

Gardenwise



The Magazine of the Singapore Botanic Gardens • Volume 60 • March 2023 • ISSN 0129-1688

2 Remembering the life of Junichi Inada in Singapore



6 Flora of Southeast Asia:
Contemporary artworks on native
plants of Southeast Asia

21 Women in plant taxonomy

30 Celebrating the Singapore
Garden Festival at the Jacob
Ballas Children's Garden



- 1 Message from the Director
Tan Puay Yok

Articles

- 2 Remembering the life of Junichi Inada in Singapore
Whang Lay Keng
- 4 In Memoriam Haji Samsuri Bin Haji Ahmad (1936–2022) - ‘The King of Trees’
S.K. Ganesan, Serena Lee
- 6 Flora of Southeast Asia: Contemporary artworks on native plants of Southeast Asia
Michele Rodda
- 10 Uncommon market vegetables: An exhibition at the Centre for Ethnobotany
Louise Neo, S.K. Ganesan
- 15 A blooming year: Spotlight on the Gardens’ named orchid hybrids in 2022
Rachel Tan, Whang Lay Keng

Regular Features

- 21 **From the Taxonomy Corner**
Women in plant taxonomy
David Middleton
- 23 **Staff Publications**
Publications by Gardens’ staff in 2022
- 25 **Edibles**
Plants with a lemon-like scent
Wilson Wong
- 27 **From the Earth**
History of macrofungal research at the Singapore Botanic Gardens
Serena Lee
- 30 **From Education Outreach**
Celebrating the Singapore Garden Festival at the Jacob Ballas Children’s Garden
Natalie Cheong
- 35 **What’s Blooming**
Copernicia macroglossa – one ‘dressed’ up palm!
Nura Abdul Karim
- 37 **Beyond the Gardens**
The 7th Global Botanic Gardens Congress – a testament to perseverance in times of a global pandemic!
Nura Abdul Karim
- 39 **Around the Gardens**
The Exceptional Species Micropropagation & Cryopreservation Workshop 2022
Nura Abdul Karim
- 41 **Around the Gardens**
List of VIP orchid hybrids named by the Gardens
- Back Cover** **From the Archives**
William Griffith’s *Icones Plantarum Asiaticarum*
Michele Rodda, Martina Yeo



Cover

Inada imbued the personality of rocks as the core design concept of Evolution Garden in the Singapore Botanic Gardens. Rocks represent strength, permanence and resistance, which befits the fiery beginnings of our planet to the first living organisms and evolving plant life on land.
(Photo credit: Benjamin Aw)

Editors

Tan Puay Yok
Low Yee Wen

Production Manager

Low Yee Wen

Production Assistants

Bazilah Ibrahim
Felicia Tay
Uma Manikantan

Design

Chung Printing Pte Ltd

Singapore Botanic Gardens

1 Cluny Road, Singapore 259569
National Parks Board

www.nparks.gov.sg
www.nparks.gov.sg/sbg

Message from the Director

Over the last quarter, the Gardens had several notable collaborations and meetings with our Japanese counterparts. I share a brief account of these in this message. It was also during this period that we learnt with great sadness that our long-time colleague and friend, Mr Junichi Inada, passed away in Osaka on 5 Dec 2022, just days after we had spoken on the phone when I was on a visit to Hyogo Prefecture on a trip initiated by him. We want to remember Mr Inada fondly in this issue of *Gardenwise* for his passion and dedication to the Gardens and greening of Singapore (see page 2).

At the suggestion of Mr Inada, we concluded a Memorandum of Understanding with Awaji Greenhouse in Hyogo Prefecture in Sep 2022. As part of the collaboration on plant and knowledge exchange, we presented Awaji Greenhouse the SBG orchid hybrid, *Dendrobium* Naruhito Kotaishi Denka, during our visit on 21 Nov 2022. The orchid was named in honour of Crown Prince Naruhito (now Emperor) after his marriage with Crown Princess Masako (now Empress) in 1993. Earlier in the same year, then President of Singapore, Mr Wee Kim Wee had presented *Dendrobium* Masako Kotaishi Hidenka, another SBG orchid hybrid, to commemorate the wedding. Our gift this time was particularly meaningful, as it completes the pair of orchids named after the royal couple, both of which are now in Hyogo Prefecture. It was delightful to see both orchids placed side by side in Awaji Greenhouse during my visit, and I look forward to seeing both flowering together under the care of horticulturists of Awaji Greenhouse and Hyogo Flower Centre.

I also took the opportunity during this visit to connect with key botanic gardens in Japan, including the Makino Botanical Garden in Kochi Prefecture, Kyoto Botanical Gardens and the Koishikawa Botanical Garden of The University of Tokyo.

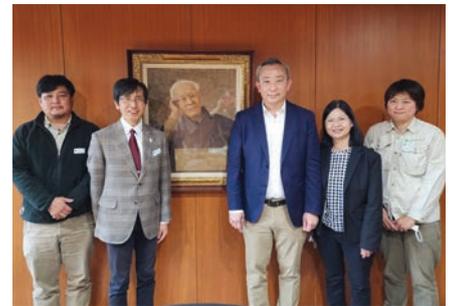
In fact, it was more of a reconnection with the first two gardens. Our friendship with the Makino Botanical Garden started more than twenty years ago when it staged a special exhibition of the Gardens' work and programmes from September 2002 to February 2003. In turn, Makino Botanical Garden ran an exhibition of rare Japanese herbal books in conjunction with the launch of the Healing Garden of the Singapore Botanic Gardens in October 2011. Our botanists also made ad hoc study visits to examine their herbarium collection and botanical drawings some years ago. Recent contacts have been sporadic and so this was a very useful visit to understand the recent activities and directions of the Makino Botanical Garden under the directorship

of Dr Nobuo Kawahara. It was personally wonderful for me to see a whole permanent gallery dedicated to the life and work of Dr Tomitaro Makino, the "Father of Japanese Botany", whose *magnum opus*, the *Illustrated Flora of Japan* published in 1940, is still a key reference on Japanese flora today. Interestingly, the Makino Botanical Garden is also working with NHK, the Japan Broadcasting Corporation, on a TV series named *Ranman*, which is based on the early life of Dr Makino as a budding botanist in Koichi City, which I am confident will generate more interest in and recognition of the important works of the garden. Perhaps a similar Singaporean TV serial on the life of our Gardens' staff, past or present, fictitious or real, would also reveal much more to the public the fascinating and important work of the Gardens.

At the visit to Kyoto Botanical Garden, Director Hiroshi Tobe and I noted our long-standing connection that dates back more than 80 years. Probably not widely known to most, Professor Kwan Koriba, Director of the Singapore Botanic Gardens from 1942 to 1945, was also the first Director of the Kyoto Botanic Garden when it opened in 1925. Thus, even though SBG and Kyoto Botanical Garden signed an MOU in 2016, our connection actually started much earlier. We also share a common reputation as among the most visited gardens in the two countries. Both gardens have much to share and exchange knowledge on topics of visitor engagement, plant displays and management. The Kyoto Botanical Garden is also planning to renovate its impressive conservatory, currently the largest in Japan, and I look forward to seeing the refreshed facility in the future.

It was also due to Professor Koriba that we were paid a visit by planning officials from Hirosaki City in Jan 2023. Hirosaki was where Professor Koriba had served as the second president of Hirosaki National University after his appointment in Singapore and where he passed away in 1957 while in office. The officials from Hirosaki City have been encouraged by Mr Inada to visit Singapore to learn about the contributions of Professor Koriba here and develop the Hirosaki Park into a world class cherry blossom Garden.

I am also thankful to Mr Inada for giving me his book *The Marquis, A Tale of Syonan-to* during my Nov 2022 visit. Reading it over the year-end break gave me much more insights into the role of the Marquis Yoshichika Tokugawa, Hidezo Takakadate and soon after, Kwan Koriba in protecting the grounds of the Gardens and its precious collections of herbarium specimens, books and other documents during the Japanese occupation



Dr Nobuo Kawahara (2nd from left), Director of the Makino Botanical Garden and staff welcomed me and Ms Wlang Lay Keng (2nd from right), Curator of the National Orchid Garden on our official visit to their garden in November 2022. (Source: Wlang Lay Keng)

of Singapore. Of course, it was also equally due to the dedication and perseverance of Professor E.J.H. Corner, Assistant Director (1929–1945), Professor Richard Eric Holttum, Director (1925–1949), and staff that the Gardens went through the war period relatively unscathed.

In February 2023, we welcomed Professor Atsushi Kawakita, the Director of Koishikawa Botanical Garden (Botanical Gardens of the University of Tokyo), and his colleagues from the University of Tokyo. This is a return visit following mine to their beautiful garden in November 2022. Koishikawa Botanical Garden was established in 1684 as a medical herb garden and was where modern botanical research started in Japan. It continues to hold very important collections of plants, herbarium specimens and books on Japanese and East Asian flora. The exchange of visits by both institutions should pave the way for collaborative activities in the future.

Through forging these connections and after reading Inada's book, I am reminded of the good fortune of the Gardens to have had the support of the numerous international collaborators, and the dedication of past and current staff of the Gardens. It seems to me too that those of us in the botanical world are connected by a love for plants, quest for knowledge, and desire to protect nature. These qualities transcend culture, even when two countries are at war. As we continue to forge new collaborations among institutions in the years ahead, we should not forget that it is the individuals, friendship and collegiality, more than institutions, that produce lasting legacies. And we should always remember that to have come thus far, we have stood on the shoulders of these giants.

Tan Puay Yok
Group Director
Singapore Botanic Gardens

Remembering the life of Junichi Inada in Singapore



Inada at his work desk as the Director of Planning and Development, National Parks Board (1990–1994). (Image courtesy of the Singapore Botanic Gardens Archives)



Inada (second from left) with colleagues from NParks (from left to right) Yong Yee Sheong, Camelia Merican and Peggy Chong at Eco-Lake, Bukit Timah Core, Singapore Botanic Gardens. (Image courtesy of the Singapore Botanic Gardens Archives)

With great sadness, we received news of Mr Junichi Inada's passing on 5 December 2022 at the age of 70. He was a talented and well-respected Japanese landscape architect who contributed significantly to the greening of Singapore.

Inada began his practice as a landscape architect in Osaka, Japan, soon after he left the university. Upon his professor's recommendation, he joined the Parks and Recreation Department, Ministry of National Development, Singapore, as a Senior Landscape Architect in 1983. Subsequently, he became the Chief Landscape Architect and Head of the Planning and Development Branch at the Singapore Botanic Gardens (SBG) from 1988 to 1990. Later, he went on to become the Director of the Planning and Development Division in the National Parks Board (NParks) (1990–1994). Some of the signature public projects he was involved in include the initial implementation of the Park Connector Network and the development of Pasir Ris Park. While in SBG, he played a pivotal role in shaping the landscape of the Gardens through iconic projects such as improvement works for the Orchid Enclosure (presently the Ginger Garden), execution of the Gardens' 130th Anniversary demonstration garden and implementation of the Gardens' redevelopment Master Plan, which included the National Orchid Garden, Evolution Garden and Eco-

Lake of the Bukit Timah Core. During this period, he was also involved in the redevelopment project of Fort Canning Park and the Visitor Centre in Bukit Timah Nature Reserve.

Inada was greatly inspired by Singapore's Garden City vision and strived to create lush outdoor public green spaces for people to enjoy. He was well-known for incorporating the essence of the 'Japanese sense of beauty' into many of his projects, including transforming parts of SBG through *Fuzei* (ふぜい). *Fuzei* is a philosophical term introduced in *Sakutei-ki*, one of the oldest world classics on the art of gardening, and it relates to the mood of a garden that can be achieved through asymmetry and proportion and appreciated by the five

basic human senses: sight, smell, touch, taste and hearing. To implement *Fuzei*, elements such as water, rocks, plants and sculptures are utilised. This design concept is evident in the Nassim Gate entrance precinct, Evolution Garden and the National Orchid Garden.

After spending 11 years in Singapore, Inada returned to Japan in 1994 but continued to work on projects in Singapore as an Osaka-based landscape consultant. His last assignment with NParks was in 2020, a project to upgrade the Japanese Garden in Istana. Inada was accorded the Public Service Star at the 2016 National Day Awards for his outstanding contributions to the greening of Singapore.

Whang Lay Keng
National Orchid Garden



Inada (foreground) briefing Mr Goh Chok Tong (on Inada's right), Emeritus Senior Minister (ESM) of Singapore, and Mr Kenneth Er (on Inada's left), CEO of the National Parks Board, Singapore, of his "Citrus Garden" design concept at the Designer Landscape Gardens during the Community Garden Festival, Festival of Edibles in 2017 held at HortPark. (Photo credit: Eri Imose)

Tributes to Inada

When we think of Inada, we are reminded of his passion, dedication, and humility. He was consultative in his approach to achieving his vision and had walked the grounds of the Botanic Gardens with many co-workers to hear their views and ideas. He was an inspiration and will always be fondly remembered.

Mr Kenneth Er (CEO/National Parks Board)

“Inada-san was a colleague and friend to many of us. I have learnt much from him over the last two decades, as we worked closely on various projects in NParks and Gardens by the Bay. In the past 8 years, we worked on several projects that were close to Inada’s heart. This included the redevelopment of the National Orchid Garden, a project that he first started with Dr Kiat Tan in the early 1990s, as well as the enhancement of the Japanese Garden and Swan Lake at the Istana. I recall discussing the concept of the Japanese Garden and Swan Lake with Inada-san. His ability to see depth and texture within the landscape was truly enlightening.

I am also grateful to Inada-san for sharing his experience and knowledge with many of us. The exhibition that he put together of his lifetime’s work on the landscapes and gardens of Singapore at the CDL Gallery in the Singapore Botanic Gardens showed how he had tropicalised the Japanese art of landscape architecture and brought to bear many of the landscapes that we see today including the Park Connector Network, Pasir Ris Park, Bishan-Ang Mo Kio Park and the National Orchid Garden to name a few.

In more ways than one can imagine, he has been a large part of the NParks family. We will miss him dearly.”

Dr Leong Chee Chiew (Executive Director of National Parks, Gardens & Nature Reserves Cluster and Commissioner of Parks & Recreation/ National Parks Board)

“Inada-san will be remembered for his professionalism, cheerful and humble disposition. Working with him was always a pleasure. I feel that he genuinely wanted to contribute to what we are doing to ensure a highly liveable environment through greenery and nature. He admired Singapore’s boldness of vision.

Inada-san’s passing on 5th Dec 2022 was untimely. His last email to me on 3rd Nov 2022 expressed happiness and honour at having worked with the NParks team to complete the upgrading of the Japanese Garden in the Istana. In a subsequent telephone conversation, he sounded upbeat and appreciative of what he could do in Singapore. We will miss Inada-san for the many other contributions he could have made if he were still with us.”

Mr Teo Chan Seng (Senior Manager/Singapore Botanic Gardens)

“When I joined NParks as Clerk of Work/ Projects, Mr Inada was the Director/ Planning and Development. He would personally show me the grounds of the Singapore Botanic Gardens and share many ideas to enhance the beauty of the Gardens. I remember working with him to design a wooden bench now being used across the Gardens. I also learnt how to create

trellises based on what he had taught me. I have learned a lot from him.”

Ms Whang Lay Keng (Curator of the National Orchid Garden/Singapore Botanic Gardens)

“It was a pleasure working with Mr Inada on the improvement of the Orchid Enclosure and the landscape design of the National Orchid Garden. He shared with me his ideas of adopting the art of Japanese garden design in selecting tropical plants to showcase the colour palettes of the four seasons. He was meticulous at work, paying attention to detail, such as selecting and arranging rocks and sculptures to create a well-balanced garden. After he left Singapore in 1994, we continued to work together on the National Orchid Garden and his ability to employ techniques and rhythm to create a well-designed garden never ceased to impress me. I am grateful for his sharing and blessed to have known him.”

Mr Mark Choo (Assistant Curator of the National Orchid Garden/Singapore Botanic Gardens)

“Inada-San was a cheerful and jovial person who never failed to encourage and inspire those around him. The master plan of the National Orchid Garden that he developed has remained timeless and is a testament to his foresight and ingenuity. During the development of the Tropical Montane Orchidetum, Inada-san taught the team techniques that elevated the landscapes. He was a true inspiration to me, and I will always be indebted to him for his words of wisdom.”



Inada (right) with Teo Chan Seng (left), a former colleague at the Planning and Development Division in the National Parks Board in the early 90s, now with Singapore Botanic Gardens. (Photo credit: Eri Imose)



Inada (fifth from left) meticulously positioning a large rock during the enhancement work carried out for the Japanese Garden at Istana on 22 Dec 2020. (Photo credit: Eri Imose)

In Memorium Haji Samsuri Bin Haji Ahmad (1936–2022) - ‘The King of Trees’



Sam on a field trip to Pulau Sibü in 1991. (Photo credit: Neo Hwee Hwee)

Haji Samsuri Bin Haji Ahmad, a long-time Gardens and Herbarium staff passed away peacefully in July 2022 at the age of 85. Sam, as he was affectionately known, had a career which spanned some 60 years. During his work with the Herbarium of the Singapore Botanic Gardens (SING), Sam participated in many floristic surveys and collected over 3000 plant specimens, with him as the principal collector. He was renowned for his plant identification skills and generosity in sharing plant knowledge he acquired over the years in botany. Between the late 1990s to early 2000s, Sam was responsible for the general identification of incoming plant materials, native as well as exotics, brought into the herbarium by staff and the public. Sam’s proficiency in plant identification led to an article in the Singaporean Malay newspaper *Berita Harian* titled ‘*Dulu Hang Kebun Sekarang Raja Pokok*’, which can be translated to ‘*From a Humble Gardener to the King of Trees*’. Sam loved fieldwork, especially in the lowland mixed dipterocarp forest and often remarked that he felt like a 16-year-old

whenever he was in the forest. In the field, his penchant was identifying trees through their bark and fallen leaves.

Plant identification is a skill that one cannot master solely from books. To put a name to a plant, one requires many years of experience, preferably under the tutorship of a mentor. Sam considered the renowned Malayan forest botanist K.M. Kochummen as one of his mentors. Besides Kochummen, Mohammed Shah Bin Mohamed Nur, then an assistant herbarium curator, was also regarded as his teacher. Nevertheless, his excellent photographic memory enabled him to master the art of plant identification. Sam’s approach to identifying a plant sample was first to assign it to a family and then a genus. Subsequently, he would consult the relevant checklist, which would trigger his memory of a possible species name. His final step of the plant identification flow was to consult specimens held at the herbarium for confirmation. If the plant sample did not match, he

would search for an alternative match in other members of the genus. As he dealt primarily with native plants from Singapore and Peninsular Malaysia, his primary checklists for consultation were those of I.M. Turner:

Turner, I.M. (1993). The names used for Singapore plants since 1900. *Gardens’ Bulletin, Singapore* 45: 1–287.

Turner, I.M. (1997 [‘1995’]). A catalogue of the vascular plants of Malaya. *Gardens’ Bulletin, Singapore* 47: 347–757.

Sam started his humble career as a gardener at the Gardens in 1952 at the age of 16 when his father, Ahmad Bin Yusof, was ill. John Ewart, then an Assistant Curator at the Gardens, offered Sam the opportunity to take over his father’s position at the Gardens. In addition, his family would be allowed to continue living in the staff quarters. Considering the accommodation offered and a salary to support his parents and siblings, Sam



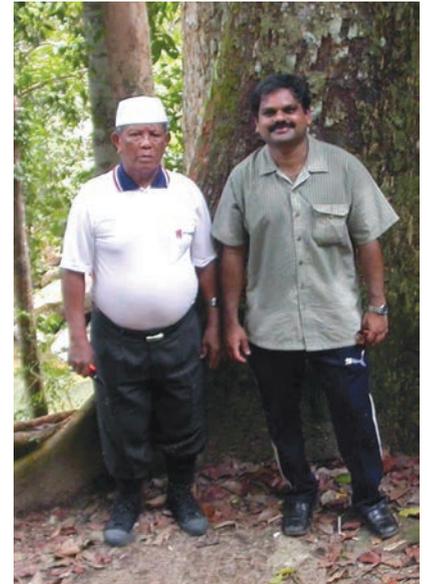
Sam (front row kneeling, 1st from right) with students from the National University of Singapore at the Endau Rompin National Park, Johor, Malaysia in 1994. (Photo credit: Jean Yong)



Paul Leong goofing around with Sam while on fieldwork at Nee Soon swamp forest in 2003. (Photo credit: Serena Lee)



Sam at his desk at work identifying plants with his reference books in 2009. (Photo credit: Serena Lee)



Sam with Ganesan at Kota Tinggi in 2004. (Photo credit: S.K. Ganesan)

took the job offer and dropped out of school at Tanglin Besar Malay School to commence work. In 1968, he was promoted to Plant Collector. Before he was appointed as a plant collector, Sam had already accompanied various botanists on botanical expeditions as early as 1962 when he accompanied B.L. Burt and P.J.B. Woods to Pulau Langkawi, Malaysia, in which he described cycling in near-total darkness at night to buy food. Another notable expedition for Sam was the 1964 Royal Society Expedition to Gunung Kinabalu, Sabah, Malaysia. He spent five months in the field collecting

with several botanists, including Prof. E.J.H. Corner. He remembered that Corner was a strict expedition leader who would inspect that staff had lights off at night and was up in the morning by stipulated hours. Sam, who had recently married, said that he was often homesick in those five months and told us that he sometimes would cry quietly when he was alone. Sam worked at the Gardens until March 1982, when he took up the Herbarium Assistant position at the National University of Singapore Herbarium (SINU) at the Department of Botany, National University of Singapore (NUS). He

fondly remembered collecting plants for laboratory sessions for students and working with Prof. A.N. Rao. Sam retired from NUS at the age of 60 in 1997. After his retirement, Sam returned to the Botanic Gardens in May 1997 and worked for 15 years until 2012. During this period, Sam recounted his botanical travels in Singapore and Peninsular Malaysia to herbarium colleagues, most notably his assignment on Annonaceae with James Sinclair. He also reminisced about his collection trips with H.M. Burkill, Director of the Gardens from 1957 to 1969, who performed free diving to collect seaweed for his research.



Sam at his farewell party in 2012 with colleagues and friends who came to the herbarium especially to wish him well. (Photo credit: Herbarium Archives)

Sam married Siti Zainon Binti Sarbon, a daughter of a gardener in the Gardens, in 1964 and they were blessed with three sons. In 1977, Sam and his family moved from a staff-quarters to a Housing Development Board (HDB) flat at Clementi.

With the passing of Sam, the Gardens has lost the last plant collector, a position that can be traced back to Ridley's time. We have lost a lovely friend with, at times, very childlike innocence and someone whose generosity was boundless in many ways. He will indeed be missed by the many who knew him. But, even the mightiest tree in the forest must one day pass on.

S.K. Ganesan
Serena Lee
Herbarium

Flora of Southeast Asia: Contemporary artworks on native plants of Southeast Asia

Flora of Southeast Asia is the first international botanical art exhibition to feature contemporary artworks on native plants of Southeast Asia. The show is organised by the Botanical Art Society (Singapore) (BASS) and the Singapore Botanic Gardens (SBG) in their first-ever collaboration with the Indonesian Society of Botanical Artists (IDSBA), Thai Botanical Artists (THBA) and the Philippine Botanical Art Society (PhilBAS). Artists from 13 countries submitted 189 botanical artwork entries. Each entry was judged by a panel of botanists and botanical artists on scientific accuracy, artistic merit, mastery of the chosen medium and overall impact. This exhibition includes the top 120 artworks by 85 artists, of which 80 originals were displayed in the rooms of the Gallery. An additional

40 facsimile paintings are shown at the People's Gallery exhibit spaces throughout the Gardens, including Tanglin Gate, Nassim Gate, Bukit Timah Gate and the Green Pavilion at Botany Centre. The exhibition ran from 15 November 2022 to 15 February 2023.

Why focus on native plants

Southeast Asia is one of the tropical regions known for its immense plant diversity, with an estimated 50,000 flowering plant species alone – about 15% of the world's total. The region includes four of the world's 25 biodiversity hotspots. Native plants in this region have co-evolved and formed symbiotic relationships with local fauna, providing food sources like nectar, pollen, fruits and seeds to insects, birds,

mammals and other animals. Sadly, much of Southeast Asia's native flora is threatened by habitat loss and extinction linked to agriculture, urbanisation, illegal harvesting and over-exploitation for plant trade, pollution, competition with exotic and often invasive plant species and climate change. The show highlights an array of plant diversity in Southeast Asia. The displayed paintings were grouped by growth form, habitat, or family, highlighting some important elements of Southeast Asia's plant diversity.

Michele Rodda
Herbarium & Botanical Art Gallery

All photos by Dr Michele Rodda, unless otherwise indicated.



The display of orchids and epiphytic plants (background) and wetland species (foreground).



The three artworks shown here were selected as the Best of Show after two rounds of judging by botanical artists and botanists who were part of an international panel of 17 jurors. Each artwork was evaluated for botanical accuracy, artistic merit, mastery of media and overall impact. The best of show artworks are (Top left) *Stelechocarpus burahol* (Blume) Hook.f. & Thomson by Dianne Sutherland (United Kingdom, BASS member) (Artwork title: *Stelechocarpus burahol*), (Top right) *Hydnophytum formicarum* Jack by Teo Nam Siang (Singapore, BASS member) (Artwork title: Ant Plant no. 1) and (bottom) *Sterculia oblongata* R.Br. by Deinitisa Amarawi (Indonesia, IDSBA member) (Artwork title: The Blooming Fruit II: Beneath the Canopy).



A painting demonstration conducted by the artists during the exhibition's opening weekend. Further painting demonstration sessions, guided tours and workshops for the public were scheduled throughout the show.



Guided tour during the VIP opening event on 18 November 2022, led by Botanical Art Society (Singapore) volunteer guide and artist David H.H. Toh.



Artists from the four participating societies gathered outside the Botanical Art Gallery for a photoshoot during the Artist Networking Event on 19 November 2022. (Photo credit: Krittaya Siririthichai)



Flower Fragments in Rainbow Colours watercolour workshop for children conducted by Sunanda Widel, a member of the Botanical Art Society (Singapore) and one of the artists who participated in the exhibition. (Photo credit: Botanical Art Society (Singapore))



Dr Mabel Yap of the Botanical Art Society (Singapore) conducting the *Zen of Appreciating Botanical Art* workshop. In the workshop, participants learn how to appreciate art in a more profound and mindful experience. (Photo credit: Botanical Art Society (Singapore))



Kelly Bassett of the Botanical Art Society (Singapore) training volunteer guides from the Singapore Botanic Gardens and the Botanical Art Society (Singapore) who conducted free guided tours throughout the duration of the exhibition covering both the Flora of Southeast Asia exhibition and the Gallery's permanent exhibition on Level 2.



An overview of the two exhibition rooms.



Part of the display at Green Pavilion at Botany Centre.

Uncommon market vegetables: An exhibition at the Centre for Ethnobotany

Ethnobotany is the study of plants, people's relationships with them and how these have shaped human culture, often with a special focus on traditional knowledge and customs. In Singapore, we have the opportunity to study the ethnobotany of a diverse range of ethnic groups.

One of the most important and familiar ways in which people utilise plants is as a food source. Plants or plant parts (excluding ripe fruits) that are eaten can be broadly defined as vegetables. The many different parts of a plant may be edible, including aboveground parts such as the leaves, stems, flowers and unripe fruits, and underground parts such as the roots, tubers, rhizomes, and bulbs. Vegetables are consumed for their nutritional value and often also for health and medicinal benefits that they might confer, such as in herbal remedies.

It has been estimated that an average person eats about 100 different species of plants in a year — whereas about 30,000 or more edible plant species are recognised worldwide. The variety of vegetables we eat may be limited by what is familiar and usually offered in our supermarkets and wet markets. These are often the high-yielding and more profitable crops. However, edible plants and plant parts that are not typically produced and sold on a commercial scale, and therefore less common and lesser-known, can also be worth exploring. Including a variety of less commonly available vegetables in our diet can be one way to diversify our food supplies towards achieving better food security.

Certain vegetables may be 'lesser-known' because they are more commonly eaten in some cultures than others. Introducing these edible plants into our diet would allow us to experience the flavours and cuisines of other local and regional cultures.



Leafy vegetables on sale in a typical Southeast Asian wet market. (Photo credit: M. Sugumaran)



Some lesser-known vegetables include the under-utilised parts of plants commonly eaten such as the inflorescence of the banana plant (*Musa acuminata* and its hybrids) — seen here on sale in Geylang Serai wet market, Singapore with banana leaves and the inflorescences of torch ginger (*Etilingera elatior*). (Photo credit: L. Neo)

Many of these lesser-known or uncommon vegetables are associated with a wealth of traditional knowledge, including cultural beliefs about their purported health benefits and medicinal properties. This suggests that these plants have the potential as untapped resources for pharmacological research and drug discovery.

In the Singapore Botanic Gardens, a variety of lesser-known edible plants are featured in the Ethnobotany Garden, Eco-Garden (Herbs & Spices), and Healing Garden. Some



A variety of vegetables used in the traditional Malay salad *ulam*, including some specifically used for their medicinal properties. (Photo credit: M. Sugumaran)

of these can also be found as vegetables in wet markets or supermarkets (rarely) in Singapore, where they may be sold with limited or seasonal availability. Here, we present some examples of uncommon vegetables mainly used in Chinese, Malay and Indian cuisine but not restricted to only these ethnic groups.

For many plants, the leaves are the part that is primarily eaten. One such example is *Sesbania grandiflora* (Fabaceae), also known as the hummingbird tree or *agathi keerai* in Tamil. *Sesbania grandiflora* grows as a tree up to 15 m tall with attractive red, pink, or white flowers, and it can be found in the Ethnobotany Garden, Eco-Garden, and Healing Garden. The leaves may be eaten steamed, boiled or mixed in curries, and also dried and made into tea. To a lesser extent, the flowers may be eaten deep-fried or mixed in curries, while the unripe pods may be consumed as string beans. There is also significant traditional medicinal knowledge associated with *Sesbania grandiflora* in Indian culture. It has been used in a multitude of traditional treatments, including to decrease body heat, as a laxative, a cure for depression, blocked nose, headaches and poor vision. In the *Medical Book of Malayan Medicine*, the use of the bark is recommended for tongue and gastrointestinal tract ulcers.

Breynia androgyna (Phyllanthaceae), also known as the sweet leaf bush, *mani chye* in Mandarin and *cekur manis* or *sayur manis* in Malay, is another plant of which the leaves may

be eaten, typically in stir-fry dishes or soups. The very young shoots are considered a delicacy in Malaysia. Studies of the nutrient composition of *Breynia androgyna* have suggested that it has higher protein and Vitamin C contents as compared to other common leafy vegetables. However, the fresh leaves are known to contain high concentrations of papaverine, a vasodilator, and excessive consumption of raw leaves may cause side effects such as drowsiness, constipation and breathing difficulties. Juice extracted from the leaves can also be used as a natural green dye. *Breynia androgyna* grows as a shrub up to 5 m tall and can be found at the Ethnobotany Garden, Eco-Garden, and Healing Garden.

For other plants, flowers and unripe fruits may be eaten as vegetables. *Trichosanthes cucumerina* (Cucurbitaceae), also known as the snake gourd or *petola ular* in Malay, is a plant which climbs by tendrils and bears fruits which are gourds of typically up to 50 cm but can be grown to over 2 m long by hobbyists. In the Singapore Botanic Gardens, it can be seen in the Jacob Ballas Children's



Sesbania grandiflora. (Clockwise from top right) A white-flowered form with fruit pods; Leaflets stir-fried with coconut cream, turmeric powder, onions and various condiments in an Indian dish called *Agathi Keerai Coconut Stir Fry*; Leaves sold as a vegetable in a wet market in Singapore; The plant is also often used in landscaping as the attractive red flowers have ornamental value. (Photo credits: (top left and top right) X.Y. Ng; (bottom left) L. Neo; (bottom right) Lee Wei Qiang)



***Breynia androgyna*.** (Clockwise from top right) Ripening pink fruits which can have ornamental value; Female flowers along a branch; Leaves cooked with egg and other condiments in a dish ‘Stir-Fried Mani Chye with Egg’; Leaves with characteristic white markings. (Photo credits: (top left) L. Neo; (top right and bottom right) X.Y. Ng; (bottom left) Liew Yong Xuan)

Garden. The unripe fruits may be eaten as a vegetable and cooked in curries, especially in Indian cuisine. The ripe fruits are not typically eaten, but the pulp has been used in West Africa as a substitute for tomato paste. There is some pharmacological evidence for the anti-inflammatory and gastroprotective properties of the plant extract.

While the fruits are the most well-known edible product of the banana plant (*Musa acuminata* and its hybrids; Musaceae), the inflorescence, known as *jantung pisang* (literally translated as banana heart) in Malay, is eaten as a vegetable in Southeast Asia and can be prepared in several ways. For example, the inflorescence core can be cooked in curry, the florets can be

deep-fried with batter, and the bracts can be made into a salad. The meat-like texture of the cooked inflorescence has resulted in its popularity as a meat alternative and has been considered the best vegan substitute for fish. The inflorescence has also been used in traditional medicine in many parts of Asia. A common use is for menstrual health. For example, in India and the Philippines, the florets are eaten with curd or yoghurt to treat severe menstrual pain and bleeding. In traditional Thai cuisine, the inflorescence is consumed by breastfeeding mothers to stimulate lactation. There is pharmacological evidence that the inflorescence of *Musa* × *paradisiaca*, the hybrid of *Musa acuminata* and *Musa balbisiana*, is a

natural source of progesterone. In the Singapore Botanic Gardens, various *Musa* species and cultivars are planted in the Ethnobotany Garden, Eco-Garden and Jacob Ballas Children’s Garden, among other locations.

Besides preparation into savoury dishes, edible plants and plant parts may also be used to make medicinal soups and teas, which are consumed for their purported health benefits. *Alternanthera sessilis* ‘Red’ (Amaranthaceae), also known as the red sessile joyweed, *bayam keremak merah* in Malay and *hong tian wu* in Mandarin, is a creeping herbaceous plant with reddish-purple leaves and stems. It may be stir-fried as a vegetable or used to make herbal tea.



Trichosanthes cucumerina. (Top) Unripe fruits on sale in a wet market; (Bottom right) Unripe fruit sliced longitudinally; (Bottom left) After removing the seeds, the unripe fruits may be chopped up and cooked with egg and other condiments in a dish ‘Snake Gourd with Spicy Eggs Stir Fry’. (Photo credits: (top) Bhaskaranaidu [Wikimedia Commons]; (bottom left and bottom right) Ivy Yeo)



An inflorescence of a banana plant *Musa* spp. consists of bracts, florets and a rachis, all of which can be eaten. (A) Cross-sectional view of the inflorescence showing two rows of male florets attached to the inner side of every bract; (B) An overview of the inflorescence and one outermost bract detached showing the structure of the florets. (Photo credit: Ng Zhao Rong)

There is pharmacological evidence for the anti-oxidant properties of phenolic compounds extracted from the plant. Herbal tea mixtures containing the plant are marketed as being able to improve blood circulation and treat high cholesterol. *Alternanthera sessilis* ‘Red’ can be found in the Healing Garden of the Singapore Botanic Gardens. As it is also a popular ornamental plant, *Alternanthera sessilis* ‘Red’ can also be seen in parks and gardens.

Tradescantia spathacea (Commelinaceae), also known as the boat lily or oyster plant and he *bao lan* or *ru yi lan* in Mandarin, is another plant used in herbal remedies. A semi-epiphytic succulent plant, *Tradescantia spathacea* can be recognised by its long fleshy leaves, which are dark green on the upper surface and purple beneath. In the Singapore Botanic Gardens, it can be found in the Ethnobotany Garden, Eco-Garden, and Healing Garden. A beverage prepared from boiled leaves is believed to have anti-inflammatory properties and is used as a remedy for cough in traditional Chinese medicine. There is some pharmacological support for the antioxidant and anti-bacterial properties of the leaves. In Mexico, dried leaves have been used as a beverage to treat cancer, and there is some pharmacological evidence that the leaf extracts contain compounds that may control cancer. *Tradescantia spathacea* is also a popular ornamental plant commonly used in landscaping.

More information about the lesser-known edible plants featured in this article and several other species can be found in an ongoing exhibition at the Centre for Ethnobotany. The content for this exhibition was researched and contributed in part by students at the National University of Singapore Department of Biological Sciences (Faculty of Science) LSM3258 Comparative Botany course in AY2021/2022 Semester 1, under the supervision of course lecturer and coordinator Dr Amy Choong. In the exhibition, brief descriptions of the plants and examples of how they can be prepared for consumption are presented with other known uses of the plants. The exhibition also showcases some literature to which visitors can refer to learn more about uncommon or lesser-known edible



Alternanthera sessilis 'Red'. (Clockwise from left) Plants for sale at a stall selling other local vegetables and fruit trees in Kota Kinabalu, Sabah; Leaves and stems may be boiled with pandan leaves, dried longans, red dates and brown sugar to make a herbal tea that can be served hot or cold; A bowl of cold herbal tea brewed from the plant. (Photo credits: (left) L. Neo; (top right and bottom right) Yee Yan Ling)



Tradescantia spathacea. (Clockwise from top right) Leaves bought from a wet market may be boiled with rock sugar or red sugarcane (*Saccharum officinarum*) for making herbal drinks; A cup of the distinctive purplish herbal tea brewed from the plant; Three-petalled white flowers of the plant are borne close to the ground; Plants showing the characteristic purple under surfaces of the leaves. (Photo credits: (top left) L. Neo; (top right and bottom right) Mandy Wong; (bottom left) X.Y. Ng)

plants from our region. This includes works by I.H. Burkill, the second Director of the Singapore Botanic Gardens, who had a keen interest in economic botany and ethnobotany and compiled or contributed to accounts such as *The Medical Book of Malayan Medicine*, *Malay Village Medicine* and *A Dictionary of the Economic Products of the Malay Peninsula*. Some of these references can be found in the Library of Botany and Horticulture of the Singapore Botanic Gardens.

The exhibition is ongoing at the Centre for Ethnobotany until August 2023. The Centre is open daily from 9 am to 6 pm, except for the last Wednesday of every month. Admission is free, so do stop by on your next visit to the Gardens.

Louise Neo
S.K. Ganesan
Herbarium & Centre for Ethnobotany

A blooming year: Spotlight on the Gardens' named orchid hybrids in 2022

Did you know that the Singapore Botanic Gardens has an orchid hybridisation programme that has been running for nearly a century now? The programme began in 1928 by the director of the Gardens then, Richard Eric Holttum, who got inspired by the hardy and free-flowering *Vanda* Miss Joaquim (*Papilionanthe* Miss Joaquim), which was grown in almost every household then. The production of orchid hybrids was also spurred by the introduction of Lewis Knudson's new method of asymbiotic orchid seed germination at the time. This method accelerated the growth of seedlings in controlled conditions.

Fast forward to 1956, Singapore started honouring visiting heads of state and equivalent VIPs with the special

gesture of naming an orchid hybrid after them, a practice distinctive to Singapore known as orchid diplomacy. The Singapore Botanic Gardens creates these hybrids in a multi-step process that spans two to eight years from pollination to first flowering, depending on the orchid variety. Over these past six decades, the Gardens has produced over 250 orchid hybrids named after VIPs.

While VIP orchid namings have taken place almost every year, 2020 saw this steady momentum abruptly interrupted by the onslaught of the COVID-19 pandemic. Only two orchids were named after VIPs from 2020 to 2021 – *Papilionanda* Kamala Harris and *Dendrobium* Ismail Sabri Yaakob. However, once COVID-19

measures were relaxed locally and worldwide and air travel recovered, the number of state visits to Singapore by foreign dignitaries quickly soared. This led to a surge in orchid namings by the Gardens in 2022. From January through December 2022, 16 orchid hybrids were named after dignitaries, organisations, and important events.

Presented here are the Gardens' named orchid hybrids in 2022, arranged in chronological order of the respective naming ceremonies. Drop by the VIP Garden in the National Orchid Garden for a chance to see some of these orchids and an array of other VIP orchids up close!

Rachel Tan
Whang Lay Keng
National Orchid Garden



(Photo credit: Rachel Tan)

***Dendrobium* Expo 2020 Dubai**

Parentage: *Dendrobium* Peter Furniss × *Dendrobium* Lim Tee Hooi

Naming occasion: This orchid was created by the Singapore Botanic Gardens in honour of Expo 2020 Dubai and to commemorate Singapore's National Day at Expo 2020 Dubai on 22 January 2022.

This orchid produces upright inflorescences of up to 50 cm in length that bear 10 to 23 well-arranged flowers, each flower measuring approximately 5 cm across. The sepals and gracefully twisted petals are golden yellow and beautifully complemented by an earth-tone lip lined with light purple veins.



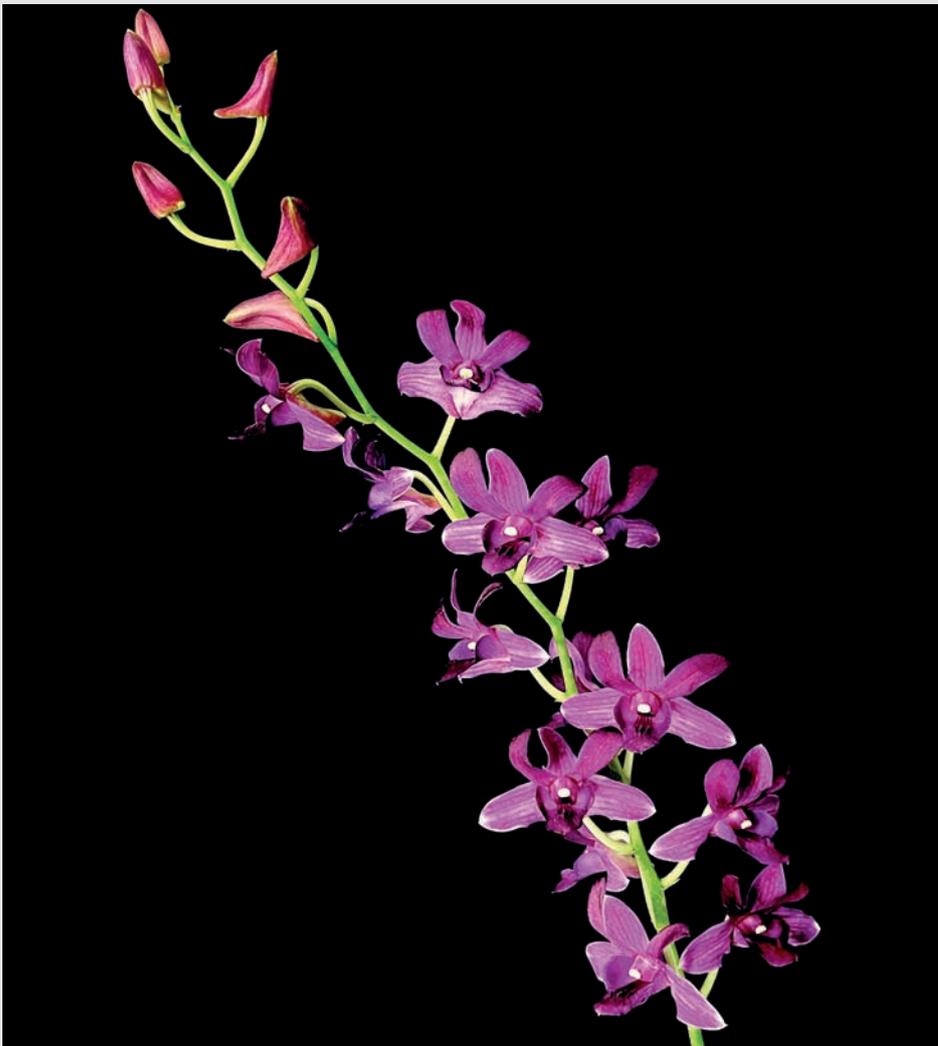
(Photo credit: Rachel Tan)

Dendrobium Jacinda Ardern

Parentage: *Dendrobium* Lim Wen Gin × *Dendrobium* Takashimaya Singapore

Naming occasion: This orchid is named after The Right Honourable Jacinda Ardern, Prime Minister of New Zealand, on 19 April 2022.

This orchid produces semi-erect inflorescences of up to 80 cm in length that bear 23 to 30 well-arranged flowers, each flower measuring approximately 6.5 cm wide. The petals and sepals are white with a flush of orchid purple towards the tips and are delicately complemented by a greenish-white column in the centre.



(Photo credit: Rachel Tan)

Dendrobium Kishida Fumio

Parentage: *Dendrobium* Kiyoshi Blue × *Dendrobium violaceoflavens*

Naming occasion: This orchid is named after His Excellency Kishida Fumio, Prime Minister of Japan, on 11 June 2022.

This orchid produces semi-erect inflorescences of about 50 cm in length that bear around 20 well-arranged flowers, each flower measuring approximately 5 cm across. The magenta sepals, which bear faint pink striations, complement the velvet purple petals and lip.



(Photo credit: Rachel Tan)

Papilionanda Luvsannamsrai Oyun-Erdene

Parentage: *Papilionanda* Josephine van Brero × *Vanda* Fred's Choice
Naming occasion: This orchid is named after His Excellency Luvsannamsrai Oyun-Erdene, Prime Minister of Mongolia, on the occasion of his visit to the National Orchid Garden on 8 July 2022.

This orchid produces sturdy and upright inflorescences of about 40 cm in length that bear around 7 large and attractive flowers, each flower measuring approximately 10 cm wide. The apricot orange petals and sepals are speckled with carmine and delightfully complemented by a prominent red lip.



(Photo credit: Rachel Tan)

Dendrobium Hassanal Saleha

Parentage: *Dendrobium* Singa Friendship × *Dendrobium* Simon Tan
Naming occasion: This orchid is named after His Majesty Sultan Haji Hassanal Bolkiah Mu'izzaddin Waddaulah, Sultan and Yang Di-Pertuan of Brunei Darussalam, and Her Majesty Raja Isteri Pengiran Anak Hajah Saleha on 26 August 2022.

This orchid produces erect inflorescences of about 50 cm in length that bear over 30 well-arranged flowers, each flower measuring approximately 4 cm wide. The sepals have a white background adorned with pink striations, while the royal magenta petals curl gracefully. The sepals and petals are complemented by a delicate lilac lip.



(Photo credit: Rachel Tan)

Dendrobium Ibrahim Zarith

Parentage: *Dendrobium tangerinum* × *Dendrobium* Asian Youth Games Singapore 09
Naming occasion: This orchid is named after His Majesty Sultan Ibrahim Ibni Almarhum Sultan Iskandar, Sultan and Sovereign Ruler of the State and Territories of Johor Darul Ta'zim, and Her Majesty Raja Zarith Sofiah Binti Almarhum Sultan Idris Shah, Permaisuri of Johor, on 20 July 2022.

This orchid produces semi-erect inflorescences of about 45 cm in length that bear 12 to 15 well-arranged flowers, each flower measuring approximately 4.5 cm wide. The ochre petals, overlaid with persian orange, are upright and gracefully twisted, while the sepals curl back elegantly. They are complemented by a golden yellow lip lined with white ridges.



(Photo credit: Rachel Tan)

Dendrobium Ferdinand Louise Marcos

Parentage: *Dendrobium Dr* and *Mrs Hew Choy Sin* × *Dendrobium lineale*

Naming occasion: This orchid is named after His Excellency Ferdinand Romualdez Marcos Jr., President of the Republic of the Philippines, and Mrs Louise Araneta-Marcos on the occasion of their visit to the National Orchid Garden on 7 September 2022.

This orchid produces semi-arching inflorescences of 50 to 70 cm in length, each bearing 20 to 30 well-arranged flowers that measure approximately 4 cm across. The elegantly curled sepals have a white background adorned with lavender striations, while the distinguished petals are white and flushed with bluish mauve. The sepals and petals are beautifully complemented by a captivating violet lip.



(Photo credit: Rachel Tan)

Papilionanda CPIB

Parentage: *Vanda Kulwadee Fragrance* × *Papilionanthe Miss van Deun*

Naming occasion: This orchid was created by the Singapore Botanic Gardens to commemorate the 70th anniversary of the Corrupt Practices Investigation Bureau (CPIB). It was officially named in a ceremony officiated by President Halimah Yacob at the Istana on 21 September 2022.

This orchid produces sturdy and upright inflorescences of about 40 cm in length that bear around 10 large and attractive flowers, each flower measuring approximately 9 cm in width. The brilliant lilac petals and sepals are adorned with prominent orchid purple speckles and are beautifully complemented by a showy magenta lip.



(Photo credit: Rachel Tan)

Dendrobium Phankham Sichanh Viphavanh

Parentage: *Dendrobium Singapore Blue Antler* × *Dendrobium violaceoflavens*

Naming occasion: The orchid is named after His Excellency Phankham Viphavanh, Prime Minister of the Lao People's Democratic Republic, and Mrs Sichanh Viphavanh on the occasion of their visit to the National Orchid Garden on 28 September 2022.

This orchid produces upright inflorescences of about 45 cm in length that bear 15 to 25 well-arranged flowers, each flower measuring approximately 6 cm wide. The wavy sepals have a white background gradually suffused with chartreuse yellow towards the tips, while the elegantly curled petals are golden yellow. The lip beautifully complements them with its captivating violet colour.



Dendrobium Queen Azizah of Malaysia

Parentage: *Dendrobium Istana* × *Dendrobium Lim Tee Hooi*
Naming occasion: This orchid is named after Her Majesty Tunku Hajah Azizah Aminah Maimunah Iskandariah Binti Almarhum Al-Mutawakkil Alallah Sultan Iskandar Al-Haj, Raja Permaisuri Agong of Malaysia on 26 October 2022.

This orchid produces semi-erect inflorescences of about 50 cm in length that bear over 20 well-arranged flowers, each flower measuring approximately 4.5 cm in width. The elegantly curled petals and sepals are golden yellow, complemented by a beautiful magenta lip.

(Photo credit: Whang Lay Kheng)



(Photo credit: Rachel Tan)

Dendrobium Mohammad Shtayyeh

Parentage: *Dendrobium Jaquelyn Thomas* × *Dendrobium Boys' Brigade*
Naming occasion: The orchid is named after His Excellency Dr Mohammad Shtayyeh, Prime Minister of the Palestinian Authority, on the occasion of his visit to the National Orchid Garden on 28 October 2022.

This orchid produces semi-erect inflorescences of 40 to 60 cm in length, each bearing 13 to 25 well-arranged flowers that measure approximately 5 cm across. The velvet violet petals and lip are complemented by magenta sepals outlined with white margins.



(Photo credit: Rachel Tan)

Vanchoanthe SG Families

Parentage: *Papilionanda Josephine van Brero* × *Vandachostylis Thai Noi*
Naming occasion: This orchid was created by the Singapore Botanic Gardens to celebrate SG Families and signify the whole-of-society support for the Year of Celebrating SG Families in 2022. It was officially named in a ceremony officiated by Deputy Prime Minister Heng Swee Keat on 8 November 2022.

This orchid produces sturdy and upright inflorescences of 20 to 32 cm in length. The inflorescence bears around six to 14 attractive flowers, each flower measuring approximately 5 cm across. The apricot orange petals and sepals are beautifully complemented by a golden yellow throat and a captivating salmon pink lip speckled with carmine.



(Photo credit: Rachel Tan)

Renanthera Olaf Scholz

Parentage: *Renanthera* 20th WOC Singapore 2011 × *Renanthera* National Orchid Garden
Naming occasion: This orchid is named after His Excellency Olaf Scholz, Federal Chancellor of the Federal Republic of Germany, on 14 November 2022.

This orchid produces branching sprays of around 60 cm in length, each bearing over 50 well-arranged flowers that measure approximately 4.5 cm in width. The velvety sepals and petals are brilliant crimson red with dark red striations. They are beautifully complemented by the lip, which has a striking lemon-yellow centre.



(Photo credit: Rachel Tan)



(Photo credit: Rachel Tan)

Vanda Benny Lim

Parentage: *Vanda tessellata* × *Vanda arcuata*
Naming occasion: This orchid is dedicated to Mr Benny Lim, Chairman of the National Parks Board (NParks), Singapore, for his role in nurturing generations of public officers and pioneering and guiding the realisation of NParks' City in Nature vision. It was named on 16 November 2022.

This orchid bears fragrant flowers that are attractive for their understated elegance. A primary hybrid between two orchid species, *Vanda Benny Lim* combines the best traits of both its parents and improves upon them to pave the way for new breeding lines.

Dendrobium José Ramos-Horta

Parentage: *Dendrobium* Kiyoshi Blue × *Dendrobium taurinum*
Naming occasion: The orchid is named after His Excellency Dr José Ramos-Horta, President of the Democratic Republic of Timor-Leste, on the occasion of his visit to the National Orchid Garden on 8 December 2022.

This orchid produces semi-arching inflorescences of about 60 cm in length that bear around 25 to 30 well-arranged flowers, each flower measuring approximately 5.5 cm across. The velvet-purple petals and lip are complemented by magenta sepals with faint pink striations.

Women in plant taxonomy



Chang Kiaw Lan, mycologist and Keeper of the Herbarium from 1970–1987, in the Gardens' library in 1999. (Photo credit: Ali Ibrahim)



Ruth Kiew (2nd from left) botanising with colleagues at Bukit Sarang, Sarawak in 2004. (Source: Serena Lee)

The research of the Singapore Botanic Gardens' herbarium and labs revolves around finding, describing and explaining the remarkable plant diversity of our island nation and the wider Southeast Asian region. Over the almost 150 years of research conducted in the Gardens, most of it has been done by male scientists. Nevertheless, even though there have been fewer women researchers in the Gardens over its history, in this article I want to celebrate their work and look more broadly at women in plant taxonomy. Why focus on this? The answer is threefold: firstly, as an organisation, we study and celebrate diversity, and that should begin with us; secondly, by highlighting the contribution of the women of Singapore Botanic Gardens to an understanding of the plant diversity of Southeast Asia, I hope their stories will inspire girls to contemplate studying biology and be the next generation of biodiversity scientists; and thirdly, recent research on success in scientific organisations (as measured by publication impact) has revealed that those with greater numbers of women scientists (and also other measures of diversity such as a range of ages and ethnicities), publish more impactful work. Simply put, organisations that have a more diverse workforce, including in fostering a more equitable gender balance, produce better work than those that lack diversity, quite apart from any moral and social reasons that should also be considered.

Singapore Botanic Gardens' herbarium houses collections from throughout the region and many of these collections were made by women based in a wide variety of research establishments and universities. However, I want to focus on the women who have contributed to the history and research of Singapore Botanic Gardens. Some of these women have had active

scientific careers in the Gardens and other organisations, but here we shall highlight their entire bodies of work. Not all women working in the Gardens have named new species. Still, they have contributed to the furtherance of plant taxonomy in Singapore and the region in other ways, such as in the development and curation of the collection, editing of scientific works, botanical illustration, and in recent years in molecular phylogenetics. And women in the nineteenth and twentieth centuries would often have been the unsung supporters of the male botanists of the Gardens and will have contributed to their work in ways not now known.

Ethel Burkill, the wife of Isaac Henry Burkill who was the Director of Singapore Botanic Gardens from 1912 to 1925, was a keen artist with a particular interest in fungi. She often painted the fungi that she collected (see page 29 and *Gardenwise* 22). These collections accompanied by the paintings have been an invaluable taxonomic resource for a group of organisms that are notoriously difficult to study from dried specimens alone. Several new species of fungi were described from these collections, two of which were named after her.

The mycologist Chang Kiaw Lan was Keeper of the Herbarium from 1970 to 1987 at a time when the research staff of the Gardens was reduced to a skeleton. She kept the herbarium properly curated, enabled visiting researchers to use the collections, and maintained the international profile of the Gardens' research through her editorship of *Gardens' Bulletin Singapore*. Her contemporary, Geh Siew Yin, was employed as a botanist at the Gardens in 1971, collected in the region, and later became Assistant Commissioner of the Botanic Gardens. When Chang Kiaw Lan

retired in 1987, Geh Siew Yin effectively became the Keeper of the Herbarium and from 1987 to 1993 also served as editor of *Gardens' Bulletin Singapore*. It has been noted in other publications that the 1970s and 1980s were a lean period for research at the Gardens and it was primarily these two women who maintained the standards of curation of the herbarium and high standards of editing for *Gardens' Bulletin Singapore* during this time.

I estimate that more than 600 species of land plants have been named by the women of Singapore Botanic Gardens in plant families such as the gingers, begonias, grasses, legumes and the coffee family. Ruth Kiew was Keeper of the Herbarium and editor of *Gardens' Bulletin* from 1997 to 2006 and was one of the key people instrumental in reviving and expanding research in the Gardens. Ruth had a fruitful career in Malaysia before and after she came to Singapore Botanic Gardens. After she left the Gardens, she began work at the Forest Research Institute Malaysia and is now one of the co-editors of the *Flora of Peninsular Malaysia*. Over her career in Singapore and Malaysia, she has been the most prolific author of new plant names of the women of Singapore Botanic Gardens. She has worked on various plant groups but was especially noted for her work on *Begonia*, the Oleaceae and the Gesneriaceae during her time in Singapore. Ruth continues to collaborate closely with the Gardens on projects of mutual interest, including the *Flora of Singapore* project.

Leni Duistermaat is a Dutch botanist who worked at Singapore Botanic Gardens from 2002 to 2005. She specialised in the Poaceae and Commelinaceae during her time at the Gardens. Since returning to the Netherlands, she has continued to collaborate through her work on the



Leni Duistermaat at the Eco-Lake, Singapore Botanic Gardens in 2005.
(Photo credit: Serena Lee)



Jana Leong-Škorničková in the field at Chestnut Peninsula, Central Catchment Nature Reserve, Singapore in 2017.
(Photo credit: Derek Liew)

Poaceae for the *Flora of Singapore* which was published in volume 7 in 2019.

Jana Leong-Škorničková is a Czech botanist who joined Singapore Botanic Gardens in 2006 and conducts research on gingers and other monocot families. With her colleagues in the Gardens and NParks' Native Plant Centre she was instrumental in setting up the *Flora of Singapore*, is the author or co-author on the accounts of four families in volume 7, and is slated to contribute the accounts of several more, including the ginger family. She has been a prolific collector of plant specimens in Southeast Asia, is the author of many new species, including new species endemic to Singapore, and has written many books and research papers.

Carmen Puglisi is an Italian botanist who worked at Singapore Botanic Gardens from 2016 to 2018. During that time, her research focused on the Gesneriaceae, Loganiaceae and Ebenaceae for the *Flora of Thailand* and *Flora of Singapore*. Her work on Gesneriaceae at the Gardens resulted in the publication of many new species. Her account of the Loganiaceae was published in the *Flora of Singapore* volume 13. After leaving the Gardens she continued her research on Ebenaceae at the Royal Botanic Gardens Kew, UK.

Today, the research staff of Singapore Botanic Gardens includes women working on Asparagaceae, Burseraceae, Calophyllaceae, Dilleniaceae, Dioscoreaceae, Fabaceae, Gesneriaceae, Hanguanaceae, Malvaceae, Marantaceae, Nyctaginaceae, Orchidaceae, Rubiaceae, Sapotaceae, Zingiberaceae, introduced species, fungi and more. There are currently more women, all from Singapore,



Serena Lee, herbarium manager-cum-mycologist, making a collection of Veiled Stinkhorn, *Phallus multicolor*, off Commonwealth Drive, Singapore.
(Photo credit: Chan Wai Yeng)

in our youngest cohort of research staff than men. Six of the seven plant families published in the *Flora of Singapore* volume 7 were contributed or co-authored by women taxonomists. Many of the plant families awaiting publication in future volumes have been or will be contributed by women researchers, both from the staff of the Gardens and from our network of international collaborators. The taxonomic output of the herbarium is complemented by research in the Molecular Lab. The lab was first established and is led by Gillian Khew, who, with her team, conducts research on plant phylogenetics and population genomics. The herbarium and the molecular lab teams are supported by the library, which is led by Nura Abdul Karim. Can we yet boast an equal gender balance in staff and scientific output? Well, maybe not yet, but we have grounds for optimism that not only will we see an equitable balance in the near future but that the women of Singapore Botanic Gardens will be driving research on plant diversity in Singapore and the wider region for many years to come.

David Middleton
Herbarium

As discussed in *Gardenwise* 56, plant taxonomic research has long benefitted from accessible databases of plant names, most notably the International Plant Names Index (IPNI). In a paper published in 2015, a group of authors, primarily from the Royal Botanic Gardens Kew and led by Heather Lindon, interrogated this database to produce statistics on the contribution of women to the publication of new plant names over time. The Linnaean system of plant nomenclature began in 1753 with the publication of Linnaeus's *Species Plantarum*. With only a few overlooked exceptions that are added when found, every plant name published since 1753 is included in IPNI, thereby giving us 270 years of data on who is publishing plant names and, with some additional work to assess the gender of the numerous authors of these names, we have access to an unparalleled source of data on women's contribution to plant taxonomic research for that entire period. A number of caveats should be borne in mind: publication of new names is only one aspect of taxonomic research, women's contributions have not always resulted in inclusion as authors of names, and from names alone it is not always possible to assign a gender to an otherwise unknown author. Lindon and her colleagues could not assign a gender to around a quarter of all authors. Nevertheless, the IPNI data can act as a proxy for women's taxonomic research and as a launchpad to further study.

The headline findings of the study by Lindon and her colleagues are that over the last 270 years, for those authors to whom a gender could be assigned (around $\frac{3}{4}$ of the total), women make up about 12% of the authors of plant names and that altogether only about 3% of plant names include at least one woman as an author. The earliest name published by a woman, Elizabeth Blackwell in 1757, was the ginger *Amomum verum*. However, over much of the history of plant taxonomic research, women have constituted only a tiny fraction of the authors of plant names. The number of new names published by men is still much greater than those published by women, reflecting the fact that there are still many more male plant taxonomists than female ones.

But it is changing. In 2015, about 12% of new plant names were being published by women, still rather low but nevertheless a notable increase. It is to be seen when parity will be reached, especially for the total number of new names being equally published by men and women, but we have a long way to go. We need not go into the reasons why here, suffice to say that in science as in all areas of life, men have dominated. As barriers to women's more equitable participation in the workforce are lifted, these will benefit all sectors of society, including science and thereby plant taxonomy.

Publications by Gardens' staff in 2022

BOOKS

Lindsay, S., Middleton, D.J., Ho, B.C., Chong, K.Y., Turner, I.M., Ali Ibrahim, Alonso-García, M., Ang, W.F., Ashton, P.S., Ather, P., Atkins, S., Baziliah Ibrahim, Beentje, H.J., Boo, C.M., Boyce, P.C., Bramley, G.L.C., Buerki, S., Callmander, M.W., Chantanaorrapint, S., Cheek, M., Chen, C.-W., Chen, J., Chen, L.M.J., Chew, P.T., Chong, R., Choo, L.M., Chung, R.C.K., Coode, M.J.E., Chua, S.C., Cicuzza, D., de Kok, R.P.J., Davison, G.W.H., de Wilde, W.J.O., Duistermaat, H., Dubéarnès, A., Duyfjes, B.E.E., Ellis, L.T., Esser, H.-J., Gajurel, P.R., Gale, S.W., Ganesan, S.K., Gardner, E.M., Geiger, D.L., Harwood, R.K., Hassan Ibrahim, He, S., Henderson, A., Hovenkamp, P.H., Hughes, M., Zaki Jamil, Jebb, M.H.P., Johnson, D.M., Kartonegoro, A., Kiew, R., Knapp, S., Koh, S.L., Kurzweil, H., Lee, S., Leong, P.K.F., Leong-Škorničková, J., Levin, G.A., Liew, D.C.H., Lim, R.C.J., Lim, W.H., Loo, A.H.B., Low, Y.W., Lua, H.K., Lum, S., Mabberley, D.J., Mahyuni, R., Maslin, B., Murray, N.A., Neo, L., Ng, X.Y., Ngo, K.M., Niissalo, M.A., Ong, P.T., Pannell, C.M., Phang, A., Prance, G.T., Promma, C., Puglisi, C., Rodda, M.L., Rubasinghe, S.C.K., Saunders, R.M.K., Savinov, I.A., Saw, L.G., Schuiteman, A., Seah, W.W., Simpson, D.A., Strijk, J.S., Sukkharak, P., Sugumaran, M., Syahid-Emiza, S., Tan, J.P.C., Taylor, N.P., Teo, Y.K.L., Thomas, D.C., Trias-Blasi, A., Uteridge, T., van Welzen, P.C., Veldkamp, J.F., Vermeulen, J., Wang, R., Wilkie, P., Wei, Y.-M., Wong, S.Y., Wong, K.M., Yaakub, S., Yam, T.W., Yang, S., Yao, T.L., Ye, W., Yee, A.T.K., Yeo, C.K., Yeoh, Y.S., Yong, C., Yong, K.T., Zerega, N.J.C., Zhu, R.-L. & Er, K.B.H. (2022). Flora of Singapore: Checklist and bibliography. *Gardens' Bulletin Singapore* 74(Suppl. 1): 3–860.

Rodda, M. (2022). *Flower Obsession: Plant Collecting in East Asia, 1600s–1900s*. Singapore: National Parks Board.

BOOK CHAPTERS

Eiadthong, W., Chen, J., Insura, T. & Chalermglin, P. (2022). Artabotrys. In: Johnson, D. & Murray, N.A. (ed.) *Flora of Thailand*, vol. 16, part 1, *Amonaceae*, pp. 38–56. Thailand: The Forest Herbarium.

Rodda, M. (2022). Nature Printing in Japan. In: Zucker, M. & Ostlund, P. (ed.) *Capturing Nature*, pp. 208–209. New York: Zucker Art Books.

Strijk, S.J., Hingsinger, D.D., Roeder, M.M., Chatrou, L.W., Couvreur, T.L.P., Erkens, R.H.J., Sauquet, H., Pirie, M.D., Thomas, D.C. & Cao, K. (2022). The Sourp Genome (*Ammonia muricata*). In: Chapman, M.S. (ed.) *Underutilised Crop Genomes: Compendium of Plant Genomes*, pp. 149–174. Springer.

CONSERVATION ASSESSMENTS

Chua, L.S.L., Cicuzza, D., Ganesan, S.K., Hamidi, A., Rachmat, H.H., Julia, S., Khoo, E., Kusumadewi, Y., Ling, C.Y., Maycock, C.R., Randi, A., Robiansyah, I., Strijk, J.S., Tsen, S., Bodos, V., Nilus, R., Sugau, J. & Pereira, J.T. (2022). Conservation assessments for a *Dipterocarpaceae* sp., 3 *Hopea* species and a *Shorea* sp. *The IUCN Red List of Threatened Species* 2022: [D. palembanicus] e.T63019A143158115; [H. bracteata] e.T36283A122855161; [H. dyerii] e.T36285A125629909; [H. novoguineensis] e.T37523A171989515; [S. scrobiculata] e.T36353A171989447.

Chua, L.S.L., Cicuzza, D., Ganesan, S.K., Hamidi, A., Rachmat, H.H., Julia, S., Khoo, E., Kusumadewi, Y., Ling, C.Y., Maycock, C.R., Randi, A., Robiansyah, I., Strijk, J.S., Tsen, S., Bodos, V., Nilus, R., Sugau, J., Pereira, J.T., Tobias, A.B. & Malabrigo, P. (2022). Conservation assessments for *Shorea* spp. *The IUCN Red List of Threatened Species* 2022: [S. fulcifloroides] e.T33413A114505436; [S. virescens] e.T36349A114505572.

JOURNAL ARTICLES

Ardi, W.H. & Thomas, D.C. (2022). Synopsis of *Begonia* (Begoniaceae) from the northern arm of Sulawesi, Indonesia, including three new species. *Edinburgh Journal of Botany* 79 (*Begonia* special issue, article 405): 1–50.

Ardi, W.H., Ardaka, I.M., Kusuma, Y.W.C., Lewis, C.L. & Thomas, D.C. (2022). Studies of *Begonia* (Begoniaceae) from the Moluccas IV: Two new species from Halmahera, Indonesia. *Taiwania* 67(3): 335–340.

Ashokan, A., Suksathan, P., Leong-Škorničková, J., Newman, M., Kress, W.J. & Gowda, V. (2022). Floral evolution and pollinator diversification in *Hedydium*: Revisiting Darwin's predictions using an integrative taxonomic approach. *American Journal of Botany* 109(9): 1410–1427.

Ashokan, A., Xavier, A., Suksathan, P., Ardiyani, M., Leong-Škorničková, J., Newman, M., Kress, W.J. & Gowda, V. (2022). Himalayan orogeny and monsoon intensification explain species diversification in an endemic ginger (*Hedydium*: Zingiberaceae) from the Indo-Malayan realm. *Molecular Phylogenetics and Evolution* 170: 107440

Bai, L., Leong-Škorničková, J. & Xia, N.H. (2022). Typification of Adanson's generic name *Pacoseroica* (Zingiberaceae) and its implications. *Taxon*: doi.org/10.1002/tax.12773.

Bai, L., Xia, N.H. & Leong-Škorničková, J. (2022). Proposal to reject the name *Pacoseroica* (Zingiberaceae). *Taxon* 71(4): 907–908.

Begonia Phylogeny Group [Ardi, W.H., Campos-Domínguez, L., Chung, K.-F., Dong, W.-K., Drinkwater, E., Fuller, D., Gagul, J., Garnett, G.J.L., Girmansyah, D., Goodall-Copestake, W.P., Hughes, M., Jacques, E.L., Jara-Muñoz, O.A., Julia, S., Kidner, C.A., Kiew, R., Krishna, N., Li, R., Marasinghe, L.D.K., Maw, M.B., Lin, C.W., Moonlight, P.W., Nguyen, H.T., Nguyen, H.Q., Phutthai, T., Pradeep, A.K., Rajbhandary, S., Rubite, R.R., Scherberich, D., Souvannakhoummane, K., Sreenath, M., Tebbitt, M.C., Thomas, D.C., Tian, D., Tseng, Y.-H. & Wilson, H.P.] (2022). Resolving phylogenetic and taxonomic conflict in *Begonia*. *Edinburgh Journal of Botany* 79 (*Begonia* special issue, article 1928): 1–28.

Böhmová, A., Leong-Škorničková, J., Šida, O., Poulsen, A.D., Newman, M.F. & Fer, T. (2022). Next-generation sequencing data show rapid radiation and several long-distance dispersal events in early Costaceae. *Molecular Phylogenetics and Evolution* 179: 107664

Chan, P.J., Lam, W.N., Ting, Y.Y., Phang, A., Chong, R., Rahman, N.E. & Chong, K.Y. (2022). Towards a field guide to the trees of Nee Soon Swamp Forest (VIII): Sapotaceae. *Nature in Singapore* (Supplement 1): e2022074.

Chen, J. & Wong, K.M. (2022). *Timonius hughtanii*, a new species from Borneo. *Nature in Singapore* (Supplement 1): e2022071.

Choo, L.M., Ang, W.F., Loo, A.H.B. & Er, K.B.H. (2022). Unravelling the identity of *Sindora* (Fabaceae, Detarioideae) trees in the historical landscapes of Singapore. *Gardens' Bulletin Singapore* 74(2): 159–181.

Choo, L.M., Chen, L.M.J. & Turner, I.M. (2022). Flora of Singapore precursors, 31: The genus *Boerhavia* (Nyctaginaceae) in Singapore and clarification of *Boerhavia diffusa* in Singapore and Peninsular Malaysia. *Gardens' Bulletin Singapore* 74(1): 19–36.

Choo, L.M., Loo, A.H.B., Ang, W.F. & Er, K.B.H. (2022). A natural hybrid of *Sindora* (Fabaceae, Detarioideae) from Singapore. *PhytoKeys* 190: 87–102.

Choo, L.M., Ng, X.Y. & Lua, H.K. (2022). Rediscovery and lectotypification of a native vine, *Plukenetia corniculata* Sm. (Euphorbiaceae) in Singapore. *Nature in Singapore* 15: e2022001.

Cvetkovic, T., Hingsinger, D.D., Thomas, D.C., Wieringa, J.J., Velutham, E. & Strijk, J.S. (2022). Phylogenomics and a revised classification of subfamily Dipteroocarpoideae (Dipterocarpaceae). *Taxon* 71(1): 85–102.

Deshmukh, U.B., Majumdar, S. & Ho, B.-C. (2022). *Daltonia hookeriana*, a new name for *Daltonia heterophylla* (Wilson ex Mitt.) B.C.Ho & L.Pokorny (Daltoniaceae, Bryophyta). *Phytotaxa* 538: 84–86.

Er, K.B.H., Chong, K.Y., Ang, W.F., Ng, X.Y. & Loo, A.H.B. (2022). Three decades of floristic inventory, description and recovery efforts in Singapore. *Nature in Singapore* (Supplement 1): e2022067.

Fu, L.F., Wen, F., Maurin, O., Rodda, M., Gardner, E.M., Xin, Z.B., Wei, Y.G. & Monro, A.K. (2022). A revised delimitation of the species-rich genus *Pilea* (Urticaceae) supports the resurrection of *Achudemia* and a new infrageneric classification. *Taxon*: doi.org/10.1002/tax.12711

Ganesan, S.K. (2022). Flora of Singapore precursors, 29. Typifications in Dipteroocarpaceae. *Kew Bulletin* 77: 773–779.

Ganesan, S.K. (2022). Flora of Singapore precursors, 33: Further typifications and notes on Dipteroocarpaceae. *Gardens' Bulletin Singapore* 74(2): 145–149.

Ganesan, S.K. & Neo, L. (2022). Lectotypification of the Linnaean plant name *Durio zibethinus* (Malvaceae), based on Rumphius's illustration. *Taxon* 71(4): 897–899.

Gardner, E.M., Jimbo, T. & Zerega, N.J.C. (2022). *Artocarpus buyangensis*, a new species from Papua New Guinea. *Systematic Botany* 47(2): 452–456.

Goh, T.A., Ramchunder, S.J. & Ziegler, A.D. (2022). Low presence of potentially toxic elements in Singapore urban garden soils. *CABI Agriculture and Bioscience* 3: 60 (2002).

Hlavatá, K., Leong-Škorničková, J., Závěská, E., Šida, O., Newman, M., Mandáková, T., Lysak, M.A., Marhold, K. & Fer, T. (2022). Phylogenomics and genome size evolution in *Amomum* s.s. (Zingiberaceae): Comparison of traditional and modern sequencing methods. *Molecular Phylogenetics and Evolution* 178: 107666.

Ho, B.-C., Alonso-García, M., Chantanaorrapint, S., Ellis, L.T., Promma, C., Rubasinghe, S.C.K., Wei, Y.-M., Ye, W. & Yong, K.-T. (2022). Additions to the bryophyte flora of Singapore. *Herzogia* 35(2): 420–442.

Ho, B.C. & Lua, H.K. (2022). Flora of Singapore precursors, 32: Discoveries in *Mucuna* (Leguminosae, subfamily Papilionoideae) with a review of the genus in Singapore. *Gardens' Bulletin Singapore* 74(1): 37–55.

Hung, S.M.X., Seah, W.W. & Chong, K.Y. (2022). Towards a field guide to the trees of the Nee Soon Swamp Forest (VI): Calophyllum. *Nature in Singapore* (Supplement 1): e2022072.

Kurzweil, H., Tanaka, N., Mu Mu Aung & Ormerod, P. (2022). A new species of *Luisia* (Orchidaceae) from Shan State, Myanmar. *Gardens' Bulletin Singapore* 74(2): 251–256.

Lai, H.R., Chong, K.Y. & Yee, A.T.K. (2022). Ten years after: What we learned from the Mandai storm forest. *Nature in Singapore* (Supplement 1): e2022121.

Lam, W.N., Loh, J.W., Chong, R., Ting, Y.Y., Chan, P.J., Nur Estya Rahman & Chong, K.Y. (2022). Towards a field guide to the trees of the Nee Soon Swamp Forest (VII): Phyllanthaceae. *Nature in Singapore* (Supplement 1): e2022073.

Lee, S.M.L. (2022). The status of bioluminescent fungal species in Singapore. *Nature in Singapore* (Supplement 1): e2022124.

Leong-Škorničková, J., Böhmová, A. & Tran, H.D. (2022). A new species and a new combination in basally flowering Vietnam Costaceae. *PhytoKeys* 190:103–111.

Leong-Škorničková, J., Soonthornkalump, S., Niewesrat, S. & Lim, S.Q. (2022). *Curcuma lindstromii* (Zingiberaceae: Zingiberoideae), a new species from southeastern Thailand. *Gardens' Bulletin Singapore* 74(2): 243–250.

Li, L., Chen, X., Fang, D.-M., Dong, S., Xing, G., Li, N., Campos-Domínguez, L., Wang, W., Liu, Y., Lang, X., Peng, Y., Tian, D., Thomas, D.C., Mu, W., Liu, M., Wu, C., Yang, T., Zhang, S., Yang, L., Yang, J., Liu, Z.-J., Zhang, L., Zhang, X., Chen, F., Jiao, Y., Guo, Y.-L., Hughes, M., Wang, W., Liu, X., Zhang, C., Li, A., Sahu, S.K., Yang, H., Wu, E., Sharbough, J., Lisby, M., Liu, X., Xu, X., Soltis, D., van der Peer, Y., Kidner, C., Zhang, S. & Liu, H. (2022). Genomes shed light on the evolution of *Begonia*, a mega-diverse genus. *New Phytologist* 234(1): 295–310.

Liede-Schumann, S., Reuss, S.J., Meve, U., Gateble, G., Livshultz, T., Forster, P.L., Wanntorp, L. & Rodda, M. (2022). Phylogeny of Marsdenieae (Apocynaceae, Asclepiadoideae) based on chloroplast and nuclear loci, and a conspectus of the genera. *Taxon*: doi.org/10.1002/tax.12713

Lim, J., Chong, R., Chia, Z., Teo, J. & Ang, W.F. (2022). Biodiversity Record: New locality record for the palm, *Pinanga simplicifrons*, in Singapore. *Nature in Singapore* 15: e2022043.

- Lim, R.C.J., **Chan, P.J.** & Ng, X.Y. (2022). Cone to seed: Hand-pollination and seed germination of *Cycas edentata* de Laub. (Cycadaceae) in Singapore. *Nature in Singapore* (Supplement 1): e2022122.
- Lim, V.-C., Sing, K.-W., **Chong, K.Y.**, Jaturas, N., Dong, H., Lee, P.-S., Nguyen, T.T., Dzung T.L., Tsang, T.P.N., Chu, L., Brandon-Mong, G.-J., Kong, W.-L., Soga, M. & Wilson, J.-J. (2022). Familiarity with, perceptions of and attitudes toward, butterflies of urban park users in megacities across East and Southeast Asia. *Royal Society Open Science* 9: 220161.
- Low, Y.W.**, Rajaraman, S., Tomlin, C.M., Joffre, A.A., Ardi, W., Armstrong, K., **Athen, P.**, Berhaman, A., Bone, R., Cheek, M., Cho, N.R.W., **Choo, L.M.**, Cowie, I., Crayn, D., Fleck, S.J., Ford, A.J., Forster, P.I., Girmansyah, D., Goyder, D., Gray, B., Heatubun, C.D., **Ibrahim, A.**, **Ibrahim, B.**, Jayasinghe, H.D., Muhammad Ariffin, A.K., Kathiriarachchi, H., Kintamani, E., **Koh, S.L.**, Lai, J.T.K., **Lee, S.M.L.**, **Leong, P.K.F.**, **Lim, W.H.**, Lum, S.K.Y., Mahyuni, R., McDonald, W.J.F., Metali, F., Mustaqim, W.A., Naiki, A., Ngo, K.M., **Niissalo, M.**, Ranasinghe, S., Repin, R., Rustiami, H., Simbiak, V., Sukri, R.S., Sunarti, S., Trethowan, L., Trias-Blasi, A., Vasconcelos, T.N.C., Wanma, J.F., Widodo, P., Wijesundara, D.S., Worboys, S., Yap, J.W., Yong, K.T., **Khew, G.S.W.**, Salojarvi, J., Michael, T.P., **Middleton, D.J.**, Burslem, D.F.R.P., Lindqvist, C., Lucas, E.J. & Albert, A.A. (2022). Genomic insights into rapid speciation within the world's largest tree genus *Syzygium*. *Nature Communications* 13: 5031 (2022).
- Middleton, D.J.**, Atkins, S., Beentje, H.J., **Chen, L.M.J.**, **Choo, L.M.**, **de Kok, R.P.J.**, de Wilde, W.J.J.O., Duyfjes, B.E.E., **Ho, B.C.**, Lindsay, S. & Lua, H.K. (2022). Additions to the Flora of Singapore: New and overlooked records of casual and naturalised plant species (6). *Gardens' Bulletin Singapore* 74(1): 57–70.
- Niissalo, M.A.**, **Gardner, E.M.**, **Khew, G.S.**, Šída, O., Poulsen, A.D. & **Leong-Škorničková, J.** (2022). Whence came these plants most foul? Phylogenomics and biogeography of Lowiaceae (Zingiberales). *Frontiers in Ecology and Evolution* 9: doi.org/10.3389/fevo.2021.794977
- Ormerod, P., **Kurzweil, H.** & Ba Vuong Truong (2022). Additional notes on the orchid flora of Myanmar and some other ancillary studies. *Harvard Papers in Botany* 27(1): 61–73.
- Phang, A.**, Atkins, H. & Wilkie, P. (2022). The effectiveness and limitations of digital images for taxonomic research. *Taxon* 71(5): 1063–1076.
- Rahayu, S., Ahmad, R.P.P. & **Rodda, M.** (2022). Hoya of Sulawesi, Indonesia: A checklist, two new species, a new subspecies and six new records. *Gardens' Bulletin Singapore* 74(2): 207–221.
- Randi, A., Wijedasa, L. & **Thomas, D.C.** (2022). *Disepalum rawagambut* (Annonaceae), a new tree species from peat swamp forest of Sumatra, Indonesia. *Phytotaxa* 530(1): 121–126.
- Rodda, M.** & Rahayu, S. (2022). Nine new species and one new subspecies of *Hoya* (Apocynaceae: Asclepiadoideae) from Borneo. *Gardens' Bulletin Singapore* 74(1): 101–129.
- Rodda, M.** & Simonsson, N. (2022). Contribution to a revision of *Hoya* of Papuaia. Part II: eight new species, one new subspecies. *Blumea* 67(2): 139–155.
- Sim, D.Z.H., Mowe, M.A.D., **Chong, K.Y.** & Yeo, D.C.J. (2022). An overview and checklist of non-native and cryptogenic vascular macrophytes in Singapore's fresh waters. *Nature in Singapore* (Supplement 1): e2022120.
- Sim, H.J., Lam, W.N., Chisholm, R.A. & **Chong, K.Y.** (2022). Downstream resource leakage a necessary condition for the Stress-Gradient Hypothesis in processing chain commensalisms. *Journal of Theoretical Biology* 538: 111043.
- Smith, S.W., Rahman, N.E.B., Harrison, M.E., Shiodera, S., Giesen, W., Lampela, M., Wardle, D.A., **Chong, K.Y.**, Randi, A., Wijedasa, L.S., Teo, P.Y., Fatimah, Y.A., Teng, N.T., Yeo, K.Q.J., Alam, M.J., Sintes, P.B., Darusman, T., Graham, L.L.B., Katoppo, D.R., Kojima, K., Kusin, K., Lestari, D.P., Metali, F., Morrogh-Bernard, H.C., Nahor, M.B., Napitupulu, R.R.P., Nasir, D., Nath, T.K., Nilus, R., Norisada, M., Rachmanadi, D., Rachmat, H.H., Capilla, B.R., Salahuddin, Santosa, P.B., Sukri, R.S., Tay, B., Tuah, W., Wedeux, B.M.M., Yamanoshita, T., Yokoyama, E.Y., Yuwati, T.W. & Lee, J.S.H. (2022). Tree species that 'live slow, die older' enhance tropical peat swamp restoration: evidence from a systematic review. *Journal of Applied Ecology* 59: 1950–1966.
- Soonthornkalump, S., Kongphapa, J., Vianmana, S., Kunlapa, N. & **Leong-Škorničková, J.** (2022). *Curcuma stahlianthoides*, a new species from northeastern Thailand dispersed by ants. *Blumea* 67: 71–75.
- Sugumaran, M., Wong, V.W.C. & **Wong, K.M.** (2022). The importance of tree stands for natural regeneration and population maintenance of *Porterandia scortechinii* (Rubiaceae), an endemic tree in the Malay Peninsula. *Sandakania* 23: 1–18.
- Sunarti, S., Rugayah, **Low, Y.W.** & Lucas, E.J. (2022). *Syzygium nusatenggaraense* (Myrtaceae), a new rainforest tree species with a calyptrate calyx from the Lesser Sunda Islands, Indonesia. *Telopea* 25: 1–6.
- Teo, S. & **Neo, L.** (2022). Towards an automated workflow for gathering plant phenology data from crowd-sourced photographs. *Nature in Singapore* (Supplement 1): e2022123.
- Terra, V., Ringelberg, J.J., **Maslin, B.R.**, Koenen, E.J.M., Ebinger, J.E. & Seigler, D. (2022). Dilemmas in generic delimitation of *Senegalia* and allies (Caesalpinioideae, mimosoid clade): how to reconcile phylogenomic evidence with morphology and taxonomy? *PhytoKeys* 205: 261–278.
- Turner, I.M.** (2022). Singapore as a type locality for angiosperm taxa. *Nature in Singapore* (Supplement 1): e2022069.
- Turner, I.M.** (2022). A new combination in *Rennellia* (Rubiaceae). *Thai Forest Bulletin (Botany)* 50: 52–55.
- Turner, I.M.** (2022). From Tranquebar to Madras and back again, again: Typification of the plant names published in Rottler's account of an Indian journey in 1799–1800. *Taxon* 71: 447–458.
- Turner, I.M.** (2022). Proposal to conserve the name *Mitrella* against *Pyramidanthe* (Annonaceae). *Taxon* 71: 476–477.
- Turner, I.M.** (2022). Proposal to conserve the name *Magnolia oblonga* (Wall. ex Hook. f. & Thomson) Figlar (Magnoliaceae) against *M. oblonga* M.Chandler (fossil Magnoliaceae). *Taxon* 71: 479.
- Turner, I.M.** (2022). Proposal to conserve the name *Pycnarrhena* against *Antitaxis* (Menispermaceae). *Taxon* 71: 697–698.
- Turner, I.M.** (2022). Proposal to conserve the name *Engelhardia roxburghiana* (Juglandaceae) with a conserved type. *Taxon* 71: 1320–1321.
- Turner, I.M.** (2022). An overlooked name provides the basionym for a new combination in Malagasy *Tarenna* (Rubiaceae). *Candollea* 77(2): 237–240.
- Turner, I.M.** (2022). Correcting a minor error: A new name for a Marantaceae species from New Guinea. *Reinwardtia* 21(2): 81–82.
- Turner, I.M.** (2022). Flora of Singapore precursors, 30. Notes on Symplocaceae in Singapore. *Gardens' Bulletin Singapore* 74: 5–18.
- Turner, I.M.** (2022). From *Acacia* to *Ziziphus*: Plant names commemorating the botanist William Roxburgh. *Edinburgh Journal of Botany* 79(Art. 1911): 1–102.
- Turner, I.M.** (2022). New name for a species of *Cinnamomum* (Lauraceae) from the Philippines. *Philippine Journal of Science* 151(5): 1747.
- Turner, I.M.** & Cheek, M. (2022). Jack's appendix: when did it come out? *Taxon* 71: 682–685.
- Turner, I.M.** & García, M.A. (2022). Proposal to reject the name *Cuscuta aggregata* (Convolvulaceae). *Taxon* 71: 909–910.
- Turner, I.M.** & Kumar, A. 2022. Prain's *Erycibe* (Convolvulaceae) types. *Webbia* 77: 169–172.
- Turner, I.M.** & **Leong, P.K.F.** (2022). *Pycnarrhena* (Menispermaceae), a new generic record for the native flora of Singapore. *Gardens' Bulletin Singapore* 74: 139–144.
- Voto P, **Lee S.M.L.**, Dibán, M.J., Maraia, G. (2022). *Rachipsathyra*, a new genus in Psathyrellaceae - Part I. *Mycological Observations* 4: 11–12.
- Wong, K.M.** & **Chen, J.** (2022). The *Timonius* conundrum: Taxonomic deliberations around a complex alliance in the Rubiaceae. *Nature in Singapore* (Supplement 1): e2022070.
- Yam, T.W.** (2022). Breeding with *Dendrobium lasianthera* at the Singapore Botanic Gardens. *Malayan Orchid Review* 55: 21–28.
- Zou, J., Ziegler, A.D., Chen, D., McNicol, G., Ciais, P., Jiang, X., Zheng, C., Wu, J., Wu, J., He, X., Brown, L.E., Holden, J., Zhang, Z., **Ramchunder, S.J.**, Chen, A. & Zheng, Z. (2022). Rewetting global wetlands effectively reduces major greenhouse gas emissions. *Nature Geoscience* 15: 627–632.

MAGAZINE ARTICLES

Chen, M.L. & **Tan, H.M.** (2022). From Education Outreach: Marvellous Trees, a programme for preschools. *Gardenwise* 59: 34.

Chia, E. (2022). Exploring the origins of a remnant of early ornamental cast ironwork. *Gardenwise* 58: 13–15.

Chia, E. (2022). Shedding light on House 6 and the Field Assistant's residence with historical maps. *Gardenwise* 59: 6–10.

Chong, K.Y., **Khew, G.**, **Middleton, D.**, **Thomas, D.** & **Wong, K.M.** (2022). Nurturing the next generation of botanists. *Gardenwise* 59: 21–23.

Ganesan, S.K. & **Neo, L.** (2022). The King of Fruits: Ethnobotany and diversity of the durians. *Gardenwise* 58: 23–26.

Ho, B.C. & **Chen, L.** (2022). Edible legume flowers in Asia. *Gardenwise* 59: 2–5.

Ho, B.C. & **Wong, R.** (2022). A new record of plant species for Singapore growing on the Lady McNiece tree. *Gardenwise* 58: 2–4.

Law, I.S., Law, I.T., Wan, A., **Lai, S.** & **Lim, J.** (2022). Monitoring the monitors. *Gardenwise* 58: 16–18.

Lee, S. & Jaya Seelan, S.S. (2022). From the Earth: Edible fungi in Sabah and Singapore. *Gardenwise* 59: 30–33.

Low, Y.W. (2022). The looped string or woven bags of New Guinea. *Gardenwise* 58: 19–22.

Middleton, D. (2022). Around the Gardens: The 18th Flora of Thailand Conference, Singapore, July 2022. *Gardenwise* 59: 39.

Middleton, D., Lindsay, S., **Ho, B.C.**, **Chong, K.Y.** & **Turner, I.** (2022). From the Taxonomy Corner: A new checklist and bibliography of the plant diversity of Singapore. *Gardenwise* 59: 24–25.

Middleton, D. (2022). From the Taxonomy Corner: Endemic species in Singapore. *Gardenwise* 58: 27–28.

Nura, A.K. (2022). Around the Gardens: Extending a welcome to the National Research and Innovation Agency of the Republic of Indonesia. *Gardenwise* 59: 37–38.

Nura, A.K. (2022). What's Blooming: The Golden Gardenia, a garden showstopper! *Gardenwise* 58: 34–35.

Nura, A.K. (2022). What's Blooming: Coming of age, the first blooms of a maiden. *Gardenwise* 59: 35–36.

Nurul Izzah, T. & **Chia, E.** (2022). *Shorea macroptera*, one tree's legacy. *Gardenwise* 58: 5–7.

Rodda, M. (2022). From the Archives: Banks' Florilegium. *Gardenwise* 58: Back cover.

Rodda, M. (2022). Flower Obsession: Plant Collecting in East Asia, 1600s–1900s. *Gardenwise* 59: 15–19.

Rodda, M. (2022). From the Archives: Corner and his monkeys. *Gardenwise* 59: Back cover.

Rodda, M. (2022). Pen and ink illustrations from the Singapore Botanic Gardens Archives. *Gardenwise* 58: 38–40.

Tan, B. & **Tandon, R.** (2022). Building water resilience at the Singapore Botanic Gardens. *Gardenwise* 59: 11–14.

Tan, J. (2022). Around the Gardens: Trees of the World 2021. *Gardenwise* 58: 36–37.

Tan, R. & **Whang, L.K.** (2022). The SGF Hort Show 2021 Orchid Competition. *Gardenwise* 58: 8–12.

Whang, L.K. (2022). Around the Gardens: Spotlight on the Gardens' recently named hybrids. *Gardenwise* 58: 41.

Plants with a lemon-like scent

We often hear the saying, “When life gives you lemons, make lemonade”. It tells us to make the best out of the challenging situation that we are in. This sour-tasting fruit is not something terrible that we would want to avoid. It is such a fixture in our lives that you will almost always find it in the supermarket fresh produce section and one of the most versatile ingredients used to make a wide range of food, household, lifestyle and wellness products. Lemon (*Citrus × limon*) is a shrub or small tree from the citrus family, Rutaceae, that produces the familiar yellow fruit. The scent associated with it is due to essential oil found in oil glands in the fruit skin or rind, as well as its foliage. The zesty aroma caused by the essential oils is due to a complex mixture of hydrophobic compounds such as terpenes, sesquiterpenes, aldehydes and esters.

Interestingly, plants from other botanical families can also produce a lemon-like aroma. Essential oil of these plants contains the same chemical compounds found in lemon but in varying combinations and ratios that lead to a range of lemon-like scents with distinctive tones, where a commonly used Singaporean phrase of “same, same but different” can quickly summarise. Hence, it is unsurprising that these species’ essential oils and plant parts have been used as a substitute for lemon for various purposes. This article presents a selection of plants with lemon-like essential oil in their leaves. They can be grown in tropical Singapore and are a great addition to any sensory or therapeutic garden to stimulate the sense of smell of visitors.



Lemongrass

Botanical name: *Cymbopogon citratus*

Family: Poaceae (Grass family)

Lemongrass grows as a clump-forming plant over 1 m tall. The pseudostem consists of tightly-overlapping leaf sheaths found at the base of the plant and is sold as a spice for use in the kitchen. To propagate lemongrass, pseudostem can be rooted in a glass of water and later planted into a pot of soil for cultivation. Once the plant has grown large enough, it can be transferred to its final outdoor growing location. Established clumps can be divided to yield more plants. Lemongrass is best grown outdoors under full sun in well-drained soil. Lack of light leads to weak plants that are prone to pest attacks. It is best to avoid planting lemongrass close to pathways as the sharp leaf margins may cut passers-by.



Lemon Basil

Botanical name: *Ocimum cultivars*

Family: Lamiaceae (Mint family)

Basil is a well-known herb with many uses in the kitchen, and there are various cultivars with different aromas and flavour profiles. For example, Lemon Basil (*Ocimum × africanum*) is sold locally as a cut herb or potted plant for use in Indonesian, Lao and Thai cuisines. Some lemon-scented Sweet Basil (*Ocimum basilicum*) cultivars are known to have an intense lemon-like essential oil than lemon basil, and they include ‘Mrs Burns Lemon’ and ‘Sweet Dani’. Lemon Basil is a herbaceous plant with a shrubby growth habit that produces white flowers. It can be easily propagated from seeds and also from stem cuttings. Generally, basil plants prefer well-drained growing media and can be planted in pots, but they tend to be pot-bound rather quickly. However, the plant should never be allowed to dry out, and the growing media should always be kept moist. Basil plants can be exposed to direct sunlight for at least 6 hours daily. Otherwise, it is recommended to grow them under bright conditions away from direct sunlight. For basil plants to keep producing leaves, plants should be harvested regularly to delay the flowering and maturity of the individual plant. Leaves of basil cultivars are prone to fungal infection when exposed to rain, and growing plants under shelter will reduce the severity of the disease.



Lemon Balm

Botanical name: *Melissa officinalis*

Family: Lamiaceae (Mint family)

Lemon Balm is a herbaceous shrub with several cultivars grown by hobbyist gardeners. In Singapore, the plant is commonly sold as a potted plant in supermarkets and plant nurseries. Lemon Balm can be easily propagated from seeds or shoot tip cuttings. The latter can either be rooted in water or planted directly into a soil-less propagation mix. Lemon Balm is best grown under filtered sunlight for at least 6 hours daily and should be protected from rain. Therefore, Lemon Balm is an ideal herb for high-rise gardeners, suitable on a sunny windowsill or corridor. Like growing basil, Lemon Balm's growing media should be well-drained and moisture-retentive, with plants never being allowed to dry out.



Lemon Myrtle

Botanical name: *Backhousia citriodora*

Family: Myrtaceae (Myrtle family)

Lemon Myrtle is a large tree with leaves known to produce a lemon-like essential oil. Hence, dried leaves of the plant are known to be used to flavour milk-based food products as they do not contain acid that will cause milk proteins to curdle. Lemon Myrtle requires full sun to thrive, and this delightful tree can occasionally be found on sale in plant nurseries in Singapore. Propagation by stem cuttings is very challenging to establish successfully. Although Lemon Myrtle is a tree, it can be grown as a shrub in a large container with well-drained soil and placed in a sunny spot.



Lemon Verbena

Botanical name: *Aloysia citrodora*

Family: Verbenaceae (Verbena family)

Lemon Verbena is a shrub with long branches bearing characteristic verticillate leaves (a character in which three leaves emerge from the same node) arrangement. Due to its tendency to produce long stems, Lemon Verbena must be pruned regularly to obtain a neat growth habit. Leaves of Lemon Verbena are light green in colour and rough to the touch. Lemon Verbena can be propagated via tip cuttings, and such cuttings can be rooted in water or planted directly into a soil-less propagation mix. In cultivation, Lemon Verbena must be placed in a location exposed to filtered sunlight for at least 6 hours daily and protected from rain. Meanwhile, growing media used should be well-drained and moisture-retentive.

Wilson Wong

Jurong Lake Gardens

All photos by Dr Wilson Wong unless otherwise stated.

(Photo credit: Joan Hung)

History of macrofungal research at the Singapore Botanic Gardens

Interest in mycology at the Gardens began with Henry Ridley, the Gardens' first Director (1901–1912). Amongst his broad botanical interests, Ridley also arranged for macrofungi occurring in the Gardens to be collected and painted by the Gardens' resident artist, Charles de Alwis (see *Gardenwise* 15, back page; *Gardenwise* 25, page 9).

When Isaac Burkill was appointed Director of the Gardens (1912–1925) to succeed Ridley, Ethel Burkill accompanied him to Singapore. While in the Gardens, Ethel developed an interest in macrofungi and made numerous herbarium vouchers with detailed observation notes, including watercolour illustrations painted by her (see *Gardenwise* 22, back page).

Progress in mycology advanced further in the Gardens when Edred John Henry Corner joined as a mycologist and was appointed as the Assistant Director from 1929 until 1941. A total of 1503 fungal names new to science were described by Corner based on

material he gathered and studied at the Gardens. As Corner was a gifted botanical artist, he illustrated most of the new species he described in watercolour.

After the Second World War, Chang Kiaw Lan joined the Gardens in 1959 as a botanist but left in 1962 to pursue her doctoral degree in botany, specialising in mycology at the University of Cambridge under Corner. Her dissertation was on “*The Structure and Taxonomy of Lentinus Fr.*”, a widespread macrofungal genus occurring in the tropical and subtropical regions of the world, including Singapore. Upon her return to Singapore in 1965, Kiaw Lan's research in mycology declined gradually as she took on institutional responsibilities to support the development of Singapore towards the Garden City vision. In addition, she was also involved in editing the Gardens' scientific journal, *The Gardens' Bulletin, Singapore*, until her retirement in 1987. As a result, many of her collections remained unidentified.

The Gardens' Rainforest, also known as the Gardens' Jungle in the past, is one of the key localities in Malayan mycological research. A number of the new fungal species described by Corner were gathered from the Garden's Rainforest between 1929 and 1945. To date, 1186 mushroom specimens have been collected from the Singapore Botanic Gardens. As sequencing technology and database of fungal sequences improve over time, we look forward to systematically identifying and studying these macrofungi diversity in the Gardens over the next few years.

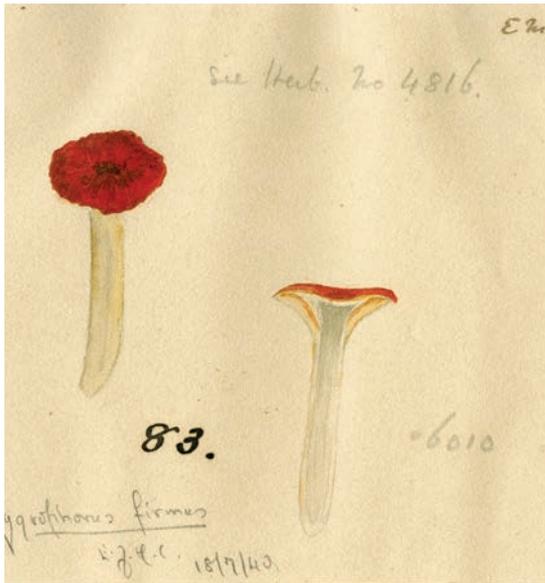
Here are a few fungi found in the Singapore Botanic Gardens from our ongoing mycological research in the last seven years. Do look out for them when you are visiting the Gardens next! Seek, and you shall find!

Serena Lee
Herbarium

All photos by Serena Lee unless otherwise indicated.



Marasmius sp. (Marasmiaceae) painted by Charles de Alwis. (Courtesy of the Singapore Botanic Gardens Archives)



SINGAPORE BOTANIC GARDENS
SING 0039988

83

Malay Peninsula

Locality Botanic Garden, Singapore

Habitat in grassy meadow Rhopaloblaste

Colour above vermillion

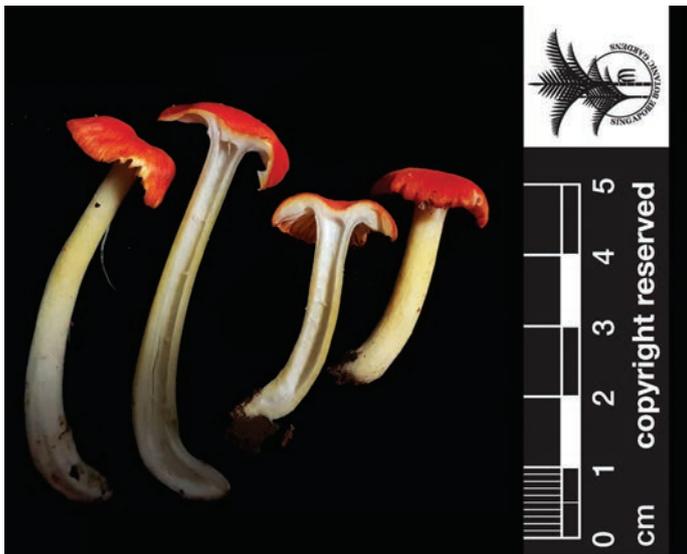
Colour below yellowish

Smell, etc. stalk thick & flattened

Date, 10 Aug 1913

Ethel M. Burkill.

(Left) *Hygrocybe firma* (Hygrophoraceae) painted by Ethyl M. Burkill, later determined by Corner as *Hygrophorus firmus*. The accepted name of this species now is *Hygrocybe firma*. (Right) The vouchered specimen made by Ethyl M. Burkill in 1913, soon after the watercolour painting was completed. (Courtesy of the Singapore Botanic Gardens Archives)



Fungi of Singapore
Singapore Botanic Gardens Herbarium

Family: Hygrophoraceae
Name: *Hygrocybe firma*

Det: _____
Det date: _____ Vernacular: _____

Locality: Singapore, Nee Soon Freshwater Swamp Forest
Habitat: 1°23' N, 103°49' E
In soil, solitary.

Notes: Pileus red-orange, 3cm across covered with velutinous hairs (sausage-shaped cells 73-142 um long, 17-22um wide; stipe whitish-pale yellow, hollow, fibrous-gelatinous, 6.5 x 0.3cm; gills white, decurrent.

Collector: Lee, S.; Liew, D.; Phang, A. Chen, J.
Number: SL 1616
Date: 3 November 2020
Distribution: SING

Kindly return new determinations to:
Serena Lee (Serena_lee@nparks.gov.sg), Manager Herbarium



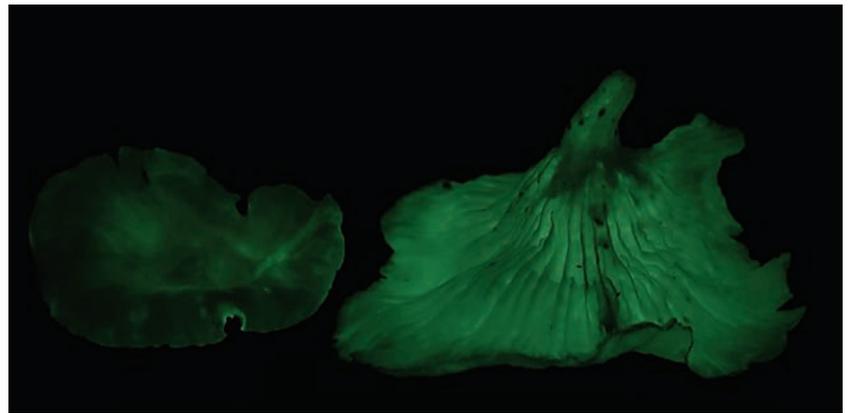
A recent collection of *Hygrocybe firma* from Singapore. (Left) Fresh specimens with bright red caps. (Right) A dried herbarium voucher in the fungarium.



Pleurotus giganteus (Pleurotaceae) painted by E.J.H. Corner. (Courtesy of the Singapore Botanic Gardens Archives)



Lactarius brunneocinnamomeus (Russulaceae), two specimens turned upside down to reveal cream-coloured gills, is an example of an ectomycorrhizal genus occurring in the Gardens.



Neothopanus nambi (Omphalotaceae), a bioluminescent species found in the Gardens' Rainforest. (Left) Fresh materials with a scale seen under artificial lighting. (Right) Fresh materials photographed in the dark under prolonged exposure.



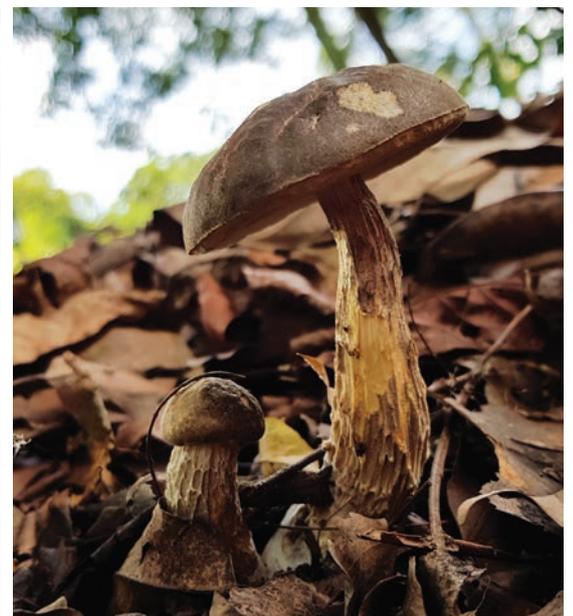
Phallus multicolor (Phallaceae), an attractive stinkhorn that can be commonly seen in the Gardens.



An often overlooked small (less than 1 cm long) resupinate coral-like fungi, *Physalacia sulphurea* (Physalacriaceae), that can be found growing on the undersides of decaying logs.



Russula bellissima (Russulaceae).



Spongispora temasekensis (Boletaceae), an ectomycorrhizal species to *Hopea odorata* (Dipterocarpaceae) described from the Gardens in 2018.

Celebrating the Singapore Garden Festival at the Jacob Ballas Children's Garden

The Jacob Ballas Children's Garden was part of the Singapore Garden Festival held from 30th July to 9th August 2022. Children and families had the chance to explore the children's garden through a naturalist's lens and examine the themes of wildlife, plants and nature play. More than 50 programmes were conducted for the festival and the Gardens buzzed with life. Images below illustrate some of the memorable moments from the festival, organised under the themes of Nature Play, Incredible Edibles and Wonderful Wildlife.

Nature Play

Nature Play: Art in the Garden

The role of Nature Play in helping children form a relationship with their natural environment through self-exploration has grown in recognition. This festival, we encouraged visitors to create works of art using natural materials that can be found on the garden floor. Pictures of sample artwork were provided as inspiration and placed in five shelters during the event. We saw many visitors immersed in their creations, perhaps with a newfound awareness and appreciation for nature's colours, forms and textures. Enjoy the artwork created by visitors below.



Five rest shelters were used for nature art interpretive signs. Each hut had a unique theme – some featured modes of transport, while others featured wildlife such as Oriental-pied Hornbills and Sambar deer. Visitors were encouraged to locate all five huts.



Nature art created by visitors to the Jacob Ballas Children's Garden.

Nature art was an activity suitable for both young and old and was a playful supplement to a visitor's time in the Gardens. We hope that families will continue to explore the materials of nature and form lasting memories of their time here.

Nature's Prints

The education team also hosted nature-inspired sessions entitled *Nature's Prints*, where children created their leaf print art using *Ficus* leaves and learnt about various leaf shapes and venation. An incredible variety of prints were created, while imaginary creatures were sighted and stories were told! Enjoy the artwork of our young visitors below.



Leaf print art created by the children during the festival.

Incredible Edibles

On our sunny island, an interest in food is pervasive! Visitors to our Gardens had a chance to explore the theme of food through the *Incredible Edibles* display at the farm garden, where baskets of produce and products were placed in planter beds for families to explore. Watermelon, mango and corn were some of the edibles on display that the children are familiar with, as well as more unusual varieties such as asparagus and luffa! Complementary programmes such as kitchen garden tours, culinary demonstrations and workshops on growing edibles were also conducted during the festival.



Visitors admiring produce and products of asparagus, corn and sweet potato at the *Incredible Edibles* display at the Farm Garden.



A culinary demonstration allowed children to participate in making refreshing watermelon basil slushies to quench their thirst on a hot and humid day. Ingredients such as watermelon, basil and mint used in making the drink could also be found growing in our Farm Garden.



Participants at the *Ready, Set, Grow!* Workshop activated their senses by learning about essential oil of plants, dyes and plant care in a brightly sunlit classroom within the Jacob Ballas Children's Garden.



A kitchen garden tour conducted by a Festival Official (in red uniform) in the Farm Garden beside trellises of passionfruit and luffa, where participants learnt more about our incredible edibles.



Children learnt about the diversity of colour and shape of plants found in the Jacob Ballas Children's Garden.



Spotting pollinators, identifying the host plants of butterflies and pointing out nectar plants to budding naturalists during the *Plants and their Pollinators Tour*.

Wonderful Wildlife

The nature reserves, parks and gardens in Singapore host a variety of wildlife. These macro and micro fauna are essential elements of our biodiversity and draw significant interest from our park visitors! The event provided an opportunity for them to touch, magnify and identify some of these amazing critters.



Our young *Wildlife* investigators examine insects, reptiles, birds and plant adaptations at each show-and-tell station.

Meet our Pet Ambassadors

Families also enjoyed interactive storytelling sessions that were written about birds of our Gardens, such as the Sunbird and the Drongo, and some even got to meet our garden pet ambassadors – that include cats, guinea pigs, a rabbit, a tortoise and a chinchilla to learn about responsible pet care.



Our charismatic pet ambassadors captivated families who stopped by to learn more about pet care and responsibility from the AVS Education team.



The stunning outdoor bamboo pavilion where children and families sang, tweeted, danced and acted to the stories about the proud Drongo and the lovely Sunbird.

Behind the Scenes

The Singapore Garden Festival at the Jacob Ballas Children's Garden was hosted by the SBG Education team and our wonderful colleagues from NParks, who kindly volunteered their time with us. It was a commendable effort from the team, and we hope all visitors to the Gardens had an enjoyable learning experience!



Natalie Cheong
Education

All photos by SBG Education

Copernicia macroglossa – one 'dressed' up palm!

Growing slowly but surely in the Gardens' Palm Valley is a charismatic palm that hails from the savannahs in the central and western parts of Cuba. This Cuban native is known in Spanish as *Jata de Guanabacoa* or *Palmera de Abrigo*. Otherwise, it is known as the Cuban Petticoat Palm or simply Petticoat Palm.

This single-trunk palm has leaves arranged spirally on the trunk, almost circular and measuring up to 2 m wide, with very short leafstalk. These large leaves do not detach from the trunk after senescence, instead, folded neatly below new leaves as the palm grows. These dried leaves persist for many years resulting in a compact, dense turf of leaves layered atop one another, hiding the stem and creating a haystack-like appearance that makes the palm seem to be wearing a layered petticoat. Hence, the common name Petticoat Palm!

The botanical name of the Petticoat Palm is *Copernicia macroglossa*. The genus *Copernicia* honours the famous Polish astronomer Nicolaus Copernicus (1473–1543), who proposed that the sun was the centre of the universe and the earth revolved around it. The palm's specific epithet is derived from the Greek *makros* = long, and *glossa* = tongue, which may refer to its large, broad leaves or long inflorescences. Admirers of this attractive Cuban palm would agree that this scientific name befits such a unique palm that wears a 'petticoat', as it never fails to become the centre of attention and is a favourite for palm growers worldwide.

The trunk of the Petticoat Palm can reach up to 7 m high, but it is only visible in old and mature specimens as their dried leaves decompose slowly and eventually fall off. In contrast, juvenile palms appear 'stemless' as a compact mass of persistent dry leaves conceals their trunks. As the palm is a slow grower, it can take decades for a juvenile specimen to reach maturity.



A grove of Petticoat Palm at the Palm Valley.



Close-up of an inflorescence showing numerous small, hairy, creamy yellow flowers.

The Garden's Petticoat Palm has finally matured and started flowering, sending its inflorescences out of its crown. The inflorescence comprises many small fuzzy, creamy yellow, dioecious flowers. The inflorescence stalk can measure up to 2 m long. The fruits of the Petticoat Palm are globose, about 1.5 cm in diameter, starting green and maturing to black. In its native habitat, birds and bats act as the main dispersers of its seeds. Viable seeds can take up to 2 months to germinate.

The Petticoat Palm is not a common ornamental palm. Still, it has been successfully cultivated in tropical and subtropical regions in full sun, under hot and humid conditions and in well-drained soils. It tolerates poor soils, responds well to fertilisation, and is drought tolerant. The Petticoat Palm is highly sought after by palm collectors and gardeners worldwide due to its unique appearance. Commercially, mature specimens are known to fetch high prices. When sighted, the Petticoat Palm will never fail to be a conversation starter amongst plant lovers. On your next visit to the Gardens, keep a look out for this skirted palm at the Palm Valley!

Nura Abdul Karim

Library & Training and External Relations

All photos by Dr Nura Abdul Karim



Young inflorescence of *Copernicia macroglossa* piercing through the layers of large green leaves.

The 7th Global Botanic Gardens Congress – a testament to perseverance in times of a global pandemic!

The Melbourne Convention and Exhibition Centre (MCEC), located on the edge of the Yarra River in the heart of Melbourne City, was the venue of the 7th Global Botanic Gardens Congress (GBGC). Due to the COVID-19 pandemic, the 7th GBGC had to be postponed twice since the 2018 congress held in Geneva. It must have been a great relief for the organisers, namely the City of Melbourne, Royal Botanic Gardens Victoria (RBGV), Botanic Gardens Australia and New Zealand (BGANZ) and Botanic Gardens Conservation International (BGCI), to finally see the opening of the 7th GBGC, the fruit of their commitment and perseverance, and to welcome colleagues, partners and friends from the botanic gardens communities around the world to meet, share and inspire each other.

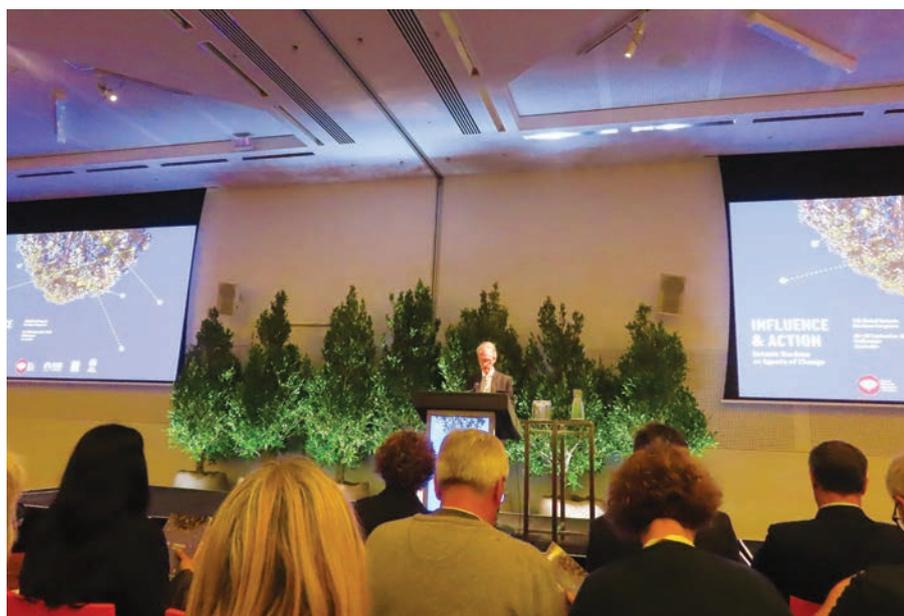
The 7th GBGC was held from 25 to 29 September 2022. Under the theme *Influence & Action: Botanic Gardens as Agents of Change*, over 500

delegates from 36 countries converged in Melbourne to explore how botanic gardens can play a more significant role in shaping our future and safeguarding our biodiversity. The conference covered topics including adapting to climate change, plant and biodiversity conservation, impactful engagement and education, greener and more liveable cities, and surviving in a post-COVID world. A total of 10 plenaries, 83 oral presentations, 12 symposia, nine workshops, five panel discussions, 10 rapid-fire presentations and 46 posters were presented at the congress. The Singapore Botanic Gardens (SBG) were represented by three staff. Dr Thereis Choo (SBG) gave a talk entitled *City in Nature – role of SBG*. Meanwhile, Dr Nura Abdul Karim (SBG) chaired a Plant & Biodiversity Conservation session. She also represented SBG at the BGCI International Advisory Council annual meeting.

The gathering began with pre-congress tours, which provided an excellent



Delegates of the 7th Global Botanic Gardens Congress held at the Melbourne Convention & Exhibition Centre, Victoria, Australia. (Photo credit: BGCI)



Dr Tim Entwisle, Director and Chief Executive of the Royal Botanic Gardens Victoria, giving the opening speech of the 7th GBGC at the Melbourne Convention and Exhibition Centre.

opportunity for the delegates to learn about the region and its natural areas, as well as the biodiversity conservation efforts of Victoria's botanic gardens. Many lectures highlighted the importance of data sharing and making it accessible, be it plant collection database, climate or directory of expertise. Over 80% of global botanic gardens have never shared their collection data with BGCI, although most have expressed interest in sharing and disclosing such data. As more reliable data and secure online sharing platforms become available, gardens can effectively manage their plant collection in regional and global plant conservation efforts.

One of the key commitments of BGCI is to bring global data together and to continue working alongside

partners in developing exciting new tools and resources, such as the Climate Assessment Tool (CAT) and the Directory of Expertise, as well as improving existing ones like Garden Search, Plant Search, Threat Search and Global Tree Search. The Climate Assessment Tool (CAT) was officially launched during the congress and is envisaged to support botanic gardens to evaluate and mitigate threats of climate change to their living collections. CAT achieved this by comparing datasets of current known occurrences of taxa in the wild and the botanic gardens.



Delegates listening to a talk in one of the parallel oral presentations. (Photo credit: BGCI)



The Royal Botanic Gardens Melbourne, one of the sites offered for the pre-congress tour, is located at the centre of Melbourne. This 38-hectare garden celebrated its 175th anniversary in 2021. It holds over 7500 species of plants worldwide in its living collection. Delegates were treated to various picturesque landscapes, including cultural significance, landscape succession and design, and plant collections.



The Royal Botanic Gardens Cranbourne, another pre-congress tour site, is located 45km southeast of Melbourne city centre. The garden is 363 ha and holds the best remnant plant communities of the Melbourne region in its bushland alongside the award-winning contemporary botanic garden, the Australian Garden. Delegates were given a tour by staff on the botanic gardens' management and key features, ecology and fire management plan of its natural landscapes and the critical work in its orchid conservation programme.

A number of the congress keynote presentations highlighted that botanic gardens hold only 30% of the world's plant species. Nevertheless, botanic gardens are essential in raising public awareness of managing the biodiversity crisis and climate change. With the advancement of plant conservation research, practices and tools, botanic gardens can be the agent of change in conservation and habitat restoration work in the face of increasing uncertainty of the world's environmental conditions. Based on various presentations, delegates were also informed on how the pandemic had accelerated the transformation of botanic gardens in embracing the digital world and how technology has assisted in outreach, data sharing, and data analysis to support education, conservation and sustainability work.

As the 7th GBGC drew to a close, Singapore was announced as the host for the next congress in 2024. Ms Leong Cheng Yee (SBG) presented a video announcement of the 8th GBGC. The Singapore Botanic Gardens is honoured to be selected as a co-host of this important event with BGCI.

Overall, the congress went well and ended with a continued optimism that with more future collaborations, botanic gardens will persist as a significant force in the endless fight to conserve biodiversity in the face of adversity. SBG is looking forward to being the next congress host for the 8th GBGC with the theme *Botanic Gardens – People and Plants for a Sustainable Future* and welcoming delegates worldwide to Singapore in 2024.

Nura Abdul Karim
Library & Training and External Relations

All photos by Dr Nura Abdul Karim, unless otherwise indicated

The Exceptional Species Micropropagation & Cryopreservation Workshop 2022

In November 2022, the Botanic Gardens Conservation International (BGCI) and its Southeast Asia Botanic Gardens Network (SEABG), together with the Singapore Botanic Gardens (SBG), successfully co-organised the Exceptional Species Micropropagation & Cryopreservation Workshop held in SBG from the 1st to 3rd November 2022. Plant species that cannot be effectively conserved through conventional seed banking, namely via collecting, processing, storing or recovering, have been collectively referred to as exceptional species. An example of exceptional species is the Dipterocarps or members of the Dipterocarpaceae family, which consists of hardwood trees occurring in tropical forests around the world. The workshop aims to improve the prospects of conserving exceptional species over the long term beyond the ex-situ living collections held at botanic gardens through feasible alternatives, namely in vitro propagation and cryobiotechnology. In addition, it was also an opportunity for experts to impart current knowledge and skills in these techniques. Through the workshop, the organisers hope to encourage and promote collaborative networking among researchers and conservationists to build up this knowledge to formulate species-specific protocols in micropropagation and cryopreservation for various tropical exceptional plant species.

SINGAPORE BOTANIC GARDENS SEED BANK



Participants of the Exceptional Species Micropropagation & Cryopreservation Workshop in front of the SBG Seed Bank. (Photo credit: Benedict Tong)

The 3-day hybrid workshop comprised online presentations and hands-on practical sessions and hosted eight participants from various institutions across Southeast Asia, namely Makiling Botanic Gardens (the Philippines), National Research and Innovation Agency (BRIN) (Indonesia), Sabah Parks (Malaysia), Tropical Rainforest Conservation & Rainforest Centre (TRCRC) (Malaysia), and Singapore Botanic Gardens (Singapore). With funding from the Rufford Foundation, BGCI was able to provide small grants to regional participants and enable

them to participate in the workshop. The workshop was facilitated by Dr Greetha Arumugam (SEABG) and Dr Nura Abdul Karim (SBG). It includes some of the world's renowned conservation biotechnology and germplasm banking experts to co-develop the training programme and participate as online trainers. Specialists who assisted in delivering specific online training modules were Dr Valerie Pence (Cincinnati Zoo & Botanical Garden, USA), Dr Cathy Offord (Royal Botanic Gardens Sydney, Australia), Dr Karen Sommerville (Royal Botanic Gardens Sydney, Australia), Dr Karin van der Walt (Wellington Botanic Garden, New Zealand), Dr Eric Bunn (Kings Parks & Botanic Garden, Australia) and Dr Bryn Funnekotter (Kings Parks & Botanic Garden, Australia). Meanwhile, Dr Greetha Arumugam and Mr Koh Teng Seah (SBG) covered the hands-on training. The presentations covered topics such as an introduction to exceptional species and its definition, overviews of micropropagation and cryobiotechnology methodologies and techniques, including how to set up a micropropagation and



Screenshot of the participants and the online trainers, Drs Cathy Offord, Eric Bunn, Bryn Funnekotter, Karen Sommerville, Valerie Pence and Karen van der Walt. (Photo credit: NParks IT)



Participants in full attention to an online presentation by Dr Bryn Funnekotter. (Photo credit: Ooi Zong Yu)



Participants were engrossed in excising tiny embryos from various seeds during a practical session. (Photo credit: Benedict Tong)



Under the supervision of Mr Koh Teng Seah, participants carefully lowered cryo vials containing their excised seed embryos into a portable cryogenic dewar flask filled with liquid nitrogen. (Photo credit: Nurulhuda Nasir)

cryopreservation lab on a budget. In addition, case studies on conserving and establishing exceptional species were also shared by the trainers.

The workshop's hybrid discussion session was essential as it gave participants insight into the current situation and challenges of how exceptional species are being conserved in other countries and potential collaboration opportunities.

Plans discussed also included the establishment of an Exceptional Species Group for Southeast Asia that will form part of the Exceptional Plant Conservation Network (EPCN) and contribute to developing a dynamic global exceptional species database that will add to the worldwide sharing of conservation methods, protocols and other relevant information to safeguard the world's diverse plant species. Separately, the participants

were also treated to tours of the SBG's Seed Bank and the National Orchid Garden. Overall, the workshop was well received by the participants, who will impart the knowledge and skills acquired to conserve threatened plant species with others in their organisations.

Nura Abdul Karim
Library & Training and External Relations

List of VIP orchid hybrids named by the Gardens

Date	Dignitary/ Organisation/ Others	Name of orchid hybrid
22 January 2022	In honour of Expo 2020 Dubai and to commemorate Singapore Day at Expo 2020 Dubai	<i>Dendrobium</i> Expo 2020 Dubai
19 April 2022	The Right Honourable Jacinda Ardern, Prime Minister of New Zealand	<i>Dendrobium</i> Jacinda Ardern
28 April 2022	Mr Thomas Bach, President of the International Olympic Committee	<i>Dendrobium</i> Thomas Bach
11 June 2022	His Excellency Kishida Fumio, Prime Minister of Japan	<i>Dendrobium</i> Kishida Fumio
8 July 2022	His Excellency Oyun-Erdene Luvsannamsrai, Prime Minister of Mongolia	<i>Papilionanda</i> Oyun-Erdene Luvsannamsrai
20 July 2022	His Majesty Sultan Ibrahim Ibni Almarhum Sultan Iskandar, Sultan and Sovereign Ruler of the State and Territories of Johor Darul Ta'zim, and Her Majesty Raja Zarith Sofiah Binti Almarhum Sultan Idris Shah, Permaisuri of Johor	<i>Dendrobium</i> Ibrahim Zarith
24 August 2022	His Majesty Sultan Haji Hassanal Bolkiah Mu'izzaddin Waddaulah, Sultan and Yang Di-Pertuan of Brunei Darussalam, and Her Majesty Duli Raja Isteri Pengiran Anak Hajah Saleha	<i>Dendrobium</i> Hassanal Saleha
7 September 2022	His Excellency Ferdinand Romualdez Marcos Jr., President of the Republic of the Philippines, and Mrs Louise Araneta-Marcos	<i>Dendrobium</i> Ferdinand Louise Marcos
21 September 2022	Commemorate the 70th anniversary of the Corrupt Practices Investigation Bureau (CPIB)	<i>Papilionanda</i> CPIB
28 September 2022	His Excellency Phankham Viphavanh, Prime Minister of the Lao People's Democratic Republic, and Mrs Sichanh Viphavanh	<i>Dendrobium</i> Phankham Sichanh Viphavanh
26 October 2022	Her Majesty Tunku Hajah Azizah Aminah Maimunah Iskandariah binti Almarhum Al-Mutawakkil Alallah Sultan Iskandar Al-Haj, Raja Permaisuri Agong of Malaysia	<i>Dendrobium</i> Queen Azizah of Malaysia
28 October 2022	His Excellency Dr Mohammad Shtayyeh, Prime Minister of the Palestinian Authority	<i>Dendrobium</i> Mohammad Shtayyeh
8 November 2022	Celebrate SG Families and signify the whole-of-society support for the Year of Celebrating SG Families in 2022	<i>Vanchoanthe</i> SG Families
14 November 2022	His Excellency Olaf Scholz, Federal Chancellor of the Federal Republic of Germany	<i>Renanthera</i> Olaf Scholz
16 November 2022	Dedicated to Mr Benny Lim, Chairman of NParks for his role in nurturing generations of public officers, and in pioneering and guiding the realisation of NParks' City in Nature vision	<i>Vanda</i> Benny Lim
8 December 2022	His Excellency Dr José Ramos-Horta, President of the Democratic Republic of Timor-Leste	<i>Dendrobium</i> José Ramos-Horta



(Photo credit: National Parks Board)

Papilionanda Oyun-Erdene Luvsannamsrai named after His Excellency Oyun-Erdene Luvsannamsrai, Prime Minister of Mongolia, during his visit to the National Orchid Garden on 8 July 2022.



(Photo credit: Ministry of Culture, Community and Youth)

Mr Thomas Bach (2nd from right), President of the International Olympic Committee (IOC), with the orchid *Dendrobium* Thomas Bach on 28 April 2022 at the Burkill Hall. Mr Bach was accompanied by Mr Edwin Tong (far left), Minister for Culture, Community and Youth, and Second Minister for Law, Singapore, Assoc. Prof. Tan Puay Yok (2nd from left), Group Director of the Singapore Botanic Gardens, and Mr Ng Ser Miang (far right), Vice-President and Member of the IOC.



(Photo credit: National Parks Board)

His Excellency Dr José Ramos-Horta (centre), President of the Democratic Republic of Timor-Leste, with the orchid *Dendrobium* José Ramos-Horta on 8 December 2022 at the Burkill Hall. Dr Ramos-Horta was accompanied by Dr Leong Chee Chiew (left), Executive Director of National Parks, Gardens and Nature Reserves, National Parks Board, Singapore, and Dr Mohamad Maliki Bin Osman (right), Minister in the Prime Minister's Office, Second Minister for Education and Second Minister for Foreign Affairs, Singapore.

William Griffith's *Icones Plantarum Asiaticarum*

Published in four parts between 1847 and 1854, the *Icones Plantarum Asiaticarum* contains 620 lithographed illustrations, of which 223 are coloured. The author, William Griffith, was a botanist and surgeon employed by the East India Company. During his extensive travels across India through Malaya, he made detailed observations of plants. However, Griffith died prematurely in 1845 at the age of 34, and his unpublished manuscripts were acquired and published posthumously by John McClelland.

The Singapore Botanic Gardens has two copies of *Icones Plantarum Asiaticarum*. One copy was presented by the Royal Botanic Gardens, Kew, as mentioned in the Gardens' Annual Report for the year 1891. The other copy contains a manuscript note in its first volume stating:

“Presented to the Singapore Library by the Honorable Colonel Butterworth C.B. Governor of Prince of Wales Island, Singapore, Malacca this 24th March 1848 [illegible] Smith (John Colson Smith) Secretary.”

Colonel Butterworth was Governor of the Straits Settlements from August 1843 to March 1855. The Singapore Library was the first public library in Singapore, established in 1845 with the support of residents, including Colonel Butterworth. On the other hand, the library of the Singapore Botanic Gardens was established in 1875 by Henry James Murton. By then, the Singapore Library was part of the Raffles Library and Museum. Unfortunately, the transfer of the volumes from the Raffles Library to the Gardens is not documented. Still, it probably took place during the brief period around 1875 when the Gardens was under the administration of the Committee of Raffles Museum and Library. *Icones Plantarum Asiaticarum* is likely one of the earliest publications acquired by Gardens' library shortly after its establishment.

Michele Rodda
Martina Yeo
Herbarium & Botanical Art Gallery

