launch of the Heritage Garden. (Photo credit: Winnie Wong)

formosum), the same species that was planted by former Prime Minister Mr Lee Kuan Yew to kick-start the greening campaign back in 1963 – and a variety of fragrant plants. Also of social and historical significance is the location of the Heritage Garden, situated on the lawn above Swan Lake. This was the site of the inaugural People's Variety

Show, which was launched by Mr Lee in 1959, and comprised a set of cultural performances with a multiracial theme. The historic event drew a gathering of 22,000 people.

The objectives of the training were to build up the students' confidence in public speaking and interacting with visitors to the Gardens, and to deepen their appreciation for Singapore's rich history and how the greening movement came to be. With this initial success, the Gardens plans to continue working with Tanglin Secondary School to train more students so that they will be able to give similar tours to their peers, and possibly to the public, in the future.

We are looking forward to a long and fruitful partnership with Tanglin Secondary School. The next project on the cards will involve the school in reforestation efforts at the new Learning Forest, which will be opened in 2017.



The student guides receiving their final pep talk from their teacher-in-charge, Mrs Ng-Leong Kai Leng. (Photo credit: Janice Yau)

Janice Yau
Winnie Wong
Education Branch



Something foul is afoot...

Heavy rains near the end of October and early November of 2016 were very welcome after weeks of intense heat in Singapore. With the rains came the flowering of many plants in the Gardens, including an interesting tree located near the Swiss Granite Fountain. A distinct unpleasant scent that occasionally drifted near the fountain brought the flowers to our attention. The source was a tree known as *Sterculia foetida*, a member of the Hibiscus family (Malvaceae). The generic name is based on the Latin word *stercus*, which is derived from the name for the Roman God of Manure, Sterquilinus. It is in reference to the foul smell of the flowers and leaves of some species in the genus. The malodorous nature of the tree is further emphasised by the species epithet *foetida*, meaning 'stinking'!

It is unfortunate that the tree produces an unpleasant scent, as it is large and handsome with a wide spreading canopy. It has a very straight trunk with smooth, greyish white outer bark, attractive horizontal branches that are whorled, and can produce large buttresses when mature. Our tree in the Gardens is about 10 m tall but the species has been recorded to grow up to 40 m in height.



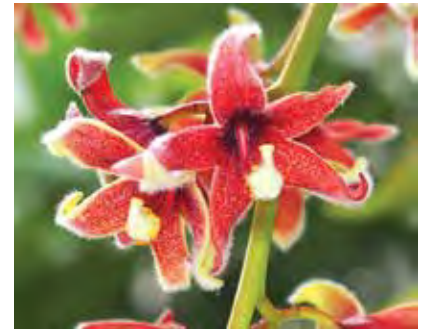
Beautiful panicles of *Sterculia foetida* with their foul-smelling flowers.

This deciduous tree is commonly known as Kelumpang Jari in Malay, and as the Giant Sterculia, Stinky Sterculia, Java Olive Tree, Skunk Tree or Wild Almond Tree in English. It is naturally distributed from Eastern Africa to Southeast Asia and Northern Australia, and grows in semi-open tropical forests and coastal areas.

The Stinky Sterculia has beautiful palmate compound leaves that cluster near the branch tips. Each leaf has a long petiole (leaf-stalk), is about 12.5–23 cm long, and consists of five to nine elliptic-lanceolate leaflets, each up to about 17 cm long with an entire margin. This species is dioecious, meaning that it produces male and female flowers on separate trees. They are borne on branched inflorescences that are pendent and 10–15 cm long. The flowers lack true petals, but have a maroon-red calyx with five lobes that are deeply divided and curled backwards at the tip, resembling petals. The fruits are hard woody ellipsoid follicles that occur singly or in aggregates of up to five; each is about 10 cm long and 5 cm broad. Initially the fruits are green then turn bright red as they mature. When ripe, they split along one seam to expose around 10 to 15 greyish black seeds inside.

Despite its unpleasant odour, the Stinky Sterculia is sometimes utilised as a shade tree in tropical parks and gardens. It is also planted along roadsides, but understandably at a certain distance from homes. It can be grown easily from seed and germinates within one to three weeks from planting. The seedling quickly forms a long taproot and its initial growth is particularly fast.

The wood of this tree is easy to work with and used to make furniture, canoes and musical instruments. The fibres from the bark have been used to make ropes and cords. The leaves are used as animal fodder, and the resin that exudes from the trunk and branches has been recorded to be used as glue. The seeds are edible when ripe and are usually eaten roasted. They are said to taste like chestnuts, but



A close-up look at the velvety maroon-red flowers of the Stinking Sterculia.



The large unripe follicles of the Stinking Sterculia.

must be taken in moderation to prevent a laxative effect. The leaves, flowers, and oil from the seeds are used in traditional medicine, and the oil has also been shown to have insecticidal properties and potential use as a biodiesel.

So on your next visit to the Gardens, if you happen to get a whiff of an offensive stench near the Swiss Granite Fountain, it could mean that the Stinking Sterculia is in bloom!

Nura Abdul Karim
Library, Training and External Relations

All photos by Tim Utteridge



The Gardens/Kew Tropical Plant Identification Course



A group photo with the participants of the course and a few of the trainers. Front row, from left to right: Tran Van Tien, Jessica Teo, Dr Laura Pearce, Dr Tim Utteridge, Dr Rodrigo Cámara Leret, Dr Nura Abdul Karim, Jacqueline Henry Ripan, Duratul Ain Hj. Durani, Veo Dalavong, Mediana Kampong, and Chew Ming Yee. Back row, from left to right: Lua Hock Keong, Paul Parusuraman S. Athen, Ng Xin Yi, Peck Geok Xin, Dr Lesley Walsingham, Jeremy Yeo, Edwin Lim, Germaine Leng, Dr Alison Moore, Dr Gemma Bramley, and Joel Dawat. (Photo credit: Benjamin Aw)

All around us are plants and these come in all shapes and sizes, from the tiniest of weeds to the most enormous of forest trees. Across Southeast Asia there are many thousands of different species, each with its own unique set of characteristics that distinguishes it from its nearest relatives. The bewildering range of form, and the huge numbers of species, can make it a daunting prospect for anyone wishing to identify plants. Yet, many people do need to identify plants: foresters to know the economically important species, conservationists to understand which species are common and which are under threat, pharmacists to know from which plant a bioactive compound was extracted,

ecologists to understand which species grow in which conditions, gardeners to know which plants are ideal for a particular landscape, you and I out of sheer curiosity, etc. These thousands of species are classified into just over 400 plant families worldwide and once a plant is identified to the family level it becomes easier to find the information needed to identify it further as genus and species. Plant family identification is not easy but it is a skill that can be taught, and from 31 October to 11 November 2016, an intensive course was run at the Singapore Botanic Gardens to do just this.

The Tropical Plant Identification Course was jointly run by the Singapore Botanic Gardens and the

Royal Botanic Gardens, Kew, based on the well-established and very popular training programme and course materials developed by Kew. The funding for the course was generously donated by the Lee Foundation through the Garden City Fund. Fifteen students attended the course from Singapore, Brunei, Malaysia, Laos and Vietnam. Amongst these students were also representatives from various divisions of the National Parks Board, including the Singapore Botanic Gardens, Streetscape, Parks, National Biodiversity Centre, Conservation (Pulau Ubin), and Horticulture and Community Gardening, along with some of our botanical partners in the region from the Brunei Forestry Centre, Pha Tad Ke Botanical Garden



Celebrating the last day of the course with a final group photo. Along with the participants and trainers shown on the opposite page are, in the second row (centre), Dr Jana Leong-Škorníčková, and in the far back row (from left), Dr Daniel Thomas, Dr David Middleton and Dr Michele Rodda. (Photo credit: Benjamin Aw)



Dr Rodrigo Cámara Leret from the Royal Botanic Gardens, Kew, explaining and illustrating the characteristics of the Legume family. (Photo credit: Benjamin Aw)

in Laos, Forest Research Institute Malaysia, Sabah Forestry Department, Sarawak Forestry Corporation, and Dalat University in Vietnam. Seven members of the staff of the Royal Botanic Gardens, Kew came to Singapore, including the principal course organiser Dr Tim Utteridge. These Kew staff members brought with them a wide range of expertise in many and varied plant families. Several staff members from Singapore Botanic

Gardens brought their own expertise to the course.

The students were taught what characteristics to look for in order to narrow down what a plant may be, rather than to rely on the 'gestalt', which is just the overall look, of a plant. By understanding what is possible for each plant family in its overall range of morphological features, the students were taught

that by examining each characteristic they could rapidly narrow down the possibilities until only one possibility is left. Each student's train of thought would be to ask themselves, in steps, the various visible characters that the plant presents, and eliminate systematically the families that do not correspond with the characters they are seeing. Questions they might ask include "Is the plant a tree, climber, epiphyte, or herb; does it have resin or latex and, if so, what colour is it; are its leaves opposite to one another, spirally arranged, or alternate in a flat plane; are its leaves simple or composed of many leaflets; is the leaf margin entire or toothed; how are the flowers arranged; what are the number of parts of the flower and how are they arranged in relation to each other; what is the fruit like, etc. etc." until all possibilities but one are eliminated.

The goal of the course was to give participants an overview of the most commonly encountered tropical plant families, as well as introduce them to plant morphology and identification tools. This was done through short illustrated lectures and extensive hands-on practical sessions during which the trainers demonstrated the key characters for each family and shared their expert tips for identification. There may be over 400 plant families but many of these are



During a typical practical session, the participants were split into groups of five, given herbarium and living plant specimens, and asked to determine their families. (Photo credit: Benjamin Aw)



Students pairing up in one of the outdoor garden sessions in search of plants exhibiting certain morphological characteristics. They were expected to document and present their findings later in the classroom. (Photo credit: Benjamin Aw)



Dr David Middleton showing and explaining the arrangement of the sori on the underside of a fern frond to the group of engrossed students. (Photo credit: Tim Utteridge)



A very happy Duratul Ain Hj. Durani being flanked by Drs Tim Utteridge and David Middleton after receiving her certificate of attendance on the last day of the course. (Photo credit: Benjamin Aw)

not found in Southeast Asia or are very rarely encountered. Therefore, the course aimed to get the students familiar with how to identify over 70 of the most commonly encountered plant families in Southeast Asia, and tested how much they had learned at the ends of the first and second weeks. Needless to say, learning this much in just 10 days of instruction was very intensive, but learning from so many experts in a wide range of these plant groups was also something to savour. The course also gave the students an opportunity to mingle and learn with colleagues and trainers from different

countries and different perspectives. As well as the training itself, building relationships and contacts between our branches, divisions, institutions and countries will benefit our shared goals of understanding and enhancing biodiversity and greenery in the future.

In short, the overall feedback gathered from the participants after the course clearly indicated that everyone had found the training immensely useful, even if they felt rather shell-shocked by the fast pace due to the large number of families covered.

We are immensely grateful to the Lee Foundation for the funding that enabled us to run the course, and to the Royal Botanic Gardens, Kew for their hard work, good humour, and dedication to sharing their knowledge and experience with the students.

David Middleton
Herbarium

Nura Abdul Karim
Library, Training and External Relations



Learning and sharing of knowledge...

Back in 2015, the Gardens entered into a Memorandum-of-Understanding (MoU) with Dalat University, Vietnam, to carry out a botanical survey of Vietnam's Central Highlands region. In October of 2016, we hosted a delegation of 12 staff from the University, comprising Vice-Deans, Deans and Lecturers. The group met with staff from the Gardens' Research and Conservation team, including Dr David Middleton (Coordinating Director), Dr Wong Khoon Meng (Principal Researcher), Dr Nura Abdul Karim (Deputy Director) and Mr Paul Parusuraman S. Athen (Herbarium Officer).

The delegation was shown around the Gardens, including the Herbarium and micropropagation laboratory, and was briefed on the work carried out in these research facilities. Later, over tea, both groups expressed interest in working together in the future to continue field surveys of the Central Highland areas of Vietnam. The Dean of the University's Faculty of Biology and Technology also expressed interest in sending staff to the Gardens for short-term training in the future.

Congenial study visits such as this one are not uncommon for the Gardens, as we strive to provide capacity-building in the fields of botany, applied horticulture and even garden management to our colleagues in other botanical institutions.



Mrs Paula Frederick-Hunte and Mr Janeil Simon, government officials from Antigua and Barbuda, discussing with Dr Nigel Taylor their redevelopment proposal for the Victoria Park Botanical Gardens. (Photo credit: Nura Abdul Karim)



The delegation from Dalat University at the National Orchid Garden with Drs Wong Khoon Meng (2nd from left), David Middleton (5th from left) and Nura Abdul Karim (centre). (Photo credit: Parusuraman Athen)



Mrs Paula Frederick-Hunte and Mr Janeil Simon posing for a photo at the National Orchid Garden. (Photo credit: Nura Abdul Karim)

So it was not surprising when we received a request from the Government of Antigua and Barbuda to host two of their officials for a study visit. The officials were Mrs Paula Frederick-Hunte, Permanent Secretary from the Ministry of Tourism, Economic Development, Investment and Energy, and Mr Janeil Simon, Nursery Manager from the Department of Environment. They were shown around the Gardens by Drs Nigel Taylor and Nura Abdul Karim, and were impressed with our infrastructure and visitor facilities. They were also fascinated with the diversity of our living collections, especially of our orchids.

Our guests from Antigua and Barbuda were full of questions and keen to learn how the Gardens has managed to maintain our strong standing as a top botanic garden given its long history. They shared that the Victoria Park

Botanic Gardens, which was established in 1893 outside of St John's City and is the only botanical garden in Antigua and Barbuda, has deteriorated due to insufficient financial support and weak management over the years. However, all this is changing and plans are underway to rejuvenate the infrastructure and plant collections of their botanic gardens.

The Victoria Park Botanical Gardens is not very large – it covers only about 6 acres (approximately 2.4 ha) – but the Government is determined to transform it into a place that can offer educational programmes and after-school activities that focus on conservation and biodiversity. They also plan to build an amphitheatre for artists to perform. However, our guests mentioned that the gardens lacks horticulture staff and has a limited water supply due to prolonged periods of drought since 2014. The obstacles facing the revitalisation of the Victoria Park Botanical Gardens are many, and we offered to provide training to its staff to enhance their knowledge of horticulture, nursery management and educational outreach.

We hope to continue to play an important role in the sharing of knowledge with our counterparts in the region and across the world who require assistance in building skills essential to the sustainability of botanical institutions.

Nura Abdul Karim
Library, Training and External Relations



Consultation workshop on the conservation of woody, ‘exceptional species’ in Southeast Asia

The consultation workshop was held by the Southeast Asia Botanic Gardens (SEABG) network from 12 to 13 September 2016 in Pintung, Taiwan. Participants included representatives from the SEABG network, namely from Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam, as well as from invited botanical institutions from Hong Kong, China, Taiwan and Papua New Guinea, and from two NGOs, the Tropical Rainforest Conservation and Research Centre in Malaysia and Botanic Gardens Conservation International (BGCI) based in the United Kingdom. The workshop was generously supported by the Dr Cecilia Koo Botanic Conservation Center (KBCC), Taiwan, and BGCI. Mr Joachim Gratzfeld, BGCI's Director of Regional Programmes, chaired and organised the workshop, along with Dr Chia-Wei Li, Director of KBCC, and his team.

The purpose of the intensive workshop-cum-meeting was to review the current and available knowledge concerning the establishment of genetically diverse *ex situ* conservation strategies, in particular regarding the banking of germplasm from exceptional species of the tropical Southeast Asian region. The term ‘exceptional species’ is defined as species that cannot be conserved *ex situ* through standard seed banking methods, and usually refers to plants that produce recalcitrant seeds which cannot tolerate drying or being subjected to below-freezing temperatures without losing viability. The term also applies to species that generate few, infrequent or non-viable seeds, reproduce clonally, or produce deeply dormant seeds or seeds that can only be banked for a short period of time.

Many researchers have argued that field gene banks are the most effective way to conserve long-lived exceptional species, especially woody species which are often difficult to establish *in vitro*.



The SEABG Consultation Workshop participants deep in discussion. They were separated into groups to tackle a certain topic of interest related to the *ex situ* conservation of exceptional species in the region. (Photo courtesy of KBCC)

However, the creation of field gene banks bears many practical challenges, such as space requirements, as well as the financial implications for their maintenance. BGCI highlighted that under the umbrella of the Exceptional Plant Species Advisory Group (EPSAG), a collaboration between BGCI and the Cincinnati Zoo and Botanical Garden's Center for Conservation and Research of Endangered Wildlife, efforts are now under way to prepare guiding principles for identifying exceptional species towards the establishment of a global list of threatened exceptional plant species, as well as to promote best practices in *ex situ* conservation. BGCI representatives also voiced the view that the SEABG network could make a significant contribution to these efforts by consolidating related knowledge from the region.

The workshop began with the participants presenting the strengths and research interests of their respective institution or organisation. Those that have been heavily involved in *ex situ* conservation practices for exceptional cases also shared their experiences and challenges. The participants came together to list and prioritise plant families from the region that are highly threatened, such as the Dipterocarpaceae and Rafflesiaceae, and in need of immediate concerted and collaborative conservation efforts. The group also identified specific capacity



The participants of the workshop posing for a group photo in one of KBCC's glasshouses. (Photo courtesy of KBCC)

building needs in the region for effective *ex situ* conservation of exceptional species. Overall, the workshop achieved its main objectives and is helping to shape the programme for the next SEABG network meeting, which will be held in Vietnam.

One other event related to the workshop is worth reporting. On the second day, 13 September, Super Typhoon Meranti (a Category 5 storm) hit Taiwan. The typhoon was recorded as one of the strongest tropical cyclones to ever hit the region, and impacted southern Taiwan, where our workshop was held, with wind speeds topping 230 mph (370 kph). Remarkably the typhoon resulted in only one death and two injuries, but more than 260,000 households lost power and hundreds of domestic and international flights were cancelled. The participants, including myself, were grateful to Dr Chia-Wei Li and his staff for efficiently coordinating our evacuation and arranging transport to the airports once flights reconvened. Thankfully, KBCC was spared the typhoon's full impact with only one glasshouse roof damaged and no casualties to staff or their plant collections. It was truly a memorable workshop.

Nura Abdul Karim
Library, Training and External Relations



The Planting of *Globba leucantha* at the Methodist Girls' School

In late 2015, we began a collaboration with the Methodist Girls' School (MGS) that led to the micro-propagation of one of our native gingers, *Globba leucantha*, and this was reported in the last issue of *Gardenwise* (Volume 47, pages 34–36). We are now pleased to let readers know that the plantlets propagated and nursed by the secondary students have produced flowers in less than a year!

The hard work and dedication of the MGS lead teacher, Mrs Lam Mei Kien, and her students paid off on 25 October 2016, when around 50 of the Globbas were planted around the school's compound. Mrs Lam also reports that two of the plantlets began flowering even before the planned planting activity! Seventeen girls came out to plant the gingers along the path leading from their school's car park to the auditorium. They were excited to get their hands dirty as they dug holes, mixed soils and planted the gingers.

No doubt, Mrs Lam was instrumental in the success of this project by encouraging the students and ensuring that they understood the basic techniques of tissue culture and how to care for the young gingers, as had been demonstrated by staff of the Gardens. The resourceful Mrs Lam even found a solution to the lack of proper nursery space at the school by encouraging the students to care for some of the plantlets at home. The girls were enthusiastic about taking on this responsibility and learning to nurse the young plants on their own. Mrs Lam also created a school blog to document this project and encouraged the girls to pen their feelings about the experience in the blog. The girls commented that they had fun working together and found the propagation and gardening activities exciting and calming.

The next phase of our collaboration with MGS will be the planting of *Globba leucantha* into suitable sites



The girls from MGS proudly displaying their *Globba leucantha* plantlets.



The girls hard at work digging and planting their *Globba leucantha* plantlets between mature spider-lily plants in beds that they had prepared.



A *Globba leucantha* plantlet producing a few flower buds.

outside of the school, and also propagating and nursing other native plant species for reintroduction around Singapore. It is heartening to know that today's youth can be successfully engaged in playing an active role in native plant conservation work. The Gardens hopes that with such small yet significant collaborative projects, more native plants can be propagated and planted into the urban landscape of Singapore.

The authors would like to thank Mrs Lam Mei Kien for her assistance in the preparation of this article.

Koh Teng Seah
Orchid Breeding and Micropropagation

Nura Abdul Karim
Library, Training and External Relations

All photos by Mrs Lam Mei Kien

Scratchpads workshop at Ubon Ratchathani University

After a short one-hour transit from Bangkok International Airport, I emerged from the Ubon Ratchathani Airport on an early Sunday afternoon. I was immediately picked up by Dr Aef, an affable lecturer from Ubon Ratchathani University, who drove me about 17 km south to the University's campus on the outskirts of the city. It was my first trip to northeastern Thailand, and my main mission was to attend a course on Scratchpads – an online platform designed for biodiversity researchers to share data more efficiently across research networks. The course was organised and hosted by Ubon Ratchathani University and was financially supported by Aarhus University in Denmark.

The one-week workshop began on Monday, 20 June 2016, and was coordinated by Dr Chortip Kantachot from the University. It started off with an opening speech by Prof. Henrik Balslev from Aarhus University on the state and progress of the Flora of Thailand project. He also touched on the relevance of modern electronic platforms such as Scratchpads for Flora projects.

The main trainer of the workshop, Dr Marta Gruca, patiently walked us through the details of creating, setting up and managing a Scratchpads webpage. The hands-on exercises provided an enhanced learning experience for the participants, despite the occasionally slow uploads due to the upgrading of the host server and other internet connection issues. I created a Scratchpads webpage entitled “Legumes of Singapore” (<http://legumes-singapore.myspecies.info>) during the course of the workshop.

Since this training course was specially targeted towards contributors to the taxonomic treatments of various genera in the Legume family



Workshop trainer Dr Marta Gruca interacting with and guiding participants on how to set up and manage a Scratchpads webpage.



Field excursion to the forest near Ubon Ratchathani Zoo, led by Prof. Henrik Balslev (far right). Also in the picture are Henrik Balslev, Chortip Kantachot, Witsanu Saisorn, Jiratti Sathaphorn, Kanokorn Ruengsawang, Wanniga Munsuk and Rattapon Somsura.



The Scratchpads webpage on the Legumes of Singapore.

(Fabaceae or Leguminosae) for the Flora of Thailand, it provided a great opportunity for me to network and exchange knowledge with others who are dealing with Southeast Asian legumes. After two days of intensive computer training, the participants were rewarded with a visit to the Ubon Ratchathani Zoo. We were also taken to a patch of forest near the zoo, where we were shown a population of *Phyllanthus chayamaritiae*, a species that was described in 2013. Dr Chortip also took us to the University's forest so

that we could explore the local plants, especially the legumes.

In the Asian custom of keeping everyone's stomach full and happy during workshops such as this, we were treated to a plethora of delectable food. At the beginning of the training course, a sumptuous welcome dinner was graciously provided by the University's Department of Biological Sciences. Among the food that was served, I could not help but notice the unopened flowers of the Vegetable



(Left) *Desmodium styracifolium*, (centre) *Melastoma saigonense* and (right) *Rhodamnia dumetorum* are among the interesting plants encountered in the forest of Ubon Ratchathani University.



(Left) Seeds of the Petai, (centre) flower buds of the Vegetable Hummingbird and (right) young shoots of the Water Mimosa on display in a restaurant, waiting to be ordered and cooked.



Kaeng som served with rice. Notice the cooked flower buds of the Vegetable Hummingbird. (Photo credit: Saowalak Bunma)

Hummingbird (*Sesbania grandiflora*), a papilionaceous legume. They were part of a Thai dish known as *kaeng som* – a type of sour curry flavoured with Tamarind (*Tamarindus indica*), which also happens to be a legume. There are different variants of the Vegetable Hummingbird, and interestingly, only the flowers of the white variant are used and not the red ones. I was also told that the stamens are sometimes removed before cooking because they have a bitter taste (but not always as some people prefer the bitterness).



A Kan Krao or Tembusu tree (*Cyrtophyllum fragrans*) planted by H.R.H. Princess Maha Chakri Sirindhorn on 21 December 2010 in front of the U-Placeubon Hotel, Ubon Ratchathani.

The Vegetable Hummingbird is also incorporated into dishes in Singapore, although here it is called Turi by the Malays, and the leaves are eaten rather than the flowers.

During one of our dinners at a local restaurant, I was amazed to find not only the seeds of the Petai or Stink Bean (*Parkia speciosa*) and the flower buds of the Vegetable Hummingbird being served, but also the young shoots of the Water Mimosa (*Neptunia oleracea*). This plant is common throughout the tropics and found in marshy fields, at the edges of ponds, or even floating on water as it has buoyant stems.

By the end of the workshop, I discovered something special that connects Ubon Ratchathani University and the Singapore Botanic Gardens – the Kan Krao tree. This is the icon of the University, and the same species as our Tembusu, *Cyrtophyllum fragrans*. After learning about this, I shared the story of our famous Heritage Tree which lives on Lawn E and is also depicted on the back of Singapore's five-dollar note. I even gave away my only two five-dollar notes as gifts!

Ho Boon Chuan
Herbarium

All photos by Ho Boon Chuan, unless otherwise indicated.



The Flora Malesiana Symposium at the Royal Botanic Garden Edinburgh



Participants at the Flora Malesiana Symposium in the RBGE lecture theatre. (Photo credit: Lynsey Wilson)

The 10th international Flora Malesiana Symposium was held at the Royal Botanic Garden Edinburgh (RBGE) on 11–15 July 2016. These symposia are held every three years to bring together people working on the plant diversity of the Malesian region. Malesia is the region that includes Malaysia, Singapore, Brunei, Indonesia, Timor Leste, the Philippines, and Papua New Guinea. Three Singapore Botanic Gardens staff members travelled to Edinburgh for this meeting where they met up with three more staff from the National Parks Board (NParks) who were already in Edinburgh for various study and training programmes. Altogether there were around 180 participants from 25 countries, a good and vibrant turnout for a Flora Malesiana Symposium held outside the region.

The theme of the symposium was 'Classify, Cultivate and Conserve'. **Classify:** In the Malesian region there are an estimated 45,000 species of vascular plants, with new species constantly being found and described. The Flora Malesiana project has the goal of publishing a series of books cataloguing and describing all of these species and providing the tools to identify them. Since 1948, when the first issue was published, only around 25% of the species have been treated. The lack of a comprehensive Flora makes the



David Middleton of the Gardens giving a lecture. (Photo credit: Maxel Ng)

identification of plants in Malesia more difficult, which in turn makes it more challenging to understand the plant diversity of forests in the region and assess conservation needs. On the theme of 'classify' there were many and varied talks and posters showing progress in research on the plant diversity of the region.

Cultivate: The herbaria of the world contain many millions of dried plant specimens that are essential for taxonomic research. Several of these herbaria are in botanic gardens that also have rich collections of living plants. These collections are particularly useful for taxonomic work in plant groups that make poor herbarium specimens (such as gingers and orchids) and allow the collection

of sterile plants in the wild that can be later identified once they flower in cultivation. For example, many gingers, Gesneriaceae and Ericaceae have been described as new species from cultivated plants of known wild origin. A central role of botanic gardens is also to conserve plants by *ex situ* cultivation and propagation that are threatened in their native habitats. And, of course, their beauty can attract visitors into botanic gardens for pleasure and education. The Royal Botanic Gardens Edinburgh has a particularly strong legacy of integrating research and horticulture, particularly on Malesian Ericaceae, Begoniaceae, Gesneriaceae and Zingiberaceae, and the staff shared many of their experiences through talks and even a hands-in-the-compost workshop.



The Flora Malesiana Foundation Board members present at the meeting. (Photo credit: Lynsey Wilson)



Some of the participants at the Symposium in the Fossil Garden. (Photo credit: Lynsey Wilson)

Conserve: Without plants there is no life and readers of *Gardenwise* need no convincing that we have a moral imperative to protect the biodiversity of our planet. Many of the talks at the Symposium discussed the need for conservation due to pressures from expanding extractive industries and increased exploitation of forests as many of the Malesian nations strive for financial security for their citizens. Many of the talks integrated the various themes by noting that effective conservation needs sound scientific underpinning. There were also talks on protected areas and IUCN conservation assessments.

Staff members from the Singapore Botanic Gardens and NParks delivered, or were co-authors on, nine presentations at the symposium. These were on a wide range of subjects including the begonias of the Moluccas, understanding the evolution of the plant family Annonaceae, the Gesneriaceae of Asia, the genus *Aeschynanthus* in Indonesia, the gardens of Singapore, *Pterospermum* in Malesia, the evolution of *Hoya* and its relatives, the genus *Hoya* in Borneo, and 'taxonomy: tricks of the trade'.

The staff and volunteers of the Royal Botanic Gardens Edinburgh must be

highly commended for putting on such a successful, stimulating and enjoyable symposium.

At each of the Flora Malesiana Symposia the Board of the Flora Malesiana Foundation meets to discuss progress on the Flora and other related activities in the region. The Board consists of 20 members representing botanic gardens, natural history museums and universities in ten Asian countries, as well as Australia, the Netherlands, the UK, and the US. The chair of the Foundation is Joeni Siti Rahajoe, the Head of the Botany Division at Herbarium Bogoriense, Indonesia. The Secretary is Marco Roos of Naturalis in Leiden, the Netherlands. The representative for the Singapore Botanic Gardens is David Middleton. At the Flora Malesiana Foundation Board meeting it was agreed that the Singapore Botanic Gardens will assist the secretariat in Leiden. The Gardens will provide a new regional contact point, work with the Flora Malesiana network to explore funding possibilities, and actively seek experts to coordinate or contribute the remaining family accounts. The Gardens' Daniel Thomas will coordinate these activities.

David Middleton
Michele Rodda
Daniel Thomas
Herbarium



Tales from the other side

The rainy season is now upon us and you would by now have seen mushrooms popping up from the ground almost anywhere. These are the fruiting bodies of certain groups of fungi. Some of you might have viewed them through a compound microscope in a science class, at most up to 1,500× in magnification but few have seen them through a Scanning Electron Microscope (SEM) which can go up to 500,000× magnification, depending on its make.

Fungi have been understudied in this part of the world since Corner's time (E.J.H. Corner, former Assistant Director of the Gardens (1929–42), was a prolific writer of many works covering topics from fungi to figs to the durian theory, which are still valuable references for many of us in various fields).

Most fungal specimens can only be determined to genus and not to species. Mushrooms cannot be identified from pictures (although well taken images do enable us to make some good guesses), but rather, they need to be collected and either dried or preserved in alcohol for further identification. Colour is important, but so are microscopic features like cap structure, stipe texture and spore colour and shape. The ultra-structures that can be seen under an SEM are sometimes now used to better differentiate the species.

This past summer, at the Royal Botanic Garden Edinburgh (RBGE), I had the opportunity to study a small group of boletoid mushrooms (fleshy mushrooms with pores instead of gills) described by Corner in the 1970s, some of which had been collected as far back as the 1930s. Many of these are known only from the type material, which was collected in Singapore (including the Gardens' Rain Forest and the Bukit Timah, Seletar and MacRitchie areas) and in Malaysia.

The reference specimens of all the Malayan fungi described by Corner are mostly found in the Herbarium E (Index Herbariorum acronym) at RBGE,



(Left) A dried-up specimen of *Boletus prebadius* that was collected from MacRitchie in 1940 and once preserved in spirit (alcohol mix); (right) despite the condition of the collection, spores from the specimen are still clear under the SEM (at 1,000× magnification).

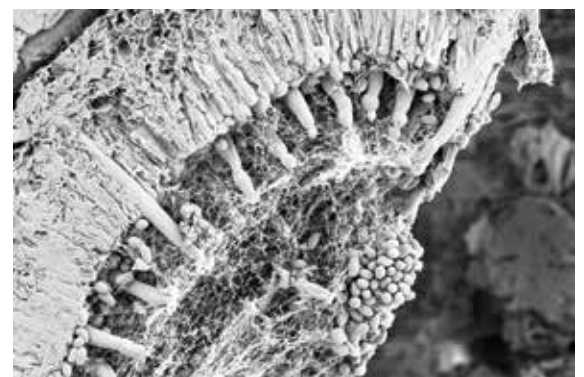


(Left) The fruiting bodies of *Boletus ferruginosporus* that were collected from Bukit Timah in 1940 and preserved in spirit (alcohol mix); (right) the spores of *B. ferruginosporus* at 10,000× magnification under the SEM.

although some are located in the Kew Herbarium in London. There is none in the SING Herbarium at the Gardens as all the material he had collected here moved with him after he left Singapore. We at SING are collaborating closely with E to try to bring more understanding to Corner's species in the light of molecular genetics.

So here are the images from the 'adventures' I had on the SEM during my time at RBGE. It was a whole new experience, akin to going into deep caverns 20,000 leagues under the sea or perhaps riding in a land rover on Mars to survey the landscapes of a new frontier!

A picture speaks a thousand words, enjoy...



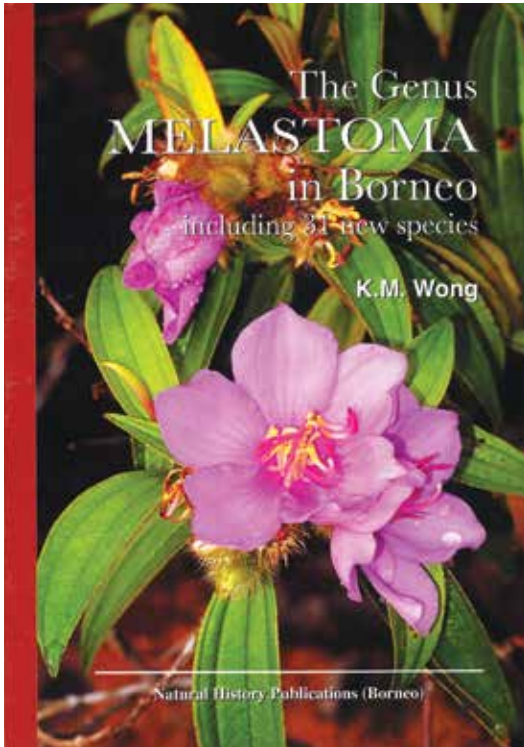
The 'caverns' of *Boletus calocystitides* with its amazing cystidia (sterile cells) are shown in the cross section of this bolete tube at 1,000× magnification under the SEM.

Serena Lee
Herbarium

All photos by Serena Lee



The Genus *Melastoma* in Borneo



by **Wong Khoon Meng**

Published in 2016 by Kota Kinabalu: Natural History Publications (Borneo), with the support of Tan Jiew Hoe, President of the Singapore Gardening Society.

22.2 × 16 cm, hardcover, viii+184 p.

ISBN 978-983-812-171-2

Price RM110.00 (approximately S\$35.00)

Melastoma is a genus of 80 to 90 species, mostly small trees or shrubs with showy pink or purple flowers. In Borneo, the genus has been considerably understudied, with only nine species thought to occur on the huge island as recently as 2001. With this new publication, Dr Wong presents us with an astonishing 31 new species, bringing the current count of Bornean *Melastoma* to 41 species.

The book is divided into two parts,

the first part including relevant information on the morphology, classification, biogeography and ecology of the species, as well as notes on their horticultural potential. Apart from the free-flowering and widespread *M. malabathricum*, which is also native to Singapore, all are endemic to Borneo. The highest species diversity was observed in the Northwest Borneo hotspot that includes southwest Sabah, Brunei and Sarawak, and on Mount Kinabalu.

As part of his revision of the *Melastoma* of Borneo, Dr Wong has devised a new system to separate the species from each other without the presence of complete flowers, which preserve poorly in herbarium specimens. Instead, his system uses the type and distribution of hairs on various parts of the plants, in particular the hypanthium, as identifying characters. The second part of his book includes an identification key using this system, followed by 41 sections, one for each of the treated species.

This publication is beautifully presented in a hardcover format with numerous technical illustrations from dried specimens as well as colour photographs of living plants, many obtained specifically for the book. Between these illustrations and the very useful taxonomic key, this book proves a valuable tool for scientists and plant lovers looking to identify Bornean *Melastoma*.

Despite their attractiveness, *Melastoma* species have yet to become popular in horticulture. Now that more of their astounding diversity has been revealed, it is hoped that more will be introduced into cultivation.

Michele Rodda
Herbarium

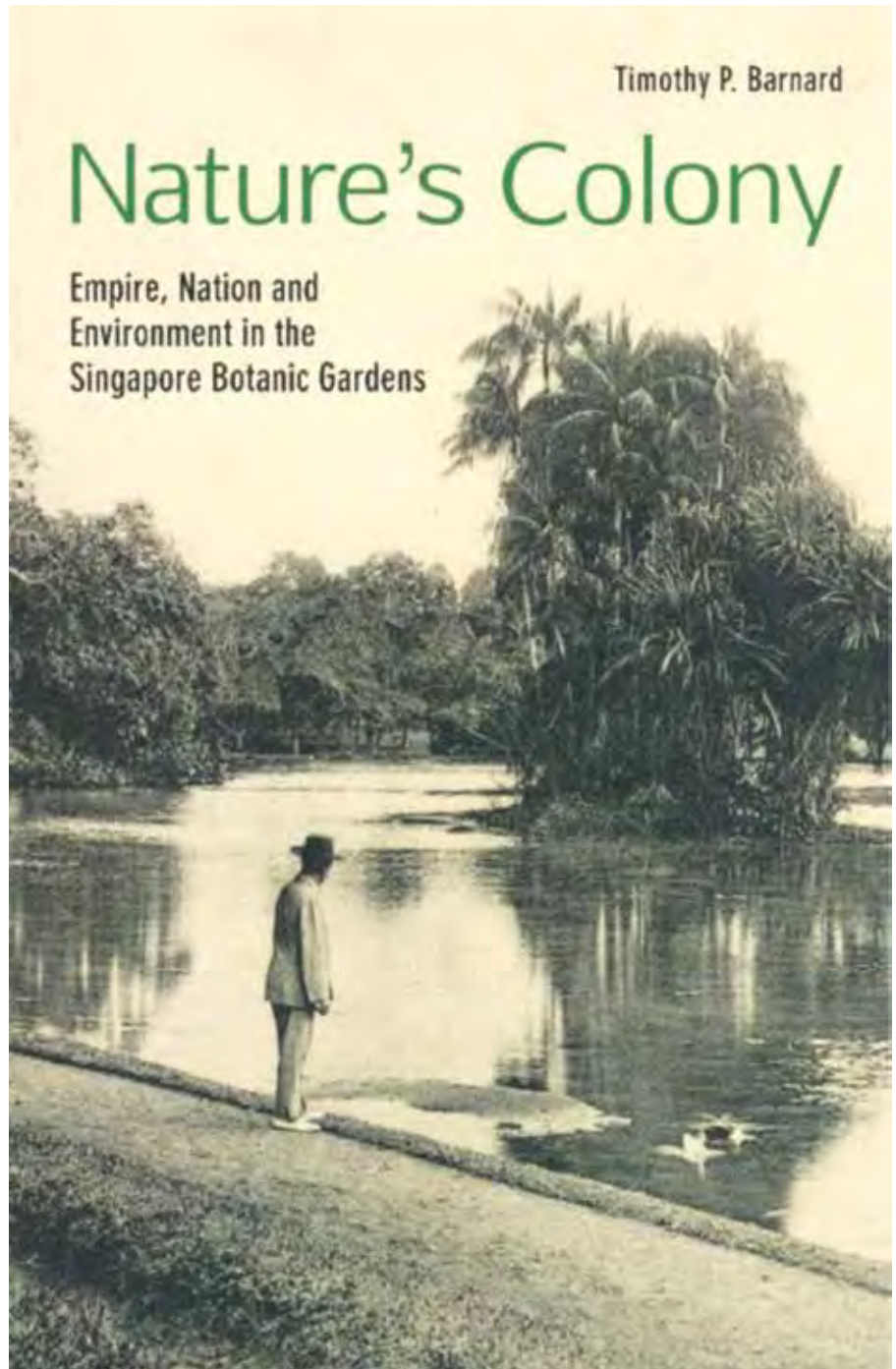


Nature's Colony: Empire, Nation and Environment in the Singapore Botanic Gardens

For more than 157 years, the Singapore Botanic Gardens has been a foremost scientific and botanical institution, first within the British colonial network in the late 19th and early 20th centuries, and later in independent Singapore. It was and still is more than just a cog in a wheel within the grand scheme of Singapore's development. Timothy Barnard's *Nature's Colony: Empire, Nation and Environment in the Singapore Botanic Gardens* tells the Gardens' history of proving its worth and holding its own within the network of botanic gardens in the British Empire, and carving its place in independent Singapore.

Here is an excerpt from the book detailing how botany was elevated as a pivotal constituent of colonial society as a result of the research done by the Gardens' first Director, Henry Nicholas Ridley, in the area of Rhinoceros Beetle and Red Palm Weevil infestations in coconut plantations:

The result of this research was the Coconut Beetle Ordinance of 1890, the first "anti-insect" legislation enacted in the Straits Settlements. The ordinance led to the creation of a "coconut tree inspector" who – along with two coolies – inspected all plantations, particularly those with "accumulations of cow-dung, tan-bark or other refuse in which the coco-nut beetles might be breeding." The inspector would serve notices to plantation owners, who were required to eliminate "all rubbish, leaves, husks and other vegetable refuse, or at least not allow piles of it to accumulate," or face a fine. The elimination of the refuse was done through fire. In addition, it became illegal to use old coconut tree trunks as posts or bridges in plantations. In the first year of the enactment of the ordinance, the inspector issued 200 notices, and almost 5000 coconut trees or stumps were destroyed



by Timothy P. Barnard

Published in 2016 by NUS Press, National University of Singapore

229 mm × 152 mm, 304 pages

ISBN 978-981-4722-22-3 (softcover)

Price S\$34.00

in Singapore. The next year, 1891, most of Singapore, with the exception of Kallang was beetle-free.

Under Ridley, the Gardens “attained a high position among the Gardens of the world”. It was further propelled onto the world map under the leadership of Director Isaac Henry Burkill (1912–25), who prioritised the Gardens’ herbarium and its work on the region’s flora. Burkill also played a remarkable role in interpreting botanical knowledge for the general public through seminal works like *A Dictionary of Economic Products of the Malay Peninsula* (1935). He compiled lists of the plants in the Gardens, which he made available to the public:

As part of this process Burkill obsessively recorded information about each plant on 3' × 5' pieces of paper, eventually collecting ten boxes of material. He then began adding interesting facts, including local names or historical accounts, about many of the species. For the longer entries numerous cards were needed, which were bound together using rubber bands. These cards are now housed in the archives at the Royal Botanic Gardens, Kew. An example can be found among the cards in the first box of the collection for the genus *Annona*, which contains a number of species that are well known in Malay Peninsula, including *Annona muricata*, better known as soursop [...]. There are 51 cards related to *Annona* which are scribbled on index cards, the backs of envelopes and even red-colored blotter paper. Each piece of paper records a different reference to the genus and its various species in the taxonomic literature, or reports a fact about it. For instance, soursop is not indigenous to Southeast Asia. It originated in the Americas and was transferred to Asia following the Columbian Exchange, the massive transfer of flora and fauna between the Old and New Worlds that occurred after Columbus’ voyages. This transfer is reflected in the local names for the fruit, such as “durian belanda” (Dutch durian), as it was introduced as a by-product of the VOC presence in Southeast Asia, which began in the 17th century. In addition, Burkill noted that soursop is available in markets in Malaya during the months of February, August and September.

During his time as Director of the Gardens, Burkill compiled more than 17,500 specimens. When he retired in 1925, he was succeeded by Richard Eric Holttum, who helped to elevate the Gardens as a place for horticultural excellence. While the Gardens had been cultivating orchids since Ridley’s time, Holttum shifted this focus away from native species and towards hybrids.

Holttum was a gentle, unassuming man at ease in the library and garden cultivating plants and conducting research. While he published numerous articles and books on ferns, which was his specific area of research interest, his attempts to breed orchids that were suitable for tropical lowland vegetation were his lasting legacy in the Gardens, as well as in larger horticultural circles in Singapore and the wider world. This was mainly accomplished through the importation of many of the orchids of Southeast Asia into the laboratory as well as the use of plants from the Americas and other parts of Asia to create new hybrids, which brought vibrancy to the local garden. His best known published works, *A Revised Flora of Malaya* and *Gardening in the Lowlands of Malaya*, reflect these interests, and they became standard works on bookshelves throughout the region, promoting the use of free-flowering plants in the gardens of Malaya and ultimately transforming the appearance of greenery throughout the region.

Years later, with nation-building well underway and a slew of greening programmes enacted to make newly-independent Singapore a Garden City, the Gardens continued to define itself in the areas of botany and horticulture. Its VIP Orchid Naming programme, which was an offshoot of the work begun by Holttum in the area of orchid hybridisation, is an example of this.

While the Botanic Gardens has focused on the development of specific hybrids for diplomatic, and occasional conservation, purposes since the 1960s, and commercial and amateur growers have become limited due to the development of an increasingly controlled and urbanized landscape, these entities still come together to support and celebrate orchids in Singaporean society. This was best symbolized

in Singapore hosting the World Orchid Conference, once again, in 2011. While orchid societies bid for the right to host, which OSSEA [The Orchid Society of South-East Asia] secured the right to do so in 2005, the Orchid Society jointly organized the gathering with the National Parks Board, which is the administrative body that oversees the Singapore Botanic Gardens. Another sign of the continuing interest in orchids is the inclusion of a new hybrid from Singapore in every quarterly issue of the Register, still known affectionately as *Sander’s List*. By 2015, Singapore registered one orchid a week, on an average. For example, in January 2015, the Singapore Botanic Gardens registered *Dendrobium* Serena Williams following her victory in a tennis tournament that Singapore hosted. Much of this activity revolving around orchids occurred in a Singapore Botanic Gardens that faced new challenges related to its transition from a colonial botanic garden to one serving an independent Singapore in which horticulture will be emphasized. The VIP Orchid Naming Program was only the beginning of the integration of the Gardens to the needs of an independent, and small, nation, but it was the culmination of efforts of Singapore-based botanists to enter complex scientific economic and diplomatic networks that were not rooted in supervision from the Royal Botanic Gardens, Kew.

Nature’s Colony’s is a well-researched and comprehensive exposition of how the Singapore Botanic Gardens, as we know it today, came to be. Drawing from a myriad of sources and materials ranging from colonial records and journals to oral archival recordings and personal diaries, the book makes for an informative yet amusing read as it discusses both the effects of political changes on the Gardens and the idiosyncrasies of its important personalities, their personal challenges and their scientific, botanic and even administrative contributions to the Gardens’ transformation though history.

Wong Yeang Cherng
Communications and Community Engagement



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July–December 2016



Her Excellency Aung San Suu Kyi, State Counsellor of the Republic of the Union of Myanmar, during her visit on 1 December 2016.

(Photo credit: Benjamin Aw)



His Excellency Mark Rutte, Prime Minister of the Netherlands, with his Aranda Mark Rutte during his visit on 24 November 2016.

(Photo credit: Benjamin Aw)

Mrs Amonrant Chantanaorrapint, Mr Nutdanai Putthisawong, Ms Orawanya Suwanmala, Ms Pinpawan Rojchanaumpawan and Dr Sahut Chantanaorrapint, Prince of Songkla University, Thailand

H.E. Aung San Suu Kyi, State Counsellor, Republic of the Union of Myanmar

Dr Axel Poulsen, Dr Carmen Puglisi, Royal Botanic Garden Edinburgh, United Kingdom

Dr Boonchuang Boonsuk, Mr Ponprom Pisuttimarn, Mr Pornchai Kludwong, Khon Kaen University, Thailand

Mr Brad Irwin and Mr Jim Irwin, Natural History Museum, United Kingdom

Minister Champika Ramawaka and Mr Pujitha Dilusha Hewawasam, Ministry of Megapolis and Western Development, Sri Lanka

Mr Christopher Niven, Mrs Christine Niven, and descendants of Lawrence Niven

Dr Colin Ridsdale, Dr Ed de Vogel, Mr Yu Renyong, Naturalis Biodiversity Centre, The Netherlands

Dr Daniele Cicuzza, Universiti Brunei Darussalam, Brunei Darussalam

Delegation of Ambassadors to the United Nations in New York from the 3rd Forum of Small States (FOSS), including **H.E. Ahmed Sareer, Maldives, H.E. Inga Rhonda King, Saint Vincent and the Grenadines, H.E. Kelebone Maope, Lesotho, H.E. Lois Michele Young, Belize, H.E. Ruben Ignacio Zamora, El Salvador, and H.E. Sam Terrence Condor, Saint Kitts and Nevis**

Dr Geoff Lee, New South Wales Parliament Secretary for Multiculturalism and State Member for Parramatta, Australia

Mr Hirose, Deputy Director-General for Engineering Affairs, City

Bureau, MLIT (Land, Infrastructure, Transport and Tourism), Japan

Ms Hsieh Shu-Ya, Mayor of Douliou City, Taiwan

Mr Ian Cowie, Northern Territory Herbarium (DNA), Australia

Mr Jan Metzler, Mr Johannes Steinger, Mrs Katrin Albsteiger, Mr Mark Hauptmann, Ms Ronja Schmitt, Mr Steffan Bilger, Dr Tim Ostermann and Dr Wolfgang Stefinger, Junge Gruppe of the CDU Parliamentary Group, Bundestag, Germany

Mr Janeil Simon and Mrs Paula Frederick-Hunte, Government of Antigua and Barbuda

Dr Jeff Chemnick, Ganna Walska Lotusland Botanic Garden, United States of America

H.E. Johann Schneider-Ammann, President of Switzerland

Ms Karola Maul, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany

Prof. Kim Yong Shik, Yeungnam University, Republic of Korea

Mr Koji Kuda, Ms Makiko Teruya, Mr Masahito Asato and Ms Takuya Tominaga, Okinawa Prefectural Government Office, Okinawa, Japan

Prof. Lee Myung-Yul, Ministry of Foreign Affairs, Republic of Korea, and delegation from the 22nd Raffles Programme

Dr Lu Pei-Luen, Da-Yeh University, Taiwan

H.E. Mark Rutte, Prime Minister of the Netherlands

H.E. Mohammed bin Abdullah Al-Rumaihi, Minister of Municipality and Environment, State of Qatar

Mr Nackheung Paik, Vice Governor of Seocheon County, and delegation, Republic of Korea

Mr Natthawut Triyutthachai, Khon Kaen University, Thailand

Mr Ng Lang, CEO of the Urban Redevelopment Authority of Singapore

Dr Nobuyuki Tanaka, National Museum of Nature and Science, Japan

Prof. Norbert Lammert, President of the Bundestag (Federal Parliament), Germany

Mr Olaf Scholz, First Mayor of the Free and Hanseatic city of Hamburg, Germany, and delegation

Mr Ong Ye Kung, Minister for Education (Higher Education and Skills) & Second Minister for Defence, Singapore

Mr Pakorn Tippayasri, Thailand Institute of Scientific and Technological Research and Advisor of the Thai Traditional Medicine Research Institute, Miss Punjaporn Sunthudlakhar, Mahidol University, and Miss Walaiphon Saremongkonnimit, Thai Traditional Medicine Research Institute, Thailand

Dr Paulo Silveira, University of Aveiro, Portugal

Dr Razali Jaman, Universiti Kebangsaan Malaysia, Malaysia

H.E. Rodrigo Duterte, President of the Republic of the Philippines

Mr Rudolph Docot, University of Santo Tomas, Republic of the Philippines

Dr Ruth Kiew, Forest Research Institute of Malaysia, Malaysia

Dr Sri Rahayu, Bogor Botanic Gardens, Indonesia

Mrs Subekti Nurmawati, Bogor Agricultural University, Indonesia

Mr Suzuki Atsuo, Mayor of Tokai City, Japan

Mr Takeo Sumino, and delegation from the Sumitomo Mitsui Banking Corporation (SMBC)

Dr Tanaka Nobuyuki, and delegation from the Japanese Association of Botanic Gardens

H.E. Thomas Kupfer, Ambassador of Switzerland to Singapore, H.E. Mauro Moruzzi, Ambassador, Head of International Relations at the State Secretariat for Education, Research and Innovation, Switzerland, and delegation

Assoc. Prof. Timothy Barnard, National University of Singapore

Prof. Tomo Inoue, and delegation from Kyushu University, Japan

Dang Thanh Hai, Hau Viet Hoang, Hoa Nguyen Duc, Huy Phuoc Dang, Ket Van Nguyen, Mai Ha Thi, Nguyễn Thị Ái Minh, Son Nguyen An, Tan Nguyen Huu, Thong, Tien Tran Van, Truong Nguyen Khoa, Truong Thi Ngoc Thuyen and Tu Thi Anh Le, Dalat University, Vietnam

H.E. Vira Rojpojchanarat, Minister for Culture, and Mr Kasidit Chantarasiri and Ms Pariyapa Amornwanichsarn, Ministry for Culture, Thailand

Yang Hong Mei, Director, Science and Technology Extension Department, and delegation from the Guangzhou Institute of Forestry and Landscape Architecture, People's Republic of China

Dr Yong Kien Thai, University of Malaya, Malaysia

Dr Yu Ito, Xishuangbanna Tropical Botanic Garden, People's Republic of China

H.E. Yael Rubinstein, Ambassador of Israel to Singapore, and Dr Yuval Steinitz, Minister of National Infrastructures, Energy and Water Resources, Israel

H.E. Zenon Kosiniak-Kamysz, Ambassador of the Republic of Poland to Singapore, and delegation



The Orchid Enclosure



A display in the Orchid Enclosure in 1969.

Orchids have been closely associated with the Singapore Botanic Gardens since its establishment in 1859. So it is not a surprise that they have long been favourite plants for the Gardens to display. The Orchid Enclosure, created in 1955, was a popular exhibit which showcased Gardens-bred hybrids and other orchids of interest.

The Orchid Enclosure was created by placing a wire mesh fence around Lawns P and R. Structures were erected to show off hanging orchids like Dendrobiums, and benches were constructed to display other potted orchids. Singapore's National Flower, the Vanda Miss Joaquim, was also on show and drew members of the community to see it at its best. The Enclosure also served as a centre for receiving state visitors and conducting naming ceremonies for Gardens-bred

orchid hybrids, a tradition that was started in 1956 to honour visiting dignitaries.

The Orchid Enclosure became one of the most popular places to visit in the Gardens, and was enlarged in 1981 to allow the display of more than 12,000 orchids representing over 500 hybrids and 400 species. Also showcased were species that had been collected and conserved by Gardens' staff. The expanded Orchid Enclosure also included an Orchid Demonstration Centre which exhibited the various stages of orchid breeding, from seedpod to flask culture, through photographs and live specimens.

Over the next several years, the Orchid Enclosure was redeveloped three more times to cater for increasing numbers of visitors, and was eventually replaced by the National Orchid Garden,



The Orchid Demonstration Centre in 1969.

which was officially opened on 20 October 1995 by then Senior Minister Lee Kuan Yew. Today, visitors to the National Orchid Garden can see more than 60,000 orchids comprising about 2,100 hybrids and 700 species from around the world. Key features of the garden are planned for enhancements in 2018, which will allow us to showcase even more orchids in the future.

Christina Soh
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