

Gardenwise



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Image taken
at Wat Phu,
a UNESCO World
Heritage Site
in Champasak,
during 'A botanical
expedition to Laos'.
(Photo credit: Logan Tan)

Editors

Ada Davis, Nigel P. Taylor

Production Managers

Ada Davis, Christina Soh

Design

Newmen LLC
www.newmen.info

Singapore Botanic Gardens

1 Cluny Road, Singapore 259569
National Parks Board

nparks_sbg_visitor_services@nparks.gov.sg
www.sbg.org.sg
www.nparks.gov.sg

Opposite page

The entrance to the new Downtown Line MRT station at Botanic Gardens. (Photo credit: Benjamin Aw)

Message from the Director



The Botanic Gardens' motto is 'Connecting plants and people' and this issue demonstrates our role well, through individuals and institutional partnerships. We learn of the important contributions of former staff and volunteers, in tributes to the lives of the late Mohammed Noor and Keith Hillier, a pioneer volunteer at the Gardens, both of whom passed away in 2015. On two separate occasions last year we were visited by the proud descendants of the Gardens' original designer, Lawrence Niven, as reported on page 4. VIP visits from the director of the Royal Botanic Gardens, Kew (UK) and Vice-Governor of Miyazaki Prefecture (Japan) were part of institutional agreements, the former newly signed, the latter celebrating 50 years of collaboration between the Gardens and the Aoshima Sub-Tropical Botanic Garden (see pages 36–38). Training programmes are another area where plants and people get connected – some are delivered here on site at the Gardens, others at various locations in the Southeast Asian region (see pages 30–31 ['Herbarium on Stage'] and 32–35 [A three-part training programme on tropical bryophytes and pteridophytes

of Southeast Asia]) – including both young and older participants and supported by diverse partnerships. But, arguably, the most important area where our motto is applied concerns the conservation of rare plant species, where our knowledge of laboratory techniques and tropical forest ecology can be used to repair some of the damage mankind has meted out to Mother Nature in the past (see pages 14–17 [Saving native gingers in the tissue culture lab] and 22–24 [Rediscovery and reintroduction of *Robiquetia spathulata*]). And it is not only Mother Nature that needs help, for from John Elliott, representing our partner, the Orchid Society of South East Asia, we learn that some of the outstanding orchid hybrids created since the Gardens' former director, Eric Holttum, started Singapore's orchid success, may have been allowed to go extinct in horticulture (pages 18–21).

Plant heritage is never far from the pages of this magazine and in this issue we can enjoy reading about how vegetables were grown at the Gardens during the Japanese occupation of WWII and the last of the great plant hunters, Frank Kingdon-Ward.

Botanical exploration or plant hunting, however, continues and is often focused on countries and habitats that are known to be poorly understood, such as in Laos, where we are partnered with the Pha Tad Ke Botanic Garden at Luang Prabang (see pages 10–13). These field studies contribute the data that are eventually published by our researchers and 2015 was a bumper year, both in quantity and quality, with staff of the Gardens being able to boast of papers in some of the world's top journals, not to mention a clutch of new books (pages 28–29).

Wishing our readers a green and pleasant 2016, when public access to the Gardens will be even easier for some, as the Downtown Line MRT station, which opened on 27 December 2015, will bring a new wave of Singaporean heart-landers to our Bukit Timah Core.

Nigel P. Taylor



MOHAMMED NOOR BIN JUMAAT

(1940–2015)

Mohammed Noor bin Jumaat, fondly known as Noor, passed away peacefully at the age of 75 on 19 July 2015, after a bout of illness. He retired from the Singapore Botanic Gardens in April 2013 (see *Gardenwise* 41, page 23). The Botanic Gardens was his first and sole employer for 54 years. He was 18 when initially employed as a labourer to look after the living collections, then became a plant collector attached to the herbarium to support taxonomic research activities, and was later redesignated as a park ranger based at the Bukit Timah Nature Reserve. Noor was finally transferred back to the herbarium in 1993, where he worked until his retirement. His role as a plant collector earned him recognition among tropical botanists, and he was included in the *Cyclopaedia of Malesian Collectors* published as part of the *Flora Malesiana* series. This database is accessible online, and

provides plant collecting records of all botanists active in the Malesian region, which encompasses Singapore, Brunei Darussalam, Indonesia, Malaysia, Papua New Guinea, the Philippines and Timor-Leste. The database serves as an important reference for botanical research in Malesia.

Noor was born on 14 Feb 1940 and grew up in a Malay *kampung* at the famed Lorong Engku Aman in Geylang Serai. His father was of Sumatran origin and worked at a fish market in Singapore. Noor had eight siblings, and he was the sixth child of the family. A fluent speaker of Malay and English, Noor also mastered a little Cantonese, a Chinese dialect originating from Guangdong Province in China. From his youth he was taught by his parents to be an early riser. Hence, he would leave for work before sunrise, and arrived at the herbarium at around 6 am every day. Noor

Noor in the SING Herbarium.

(Photo credit: Low Yee Wen)

used to ride a motorcycle to work, but stopped riding eight years ago, following his doctor's advice. His favourite bike was the Vespa, which he owned at one point in time. Noor was an excellent musician, and he played the drums in a band with a few of his friends. It was through jamming sessions and music that he met the love of his life, Madam Zuliah bte Daud. Noor was also a good cook and among his favourite recipes were Cantonese-style dishes.

At home, Noor was a dedicated husband and father who valued strong family bonding, a principal that he handed down to his children and grandchildren. At work, he was a gentleman with a warm heart. Noor was always ready to take on nearly any assignment given to him. He was also the herbarium's handy man, fixing everything that needed minor attention. Every year without fail, Noor would invite all the herbarium staff to his Hari Raya Aidilfitri open house, where home-cooked food was served, mostly prepared by Madam Zuliah and crafted by him. When the atmosphere in the herbarium was dull, especially on Mondays, he would crack witty jokes to cheer everyone up.

Noor is survived by his wife, Madam Zuliah bte Daud, two sons, two daughters, two granddaughters, four grandsons, two great-granddaughters, and three great-grandsons.

Low Yee Wen
Herbarium

Special thanks to Norshahid bin Mohd Noor, son of the late Mohammed Noor, for providing most of the information published here.



KEITH HILLIER

(1929–2015)

K eith Hillier, who passed away in October 2015, was a model human being and a pioneer volunteer of the National Parks Board (NParks), including the Singapore Botanic Gardens.

Keith was born into his British family in 1929 and grew up with an obsession for railways. Leaving school at 15 years of age, he became a station master on the Great Western Railway, but was not allowed to drive the trains he loved. Later he was called up for National Service and posted to Singapore, where he enjoyed the warm climate. He eventually took up a job in the shipping industry, which involved travelling to various eastern countries, and was at times stationed in Port Klang, Singapore and Penang. His wife Mei Ling was from Penang, and they were married in 1956. He made Singapore his long term home, and became a citizen of Singapore in 1983. His son, Trevor, is a well-known landscape architect based in Bali.

Keith remained in the shipping industry until his retirement, at which point he became a shipping consultant. He was active in this area and travelled regularly in Southeast Asia until 80 years of age. After his formal retirement Keith took up various hobbies, all of which were connected with his desire to learn new things, especially those relating to nature and the outdoor life. By 2000 he was already volunteering for NParks at the Sungei Buloh Wetland Reserve and Bukit Timah Nature Reserve, where he suggested the recruitment of volunteer guides to the CEO of NParks, Dr Kiat Tan, who agreed. Later he came to volunteer in this capacity at the Singapore Botanic Gardens and at Fort Canning Park. While he often acted as a guide, it was his enthusiasm as the volunteer guide coordinator that helped grow the volunteer movement.

I first met Keith in the Gardens in 2012, when I discovered he shared with me an interest in the Gardens' history. We often exchanged notes on heritage details and I recall that he was sometimes interviewed by the media on his interests. Keith was a loyal volunteer guide who gave pleasure and insights to many Gardens' visitors, whether in regard to its history, the Rain Forest, orchids, medicinal plants or edibles. It would be hard to find someone so genuinely friendly and kind. In fact, there was not a bad bone in his body and he was never known to say anything negative about anyone or anything. We have lost a very special person whose contributions to

Mr Hillier receiving a token of appreciation from the Gardens' director, Dr Nigel Taylor, for his service as one of our pioneering volunteers.

society were great and much appreciated. Keith took volunteerism to a new level and set a good example for all of us to follow. I hope we will continue to celebrate his life for years to come!

The writer is grateful to Dr Yap Swee Cheng, a volunteer guide with NParks and the Botanic Gardens, for her account of Keith Hillier as a Singaporean pioneer in her book *The stories of our Pioneers – An Extraordinary Ordinary Story* (Pagesetters Services Pte Ltd, 2015, ISBN 978-981-09-6433-7), published as a contribution to SG50.

The Gardens' volunteers celebrated Keith's life at Ridley Hall on 5 December 2015, in the presence of his widow Mei Ling and son, Trevor.

Nigel P. Taylor
Director of the Gardens

OUR TREES

*Of earthly beauties, first are trees,
Unparalleled by effigies.
Home to squirrels, birds and bees,
Residing in their sheltered lees.*

*Tembusus standing mighty, tall,
their architecture best of all;
One would think they'll never fall,
Scarcely any I recall.*

*Rain trees' canopies wide-spread,
Their leaves are intricately wed,
So sun or moon are put to bed,
And even sky has mostly fled.*

*Man doth manufactures make,
Every one its own name-sake.
Nature spurns conformity;
Uniquely different is each tree.*

*Sit entranced within the shade,
Muse awhile how things are made,
Man with all his modern aid,
Still cannot make a single blade.*

Keith Hillier

*This poem was kindly provided by
Trevor Hillier and is included here
in tribute to his father.*

Descendants of Lawrence Niven, the Gardens' first manager

Last year the Gardens received two important visits from three persons descended from the Gardens' first manager, Lawrence Niven. His life and works, so far as they are known, were recorded previously in *Gardenwise* 41: 2–3, 2013. First, on 21 July 2015, Margaret Thompson (from Sydney) and Jennifer Coffey (from New Zealand) visited the Gardens with their respective husbands, Alan and John. As part of a tour led by Dr David Middleton, deputy director and head of research and conservation, they were shown Burkill Hall where Niven was the first occupant. Margaret and Jennifer



The descendants of Lawrence Niven pose in front of his picture in the SING Herbarium: (top image) Jennifer Coffey, shown on the left, and Margaret Thompson, on the right, during their visit in July; (bottom image) Philip Duffy during his visit in October.

(Photo credits: Benjamin Aw)



Margaret Thompson and Jennifer Coffey with friends and family in front of the Bandstand gazebo.

(Photo credit: Benjamin Aw)

are the great-great granddaughters of Lawrence Niven. Second, on 16 October 2015, Philip Duffy (from Edinburgh) arrived at the Gardens, carrying a family tree drawn up by his grandmother, which proclaimed him to be Niven's great-great-great grandson. Interestingly, when Philip was interviewed by the Gardens' director, it was discovered that these two branches

of the Niven family did not know of each other! As it happened, following his trip to Singapore, Philip travelled to Australia, where he was able to meet up with Margaret and family. Here we publish photographs of these special VIP visitors.

Nigel P. Taylor

Director of the Gardens



Jennifer and Margaret on tour with Dr David Middleton. (Photo credit: Benjamin Aw)

Frank Kingdon-Ward: 'The last of the great plant hunters'

Frank (Francis) Kingdon-Ward (1885–1958) was an eminent plant collector and explorer in the mountains of south-western China, north-eastern India and northern Myanmar, having collected and catalogued over 23,000 plants for gardens in western countries as well as for British herbaria. His achievements have earned him the title 'The last of the great plant hunters' (Lyte 1989).



Kingdon-Ward's life

Francis Kingdon Ward was born near Manchester, UK, on 6 November 1885 (later he was better known as Frank Kingdon-Ward under which name he also published most of his books). He grew up in the English countryside, surrounded by gardens, fields and woodlands. In his early childhood he went on long walks with his sister Winifred and later with his close friend Kenneth Ward (no relation). Already at this time his good sense of mapping the route and describing everything he saw was apparent – something that became so important in his later life. From an early age he had a strong desire for the exploration of the unknown. After Frank's father died unexpectedly in 1906, his college activities came to an abrupt end and he was forced to find paid work. He embarked on a trip to Shanghai, China, to take up a teaching post at Shanghai Public School, although his ultimate aim was a career as a plant hunter in Asia. On the way he stopped over at Singapore, where he gained his first experience in a tropical rainforest (Bukit Timah). During the school holidays, Frank travelled from Shanghai to explore parts of Java and Borneo which further cemented his interest in tropical Asian botany.

After only two years at Shanghai Public School, Frank joined an American-led zoological expedition to search for new species of mammals in south-western China. He discovered two new species of vole (a kind of rodent) and a shrew, and also managed to collect a few herbarium specimens of plants which he sent to Cambridge. This expedition was followed by a short period of teaching in Shanghai but it was not long until

Frank Kingdon-Ward during one of his expeditions. Reproduced with permission from the Royal Geographical Society, London.

Frank received another offer to collect plants in western China, this time for the Liverpool-based seed firm ‘Bees Seeds’ to add to their catalogue of new introductions, and he immediately accepted this offer. This was the start of a long career in exploring, mapping and surveying previously uncharted territories while at the same time collecting vast numbers of botanical specimens in a region where he would spend much of his future life and which he later affectionately called ‘his country’. This remote corner of central Asia comprises south-western China (including south-eastern Tibet), north-eastern India (Assam) and what was then called northern Burma (now Myanmar).

During one of the expeditions Frank got news of the First World War and repeatedly tried to go to the front to fight the Germans, but never succeeded. He joined the Indian army and was posted to Victoria Point (known today as Kawthaung) which is the southernmost point of Burma. There he still did not see any active military service. In 1916 Frank was posted to Mesopotamia (Iraq), and later ended the war with the rank of a captain. Immediately after the war, Frank returned to exploring and headed for the ‘triangle’, a vast uncharted region in northern Burma. The second major interruption of his exploration career was World War II. Although he was in Burma at the time of the Japanese invasion, he managed to escape to India. During the war years Frank trained British forces in jungle-survival techniques. After the war his thorough knowledge of the area proved very helpful to the United States to locate downed aircraft in China, Burma and India.

It is perhaps little wonder that Frank received several awards for his achievements, including the Royal Geographical Society’s Founder’s Medal and the Royal Scottish Geographical Society’s Livingstone Medal. Awards were also received from the Royal Horticultural Society and the Massachusetts Horticultural Society.

Throughout his life Frank considered himself primarily an explorer and thought of plant collecting and book-writing mainly as a means to fund further expeditions. He was very modest and patient, and had a rather sharp sense of humour. Frank had a critical eye for detail, which helped him immensely during his explorations. He was physically very strong, and had remarkable energy and endurance.

Frank was married twice. His first wife Florinda Norman-Thompson, with whom he had two girls Martha and Pleione, was not interested in his travels but wanted a steady and substantial household income which Frank obviously could not provide, and this was probably one of the reasons for their divorce in 1937. While in India in 1947 Frank married Jean Macklin and remained married to her until his death. She liked his adventurous spirit and accompanied him on several expeditions. Jean helped with the work during their travels and wrote a book about one of her trips with Frank.

At the age of 71 years Frank climbed Mount Victoria (also known as Natma Taung) in western Burma, which at 3,035 metres above sea level is the highest mountain of the country outside of its Himalayan region in northernmost Kachin State. During this expedition in 1956 he was still discovering new plant species. Frank died

Examples of plants bearing F. Kingdon-Ward’s name

Asteraceae – genus *Wardaster*
Gentianaceae – genus *Kingdon-wardia*

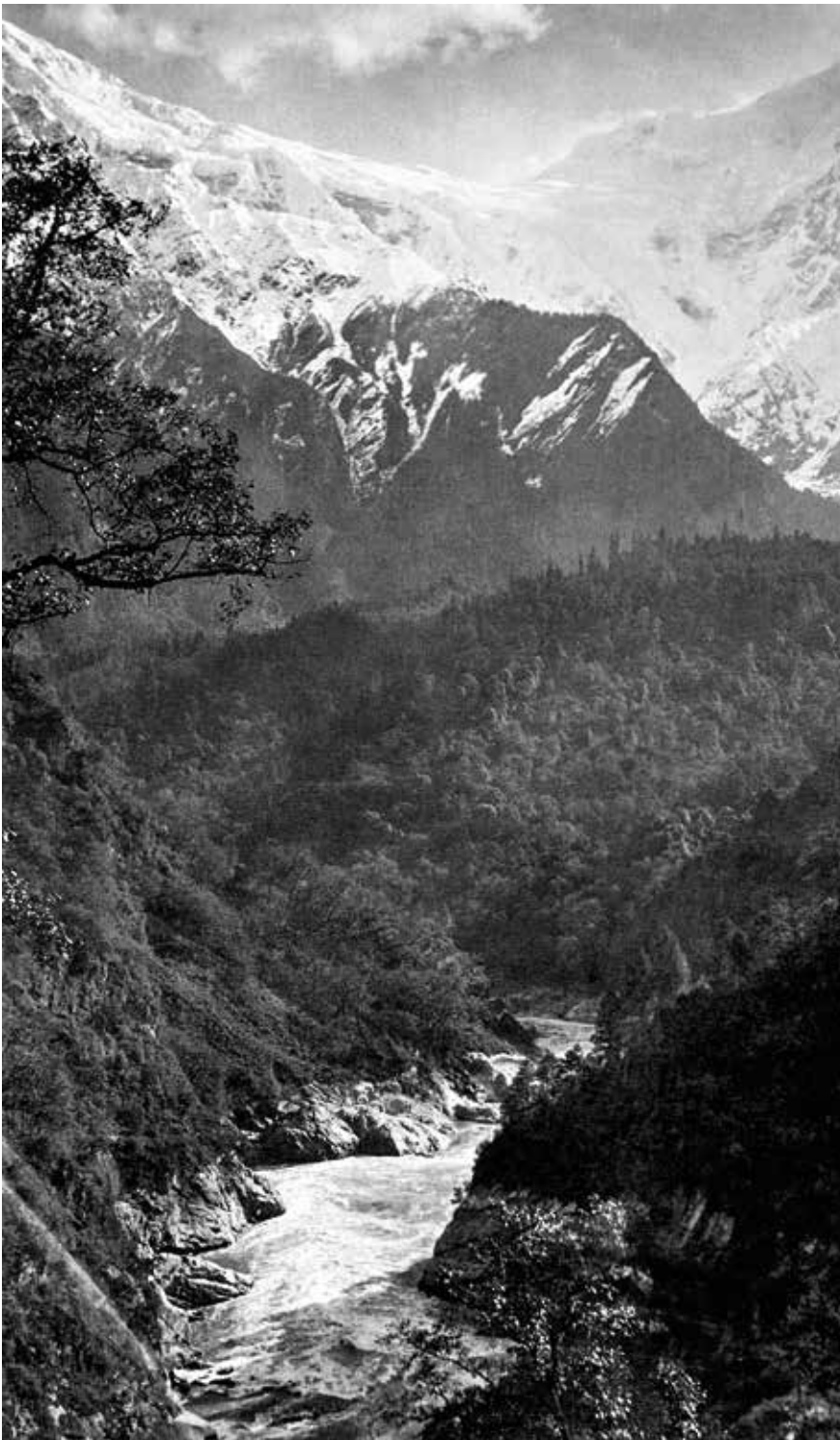
.....
Aceraceae – *Acer wardii*
Araliaceae – *Aralia kingdon-wardii*
Ericaceae – *Rhododendron wardii*
Ericaceae – *Vaccinium kingdon-wardii*
Liliaceae – *Lilium wardii*
Orchidaceae – *Paphiopedilum wardii*
Rosaceae – *Cotoneaster wardii*
Rosaceae – *Prunus kingdonwardii*
Theaceae – *Camellia wardii*
Zingiberaceae – *Roscoea wardii*

Some of the plant species described by F. Kingdon-Ward

- **Aquifoliaceae** *Ilex nothofagifolia* Kingdon-Ward
- **Ericaceae** *Rhododendron cerasiflorum* Kingdon-Ward
- **Ericaceae** *Rhododendron chrysoplepis* Hutch. & Kingdon-Ward
- **Ericaceae** *Rhododendron formosum* Kingdon-Ward
- **Ericaceae** *Rhododendron regale* Balf.f. & Kingdon-Ward
- **Ericaceae** *Rhododendron seinghkuense* Kingdon-Ward
- **Papaveraceae** *Meconopsis horridula* Kingdon-Ward
- **Papaveraceae** *Meconopsis impedita* Prain var. *rubra* Kingdon-Ward
- **Primulaceae** *Primula burmanica* Balf.f. & Kingdon-Ward
- **Primulaceae** *Primula gentianoides* W.W. Sm. & Kingdon-Ward

Frank Kingdon-Ward’s major expeditions





Tsangpo Gorge (Tibet). Photograph taken by F. Kingdon-Ward in 1924. Reproduced with permission from the Royal Geographical Society, London.

suddenly on 8 April 1958 at the age of 73 years. A few days before his death he was still discussing the possibility of another expedition to northern Iran, the Caucasus or possibly Vietnam.

The expeditions

Over a period of nearly fifty years Frank Kingdon-Ward undertook more than 20 expeditions, collecting plants in parts of south-eastern Tibet, Yunnan, northern and

western Burma and north-eastern India (the exact number is a matter of interpretation as some of his travels involved prolonged stopovers in Chinese cities, and to count them as one long expedition or as two separate ones depends on the biographer). Getting around in those days was a major challenge, as modern means of transportation like commercial air travel and efficient motorised land transport were only starting to become available, particularly in this under-developed and rugged region of

the world. Most of his trips involved long train and steam boat journeys as well as mule treks.

During his expeditions he accumulated vast numbers of herbarium specimens, seeds and bulbs. Frank's collections were sent to different gardens and herbaria in Britain (particularly the Royal Botanic Gardens, Kew, Royal Botanic Garden, Edinburgh, Ness Botanic Gardens, Rowallane Garden, Highdown Gardens and Mount Stewart), and some material also ended up in gardens in the north-eastern parts of the United States. Many of his plants turned out to be new to science and were subsequently described by him or by other botanists. Some plants had been collected before, but Frank was the first to introduce them to western gardens, such as *Rhododendron wardii*, *Meconopsis betonicifolia*, *Primula florindae*, *Gaultheria wardii*, *Lilium wardii* and *L. mackliniae*.

Unlike some of his contemporaries who collected plants in this part of the world, for example George Forrest, Frank did not employ local collectors, as he wanted to see the plants in their native habitats himself and personally wanted to collect their seeds. But Frank was not merely a collector, as he also studied the plants and recorded various observations about them. He was interested in and knowledgeable about many subjects, including geography, geology, zoology, horticulture, anthropology and ethnology. Large sections in his books are devoted to local people, their ways of living and their religions. He tried to learn a few of the languages of the region, such as Burmese and Tibetan, obviously at least in part for practical reasons (to enable him to keep track of expenditure during his expeditions).

During his expeditions he encountered several problems and difficulties, a few of these resulting from his solitary and adventurous nature. These include near-accidents like almost falling off cliffs (he sometimes undertook daring actions on mountains, despite having periods of vertigo), or a huge tree falling onto his tent (he miraculously came out



One of F. Kingdon-Ward's greatest finds is the lady's slipper orchid *Paphiopedilum wardii*, which he discovered in 1922 near Putao in northernmost Burma and which was subsequently named in his honour.

(Photo credit: Hubert Kurzweil)

without major injuries). On a few occasions he got separated from the main expedition party, and was lost in the wild, sometimes for up to a few days. During an expedition in 1950 on the border of Assam and Tibet, Frank and his second wife Jean survived one of the strongest earthquakes ever recorded (9.6 on the Richter scale). In northern Burma he contracted malaria and suffered from recurring bouts of this disease for the rest of his life. On at least one occasion he was forced to change his travel plans due to armed conflict in the region he was heading for. During an expedition in 1935 he was briefly arrested by Tibetans for entering an area that he did not have permission to access.

Contributions to botany

Frank Kingdon-Ward made extensive contributions to the floristic botany of the region, with many newly described plant species based on specimens that he

collected. His herbarium collections are not only useful because they are largely complete and well-prepared, but also because the accompanying labels are very detailed. Two entire plant genera, *Wardaster* and *Kingdon-wardia* (now included in the genus *Swertia*) were named in his honour. In addition, just over 110 plant species that were described based on his collections now bear his name, either as *kingdon-wardii*, *kingdonwardii* or simply as *wardii*. Even as late as 1995 a new species of orchid was described from a herbarium specimen originally collected by him and was subsequently named in his honour (*Rhomboda wardii*; Ormerod 1995, *Orchadian* 11: p. 327). It should also be noted that two plants were named after his first and second wife, *Primula florindae* and *Lilium mackliniae*, respectively.

Frank also described 119 plant species, either as a sole author or jointly with others. Most of these are in the genera

A selection of F. Kingdon-Ward's books

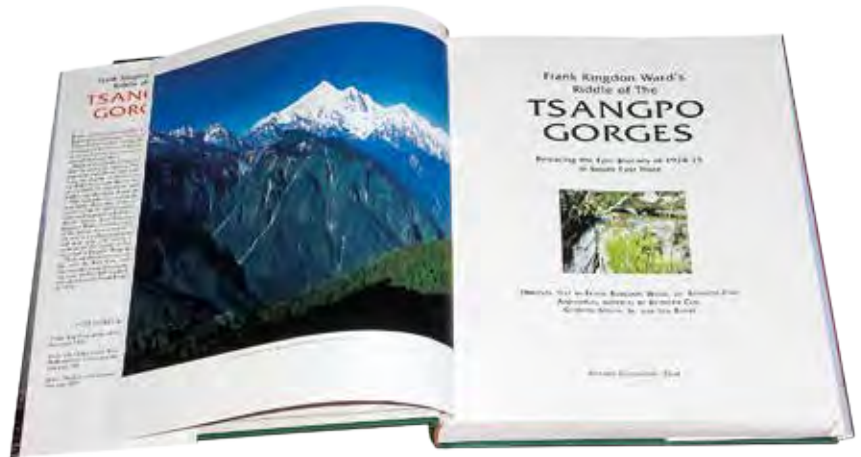
- *On the Road to Tibet* (1910)
- *Land of the Blue Poppy* (1913)
- *In Farthest Burma* (1921)
- *Mystery Rivers of Tibet* (1923)
- *The Riddle of the Tsangpo Gorges* (1926)
- *Rhododendrons for Everyone* (1926)
- *Plant Hunting on the Edge of the World* (1930)
- *Plant Hunting in the Wilds* (1931)
- *A Plant Hunter in Tibet* (1934)
- *Plant Hunter's Paradise* (1937)
- *Assam Adventure* (1941)
- *Burma's Icy Mountains* (1949)
- *Plant Hunter in Manipur* (1952)
- *Pilgrimage for Plants* (1960)

Rhododendron (62), *Meconopsis* (11) and *Primula* (37). Particularly, *Rhododendron* was close to his heart and several of his later studies focused on this genus. New plant species were mostly published in *Notes from the Royal Botanic Garden Edinburgh*, *Gardeners' Chronicle*, *Acta Botanica Yunnanica* and *Field Notes of Rhododendrons*. However, several of Frank's new species were reclassified and placed in synonymy by later authors.

Apart from floristic contributions, Frank also undertook botanical studies in other related fields. He wrote a detailed account of the vegetation of Mount Victoria in *Acta Horti Gothoburgensis* and developed hypotheses on the evolution and classification of the genus *Rhododendron*. He argued that isolation brought about by glaciation is probably the cause of the extreme diversity in the genera *Primula* and *Rhododendron*. While in Burma, Frank collaborated with local botanist U Chit Ko Ko in research into forestry in the country.

Books and other publications

Frank was a prolific writer. He authored 25 books which are mostly accounts of his travels; some of them have been



F. Kingdon-Ward's *Riddle of the Tsangpo Gorges* which first came out in 1926 and was later republished in 2001 (with additions by Kenneth Cox, Kenneth Storm, Jr. and Ian Baker).

republished recently. His books made the mountains, plants and people of the region well known to the outside world. He normally used the income generated from the sale of the books to finance new expeditions, and obviously the aim of his book-writing was also to share his passion for the unknown. In addition, short articles about his expedition can also be found in various journals, like the *Journal of the Royal Horticultural Society*, *The Geographic Journal* and *Geographical Magazine*. Frank also wrote purely botanical papers.

Frank's second wife Jean also wrote books, including *My Hill So Strong* about the great Assam earthquake. This book is also of interest as it gives insight into her husband's lifestyle of exploration.

The Singapore connection

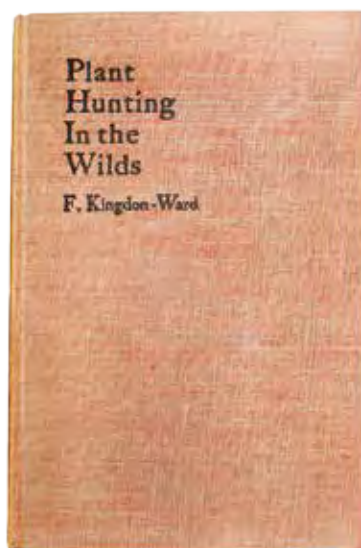
Some readers may wonder if any of Kingdon-Ward's plants also occur in Singapore. Because of major climatic differences, the plants from high-elevation areas of Frank's favourite 'hunting grounds' as well as those from the drier parts of Tibet obviously do not thrive in the humid tropical climate of our own region. However, some plants from subtropical valleys at lower elevations in northernmost Myanmar, north-eastern India and Yunnan are very widespread in tropical Asia and are also found in Peninsular Malaysia and Singapore. Examples in the orchid family include *Arundina graminifolia*,

Chrysoglossum ornatum, *Goodyera viridiflora*, *Phaius tankervilleae*, *Pholidota imbricata* and *Spiranthes sinensis*.

Acknowledgements

The Royal Geographic Society, London (UK), is thanked for supplying and granting permission to reproduce two of Kingdon-Ward's photographs. I am also grateful to my long-time collaborator Dr Saw Lwin, Yangon (Myanmar), for commenting on this manuscript.

Hubert Kurzweil
Herbarium



Plant Hunting in the Wilds, published by F. Kingdon-Ward in 1931.

Further reading

Lyte, C. 1989. Frank Kingdon-Ward: The Last of the Great Plant Hunters. John Murray Publishers Ltd.

www.plantexplorers.com/explorers/biographies/kingdon-ward/frank-kingdon-ward.htm

www.french4tots.co.uk/kingdon-ward/fkw-timeline.html

www.french4tots.co.uk/kingdon-ward/

www.rhododendron.org/v45n3p140.html

A botanical expedition to Laos

THE BOLAVEN PLATEAU

Laos is one of the least botanically explored countries of Southeast Asia and only a preliminary checklist of its flora is available, published in 2007. Among the neighbouring countries, only Myanmar is nearly as poorly collected as Laos. The Singapore Botanic Gardens has been organising yearly expeditions to Laos since 2012, with the purpose of increasing our knowledge of its flora. The Gardens' main partner in Laos is the Pha Tad Ke Botanic Garden in Luang Prabang, and a Memorandum-of-Understanding has been recently signed between the two institutions to strengthen our collaboration.

The latest botanical expedition was mounted in October/November of 2015, and included three staff from Pha Tad Ke (Jonathan Peereman, Sengtong Souvanaphou and Oudom Soulimoungchoun), two staff from the Singapore Botanic Gardens (Michele Rodda and Logan Tan), and Laura Guglielmone from the Turin Botanic Garden in Italy. In the field we were accompanied by two officers from the local forestry department.

In contrast to the first three expeditions which focussed on collecting herbarium specimens in the northern part of the country, this trip explored the far southern part of Laos and collection targets included live plants as well as herbarium specimens. For botanical gardens, collection of live specimens is important to increase living collections as well as for botanical research. Most herbarium specimens are made from fertile plants (those in bloom or fruit), while sterile plants are not collected. However, sterile plants may turn out to be species that are new to science or rare. The collection of living material allows researchers to cultivate and monitor these plants, with the hope that one day they will produce flowers that will aid us in determining their identity.



The typical habitat at the fringes of the Bolaven Plateau, with often-exposed bedrock and pockets of very thin soil. The herbaceous vegetation here was in full bloom in October and dominated by yellow *Utricularia bifida* and *Spathoglottis pubescens*.



Spathoglottis pubescens.



Aeginetia indica is a widespread annual parasitic plant that colonises the roots of grasses.



A species of *Ceropegia* that was found climbing on a small *Ficus*.



Some parts of the Bolaven Plateau are covered in sparse pine forest (left). The trees of these areas are often clothed in epiphytic orchids such as *Coelogyne* (below left), and in the understory, *Nepenthes mirabilis* (below) can be found.



while many herbaceous plants may still be blooming or in fruit. For the collection of live plants, this is also an ideal period because most herbaceous plants, annual or perennial, begin their dormancy, enabling them to be transported easily in the form of tubers or seeds.

The Bolaven Plateau is an area of flat land located to the east of Pakse, at 1000–1400 m above sea level. The climate is moist and cool year round and ideal for the cultivation of coffee, so a large part of the plateau has been converted for agricultural use. However, the edges of the plateau are mainly sandstone outcrops with a lack of fertile soil and are therefore still covered in intact vegetation. These were the areas that we explored most during our trip, which were only accessible by dirt tracks and foot-paths. We were rewarded with tracts of land with almost untouched vegetation, at that time in full bloom. On the nutrient-poor sandy soil, the vegetation included species with special environmental adaptations, such as carnivorous *Utricularia*, the parasitic *Aeginetia indica*, and species of *Burmanna* – plants known to associate with mycorrhizal fungi. Between the rocky outcrops the valleys presented fragments of primary forest where a wealth of orchids, *Hoya* and epiphytic ferns covered the branches of the trees. The forest floor was also colonised by a diverse array of plants from the Acanthaceae, Melastomataceae and Rubiaceae families, as well as ferns. Thorny rattans (climbing palms) and pandans made walking in this kind of environment more challenging but not less interesting.

At least four duplicate sets were made of all herbarium specimens collected during the expedition. Two sets were left in Laos, one to go to the National University of Laos and one for Pha Tad Ke, while the remaining sets were brought to Singapore where they will be incorporated into the collections of the SING herbarium or sent to other researchers. The herbarium specimens will be particularly useful for anybody working on the Flora of Laos and neighbouring countries.

This expedition involved extensive collecting (up to 70 specimens each day!) that was very time consuming. The field collection efforts required long trekking, and carrying tools to collect and press plants such as bags, newspaper, tags and cutting and digging tools. Long pruning tools were used to obtain specimens of tree species. For each plant we recorded

field information such as GPS coordinates and morphological information (heights of plants, characteristics of leaves and flower parts, etc.), and took photographic documentation. Back from the field, all collections meant for herbarium specimens needed to be numbered, tagged and pressed between newspapers. For the live plants, it was important to note any field data that would enable us to cultivate them successfully, and we also had to check on their health daily in order to keep them alive throughout the trip.

The trip focussed on two areas in Champasak Province, the Bolaven Plateau and Xe Pian National Biodiversity Conservation Area. October was a good time for the expedition because it is the end of the rainy season and temperatures also decrease slightly. In addition, trees and shrubs can be expected to be in fruit,

WATERFALLS



The Xe Katarm Waterfall at the eastern edge of the Bolaven Plateau is one of the largest in the area. The deep valley at the base is colonised by vegetation adapted to grow in this very moist environment and surrounded by fine mist for most of the year.

Due to the high rainfall on the plateau and its shallow soils, water collects in many streams and forms majestic waterfalls at the edges of the plateau. The plants that live at the base of waterfalls often have special adaptations to allow them to survive constant mist and relatively low light levels. In this environment we encountered many members of the Urticaceae, in particular *Elatostema* spp., a few *Begonia* species, and many gingers.

Habenaria rhodocheila, a small orchid commonly found in deep shade along streams.



Species of *Elatostema* and *Impatiens* are perfectly adapted to the ever-wet environment at the base of Pusawan waterfall.



Microchirita bimaculata growing in the vicinity of Xe Katarm Waterfall.

XE PIAN NATIONAL BIODIVERSITY CONSERVATION AREA

The slow flowing river in Xe Pian National Biodiversity Conservation Area was covered by the aquatic *Rotala wallichii* in full bloom.



Elatostema repens was commonly found growing along the trail in Xe Pian. Its male flowers burst open to release a small cloud of pollen.



Drosera burmannii is a widespread carnivorous plant that we encountered while collecting in the far south of Laos, close to the border with Cambodia.



Aristolochia pothieri is a large climber in the lowlands of Xe Pian.



The collecting team having lunch break along a stream in Xe Pian.

(Photo credit: Sengtong Souvannaphou)

The second main site we visited was Xe Pian National Biodiversity Conservation Area, a large area of mostly lowland forest located to the south of Bolaven Plateau and extending to the border with Cambodia. Xe Pian supports very diverse wildlife, although the vegetation in the accessible parts of the reserve is almost entirely secondary. In October it was much drier than the Bolaven Plateau and many plants were no longer in bloom.

Our first exploration of the south of Laos was an exciting experience that left us wanting to go back to visit the same areas in a different season to fully appreciate their incredible plant diversity.

Michele Rodda
Herbarium

Logan Tan
Horticulture, Operations and Development

All photos by Michele Rodda unless otherwise stated.

Saving native gingers in the tissue culture lab

Visitors to the Singapore Botanic Gardens often stop and look through the long glass windows on the ground level of Botany Centre, which offer a peak into our plant tissue culture labs. These labs are widely known for mass propagation of fabulous orchid cultivars. However, many people aren't aware that the lab also serves as a production centre for some of Singapore's Critically Endangered native species.

Singapore's native gingers are one of the more charismatic plant groups which receive a helping hand from our lab. Although more than 120 species of the ginger order have been recorded from Singapore, these are mostly introduced ornamental species. Only about 26 species are considered native. Based on the latest records from the Singapore Red Data Book (2008), 11 of these species are presumed to be extinct locally, while the rest are assigned the status of Critically Endangered, Endangered or Vulnerable. None of Singapore's native gingers are considered common. In 2011, the Singapore Botanic Gardens, together with colleagues from various other divisions of the National Parks Board (NParks), embarked on an intensive conservation project to survey, monitor, propagate and re-introduce native gingers around Singapore. During the past few years, we have employed two basic approaches to propagate some of the native gingers for reintroductions.

The first approach is an *ex situ* method which involves collecting seeds from wild populations and cultivating them in the nursery. However, this approach can be

Ginger species that have successfully been established in the plant tissue laboratory: (top row, from left to right) *Hornstedtia conica*, *Zingiber puberulum*, *Alpinia aquatica*; (bottom row, from left to right) *Globba leucantha*, *Zingiber singaporense*, *Hornstedtia scyphifera*.

(Photo credits: Jana Leong-Škorníková)



time-intensive as it requires regular visits to wild populations in order to monitor flowering and fruiting, and of the native gingers, only a few species produce seeds in amounts significant enough to result in large stocks of plantlets. Some of those that do are still fairly difficult to cultivate, as they are, especially in the early stages, easily infected by soil-borne pathogens such as



bacterial wilt (*Pseudomonas solanacearum*), soft rot (*Pythium aphanidermatum*) and nematodes (*Meloidogyne* spp.). Of the other native gingers, some do not seem to form seeds regularly anymore, possibly because there are insufficient individuals left in the wild to achieve cross-pollination. Some gingers produce bulbils or can be propagated from stem or rhizome cuttings, but it often takes a long time to create large numbers of plantlets through propagation by vegetative means. This is when we apply an alternative method, *in vitro* tissue culture or micro-propagation.

Micro-propagation is the culture of cells, tissues, organs or whole plants under *in vitro* aseptic (sterile) conditions in a medium full of nutrients. This method has been widely used for mass propagation of plants. A single piece of tissue (known as an explant) from the 'parent' plant can



Cages made of fine steel mesh to protect young infructescences of *Hornstedtia conica* until the seeds ripen.

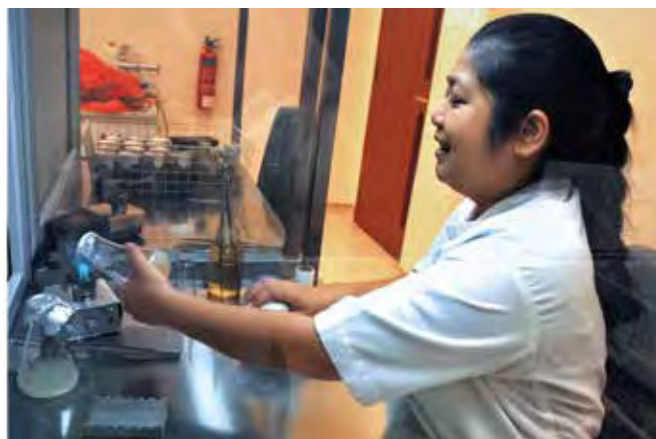
(Photo credit: Jana Leong-Škorničková)

be used to produce hundreds or even thousands of plantlets in a relatively short time period under controlled conditions.

For tissue culture techniques to be successful, clean and healthy plant tissues are required and this is one of the major obstacles in our work. The easiest way to obtain a sterile culture is to start it from seed, in other words, sterilising the surface of the seed and germinating it in the culture media. However, getting ripe seeds before wild animals do is not always an easy affair. Ginger seeds are often covered in a tasty sour-sweet aril that attracts monkeys and rodents, and the ripening fruits must be enclosed for several weeks in small steel cages and regularly monitored to harvest them at the right time. Other than seeds, rhizomes, axillary buds and shoot tips can also be used for micro-propagation. Most members of the Zingiberaceae have dormant buds that are compressed in

Dr Gillian Khew cleaning stems of *Zingiber puberulum* before the cloning process.

(Photo credit: Jana Leong-Škorničková)



(Left) Teng Seah and (right) Li Li in the process of cloning and transfer of cultures. (Photo credits: David Lim)



Different stages of cloning gingers: (left) a dormant bud, prior to beginning the cloning process; (below, from left to right) a regenerated plantlet inside a test tube, plantlets in a flask ready to be planted, and transplanted plants in the nursery.

the rhizome and buried underground. Plants that come to our lab freshly collected from the forest are often covered in mud, bacteria and fungi, and must be sterilised. Different disinfectant methods can be used to obtain clean cultures, but the sterilisation process is like a dance on thin ice. Too little of a disinfectant may not be enough to kill any bacteria or fungi present, and too much disinfectant may kill the plant tissue instead. It sometimes takes many trials before we break through this

bottleneck in the process, but once we get a sterile tissue, the battle is half-won. The next step is to mass-produce plantlets from the tissue.

Fortunately, for most native gingers, *in vitro* mass-production is relatively easy. To date, six species have been successfully established using this method. Once the plantlets pass their 'babyhood', they need to leave their '5-star hotel' – the flasks where the temperature, moisture and light levels are kept constant and nutrients are provided around the clock. This process, called 'hardening', involves transplanting the plantlets to a soil medium and gradually, under controlled nursery conditions, prepares them for life in Singapore's forests and parks. Once the plants acclimate to life





The micro-propagation laboratory at the Botany Centre: (left) the transfer room and (right) the shaker room. (Photo credits: Winnie Wong)

in the nursery and grow to a decent size, they are ready for the next step in their adventure – to be planted as part of our reintroduction efforts.

Since we started micro-propagating native gingers in 2011, more than 3,000 plantlets have been sent to the nursery for hardening. To our great joy, the first batches of our *Globba leucantha* lab babies, which were acclimatised in NParks' Pasir Panjang Nursery and planted at the Gardens, have started to flower. Our NParks colleagues from the Plant Info Unit of the Horticulture and Community Gardening Division have also been working with our micro-propagated *Globba* species, and are currently trialling them for use as house plants, particularly in terraria. We have also succeeded in establishing a couple of sterile cultures of *Zingiber singaporense*, a newly discovered endemic native ginger. We are now in the process of mass-propagating these cultures. Once ample stock has been built up, we hope to re-introduce this endemic species into various parts of Singapore, and also make this small but charming ginger available as an ornamental plant. The laboratory is currently undergoing renovation, and we look forward to its completion, as the new lab will enable us to achieve much more in the future!

Koh Teng Seah
Orchid Breeding and Conservation
Biotechnology Laboratory

Jana Leong-Škorníčková
Herbarium



(Left) Flasks of *Globba leucantha* cultures ready to be sent to the nursery for 'hardening'.

(Photo credit: Chin Li Li)

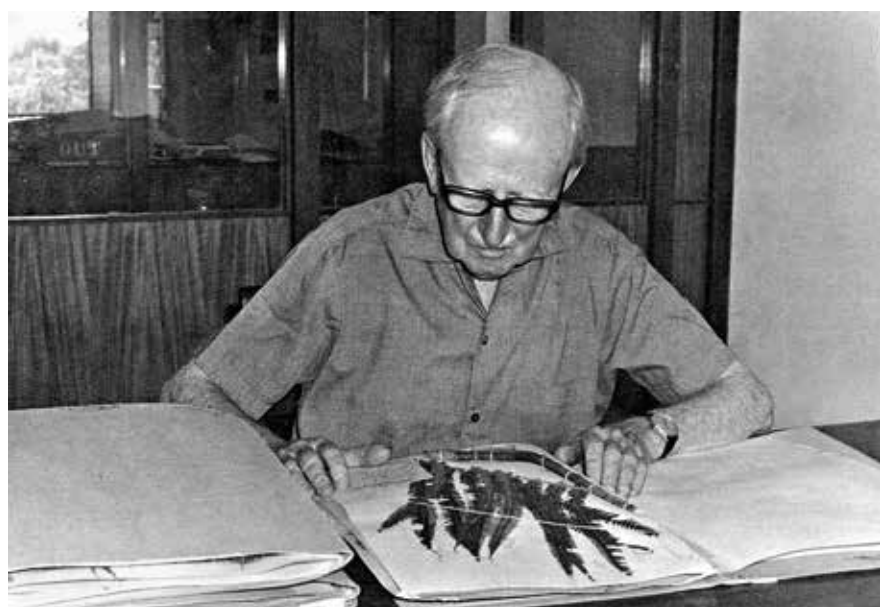


(Below left) Mdm Rasidah binte Zali from the Plant Resource Centre planting ginger plantlets from the laboratory. (Photo credit: Chin Li Li)

(Bottom) Flowering *Globba leucantha* planted in the grounds of the Singapore Botanic Gardens. These plants were cultured in the laboratory and acclimatised at NParks' Pasir Panjang Nursery. (Photo credit: Koh Teng Seah)



The Holttum orchids, and the need for conservation of heritage plants



Professor Holttum in the old herbarium, Singapore Botanic Gardens, 1975.

(Courtesy of Singapore Botanic Gardens Archives)

The late Richard Eric Holttum is well known for his contributions to the Botanic Gardens, and to gardening and local horticulture. He helped to form both the Malayan Orchid Society, now the Orchid Society of South East Asia (OSSEA), and the Singapore Gardening Society. Only two years after graduating from Cambridge with first class honours in Botany, he became Assistant Director of the Botanic Gardens, in 1922, and remained in Singapore until 1954. He became Director of the Gardens in 1925, in succession to Henry Burkill, and served through the war. In 1949 he moved to become Professor of Botany in what was then the University of Malaya in Singapore. He was botanically well regarded for his work on ferns, which he continued after his retirement from the university and his return to the UK, in 1954, as an Honorary Research Fellow of the Royal Botanic Gardens, Kew. Yet, it is for orchids

more than any other group of plants that Holttum is well remembered locally. His original laboratory in the Botanic Gardens has been christened Holttum Hall. It is where he first started experimenting with the then new Knudson method for the germination of orchid seeds in sterile agar medium. That work led to a tremendous surge in interest in orchid growing and hybridising, both inside the Botanic Gardens and among the many amateur growers locally. Eventually, it also led to the foundation of the cut-flower orchid industry.

Holttum must have been proud of his orchid hybrids. He took the highly unusual step of publishing a coloured illustration of *Spathoglottis aurea* together with examples of its 4th generation descendant hybrids (*Spathoglottis* Dwarf Legion) as the frontispiece to Vol 1 of his *Flora of Malaya*, dealing with orchids. He had many species of orchids named



Frontispiece to Holttum's *Revised Flora of Malaya*, Vol 1 Orchids, 1953. (Courtesy of Singapore Botanic Gardens Archives)



for him by others, but also had, not just a hybrid (*Pararachnis* Eric Holttum), but an entire nothogenus (*Holttumara*) named for him as well.

In addition, a number of orchid hybrids have been named for Holttum's wife and daughters. This brings me to the central point of this article. What is not always realised is that orchid hybrids, like orchid species, can and probably often do go extinct. They are actually quite vulnerable. And, while in theory they can be recovered by a repeat crossing of the parents, since the registered name attaches to the parentage, in practice hybrid offspring are highly variable, and treasured or exceptional cultivars, once extinct, cannot be re-created.

Singapore has an outstanding record of orchid hybridization. It has created commercially successful cut flowers, many sought-after hobby plants, and it has a unique tradition of VIP orchid naming. Building on Holttum's original work, Singapore breeders have registered around 2,500 hybrids in the intervening years. Many of these have won awards locally or overseas. If we take the best and most interesting of these orchids, whether those of outstanding beauty (*Papilionanda* Tan Hoon Siang, for example); or named for historical or fa-

mous people (*Ridleyara* Fascad, *Aranda* Lee Kuan Yew); or events (*Aranda* City of Singapore, named by John Laycock to commemorate the charter by which Singapore was proclaimed a city); or for their contribution as parents (*Arachnis* Maggie Oei); or in some other way notable (*Oncidesa* Goldiana – a ubiquitous cut flower to this day); then we have the makings of a distinguished collection. And, indeed, in the National Orchid Garden and elsewhere, there are a number of such heritage plants. Nevertheless, it can be said that more could be done to preserve our orchid heritage, and this need can be nicely illustrated by the Holttum orchids. Surprisingly, we cannot be sure that they have all survived.

***Dendrobium* Ursula**

(*D. lineale* × *D. discolor*; formerly *D. veratrifolium* × *D. undulatum*)

During the war, while Eric Holttum continued his work in the Botanic Gardens, his wife Ursula and daughters were in Australia. Ursula earlier made her own contribution to the Botanic Gardens in the form of a sundial, which has been preserved and restored and can be seen today in the Gardens. Judging by the bust of her daughter Deborah, she was a sculptor of some talent. She was also



Ursula Holttum modelling a clay bust, possibly of her husband.

(Courtesy of Deborah Holttum and Singapore Botanic Gardens Archives)

a weaver and designer of embroidery, and she published work on local cookery and life in Australia during the war, and in Singapore after it. Following her husband's retirement to the UK, she designed and worked a number of pew cushions for St Anne's Church on Kew Green. Later, in her 80s, Ursula worked a design into a replacement chair-back for the Linnean Society of London. She died in 1987.

Her orchid was named and registered in 1953 by the Botanic Gardens, when Holttum was no longer the director. It is an early example of a Singapore-registered *Dendrobium* hybrid (it was the 18th such hybrid, the first being in 1940), and Holttum included it in the colour plate of hybrids of *Dendrobium* in his Flora (published the same year, facing p. 342). However, I am unable to locate a contemporary plant or photograph of this hybrid.

***Parandachnis* Ursula Holttum**
(*Pararachnis* Eric Holttum × *Vanda* Dawn Nishimura)

This hybrid was registered in 1976, by Syed Yusof Alsagoff, the hybrid being made by Kranji Orchids (Chan Swie Ying). This was Yusof's own tribute to Mrs Holttum, registered when she and her husband visited Singapore after his retirement, and it is fitting that an orchid named for her husband is one of the parents.



***Parandachnis* Ursula Holttum.**
(Photo credit: David Lim)



Deborah Holttum with her orchid on her 80th birthday. (Courtesy of Deborah and Philippa Holttum)

***Aranda* Deborah**
(*Arachnis hookeriana* var. *luteola* × *Vanda lamellata*)

Deborah Holttum was the elder Holttum daughter of two. She was married, but later divorced and changed her name and that of her children back to Holttum by deed poll. For many years she worked in retail, in china and glass with Waterford Wedgwood in the UK, but after retirement resumed an interest in sewing, embroidery and textiles and exhibited with the Kingston Branch of the Embroiderers' Guild. She has also given time as a volunteer in woodland conservation for the last 18 years.

Deborah's orchid was the first Singapore *Aranda*, registered by the Botanic Gardens in 1945, and is an attractive flower. It has remained in occasional cultivation, and when her daughter Philippa wrote to the Orchid Society of South East Asia last year, asking about this orchid, a spectacular photograph was kindly provided by David Lim of the National Orchid Garden, which also had plants in flower. Philippa in turn framed this orchid and presented it to her mother on her 80th birthday, and kindly provided a photograph of her mother holding the picture of her orchid (reproduced here with permission).

***Armodachnis* Catherine**
(*Arachnis hookeriana* var. *luteola* × *Armadorum sulingii*)

Originally registered as *Arachnis* Catherine, as *Armadorum sulingii* was formerly classified as *Arachnis sulingii*.

Catherine Holttum was the younger daughter of the Holttums. She studied geography, and moved to South Africa and then to Australia. In South Africa she married a British geologist, C.B. Smith, but died in 1997 after a recurrence of breast cancer. According to her daughter Sylvia, Catherine also seems to have possessed some of the artistic character of her mother. In the 1980s, she became an artisan within the Banister Street Workshops in Fremantle, where she created hand woven shirts, ties, bags and other items.

Her orchid was registered in 1949. *Armodachnis* Catherine appears to be no longer in cultivation in Singapore, and I could find no picture of it, but like *Dendrobium* Ursula it was featured in Holttum's Flora, this time in a plate of vandaceous hybrids, facing p. 618. Unexpectedly, it was also pictured on the 30-peso Cuban stamp in 1973. Cuba has featured many orchids on its stamps,



Aranda Deborah Holttum. (Photo credit: David Lim)

including a few from the Old World (including *Arundina graminifolia*, which is native to Singapore and Southeast Asia but has become naturalised in many tropical countries in the Americas). It would be most remarkable if it turned out that one might obtain a plant of *Armodachnis* Catherine from so remote and unlikely source.



Catherine Holttum. (Courtesy of Sylvia Smith)

***Pararachnis* Eric Holttum
(*Arachnis* Maggie Oei ×
Paraphalaenopsis denevei)**

Originally registered as *Arachnopsis* Eric Holttum, since in 1950 *Paraphalaenopsis* was treated as *Phalaenopsis* for purposes of registration.

This Singapore orchid is named after R.E. Holttum. Registered by the Singapore Botanic Gardens in 1950, it once featured



Armodachnis Catherine, better known as *Arachnis* Catherine, depicted on a Cuban postage stamp.

(Courtesy of CubaPostal.com)

on the Singapore 20-cent stamp, and was itself a successful parent of subsequent hybrids with 10 first generation offspring registered. In addition, the artificial genus (nothogenus) *Holttumara*, created by combining *Arachnis*, *Renanthera* and *Vanda*, itself contains nearly 50 individual registered hybrids, though none of these are named for family members, and many have been made by breeders in other countries.

If one turns to the botanical names of species, the list of orchids named for Holttum is quite a long one (and it omits four further species that are now considered synonyms in the Kew World Checklist of monocotyledons):

- *Cleisostoma holttumii* (Carr) Garay (1972)
- *Corybas holttumii* J.Dransf. & G.Sm. (1986)
- *Crepidium holttumianum* Szlach. (1995)
- *Gastrodia holttumii* Carr (1929)
- *Peristylus holttumii* Seidenf. (1977)
- *Peristylus holttumianus* Seidenf. ex Aver. (1988)
- *Renanthera coccinea* var. *holttumii* Mahyar (1988)

It would be a pity if any of the natural species or artificial hybrids mentioned in this article were to become extinct. Extinction of a natural species is always an irreplaceable loss; but extinction of a hybrid is also a loss, perhaps not completely irreplaceable, but still a matter for regret. All the hybrids mentioned in this article ought to be considered features of our orchid heritage, through their connection with a man central to Singapore's botanical and horticultural history. Conservation efforts should be extended to hybrids as well as to species.

John Elliott

*First Vice-President,
Orchid Society of South East Asia*

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Rediscovery and reintroduction of *Robiquetia spathulata* in Singapore



Singapore used to be the home of a large number of orchid species. This diversity was due to the existence of a wide range of habitats and the favourable equatorial climate. However, as a result of development and habitat loss, more than 90% of Singapore's 228 species of native orchids are today locally Endangered, Vulnerable, or Presumed Nationally Extinct. The Orchid Conservation Programme, which was initiated by the Gardens, works toward finding ways to conserve the germplasm of native species and increase their numbers for subsequent reintroduction into appropriate habitats in nature reserves, parks, and along roadsides. Pulau Ubin has been the site of many of our reintroductions, as the island once supported a great number of orchid species. The Gardens' first director, H.N. Ridley, recorded at least three species from there himself – *Bulbophyllum medusae*, *Renanthera elongata* and the tiger orchid, *Grammatophyllum speciosum*. The Gardens' herbarium records also document the presence of *Corymborkis veratrifolia*, *Dendrobium crumenatum*, *Eulophia graminea*, *Neuwiedia veratrifolia*, *Phalaenopsis cornucervi*, *Spathogoltis plicata*, *Thrixspermum amplexicaule*, *Thrixspermum calceolus* and *Zeuxine clandestina* on the island, and some of these species can still be found there today.

Pulau Ubin, which means 'Granite Island', is situated just off the northeastern corner of the main island of Singapore. The 1,020-hectare island is largely a series of undulating, granite hills. Much of the island's original vegetation was cleared for the cultivation of rubber and crops like coffee, pineapple, coconut and jasmine, and for the mining of granite. Today, we can still see the remnants of old quarries, surrounded by secondary forest and grass-dominated habitats. Despite

Robiquetia spathulata was rediscovered on Pulau Ubin by Mark Lim.



Robiquetia spathulata is a monopodial epiphyte with a pendulous growth habit.



The inflorescences grow up to 30 cm long and hang downward.



The rachis is covered in numerous small flowers, only about 10 of which are fully open at any one time.

the changes to the island over the years, some very interesting and pretty orchid species still reside there, including *Eulophia graminea*, *Neuwiedia veratrifolia*, *Thrixspermum amplexicaule* and *Vanilla griffithii*.

In 2006, a native orchid thought no longer to exist in Singapore was rediscovered on Pulau Ubin. Mark Lim, a park ranger with NParks, found a specimen of *Robiquetia spathulata* growing on a *Vitex pinnata* tree. This species had previously only been documented once in Singapore, by Ridley, who collected it at Dalvey Road in 1892. Ridley's speci-

men is the holotype of the species and is held in the Gardens' SING herbarium. This species, which was formerly named *Saccolabium densiflorum*, is distributed from Sikkim eastward through Indochina to Hainan, and southwards to Sumatra, Java, Borneo and Halmahera. In Malaysia, it is found in lowland areas.

Robiquetia spathulata is a relatively large monopodial epiphyte, growing up to 1 m long with a pendulous growth habit and stems that turn up at their ends. The numerous thick and leathery leaves are about 18 cm long by 4.5 cm wide,

arranged in two rows, and spaced 2 to 3 cm apart along the stem. The 30 cm long flower spikes hang downward, and several flowers may be produced simultaneously along the stem, although only about 10 are fully open at any one time. The flowers are slightly cup-shaped, with sepals and petals that are yellow with brownish-red blotches, and a light cream-yellow lip and column.

Following its discovery, the Pulau Ubin specimen was closely monitored for flowering and fruiting. Although it did produce flowers, the plant did not form



Cloned plantlets in the micro-propagation laboratory.

capsules naturally, either due to a lack of pollinators, or because the plant is sexually self-incompatible (i.e., isn't capable of forming capsules via self-pollination). Subsequently, the plant was cloned in the Gardens' micro-propagation laboratory to provide stock for reintroductions around the island.

From 2012 to 2015, more than 900 plantlets of *Robiquetia spathulata* were planted at Pulau Ubin and numerous other locations, including Ang Mo Kio Town Garden West, Bukit Batok Nature Park, Bukit Timah Nature Reserve, Central Catchment Nature Reserve, Fort Canning Park, Pasir Ris Park and Upper Peirce Reservoir. So far, more than 90% of the reintroduced plants have survived, displaying strong



Planting *Robiquetia spathulata* in the canopy of a tree at Pulau Ubin.



Preparing to plant healthy plantlets at Zhenghua Nature Park.



Dr Yam Tim Wing with a reintroduced plant at Central Catchment Nature Reserve.

root systems and healthy leaves. We were very happy in 2015 when some of the plants even flowered.

The high survival rate of the plants, along with their proven ability to withstand extremes of wind and sunlight in a multitude of microclimates, indicate that *Robiquetia spathulata* is a suitable choice for reintroduction into Singapore's urban environment. During the extreme droughts of 2014 and 2015, we worked with staff from NParks' Streetscape division and various park managers to monitor the plants, and were pleased to observe that the plants not only survived, but thrived. The species has an extensive and fleshy root system

and thick leathery leaves which enable it to conserve water. The recent abnormal weather conditions are raising concerns about the pace of climate change in the region, and we are especially targeting species that can survive extreme weather conditions as part of our reintroduction efforts; in this respect, *Robiquetia spathulata* is an excellent choice.

Yam Tim Wing

Peter Ang

Felicia Tay

*Orchid Breeding and Conservation
Biotechnology Laboratory*

All photos by Yam Tim Wing



Celebrating Singapore in Plant Names

As we have just marked the 50th anniversary of Singapore's independence it seems like an opportune time to write about how Singapore has been celebrated in the names of wild plants. The scientific name of a plant species consists of two parts which form the so-called binomial. The first part of the binomial refers to the genus, the second part to the species. For example *Kopsia singapurensis* is one of 23 species in the genus *Kopsia*.

Kopsia singapurensis. (Photo credit: Xin Yi Ng)



If you see a plant with the species epithet (i.e., the second part of the binomial) in the form of *singaporensis*, *singaporensis*, *singaporeana* or *singaporiana* (and grammatical variants of these ending in -e, -us or -um) then it is safe to assume that it was named after Singapore and likely that the specimens used to describe these species were collected in Singapore. Arguably the most well-known of these is the above-mentioned *Kopsia singaporensis*, the flowers of which revel in the national colours of white and red. This is, however, a happy coincidence as it was first described in 1923 by Henry Ridley, long before the national flag was designed. *Kopsia singaporensis* is only one of around 43 species of flowering plants, ferns and bryophytes (mosses and liverworts) that have been named after Singapore, although, as we will explain later, this is fewer than the names that exist and more than the number of species which currently carry Singapore in their names.

There is a wide range of plant species named after Singapore, from the large tree *Durio singaporensis*, which can grow to almost 40 m tall, to the tiny moss *Splachnobryum temasekensis* (bearing an earlier name for the island – Temasek), which stands merely a few millimetres from the ground. The list of species also includes ferns such as *Tectaria singaporiana* and *Cephalomanes singaporianum*, palms such as *Pinanga singaporensis*, ground herbs



Durio singaporensis. (Photo credit: Paul Leong)

such as *Habenaria singaporensis*, shrubs such as *Glochidion singaporensis*, climbers such as *Strophanthus singaporianus*, and epiphytes such as *Bulbophyllum singaporeanum* and *Ceratoledjeunea singaporensis*. In almost all cases the reason the plant was named after Singapore was not that the plant had a particular cultural connection to the people of Singapore, but rather that the plant was first discovered here and, usually, that it was believed to occur only on the island at the time of publication.

Nathaniel Wallich, the Danish botanist who spent several months in Singapore in 1822, named several species after Singapore and published them in his monumental *Numerical list of dried specimens of plants in the Museum of the Honourable East India Company*. However, as he provided no descriptions, these names were not validly published by him (see the Taxonomy Corner article in *Gardenwise* 43 to learn why). Some were, however, validated by other authors who gave the credit to Wallich. It would appear that the first species to be validly published and named after Singapore was the fern *Aspidium singaporianum* in 1827. This species was published by Sir William J. Hooker & Robert K. Greville who credited the name to Wallich. Many species named after Singapore have been moved around through different genera, including *Aspidium singaporianum*, and when they move to new genera they take their name with them. Therefore, there are many more names celebrating Singapore than actual species. For example, *Aspidium singaporianum* is now correctly called *Tectaria singaporiana* but has also previously been known as *Dryopteris singaporiana*, *Nephrodium singaporianum* and *Podopeltis singaporiana*. One would hope that *Tectaria singaporiana* is where it will now stay!

The author most fond of naming species after Singapore was our very own Henry Ridley, the first Director of Singapore Botanic Gardens from 1888–1912. He named 12 species *singaporensis* or



Tectaria singaporiana. (Photo credit: Thamarat Phutthai)



Gordonia singaporeana. (Photo credit: Xin Yi Ng)

singaporensis, of which eight are still currently recognised as distinct species with one of these epithets.

A large majority of the species named after Singapore were published long ago. Only two species have been named after Singapore since it became independent in 1965, the moss *Splachnobryum temasekensis* in 2004 and the ginger *Zingiber singaporense* in 2014, the latter highlighted in *Gardenwise* 44. These two species are, rather counter-intuitively, also the only species named after Singapore that are now found exclusively in the country. Because exploration of Singapore's forests began rather early compared to exploration of many of the neighbouring regions of what is now Malaysia, Indonesia and other parts of Southeast Asia, species first found here were later found to also occur further afield. But these species continue to carry the name of Singapore with them. *Tectaria singaporiana*, for example, is found in Thailand, Peninsular Malaysia, Sumatra

and Borneo. At the same time, species originally described from elsewhere often bring their geographical names with them to Singapore (e.g., *Freycinetia sumatrana*).

Not all species named after Singapore have stood the test of time. Under the rules governing the correct name for a plant, generally speaking the earliest published name has priority. Sometimes these Singaporean species turn out to be the same as earlier described species from elsewhere. Occasionally these other names also celebrate the place from where they were first described. An example is *Smilax singaporensis* which is now correctly called *Smilax luzonensis*, i.e., from the island of Luzon in the Philippines. Only around 26 species of plant are still recognised as species named after Singapore (including the one named after Temasek). Some species have retained their Singaporean name but no longer at the rank of species. An example is *Passiflora singaporiana* which has been moved to a different genus and reduced to the rank of variety as *Adenia macrophylla* var. *singaporiana*. The status of some species still requires further research to ascertain whether its Singaporean name will remain. For some of these, different authors disagree as to its status. For example, *Magnolia singaporensis* has been recognised at species level and as a variety of another two *Magnolia* species.

Sadly, some species named after Singapore are no longer to be found here. Three orchids with Singapore still in their name, *Dendrobium singaporense*, *Habenaria singaporensis* and *Neuwiedia zollingeri* var. *singaporeana*, are presumed to be extinct in the country, while others, such as *Strophanthus singaporianus* and *Pinanga singaporensis* have not been found in Singapore for a very long time. At the same time, some species previously thought to be extinct in Singapore have been rediscovered, such as the orchid *Bulbophyllum singaporeanum* and the herb *Ophiorrhiza singaporensis*. As we continue to explore our forests we can but hope that, like *Bulbophyllum singaporeanum* and *Ophiorrhiza singaporensis*, the 'lost' species of special significance to Singapore will be rediscovered.



Dendrobium singaporense.
(Photo credit: Yam Tim Wing)

David J. Middleton
Ho Boon Chuan
Herbarium

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‘HERBARIUM ON STAGE’ – a collaboration between the Singapore Botanic Gardens, French Embassy of Singapore and Klorane Institute

In commemoration of 50 years of diplomatic relations between Singapore and France, the Singapore Botanic Gardens, together with the French Embassy of Singapore and Klorane Institute, organised the programme ‘Herbarium on Stage’ from 25 to 29 May 2015 to bring children closer to botany and nature. Held in conjunction with Voilahl!, the French Festival of Singapore, the Gardens hosted around a thousand children from diverse cultural backgrounds and 20 different schools in Singapore. During this week-long event, they were given the opportunity to experience life as a botanist by creating their very own herbarium samples out of pressed plant specimens.

A young girl mounting her very own dried *Bougainvillea* specimen.

(Photo credit: Winnie Wong)



Students from Loyang Primary School hard at work creating their very own herbarium specimens. (Photo credit: Steffi Loe)

Each child was given a workbook which included a step-by-step guide to making a herbarium specimen, along with a dried *Bougainvillea* specimen to practice with. The children enjoyed emulating the botanists who work in the Gardens’ herbarium, which has a collection of over 750,000 specimens. The workbook also came with a section for the children to exercise their creativity and paste dried flower specimens onto line drawings of the Merlion and the orchid *Renanthera* Singaporeans.

The event was held in conjunction with the ‘World of Flowers’ exhibition at the CDL Green Gallery, and so the children were also given the opportunity to explore the exhibition. In addition,



Children from PCF Sparkletots 'mounting' dried pressed flowers onto a line drawing of the Merlion. (Photo credit: Steffi Loe)



Children visiting the 'World of Flowers' exhibition at the CDL Green Gallery. (Photo credit: Steffi Loe)



Young students from Lycée Française de Singapour creating their very own herbarium specimens. (Photo credit: Steffi Loe)



Children learning about the flora and fauna of the Singapore Botanic Gardens while on a guided tour. (Photo credit: Steffi Loe)



Children from My First School posing for a group photograph. (Photo credit: Winnie Wong)

guided walks were offered to teach the children about the fascinating aspects of flowers and to appreciate their natural beauty. As a reminder of their time together at the Gardens, group photographs were taken and given to all of the children who participated.

'Herbarium on Stage' helped to connect children of diverse cultures to the environment, and was truly a celebration of our progress toward becoming a cosmopolitan City in a Garden.

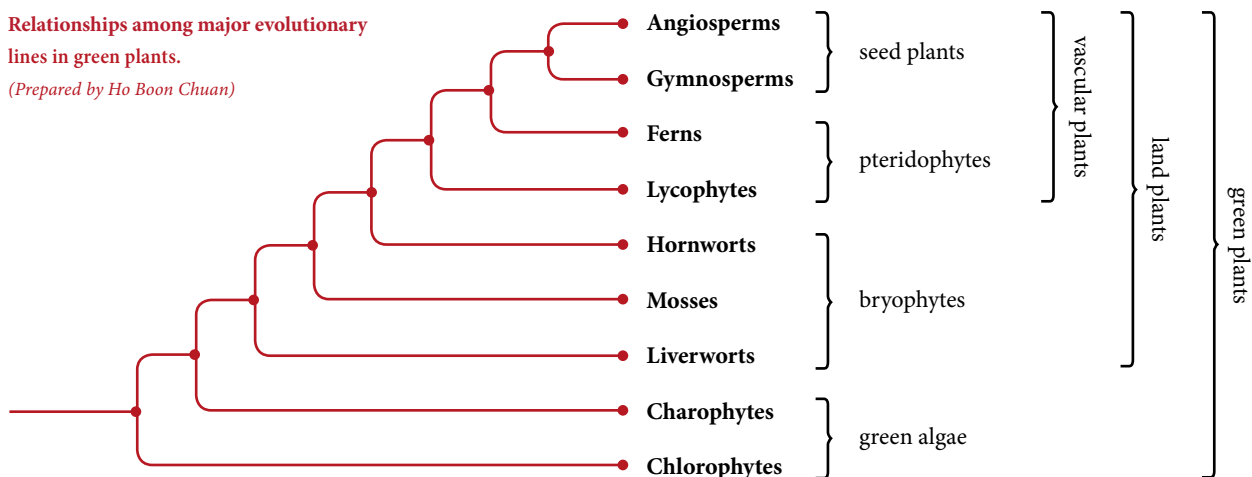
Steffi Loe
Education Branch



A three-part training programme on tropical bryophytes and pteridophytes of Southeast Asia

Relationships among major evolutionary lines in green plants.

(Prepared by Ho Boon Chuan)



Bryophytes and pteridophytes are non-flowering, seedless plants that are frequently neglected and over-shadowed by flowering plants that are often larger and more colourful. However, with keen eyes and careful observation, one can see that these generally small and delicate plants are in fact as beautiful as their larger counterparts. Although the terms

‘bryophyte’ and ‘pteridophyte’ are out-dated for these plant groups, they are still in use today for the sake of convenience. Under the current classification scheme, bryophytes are separated into three independent pathways of evolution – liverworts, mosses and hornworts, whereas lycophytes and ferns constitute two separate evolutionary lines of the traditional pteridophyte group.

Although most bryophytes and pteridophytes have little economic value, they are indispensable to our understanding of plant evolution. They are early offshoots from aquatic green algae, and having evolved over millions of years, these plants possess many characteristics that are transitional in terms of adaptation to land. They also play significant roles in their ecosystems, being part and parcel of the diversity of almost all terrestrial habitats, and are known to be good bio-indicators. Yet pteridophytes and especially bryophytes are often not included in floristic inventories, management plans and other ecological assessments. A lack of expertise has hampered the understanding, conservation and appreciation of these unique plants, especially in Southeast Asia, where they are commonly found all around us.



Field work at the Cyathea Garden of the Bali Botanical Garden. Note that the building with the dinosaur motif houses the bryophyte collection.

(Photo credit: Ho Boon Chuan)

Psilotum complanatum, one of the more interesting ferns growing in the Cyathea Garden of the Bali Botanical Garden.

(Photo credit: Ho Boon Chuan)



Not only did the participants study ferns, they were also served young fronds of the fern *Diplazium esculentum* as a vegetable in Bali.

(Photo credit: Ho Boon Chuan)



Five key botanists were invited to provide relevant training to the participants of the three activities, namely, Dr Bayu Adjie from the Bali Botanical Garden, Indonesia; Dr Dedy Darnaedi from the Research Center for Biology, LIPI, Indonesia; Dr Edwino S. Fernando from the University of the Philippines Los Baños; Dr Benito C. Tan from the University of California-Berkeley, USA; and myself, Dr Ho Boon Chuan from the Singapore Botanic Gardens.

‘Taxonomic Capacity-building on Bryophytes and Pteridophytes and their Allies’ was the first of the three planned activities, and it was held from 20 to 24 February 2014 at the Research Centre for Biology – LIPI, in Indonesia. This workshop introduced the 17 participants to the general background of these plants, including their basic biology and life-cycles. Participants also visited the Cibodas Botanic Garden, where

Participants studying bryophytes under microscopes after a demonstration at the Queen Sirikit Botanic Garden. (Photo credit: E.S. Fernando)



Up close with the mossy kind, one of the participants, Ms Henrietta Woo, trying her best to find different bryophytes in the Limestone Glass House of the Queen Sirikit Botanic Garden.

(Photo credit: Edwino S. Fernando)



Recognising the necessity to develop and enhance the taxonomic capabilities of those from ASEAN countries in understanding and documenting the enormous biodiversity of tropical bryophytes and pteridophytes in Southeast Asia, the ASEAN Centre for Biodiversity (ACB) recently embarked on a programme entitled ‘Extended Taxonomic Capacity Building for Sustainable Use of Biodiversity: Bryophytes, Pteridophytes and Economically-Important Insects

(Predators and Parasitoids)’. This project has been implemented under the East and Southeast Asia Biodiversity Information Initiative (ESABII) with the financial support of the Ministry of the Environment, Japan (MOE-J) through the Japan-ASEAN Integration Fund (JAIF). A major component of the programme involves three inter-related activities intended to train selected representatives from ASEAN member countries on the taxonomy of these non-seeded land plants.



The bryophyte team from the workshop held at the Queen Sirikit Botanic Garden.

(Photo credit: Luong Thien Tam)

an outdoor moss garden has been maintained since 2006. Two of our young and promising NParks staff members, Mr Parusuraman Athen and Mr Arthur Ng, were hand-picked to attend this workshop. They, along with Ms Henrietta Woo, a third enthusiastic participant from NParks, participated in the following two parts of the training programme.

The second training, 'Advance Course on Taxonomy of Bryophytes and Pteridophytes and Data Organization', was an eight-day event (including three days of data-processing training) commencing on 25 November 2014 in Bali, Indonesia. The main venue for this training was the campus of Universitas Dhyana Pura, where the opening event was featured in the *Bali Post*. This activity provided the 18 participants with knowledge on advanced topics

in bryology and pteridology, such as details of special morphological features, use of identification keys, up-to-date classifications and ecology. Participants were also brought to the Bali Botanical Garden to have some hands-on experience with the living collections, and a visit to the

Cyathea Garden, or 'Taman Cyathea', was especially relevant for the study of pteridophytes.

Following the success of the first two training events, which made the returning participants well prepared, the third and final activity was conducted between 20 and 30 January 2015. It was entitled 'Internship Programme on the Taxonomic Capacity Building on Bryophytes and Pteridophytes', and held in the beautiful setting of the Queen Sirikit Botanic Garden in Chiang Mai, Thailand. After two days of reviewing the fundamental essentials, the 31 participants were divided into two teams, to study either bryophytes or pteridophytes. This intensive training activity included field excursions to nearby nature areas, where they learned about collecting and processing samples of bryophytes and pteridophytes. The collections were brought back to the laboratory at the Queen Sirikit Botanic Garden, where the participants made use of microscopes and appropriate references to further process and identify

Selected bryophytes found within the Limestone Glass House of the Queen Sirikit Botanic Garden: (clockwise from top left)

Lunularia cruciata (liverwort), *Hyophila involuta* (moss), *Racopilum orthocarpum* (moss), *Phaeoceros carolinianus* (hornwort).

(Photo credits: Luong Thien Tam)



As one of the trainers, I was explaining to the participants how to recognise some bryophyte groups at Doi Inthanon National Park in Chiang Mai. (Photo Credit: Athisone Kee Silitham)



Sorting out the day's collections after a field trip to Doi Inthanon National Park in Chiang Mai.

(Photo credit: Edwino S. Fernando)



Participants identifying bryophyte specimens in the laboratory of the Queen Sirikit Botanic Garden.

(Photo credit: Ho Boon Chuan)



Final discussion of the bryophyte team just before their presentation and the closing programme in Chiang Mai.

(Photo credit: Ho Boon Chuan)

their samples. The participants were expected to produce write-ups of the species that they collected during their field work. At the end of the workshop, each team presented the fruits of their hard work to their mentors, the ACB organisers and representatives of the funding agency.

As one of the major outcomes, the species write-ups produced by the participants were not wasted, but rather compiled and edited into guidebooks. These guidebooks will be utilised as tools to implement future education and conservation programmes on the biodiversity of bryo-

phytes and pteridophytes. In fact, one of them, *Guide to the Bryophytes in the Limestone Glass House of Queen Sirikit Botanic Gardens*, has recently been published and is intended to be made available for free download on the ACB website soon.

Inadequate taxonomic capacity has been recognised as a bottleneck in the conservation of bryophytes and pteridophytes in Southeast Asia. It is hoped that this three-part training programme has benefited the ASEAN participants and their respective home institutions by equipping them with the ability to

better recognise and distinguish these interesting plants in our tropical forests. It is believed that much of the biodiversity of bryophytes and pteridophytes in Southeast Asia is yet to be discovered and documented. We need to know what is out there in order to save and protect them.

Ho Boon Chuan
Herbarium



NParks signs a Memorandum-of-Understanding with the Royal Botanic Gardens, Kew

Dendrobium Royal Botanic Gardens Kew. (Photo credit: Simon Tan)

On 3 November 2015, Mr Kenneth Er, CEO of the National Parks Board (NParks) and Mr Richard Deverell, Director of the Royal Botanic Gardens, Kew (UK), signed an historic agreement in recognition of the close collaboration between the Singapore Botanic Gardens and Kew.

The Memorandum-of-Understanding (MoU) signing was also marked by the naming of a new Gardens-bred orchid hybrid, *Dendrobium* Royal Botanic Gardens Kew, and the gift to the Gardens of 154 high quality facsimiles of Marianne North paintings, reproduced from the famous gallery of the same name at Kew

and featuring plants and scenes from Singapore, Java and Borneo. After the signing, Kew presented NParks' Adviser, Dr Kiat Tan, with the Kew International Medal, in recognition of his services to botany and horticulture.

Representatives from Kew and NParks stand alongside *Dendrobium* Royal Botanic Gardens Kew.
(Photo credit: Koh Poo Kiong)



As those familiar with our Gardens' history will know, the Royal Botanic Gardens at Kew was instrumental in the development of the Singapore Botanic Gardens from 1875 until Singapore gained independence in 1965. It was Kew's Director that was always asked to recommend the appointment of new superintendents and directors, the first being James Murton in 1875. Murton, in fact, was the person responsible for making the Gardens into a proper botanical garden – before that year it was at best a pleasure garden, which lacked any botanical focus in spite of its actual name. As the headquarters of a network of British colonial gardens, numbering more than 100 by the close of Queen Victoria's reign, Kew received their annual reports and these are the source of many historical details for the Gardens. This was used to compile



From left to right: Mr Kenneth Er (CEO of NParks), Prof. Monique Simmonds (Royal Botanic Gardens, Kew), Ms Peggy Chong (Deputy CEO of Gardens by the Bay), Dr David Middleton (Head of Research and Conservation, Singapore Botanic Gardens), Dr Nigel Taylor (Director of the Singapore Botanic Gardens), Mr Richard Deverell (Director of the Royal Botanic Gardens, Kew), Dr Kiat W Tan (CEO of Gardens by the Bay and advisor to NParks), Mr Chew Hock Yong (Second Permanent Secretary, Ministry of National Development), Mrs Marta Lejkowski (Kew Foundation), and Dr Leong Chee Chiew (Deputy CEO of NParks). (Photo credit: Koh Poo Kiong)

our UNESCO dossier during the run up to inscription of the Gardens on the World Heritage List. Kew also helped in this process, providing our archives with copies of the memoirs and correspondence of its longest-serving former directors, Henry Ridley and Eric Holttum, both of whom worked in their retirement at Kew. Even the present director, the undersigned, began his career at Kew, where he worked for 34 years before moving to Singapore, so it goes without saying that the links between these two great institutions are strong. And, besides these botanically-focused links, both are UNESCO World Heritage Sites, Kew having gained inscription in 2003.

So, given these long-standing links, what will the newly signed MoU deliver for the Gardens and Kew, its partner? The answer is many things. The agreement covers and formalises the exchange of staff, expertise, training opportunities, information and collections, including potentially loans of artwork. Kew has areas of expertise that the Gardens lacks, such as the development of seed banks, while the Gardens, through its



Mr Richard Deverell (left) and Mr Kenneth Er (right), signing the MoU.

(Photo credit: Koh Poo Kiong)

networking and knowledge of the Southeast Asian flora and the region's other gardens, can help Kew collaborate and expand its interests in the region. NParks and Gardens' staff have already benefitted from training at Kew, while Kew staff, students and Honorary Research Associates and Fellows have regularly visited the Gardens to experience or study our horticultural and botanical techniques and collections. Last, but not least, that Kew was keen to sign

such an agreement can also be said to be a measure of the esteem in which the Gardens is held by the international community.

Nigel P. Taylor
Director of the Gardens



Renewal of ties between sister gardens



H. M. Burkill, former director of the Gardens, signing the Sister Garden Agreement on 15 October 1965. The signing was witnessed by the Miyazaki representative, Mr Kuroki. (Photo courtesy of Miyazaki Parks Association's Archives)



A black and white photograph of the Plant House taken in 1965. (Photo courtesy of Miyazaki Parks Association's Archives)

On 15 October 1965, the Singapore Botanic Gardens and the Aoshima Sub-Tropical Botanic Garden (ASTBG) became sister gardens. The signing of the Sister Garden Agreement in Singapore was monumental for both sides, as it was the first agreement signed by the newly established ASTBG, which opened its doors in April of 1965, and was also the first agreement signed by our Gardens under an independent Singapore Government.

ASTBG is a small garden located on the island of Aoshima in the city of Miyazaki, Miyazaki Prefecture, Japan. It currently has over 400 species of subtropical plants in its living collection, and specialises in growing bougainvilleas. ASTBG is currently undergoing redevelopment and in March 2016 will open a new tropical greenhouse. It is open daily and is free to enter, except for the tropical greenhouse, which will be charged-for once it is open to the public.

To celebrate the collaboration between our two institutions, ASTBG has recently decided to showcase Singapore and our Gardens in a small section of its new tropical greenhouse. A collection of Vanda Miss Joaquim (*Papilionanthe* Miss Joaquim) orchids and a small replica of the Merlion statue will be incorporated into the display. Significant



The delegation comprising staff from the Miyazaki Parks Association, Miyazaki Land Development Office, Aoshima Sub-Tropical Botanic Garden and CLAIR Singapore (the Japan Council of Local Authorities for International Relations), along with Dr Nigel Taylor and Dr Nura Abdul Karim.

(Photo credit: Asako Oshikawa)

collections that have resulted from our collaboration will also be included, such as *Bougainvillea* cultivars obtained from the Gardens and VIP orchid hybrids named after Japanese royals Emperor Akihito, Empress Michiko and Princess Masako.

The year 2015 was a busy one in terms of visits stemming from our relationship with ASTBG. Not only did we receive various staff from ASTBG, but also officials from the Miyazaki Prefectural Assembly, Miyazaki Land Development Office and the Miyazaki Parks Association. During one of these visits, Mr Shinichiro Ito from the Miyazaki Parks Association shared digital copies of monochrome photographs depict-

ing scenes of the Gardens in 1965, images that are invaluable additions to our archives. In October, Dr Nigel Taylor and I hosted the Vice-Governor of Miyazaki Prefecture, Mr Hiromi Inamochi, who presented us with official invitations to the opening of the new ASTBG tropical glasshouse on behalf of the Governor of Miyazaki, Mr Shunji Kouno.

It is heartening to know that after fifty years, the relations between the Gardens and ASTBG are still warm and we hope they will continue to develop and grow stronger over time.

Nura Abdul Karim
Library, Training and External Relations

ACKNOWLEDGEMENT OF ERRORS

We regret the following errors in the 'Around the Gardens' feature of the previous issue (Volume 44):

The name of Ms Nguyen Thai Mai Huong was misspelled (correct spelling given here).

Ms Phan Thi Thanh Nha should have been identified as a member of the curatorial staff of the Herbarium of the University of Science

at Vietnam National University, rather than its curator.

The image of Ms Phan Thi Thanh Nha should have been credited to Amanda Yap instead of B.C. Ho.



Mythical Medusa in the form of an orchid...



Close-up image
of *Habenaria medusa*.

(Photo credit: David Lim)

Visitors to the National Orchid Garden (NOG) will have seen first-hand the world's most diverse and species-rich plant family, the orchids. Orchids can display truly unconventional yet strangely beautiful flower forms. Almost every day, an amazing orchid comes into bloom in NOG, and the recent flowering of *Habenaria medusa* caused jaws to drop. The genus name, *Habenaria*, comes from the Latin word *habena*, meaning 'strap' or 'rein', in reference to the shape of the spur (the nectar-bearing part of flower), or the shape of the lip in some species. In 1892, German botanist Friedrich Wilhelm Ludwig Kraenzlin gave this species its specific epithet, *medusa*. He must have been a fan of Greek mythology and had a vivid imagination to liken this orchid's prominent fringed flowers to Medusa, the monster that had venomous snakes for hair and who could turn anyone

who saw her face to stone. Fortunately, *Habenaria medusa* does not turn any of its appreciative gazers to stone like its namesake, Medusa!

Orchids in the genus *Habenaria* are commonly called bog orchids, and they are distributed extensively around the world. There are an estimated 800–1000 species of *Habenaria*, native to every continent except Antarctica, in both tropical and temperate zones. They are terrestrial or semi-aquatic herbs with fleshy or tuberous roots and leaves that are ovoid to fusiform-elongated or rarely palmate. These orchids are normally erect and glabrous (not hairy), with sessile (stalkless) leaves that sheathe the stem at their base. Their flowers are usually small or medium-sized and may be showy or inconspicuous.

Habenaria medusa is a terrestrial species from monsoonal habitats in

Indonesia and mainland Southeast Asia, and can be found growing at elevations of around 400 to 800 metres. It produces a basal rosette of leaves from an underground corm. When not in flower, it is fairly unremarkable, but when it sends up a 50 cm tall inflorescence bearing anywhere from 10 to over twenty astounding-looking flowers, it takes centre stage.

The flowers are stunning with a highly divided and lacerated white lip, in the manner of Medusa's snake-hair, or more pleasantly, like the spectacular plumage of the beautiful snowy egret. The lip has a green back and usually has a small central red to orange-brown basal patch up front. Visitors might wonder why such a lip evolved in the first place. The fringed flowers of *Habenaria medusa* are thought to be moth-pollinated, as their white colour, sweet evening fragrance and nectar spur are features known to attract moths.

Cultivating *Habenaria* orchids can be difficult, as they are intolerant of poor or chemically treated water and need a strict, dry dormant period. They rot easily if watered during their dormancy. The NOG nursery manager, David Lim, shared that he has had success by growing the corms in a potting mix consisting of 30% burnt earth, 30% fine charcoal chips, 30% chopped coconut husk and 10% vermiculite, plus 1 tablespoon of bone meal fertiliser per litre of soil.

If visitors to NOG are lucky enough to see this beautiful orchid the next time it blooms, they can be assured that they may gaze at the flowers without fear of turning into stone!

Nura Abdul Karim
Library, Training and External
Relations

David Lim
National Orchid Garden Nursery



A Garden of Medicinal Plants: Book 2 (500 Reflections on the RCP, 1518–2018)



By Henry Oakeley, Jane Knowles,
Michael de Swiet and Anthony Dayan

Published in 2015 by Little, Brown.

128 pp, 15.1 x 1.2 x 21.2 cm, paperback.

Available online from the RCP website at:
<http://shop.rcplondon.ac.uk/>

for £12.00 (approx. S\$24.00), excluding
shipping charges.

ISBN 978-1-4087-0624-4

A series of 10 books have been commissioned in celebration of the 500th anniversary of the Royal College of Physicians (RCP), coming up in 2018. Each book will focus on 50 themed elements that have contributed to the making and shaping of the RCP, collectively adding up to five hundred reflections on 500 years of existence. This is the second book in the Reflections series, and focuses on the RCP's garden and its history.

The book is laid out well and has an impressive collection of appropriately selected illustrations that enhance the reading of each chapter. The authors establish the framework of the book clearly in the first chapter to set the scene and manage readers' expectations. The book showcases important moments in the history of the RCP and the many historical luminaries that shaped it and its living plant collections. The

authors are staff members and fellows of the garden, which makes the book interesting and informative to read.

Due to space constraints, the authors were understandably unable to showcase and describe all of the approximately 1,100 plants in the RCP garden. Instead, species are highlighted which have a significant history of use by people, such as *Ricinus communis* (castor oil), *Papaver somniferum* (opium poppy), *Atropa belladonna* (deadly nightshade), *Capsicum annum* (chili), *Punica granatum* (pomegranate, which happens to be on the RCP coat of arms), *Digitalis purpurea* (foxglove), *Nerium oleander* (oleander), *Euphorbia milii* (crown of thorns), *Echinacea purpurea* (cone flower), *Nicotiana tabacum* (tobacco), *Arundo donax* (giant reed), and many others. Where possible, the authors also detail the history, myths, discovery, chemistry and therapeutic uses of the

plants, and also include references for further reading. The book also includes a chapter dedicated to plant species that are used in contemporary medicine.

Overall, this is a commendable book that is well researched and written, although the book could have served as a handy guide to the RCP medicinal garden if the authors had also included a map or other indication as to where the described species can be found on its premises. Readers will not be found wanting for interesting bite-size facts about the RCP or the properties and uses of the featured plants. This book is highly recommended to readers interested in a quick history of medicinal plant usage and ethnobotanical information about the presented plant species.

Nura Abdul Karim
Library, Training and External Relations



July–December 2015



His Excellency Xi Jinping, President of the People's Republic of China, and Mdm Peng Liyuan on the occasion of their visit to the Singapore Botanic Gardens in November 2015. On their left are Mdm Ho Ching and Mr Lee Hsien Loong, Prime Minister of Singapore, and on their right is Mr Kenneth ER, CEO of NParks.



His Excellency Ólafur Ragnar Grímsson, President of the Republic of Iceland, and Mdm Dorrit Moussaieff, with the director of the Gardens, Dr Nigel Taylor, during their visit to the National Orchid Garden in November 2015.

H.E. Abdel Fattah Al Sisi, President of the Arab Republic of Egypt

Dr Adam Garfinkle, American Interest Journal, United States of America

Mr Ajith Ashokan, Indian Institute of Science Education and Research, Bhopal, India

Dr Akihiko Tamura, and delegates from the 21st Raffles Programme, Japan

Mr Albert Radin, Mr Frederick Kugan, Mr Peter Lagan, Datuk Sam Mannan, Sabah Forestry Department, Malaysia

Ms Alžběta Böhmová, Czech Republic

Ms Bomyi Ji, Goyang International Flower Foundation, Republic of Korea

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

TRH David Cameron, Prime Minister of the United Kingdom

Prof. Deng Yunfei, Chinese Academy of Sciences, People's Republic of China

Prof. Dietmar Quandt, Rheinische Friedrich Wilhelms-Universität Bonn, Germany

Dr Dong Shiyong, Chinese Academy of Sciences, People's Republic of China

Ms Eliška Závěská, University of Innsbruck, Austria

Ms Emeily Warschefsky, Fairchild Tropical Botanic Garden, United States of America

Dr François Couplan, Collège Pratique d'Ethnobotanique, France

H.E. Geoffrey Keating, Ambassador of the Republic of Ireland (Eire) to Singapore

Ms Grace Fu Hai Yien, Minister for Culture, Community and Youth & Leader of the House, Singapore

Dr Graham Eagleton, Kebun Raya Bogor-LIPI, Indonesia

Mr Greg Sheridan, Foreign Editor, The Australian, and spouse, Australia

Dr Henk Jaap Beentje, Royal Botanic Gardens, Kew, United Kingdom

Mr Hiromi Inamochi, Vice-Governor, and delegates from the Miyazaki Prefectural Government and Aoshima Sub-Tropical Botanic Garden, Japan

Lee Ik-hyung, Director-General for Financial Management and Economy, and delegates from the Republic of Korea

Mr Isuru Kariyawasam, University of Sri Jayewardenepura, Sri Lanka

Dr Jaya Seelan Sathiya Seelan, Universiti Malaysia Sabah, Malaysia

Mrs Jennifer Coffey, Mrs Margaret Thompson, great-great granddaughters of Lawrence Niven, and friends and family, New Zealand and Australia

Sir Jerry Mateparae, Governor-General of New Zealand and delegates

Mr Jin Xiao Peng, Ministry of Foreign Affairs, People's Republic of China

Dr John Leckey, Chief Coroner (rtd), and **Jane Leckey**, Northern Ireland, United Kingdom

H.E. Joko Widodo, President of Indonesia, and spouse

Jos and Helen Burkill, great-great grandchildren of Henry Burkill, United Kingdom

Prof. Kai Müller, Westfälische Wilhelms-Universität Münster, Germany

Mr Khaw Boon Wan, Minister for Transport (former Minister for National Development), Singapore

H.E. Kirk Wagar, Ambassador of the United States to Singapore

Mr Kurt Petersen, Monash University, Australia

Mr Lawrence Wong, Minister for National Development (former Minister for Culture, Community and Youth), Singapore

Mr Lee Hsien Loong, Prime Minister of Singapore, and spouse

Prof. Li Chia-wei, Dr Cecilia Koo Botanical Conservation Center, Taiwan

Dr Linda Broadhurst, Dr Mark Clements, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

H.E. Lkhagvadorj George Tumur, Ambassador to Singapore of Mongolia

Dr Lúcia Lohmann, Biociências da Universidade de São Paulo, Brazil

Mrs Lulut Sulistyaningsih, Herbarium Bogoriense, Cibinong, Indonesia

Ms Luong Thien Tam, University of Sciences, Ho Chi Minh City, Vietnam

Prof. Madya Dr Alona Cuevas Linatoc, Universiti Tun Hussein Onn, Malaysia

Mrs Marta Lejkowski, Prof. Monique Simmonds, Mr Richard Deverell, Royal Botanic Gardens, Kew, United Kingdom

Prof. Martin Burd, Monash University, Australia

Hon Mr Matt Thistlethwaite, Australian Labor Party, Australia

Dato' Seri Mohamed Nazri, Minister of Tourism, Malaysia

Dr N.C. Bantayan, Makiling Botanic Gardens, Los Baños, the Philippines

Mr Nelson Li, President of the Taiwan Arboriculture Society, and delegates from Taiwan

Dr Ng She Cheong and students from the Forest Research Institute (FRIM), Malaysia

H.E. Ólafur Ragnar Grímsson, President, Republic of Iceland, and spouse

T.H. Sir Peter Cosgrove, Governor-General, and **Lady Lynne Cosgrove**, Australia

Prof. Sir Peter Crane and Lady Elinor Crane, Yale University, United States of America

Mr Philip Duffy, great-great-great grandson of Lawrence Niven, United Kingdom

Ms Sakuntala Ninkaew, Khon Kaen University, Thailand

Ms Salwa Binti Shahimi, University of Reading, United Kingdom

Dr Saw Lwin, Myanmar Floriculture Association, Myanmar

Mr Stanley Victor White and delegation of United States Congressional Staff

Dr Steve Scott, Melbourne, Australia

Mr Teerawat Srisuk, Khon Kaen University, Thailand

Dr Vinita Gowda, Indian Institute of Science Education and Research, Bhopal, India

Mr Vladimar Golitsyn, President of the International Tribunal for the Law of the Sea, and **Mr Philippe Gautier**, Russia

Dr William Cheung, Natural History Museum, London, United Kingdom

Ms Wipawan Kioasanthie, Mahasarakham University, Thailand

Mr Witsanu Saisorn, Khon Kaen University, Thailand

H.E. Xi Jinping, President of the People's Republic of China and spouse

Mr Xu Datong, Chairman, Tianjin Eco-City Administrative Committee, People's Republic of China

Dr Xue Bine, South China Botanical Garden, People's Republic of China

Dr Yea-Chen Liu, National Chiayi University, Taiwan

Dr Yumiko Baba, The Kochi Prefectural Makino Botanical Garden, Japan



Vegetable plots in the Gardens during the Japanese Occupation



(Left) Professor Kwan Koriba, director of the Gardens during the Japanese Occupation of Singapore.

(Right) A 1942 painting by Juraimi bin Samsuri of a brinjal grown in the Gardens.



The Japanese Occupation of Singapore in World War II took place from 1942 to 1945. During the occupation, Professor Hidezo Tanakadate, a professor of geology from Japan, took control of both the Raffles Museum and the Botanic Gardens, and Professor Kwan Koriba, a retired professor of botany, became the acting director of the Gardens. During this period a vegetable plot was set up on Lawn Y and beds were planted with a variety of vegetable crops, including brassicas, keladi, maize, sweet potatoes, brinjals and tomatoes. A small area was also dedicated for the cultivation of 10 different varieties of tapioca. Citrus and papaya were planted in both the Gardens' nursery and on Lawn R, and trial plantings of different varieties of turnips, tomatoes, onions, leeks and beets were conducted.

The harvest from the plots was good, and baskets of vegetables were taken daily to General Yamashita, the Japanese general who was at the forefront of the invasion of Singapore. Seeds were also collected and set aside for future planting, and some seeds were sent to the garden of the Marquis Tokugawa, who was also regularly supplied with vegetables. In 1943 the yield was reduced considerably as parts of the nursery area were reallocated to grow other crops, but in 1944 provision was made for growing sufficient vegetables to meet the needs of the employees.

With the intention of supplying paid staff regularly with produce, the area for growing plants such as tapioca, maize and leafy vegetables was increased. Brinjals, cucumbers, gourds, yams, kelandi and others were grown on a smaller scale

to provide food for labourers. Attempts were also made to increase the number of vegetables that were easy to grow, both for the purpose of demonstrating them, and as a source of seeds to provide to the public, schoolteachers and Japanese officials, among others. Over 2,000 seed packets of easy-to-grow vegetables were prepared and distributed among the military, including bayam (Indian spinach) and basella (climbing spinach).

The vegetable plots were maintained throughout the occupation, allowing not only the demonstration of easy to grow vegetables, but provision of food for the Gardens staff and others as well as the accumulation of stocks of seeds to supply to the public.

Christina Soh
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