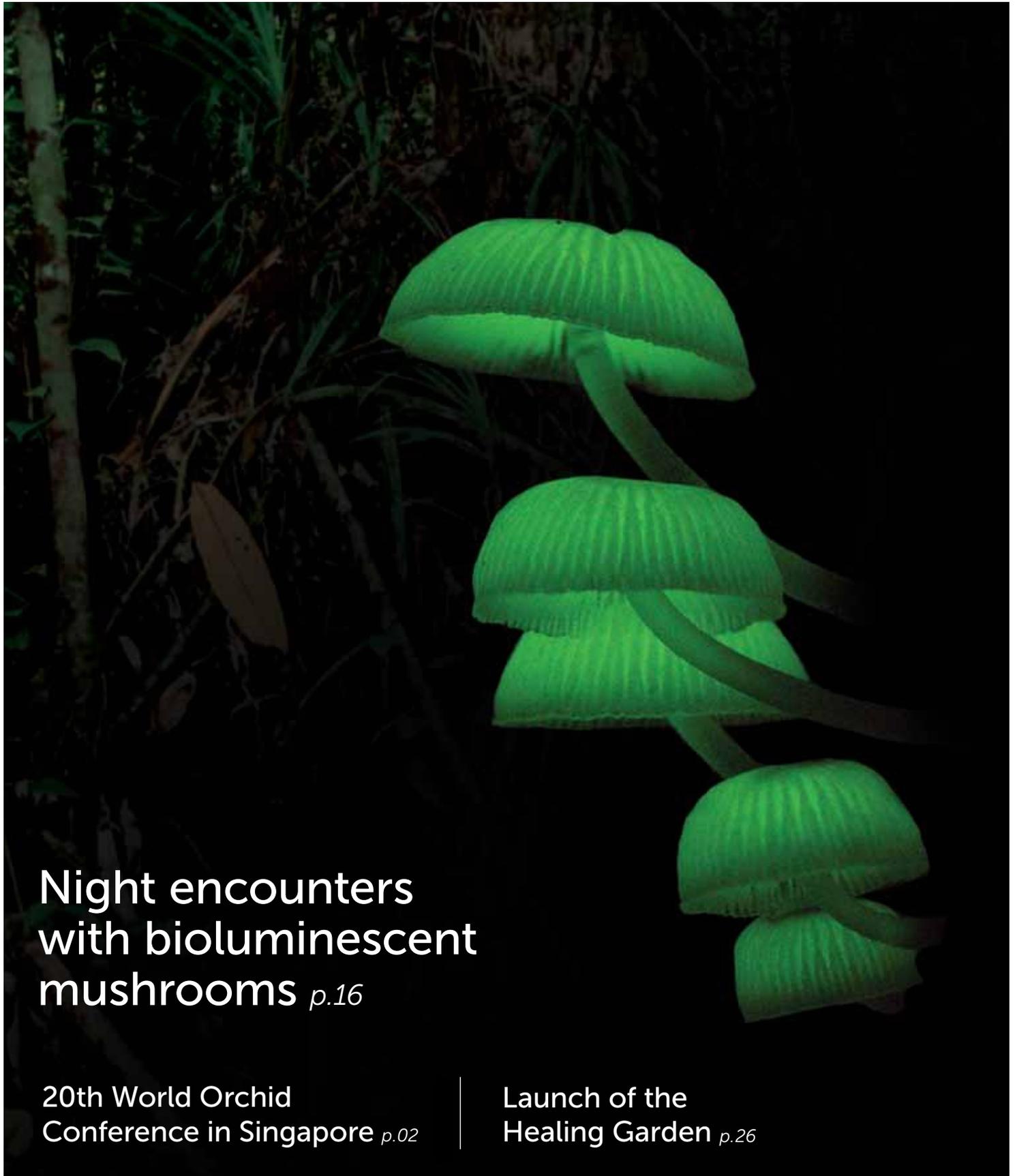


GARDENWISE

THE MAGAZINE OF THE SINGAPORE BOTANIC GARDENS VOLUME 38, JANUARY 2012 ISSN 0129-1688



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with bioluminescent
mushrooms *p.16*

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MESSAGE FROM THE DIRECTOR

► It is both a privilege and a great pleasure to introduce this issue of *Gardenwise*, from the pen of the recently appointed Director of the Singapore Botanic Gardens. Having arrived from another famous garden at Kew I am deeply impressed by everything I see and learn about in SBG. Our mission of 'connecting plants and people' is really happening and *Gardenwise* is one of various means to this end. My first 5 months have been a great introduction, including an exciting stream of new developments, enhancements and events that show the Gardens to be a vibrant institution with considerable depth, a fascinating heritage and a strong desire to go forward and succeed on all fronts.

"National Parks Board can be very proud of its achievements at SBG and the high standards that have been set and adhered to in everything that is done here."

I hope to use future editions of this message to preview forthcoming developments and plans, such as the Foliage and Fragrant Gardens we are currently building. Such projects I should note are in keeping with the modern history of SBG, which starts in the late 1980s, when my predecessor, Dr Tan Wee Kiat,

masterminded the planning and execution of many positive innovations over three decades that together make the Gardens the finest historic botanical institution in the tropical zone today, and I don't say this casually. National Parks Board can be very proud of its achievements at SBG and the high standards that have been set and adhered to in everything that is done here. This means there is a big responsibility resting on the new Director's shoulders! In future issues I will also set out some of the less obvious enhancements I wish to see progressed behind-the-scenes, because all great Gardens have hidden workings that are essential for the success of their more public areas and of their international responsibilities to plant conservation and public education.

In this issue of *Gardenwise* the major plant themes that SBG is identified with are well represented, not least the warm glow from a very successful World Orchid Conference (WOC) and Show in which Gardens staff played a huge role in partnership with members of the Orchid Society of South-east Asia (OSSEA). In so many ways Singapore can lay claim to be the natural home of nearly everything that relates to orchids, so it is good to see these plants being showcased once again. Shortly before WOC, in October, SBG's new Healing Garden was formally opened by President Tony Tan. This is the first major new garden area opened for quite some time and besides offering the visitor an insight into the multifarious uses of plants for medicine, well-being and sometimes spiritual purposes, it is also a very attractive display of mostly showy and colourful flowering herbs, shrubs and small

trees all arranged in a secluded corner of the Gardens where you can allow yourself to be lost amongst their beauty along sinuous paths. As this Gardens' feature was opened, we also benefitted from an exhibition of rare medicinal books and illustrations from old Japanese masters, a collaboration courtesy of the Makino Botanical Garden. The talents of SBG's staff were also displayed in the artistically conceived exhibition of *Forests, People & Environment*, staged in July to celebrate the UN's designation of 2011 as the international Year of Forests. Then, 2011 concluded with a blockbuster Christmas celebration entitled *Trees of the World*, in which numerous local organisations, businesses, schools, embassies, the PA and individual families decorated some 281 2-metre-tall tropical trees for the festive season. These trees were each uniquely original statements and all became spectacularly lit up every night from 3 December, turning the tropical paradise, which is SBG, into a nocturnal wonderland. The show stretched out along the paths between Botany Centre at Tanglin Gate and the Bukit Timah Core MRT station, which is a new means of access that came on line in October. Mention of this reminds me that we are set to reach another landmark as the current fiscal period draws to a close – that is a record-breaking 4 million visitors to SBG. Thanks to all, for your support!

Nigel P. Taylor

► Sometimes referred to as the 'Olympics of orchids', World Orchid Conferences (WOCs) are the most prestigious events on the orchid calendar. They are held every three years in different cities around the world and bring together orchid experts from many countries, including both hobbyists and scientists. Varied presentations are made, summarising the latest findings and perspectives, and there is active exchange of news, views and ideas. Besides the Conference, what makes the event really so spectacular and unforgettable for many is the accompanying World Orchid Show. Other activities attached to the event include social events, various meetings on specific aspects in the orchid world and tours. An incredible range of orchid plants, books and souvenirs are offered for sale at an extensive 'Market Place'.

Organising a WOC

World Orchid Conferences are normally prepared by local orchid societies and supporting organisations. Due to the sheer size of the event, the preparation needs to start very early, i.e., a few years prior to the WOC. The preparation includes, for example, selecting speakers and developing a programme, organising the orchid show, arranging the judging of the orchid plants and flowers, and planning of the social events and conference tours. However, the final responsibility rests with the World Orchid Conference Trust which was set up in 1988 by the American Orchid Society and the Royal Horticultural Society (UK).

World Orchid Conferences past

The idea of a World Orchid Conference was originally proposed by Gordon W. Dillon in 1952, aimed at bringing together leading orchid researchers as well as amateurs to exchange views and discuss their problems. Subsequently the first WOC was held in October 1954 at St. Louis (Missouri, USA), and since then such conferences have been held every three years in different parts of the world – including Honolulu (Hawaii, USA), London (UK), Long Beach (California, USA), Sydney (Australia), Medellin (Colombia), Frankfurt (Germany), Bangkok (Thailand), Durban (South Africa), Tokyo (Japan), Auckland (New Zealand), Glasgow (Scotland, UK), Rio de Janeiro (Brazil), Vancouver (Canada), Shah Alam (Malaysia) and Dijon (France). So far only two cities had the opportunity to host the event twice, namely Miami (Florida, USA; in April 1984 and then again in January 2008) and Singapore (in October 1963 and again in November 2011). Johannesburg (South Africa) was successful in its bid to host



the 21st WOC in 2014. At this year's WOC, Guayaquil (Ecuador) won the bid to host the 22nd World Orchid Conference, which is to be held in 2017. The WOC has evolved into a premier world-class masterpiece and is now one of the most significant events on the international horticultural calendar.

"The idea of a World Orchid Conference was originally proposed by Gordon W. Dillon in 1952, aimed at bringing together leading orchid researchers as well as amateurs to exchange views and discuss their problems."

Singapore's role as host city twice

Dr. Kiat W. Tan, Chairman of the 20th WOC Organising Committee and CEO of Gardens by the Bay, aptly summarised Singapore's long-standing close association with orchids: "Apart from the fact that our national flower is an orchid, Singapore has also welcomed many important guests including state dignitaries and people who have made significant contributions in their respective fields by naming our finest orchid hybrids after them. With our rich orchid heritage, it is apt for us to host the 20th WOC, and we are one of the few cities privileged to be able to host this

iconic event for a second time. Hosting our first WOC in 1963 proved to be a huge stimulus for Singapore's economy and for the local orchid industry then. Today, it is an opportunity for us not only to showcase our rich orchid heritage and expertise, but also the best of Singapore, including the Gardens by the Bay and other new developments in the Marina Bay area". He added: "Through the 20th WOC, we also hope that Singaporeans will be able to



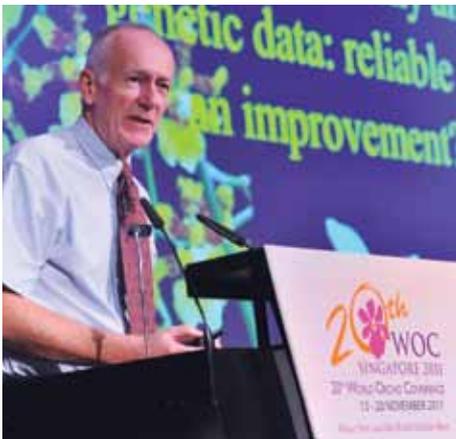
► Preview of the Flower Dome at the Gardens by the Bay.

was held in October 1963. The 4th WOC was different from that in 2011, as the show component was held before the conference. The planning committee was headed by Mr G. Ferguson Beall, and Mr Gordon Dillon chaired the programme committee. The venue for the show was the Singapore Turf Club as it was spacious and provided a natural setting for the exhibits. Following lengthy preparations, the WOC was finally opened by His Excellency Tun Yusof bin Ishak, the Yang di-Pertuan Negara (The Head of State of Singapore) and Toh Puan Noor Aishah, the First Lady. A plant of *Grammatophyllum speciosum* exhibited by HRH The Sultan of Johore, with 30 sprays of flowers, each 5 feet long, and forming a yellow mass mottled with brown, was awarded a Certificate of Cultural Commendation. The display of the Malayan Orchid Society covered an area of nearly 200 m² with an estimated 2500 plant pots. It included *Dendrobium* hybrids, terete and semi-terete *Vanda* hybrids (e.g., *Vanda Tan Chay Yan*), various intergeneric hybrids (among them *Aranthera James Storie*, and *Aranda Deborah*) and the showy *Oncidium Goldiana*. A gold medal in the large landscape category was awarded to the joint exhibit by the Singapore Botanic Gardens and Penang Botanic Gardens. Also the local exhibitors Nam Kee Nursery, Singapore Orchids and Seng Heng Orchid Nursery won gold medals for their displays. Gold medals were also won by several overseas exhibitors like the Orchid Society of New South Wales and Vacherot & Lecoufle (France). The conference component was held at the Victoria Theatre. H.M. Burkill, Director

of the Singapore Botanic Gardens, gave his opening lecture on the role of the Singapore Botanic Gardens in the development of orchid hybrids. Other eminent speakers included Yeoh Bok Choon, Eric Holttum, George Alphonso, John Ede, Tan Hoon Siang, Quek Kiah Huat, Gracia Lewis, Gordon Dillon, Thomas A. Fennel, Lewis Vaughn, Oscar M. Kirsch, H. Kamemoto, Leslie Garay, F.A. Stewart, Ben Kodama and Rapee Sagarik.

This time in Singapore: the 20th WOC

The 20th World Orchid Conference, held in Singapore from 13th to 20th November 2011, was jointly organised by the National Parks Board (NParks) and the Orchid Society of South East Asia (OSSEA). The venue was the newly completed Marina Bay Sands Expo and Convention Centre. The conference theme was Where New and Old World Orchids Meet. The WOC Organising Committee included, among others, Dr. Kiat W. Tan (Chairman), Dr. John M. Elliott (Chairman, Conference), Mr Chris Dalzell (Co-Chairman, World Orchid Show), Mr Syed Yusof Alsagoff (Co-Chairman, World Orchid Show) and Dr. Khoo Chong Yee (Chairman, Judging). Expectations for an overwhelming success were neatly stated by the President of the World Orchid Conference Trust, Peter Furniss: "There are three areas that a World Orchid Conference needs to provide its registrants – a world-class show, an excellent conference schedule, and alluring social events. Singapore excels in all of these, and the 1,000 plus registrants have the opportunity to experience each one, while the expected 300,000 show attendees



► Dr. Mark W. Chase (Royal Botanic Gardens Kew, London, UK), one of the plenary speakers.

learn more about our rich orchid heritage and the contributions of orchids to many products and discoveries, better appreciate the intricate beauty of orchids, and find for themselves a little piece of paradise at the show." Finally, Singapore's position as a 'City in a Garden' was greatly enhanced by hosting the WOC.

The 4th WOC

Singapore's first World Orchid Conference

A beautiful *Lepanthes calodictyon* at the Colombian display.



Paphiopedilum callosum.



will be able to revel in the stunning beauty of what promises to be an extraordinary experience”.

The conference component attracted over a thousand registrants from around the world. Over 120 lectures were given by experts from 31 countries. The programme was strong in scientific content but at the same time included also popular presentations aimed at growers and botanically interested laymen, covering fields as diverse as the latest advances in molecular phylogeny, taxonomy, floristic studies, morphology, ecology, physiology, cytology, biotechnology, computer databasing, ethnobotany, pests and diseases of orchid plants, and orchid growing and breeding. A strong emphasis was on various aspects on conservation, where 25 lecture presentations were delivered. A total of eight plenary lectures were presented by well-known speakers like Mark W. Chase and Phillip Cribb (both from the Royal Botanic Gardens Kew, London, UK), Kingsley Dixon (Kings Park and Botanic Garden, Perth, Australia), Michio Tanaka (Kagawa University, Japan), Wen Huei Chen (National Cheng Kung University, Taiwan), John Elliott (Orchid Society of South East Asia, Singapore), Steve Johnson (University of KwaZulu-Natal, South Africa) and Wong Sek Man (National University of Singapore). Many of the talks were grouped in ‘special interest symposia’. Forums were held on orchid hybrid registration, on orchid judging and on slipper orchids. Although the scope of the WOC was generally international, the Singapore event also highlighted tropical Asian orchids. Nearly 70 posters on various aspects were also presented. In addition, a number of meetings were held, among

them, two IUCN (International Union for the Conservation of Nature) Orchid Specialist Group meetings, a meeting of the International Orchid Commission (IOC), and a Site Selection Meeting (where the venue for the 22nd WOC in 2017 was determined).

“The conference component attracted over a thousand registrants from around the world. Over 120 lectures were given by experts from 31 countries.”

Seventy-five stunning exhibits of orchid species and hybrids from 19 countries went on display in the Orchid Show in the exhibition hall. It provided not only a visual extravaganza, but also included several educational exhibits. Centrepiece was the World Orchid Map exhibited by the National Parks Board, Singapore, which outlined the occurrence of orchids in different parts of the world. Popular among visitors was also a video on the pollination of orchids by flies, produced by Ong Poh Teck of the Forest Research Institute Malaysia (FRIM). Also limited-edition volumes from the ‘Orchid Album’, published in the 1890s with magnificent hand-painted orchid drawings, were on display. Further educational displays explained the structure of the orchid flower, its pollination, and efforts to

conserve the native orchids of Singapore. An interesting display was exhibited by the Myanmar Floriculturist Association. It contained two life-size puppets with traditional dress worn in Kachin State (northern Myanmar), with the golden-yellow ornaments made from stem fibres of the orchid *Dendrobium moschatum*.

An international panel of over 210 orchid judges from 25 countries judged both the displays and the orchids in them. As in other flower shows, trophies, medals and ribbons were awarded to outstanding plants (trophies are a small number of awards given to the best displays or plants of the show; medals are awarded on the basis of absolute merit, when compared to an ideal or perfect example; ribbons are awarded for first, second and third placing within certain classes of exhibited plants). The trophy for the Grand Champion Display was awarded to the Chaiwathana Orchid Garden Co., Ltd. from Thailand, and the trophy for the Reserve Champion Display was won by the Orchid Society of Papua New Guinea Inc. A plant of *Cycnodes Taiwan Gold*, grown by the Taiwan Orchid Growers Association won the trophy for Grand Champion Plant, and the trophy of Reserve Champion Plant went to a specimen of *Paphiopedilum Du Motier ‘Victoria Village’* of the Eric Young Orchid Foundation. A plant of *Dendrobium lasianthera*, grown by Neo Cheng Soon Farm, Singapore, was judged the Best Species, and a specimen of *Cycnodes Taiwan Gold* belonging to the Taiwan Orchid Growers Association the Best Hybrid. The trophy of the Best Specimen Plant was won by a plant of *Vanda lamellata* exhibited by the National Parks Board, Singapore. Three other trophies were



01



02



03



04



05



06



07

01. An entry for the Ikebana category. 02. *Lycaste Auburn*. 03. Display of the Orchid Society of Papua New Guinea, the Reserve Champion Display of the show. 04. *Lycaste Hugheuden* (left) and *Lysudamuloa Red Jewel* (right). 05. *Paphiopedilum* cultivars. 06. Grand Champion Display by the Chaiwathana Orchid Garden, Thailand. 07. Traditional costume of the Kachin ethnic group, yellow patterns of the costume are thread from stem fibres of the yellow-flowered *Waso* orchid (*Dendrobium moschatum*) in the display of the Myanmar Floriculturist Association.



Display by the Bali Orchid Society.

won by plants exhibited by the Singapore Botanic Gardens (Best *Vanda* Species Trophy, Best Angraecoid or Other Vandaeae Trophy and Best Standard Antelope *Dendrobium* Hybrid Trophy). In addition, displays, orchid species and orchid hybrids exhibited by the Singapore Botanic Gardens won four gold medals, two silver medals, four bronze medals and more than 40 ribbons. Orchid hybrids bred by the Singapore Botanic Gardens (SBG) won 11 prizes, among them trophy for the Best Standard Antelope *Dendrobium* Hybrid, a gold medal, two silver medals and a bronze medal (for details see the table). SBG was also awarded a gold medal for its World Orchid Map. A trophy, called Joyce Stewart Trophy, was also awarded for the best poster presented, and was won by AVA, the Agri-Food & Veterinary Authority of Singapore. This trophy is named in honour of the late Mrs Joyce Stewart, a WOC Trustee who was very much involved in the preparation of Singapore's 2011-WOC, but who passed away unexpectedly earlier this year.

Fine orchid plants as well as orchid-related products (like orchid books, T-shirts and souvenirs) were on sale at the Marketplace adjacent to the Orchid Show, provided by 80 vendors from 17 countries, from Singapore, Malaysia, Indonesia, Thailand, the Philippines, Taiwan, USA, Brazil, Ecuador and others. A large booth was also provided by the library of the Singapore Botanic Gardens where a wide range of books were on sale. The Orchid Society of South East Asia made available a good selection of orchid books for orchid lovers. Also other organisations and societies were represented here, including the Nanyang Orchid Society, Gardening Society of Singapore and the Nature Society of

Singapore. A stall manned by AVA staff was also present to examine plants purchased by overseas visitors and issue various permits required for their export. Food and drinks were available in a section next to this Marketplace.

For many visitors, the social events were another important highlight of the WOC. Particularly, the Gala Dinner in the Flower Dome of the Gardens by the Bay in the evening of Sunday 13th November was a grand occasion, and also provided the rare opportunity of a preview of the Gardens there (much of the Gardens by the Bay is still under construction and will be open to the public only in June 2012). Various tours were arranged, ranging from short city tours in Singapore, visits to the Singapore Botanic Gardens and to the Gardens by the Bay to post-conference tours to exciting orchid-rich areas in SE-Asia (Peninsular Malaysia, Borneo, Philippines, Thailand, and Java).

A major effect of the 20th WOC was that it boosted the orchid industries both locally and in Southeast Asia as a whole. The landscape and orchid industry provided major exhibits and made available both plants and materials. Not only were plants and expertise showcased to the international visitor, but also business opportunities emerged both regionally and worldwide.

The WOC indeed proved to be an overwhelming success. On closing, Ms Elizabeth Banks from the World Orchid Conference Trust and the President of the Royal Horticultural Society proclaimed the 20th WOC in Singapore as "the finest there has ever been".

► Prizes won by SBG hybrids at the 20th WOC.

Best Standard Antelope <i>Dendrobium</i> Hybrid Trophy	<i>Dendrobium</i> Asian Youth Games Singapore 09
Gold Medal	<i>Dendrobium</i> Asian Youth Games Singapore 09
Silver Medal	<i>Paravanda</i> Istana <i>Spathoglottis</i> Lion of Singapore
Bronze Medal	<i>Dendrobium</i> Alois
First in class (Blue Ribbon)	<i>Dendrobium</i> Asian Youth Games Singapore 09 <i>Spathoglottis</i> Lion of Singapore
Second in class (Red Ribbon)	<i>Spathoglottis</i> Philippe 'Mathilde'
Third in class (White Ribbon)	<i>Spathoglottis</i> Joyce Stewart <i>Paravanda</i> Istana <i>Dendrobium</i> Alois

The next WOC

The 21st WOC will be held in three years' time at the Sandton Convention Centre in Johannesburg (South Africa), and the official conference theme will be Orchids: Gold in the Green Age. Organisers of the event will be the Johannesburg, Edenvale, and Pretoria orchid societies. The WOC will also provide an opportunity to visit some of South Africa's many attractions, like game parks where tourists can see the big five – elephant, lion, buffalo, hippo, and leopard – or the unique floral kingdom in the Western Cape.

For further details on the 20th WOC please visit: <http://www.20woc.com.sg/site/>

Hubert Kurzweil

Herbarium

Tim Yam Wing

*Orchid Breeding and
Micropropagation Laboratory*

*Photos by Hubert Kurzweil, Yam Tim Wing and
Chang Yoon Ching (OSSEA)*



**Singapore Garden
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Admire an enchanting display of beautiful flowers, creatively and delicately designed by celebrated local and international floral designers.

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Let our colourful displays inspire you to transform your own balcony into a soothing personal retreat for the senses.

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Satisfy all your gardening needs in a one-stop marketplace that will see over 100 retailers offer their wares!

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• **Venue: Suntec Singapore**

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THE PRECOCIOUS FLOWERING OF *ARUNDINA* 'SINGAPORE BOTANIC GARDENS', THE WORLD'S ONLY *ARUNDINA* HYBRID



▶ Orchids are naturally pollinated by insects, and in rare instances, by birds. They can also, however, be artificially pollinated by humans. Artificial pollination requires an orchid breeder to pick the pollinia of one flower and place it on the stigma of another. A successfully pollinated flower gives rise to a seed capsule. A seed capsule can take between one month and two years to mature. Take, for example, the common orchid genera in Singapore — *Vanda* seed capsules usually take 4 months to mature, *Dendrobium* seed capsules take 3 months, and terrestrials such as *Spathoglottis* and *Arundina* usually take 1 to 2 months. After the seed capsules ripen, they are sent to a laboratory for germination on sterile media. Seedlings can take up to a year in the lab before they can be despatched to a nursery for acclimatisation and culture. Vandas and *Dendrobiums* can take between 2 to 5 years in the nursery before producing their first flower spikes, whereas terrestrials usually produce their maiden bloom 8 months to 1 year after potting out from sterile culture.

Arundina

Arundina graminifolia, commonly known as the bamboo orchid, is a very variable multi-perennial terrestrial orchid with reed-like stems that grow to a height of about 70 cm to 2 m. The grass-like leaves are about 9 to 19 cm long and 0.8 to 1.5 cm wide. Its flowers are 5 to 8 cm across. Up until 2007, it was thought that the genus consisted of only one species: *A. graminifolia*. Synonyms (other given names not considered correct any more) include *A. bambusifolia*, *A. chinensis*, *A. minor* and *A. speciosa*. *Arundina graminifolia* is found distributed throughout tropical Asia and the Pacific Islands. It grows well in a medium of burnt earth, compost and organic fertiliser and requires full sun.



Arundina caespitosa is a relatively new species described by the Russian botanist L.V. Averyanov in 2007. It is found exclusively in Vietnam and was previously wrongly reported under the name *A. chinensis*. It is a lithophytic herb commonly found along natural waterways. It is much smaller than *A. graminifolia* with stems of about 25 to 60 cm tall. Its leaves are also grass-like, 10 to 18 cm long and 0.2 to 0.6 cm wide. Its flowers are 2.5 to 3 cm across.

A fortuitous acquisition

Our hybrid's story begins with the Singapore Garden Festival held in July 2010. One of us (David Lim, an orchid breeder), purchased what looked like a miniature *A. graminifolia* from the Festival's marketplace. This orchid was marketed as *A. graminifolia* 'Laos'.



► *Arundina* 'Singapore Botanic Gardens' variant 1.



► *Arundina* 'Singapore Botanic Gardens' variant 2.



► *Arundina* 'Singapore Botanic Gardens' variant 3.



► Comparison of *A. caespitosa* and *A. graminifolia* clumps.

This plant was subsequently identified (Nura, our plant records manager) as *A. caespitosa*.

The pollen from *A. graminifolia* was used to pollinate a flower of *A. caespitosa* on 6 August 2010. The resulting seed capsule was harvested and sown in the Orchid Breeding and Micropropagation Laboratory at the Gardens by Ms. Chin Li Li on 10 October 2010. The germinated seedlings were sent to the National Orchid Gardens nursery and planted out on 15 April 2011 under the care of Mr. How Wai Ron. The first flowering of progeny from this cross was observed on 12 October 2011, a mere 6 months after planting out. The flowering of the hybrid progeny only one year after

seed harvest is the earliest flowering of any tropical terrestrial orchid which we are aware of. Other *Arundina graminifolia* cultivars usually require at least 15 months for seed harvest to flowering and *Spathoglottis* cultivars often take at least 18 months.

"...the common orchid genera in Singapore – Vanda seed capsules usually take 4 months to mature, Dendrobium seed capsules take 3 months, and terrestrials such as Spathoglottis and Arundina usually take 1 to 2 months."

The hybrid was registered as *Arundina* 'Singapore Botanic Gardens' with the Royal Horticultural Society (London) under the International Orchid Register on 12 December 2011. The hybrid flowers at a much shorter height than either parent – at a stem height of about 7 cm, it carries a bloom of about 5.4 cm. Flowers are intermediate between both parents in colour and size. This is the first *Arundina* hybrid in the world which is indeed a proud achievement for its originator, David Lim.

David Lim

National Orchid Garden

Nura Abdul Karim

Plant Records

Gillian Khew Su-Wen

*Orchid Breeding and
Micropropagation Laboratory*

All photos by Gillian Khew



RESOLVING A CENTURY-OLD MYSTERY: THE PARENTAGE OF VANDA MISS JOAQUIM, SINGAPORE'S NATIONAL FLOWER

► *Vanda Miss Joaquim.* (Photo credit: Gillian Khew)

► Our national flower, *Vanda Miss Joaquim* 'Agnes', is indeed a 'lady' of beauty and mystery, about which we know very little, even though it is an important hybrid orchid. The hybrid arose in the garden of Miss Agnes Joaquim in 1893. The plant was shown to Henry N. Ridley, then Director of the Singapore Botanic Gardens, who described the plant in the *Gardeners' Chronicle* that very year. He stated that it was the result of a cross between *Vanda hookeriana* and *Vanda teres* and that it was not known which plant was used as the male parent.

Although Ridley explicitly stated that the hybrid was made by Miss Joaquim, doubt regarding the plant's true origin has surfaced over the years – whether it was really the result of human-mediated pollination. Those who doubt that the hybrid was created by Miss Joaquim maintain that any true orchid breeder would have kept records regarding which was used as the male or female parent. In addition, germinating orchid seeds in those days was a hit-and-miss venture. One would have only as much luck germinating orchid seeds as nature would have in its own random way. Orchid seeds are the

"In recent collaborative work between the Gardens and the Natural Sciences and Science Education Academic Group of the National Institute of Education, molecular techniques were used to unravel this long-standing mystery."

smallest seeds in the world. They are dust-like and do not contain reserves to assist germination. In nature, an association with a specific fungus is required for orchid seeds to germinate. The fungus provides the necessary nutrients for germination in what is a very specific symbiotic relationship. In Miss Joaquim's day, orchid seeds would have to be sprinkled around existing orchid pots in the hope that the necessary fungus was present. It wasn't

until 1922 when a complete nutrient medium was formulated by Lewis Knudson that sterile germination of orchid seeds was possible and this greatly increased the rate of successful orchid seed germination. To this day, debate regarding the origin of *Vanda Miss Joaquim* continues.

The second part of the mystery was raised by Ridley himself. Which parent acted as the male, and which as female? Arthur George Alphonso, Chief Administrator of the Singapore Botanic Gardens from 1970 to 1976, brought the question a step further and asked which variety of *V. teres* was used in the cross.

In recent collaborative work between the Gardens and the Natural Sciences and Science Education Academic Group of the National Institute of Education, molecular techniques were used to unravel this long-standing mystery. Most of an animal or plant cell's DNA is contained within the nucleus but some DNA also exists in organelles called mitochondria and chloroplasts, the latter of which occur only in plants and algae. The mitochondria and chloroplasts of flowering plants are often passed down exclusively from the mother



▶ *Vanda hookeriana*. (Photo credit: J.B. Tay)



▶ *Vanda teres* var. *alba*. (Photo credit: J.B. Tay)



▶ *Vanda teres* var. *andersonii*. (Photo credit: J.B. Tay)

to all progeny and therefore all genes occurring within the two organelles are identical copies of the mother's organellar genes. This mode of inheritance allows us to trace a plant's maternal heritage through countless generations. Maternal identity can be established by sequencing organellar genes and looking for an exact match.

The chloroplast gene, *matK*, was used in our study. We amplified and sequenced this gene from five related taxa: *V. hookeriana*, *V. teres* var. *alba*, *V. teres* var. *andersonii*, *V. teres* var. *aurorea* and *V. Miss Joaquim* 'Agnes'. *Vanda hookeriana* has two forms: coloured and *alba*, the latter being rare and unlikely to be the parent of *V. Miss Joaquim*. It was the coloured form of *V. hookeriana* which was used in the study. In addition to fresh samples, we used original herbarium specimens of *V. teres* and *V. Miss Joaquim* collected in 1893 by Miss Joaquim and Henry Ridley, respectively. The *matK* sequences from these plants were aligned by computer software and trimmed to a 730-base pair region. Gaps in identity are indicated by vertical black lines within the grey bars. Solid grey bars indicate a complete sequence match with *V. Miss Joaquim*. Several conclusions could be drawn from this work:

1. The *matK* sequence of *V. teres* var. *andersonii* is completely identical to *V. Miss Joaquim*. This implies that *V. teres* var. *andersonii* is the maternal parent of *V. Miss Joaquim* and that it is the variety

andersonii that was used in the cross which produced *V. Miss Joaquim*.

2. The *matK* sequence of *V. teres* var. *andersonii* is also completely identical to that of the herbarium specimen of *V. teres* indicating that it is this variety of *V. teres* which Miss Joaquim possessed in her collection, and therefore the likely parent of *V. Miss Joaquim*.
3. The *matK* sequences of both contemporary and herbarium specimens of *V. Miss Joaquim* are identical and share complete identity with contemporary and herbarium specimens of *V. teres* var. *andersonii*, confirming that they share the same inferred parentage.
4. By inference, *V. hookeriana* is the likely paternal parent of *V. Miss Joaquim*.

We have thus solved the century-old mystery of *V. Miss Joaquim*'s parentage and identified the variety of *V. teres* which gave rise to our national flower!

Gillian Khew Su-Wen

*Orchid Breeding and
Micropropagation Laboratory*

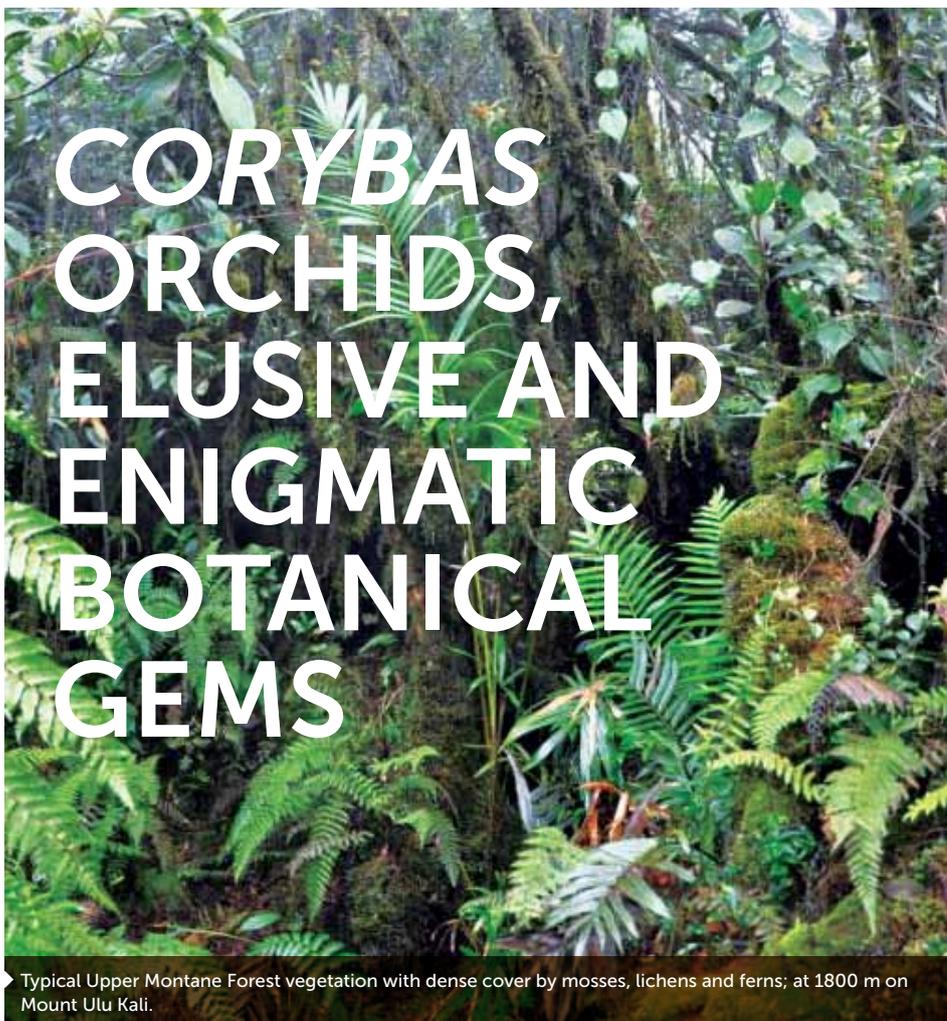
Chia Tet Fatt

*Natural Sciences and Science Education
Academic Group
National Institute of Education*



▶ *Vanda teres* var. *aurorea*. (Photo credit: J.B. Tay)

CORYBAS ORCHIDS, ELUSIVE AND ENIGMATIC BOTANICAL GEMS



Typical Upper Montane Forest vegetation with dense cover by mosses, lichens and ferns; at 1800 m on Mount Ulu Kali.



Corybas carinatus, the most widespread helmet orchid species, occurs from the Malay Peninsula to Sumatra, Java, and Borneo, at 400–2000 m. (Photo credit: Paul Leong)



Close-up of a *Corybas villosus* flower, showing the oversized helmet-like dorsal sepal and lip, compared to the inconspicuous thread-like petals and lateral sepals.

“From the outset, this tiny plant has elicited some exciting imagery in its beholders”

► The genus *Corybas* was first described by Richard A. Salisbury in 1805 after dancing priests, known as Corybantes, who worshipped the Phrygian goddess Cybele (the Earth Mother in Greek mythology). Perhaps that was the very first impression Salisbury had when he chanced upon the flower of this remarkable orchid and reminisced a group of exotic frenzied dancers. However, the first person who discovered and collected this amazing tiny orchid was Robert Brown, during the Flinders Survey Expedition (1801–1805) in Australia. He described the genus in 1810 as *Corysanthes* (in Greek, *korys* = helmet, *anthos* = flower; referring to the helmet-like dorsal sepal of the flower) after his collection in *Prodromus Florae Novae Hollandiae et Insulae van-Diemen* (“A publication of the Flora of New Holland and Van Diemen’s Land”). In his work, Brown dismissed Salisbury’s earlier published name, *Corybas*, as he accused Salisbury of unethically copying Ferdinand Bauer’s drawing of *Corysanthes bicalcarata* that was commissioned by him. For a time, Brown’s name was upheld; however due to the concept of priority in providing stability for taxonomy, Salisbury’s earlier published name is now the accepted one.

Helmet or spider orchids

Among today’s orchid enthusiasts and botanists, *Corybas* are commonly known as the helmet orchids or spider orchids. The analogy is based on the flower, dominated by a large hood-like dorsal sepal that resembles a helmet (hence, helmet orchid). In contrast, the petals and lateral sepals are inconspicuous and thread-like, spreading outward, away from the flower (hence, spider orchid). It is clear that, from the outset, this tiny plant has elicited some exciting imagery in its beholders. With a diversity of about 120 species, *Corybas* is distributed from the Himalayas through to mainland Southeast Asia, Taiwan, the Malay Peninsula and Archipelago, New Guinea, Australia, New Caledonia, the Polynesian islands and Macquarie Island (a subantarctic island in the Antipodes Subantarctic Islands tundra eco-region). Remarkably, this qualifies *Corybas* as the orchid genus with the southernmost distribution in the world.

Corybas species are generally photosynthetic orchids; however two non-

photosynthetic species, *C. cryptanthus* from New Zealand, and *C. saprophyticus* from New Guinea exist. Such plants, which obtain nutrients through their fungal symbiotic partners, are known as myco-heterotrophic species (previously they were also called saprophytic species, but that term is now considered inaccurate as, unlike fungi, they do not actually obtain nutrition directly from breakdown of dead organic matter). *Corybas* are small terrestrial (rarely epiphytic) orchids compared to other horticulturally well-known orchid genera, such as *Bulbophyllum*, *Dendrobium*, *Phalaenopsis*, *Spathoglottis*, *Vanda*, etc. Taxonomically, *Corybas* is under subfamily Orchidoideae, and has the subfamily characteristic of forming subterranean tubers. The tuber is generally rounded to slightly oval, and resembles miniature potatoes. Mature tubers produce a single, heart-shaped to rounded leaf that is decorated with pale silver to pale green venation in some species. Then, the bizarre flower is produced, subtended by the relatively small leaf. Besides that, the tuber also produces long and slender subterranean rhizomes that enable the plant to reproduce vegetatively. Dormancy has been reported for some *Corybas* species in Australia and New Zealand, elsewhere little is known about the growth of this elusive group of plants.

Very little is known about its pollination in the wild, but the mysterious *Corybas* orchid has a dark-coloured flower that has been interpreted as a "non-rewarding flower" with a deception mechanism to attract pollinators. Botanists have hypothesised that the flower actually mimics the brood-site of fungus gnats (Mycetophilid flies) that eventually pollinate it. However, self-fertilisation has been reported for *C. trilobus* in cultivation under controlled environment in New Zealand.

Helmet orchids in the Malay Peninsula

Based on today's political boundary, the Malay Peninsula is shared between four countries, namely, Myanmar, Thailand, Malaysia and Singapore. This region is floristically rich and well-known within botanical circles as part of Malesia, the phytogeographical region that includes the Malay Archipelago and New Guinea.

Twelve species of *Corybas* have been enumerated for the Malay Peninsula, occurring from lowland forest at about 200 m elevation, to upper montane forest at 1800 m. One species was enumerated from Southern Thailand (*C. ecarinatus*), and 11 other species were enumerated

from Peninsular Malaysia (*C. calcicolus*, *C. calopeplos*, *C. carinatus*, *C. caudatus*, *C. comptus*, *C. fornicatus*, *C. geminigibbus*, *C. holttumii*, *C. ridleyanus*, *C. selangorensis* and *C. villosus*). *Corybas* has not been recorded from Singapore. Of the species recorded, nine are endemic (restricted) to the Malay Peninsula (*C. calcicolus*, *C. calopeplos*, *C. caudatus*, *C. comptus*, *C. ecarinatus*, *C. holttumii*, *C. ridleyanus*, *C. selangorensis* and *C. villosus*). The most recent monograph of this enigmatic group of orchids in our region is "A synopsis of *Corybas* (Orchidaceae) in West Malesia and Asia" by John Dransfield, J. B. Comber and G. Smith, published in the Kew Bulletin in 1986.

Very little is known about its pollination in the wild, but the mysterious Corybas orchid has a dark-coloured flower that has been interpreted as a "non-rewarding flower" with a deception mechanism to attract pollinators.

Most *Corybas* species recorded for the Malay Peninsula occur in the highlands between 1000 m to 2000 m elevation, but *C. calcicolus* (known from Peninsular Malaysia only) and *C. ecarinatus* (Thailand) are lowland species of limestone hills. *Corybas* can usually be found growing in partial to well-shaded sites, with tubers buried deep inside the well-drained but moist humus, usually in association with mosses. In the highlands, *Corybas* inhabit sites with dense moss cover that carpets the ground, boulders, tree trunks and branches. Typically, *Corybas* is very much localised, and can form impressive colonies in one spot. However, isolated individuals do occasionally occur, but rarely too far away from colonies.

Corybas in cultivation

In the tropics, *Corybas* is rarely cultivated, as many orchid enthusiasts have reported failure in trying to sustain this orchid in their collections. Perhaps, some suitable helmet orchid species may thrive in artificially



A colony of *Corybas abellianus* in the Atherton Tableland rainforests, Cairns, Australia. (Photo credit: Bruce Gray)



A colony of the elusive *Corybas holttumii* flourishing on a moist mossy carpet.

controlled environments in the tropical lowlands. In contrast, a few species, such as *C. diemenicus*, *C. fimbriatus*, *C. pictus*, *C. sinii* and *C. taiwanensis*, have been reported successfully cultivated in cool-climate countries, such as Australia, Europe, Japan, New Zealand, Taiwan, and the United States.

In cool-climate cultivation, the tuber is recommended to be planted in a loose and well-drained planting mixture that consists of gravel, pumice or sand, sphagnum moss and organic matter. Generally, tubers should not be planted too deeply and some growers report just placing the tuber on the planting medium, covered by a layer of sphagnum moss to prevent drying out. As some species might undergo dormancy, tubers planted should be kept in the same medium and conditions as their original habitat. During the growth period, it is advisable not to dig out tubers planted until the next dormancy cycle starts. Over-watering was reported to be the main cause for tuber and leaf rot in cool-climate cultivation. Therefore, if the medium is still moist, watering should be avoided, at least not directly onto the leaves or flowers. As seed propagation is very little known for *Corybas*, the most successful propagation in cultivation is by division of underground tubers.

Low Yee Wen
Herbarium

All photos by Low Yee Wen unless otherwise stated

JOE ARDITTI'S COLLECTION OF ORCHID LITERATURE COMES TO SINGAPORE: A RENOWNED ORCHIDOLOGIST'S RESEARCH COLLECTION OF PAPERS IS NOW WITH THE SINGAPORE BOTANIC GARDENS



► Professor Joseph Arditti at the gardens recently while attending the 20th World Orchid Conference.

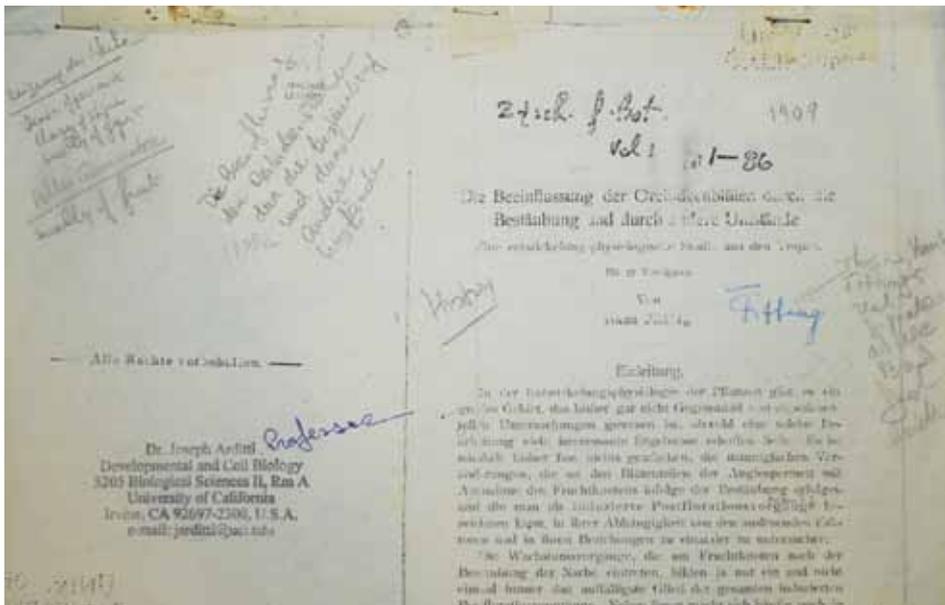
“Joe’s interest in Singapore was generated in his graduate school days when his department chairman, the late Professor Paul Saunders showed pictures of the Botanic Gardens and its orchids after visiting Singapore.”

► There are so many research papers, articles and short communications on orchids, in numerous languages and spanning hundreds of years, that many are very hard to find. Patience, persistence, luck, dedication and expertise are required to collect, if not all, at least a large proportion of these. Beginning in about 1959 Professor Emeritus Joseph Arditti (University of California, Irvine) started to collect copies and reprints of orchid literature. He accumulated a vast collection and stopped collecting only in 2000, just before retiring in 2001. Several years later, Prof. Arditti approached Dr. Kiat Tan, his friend and former Director of the Gardens and offered to donate his collection to SBG. His collection arrived at SBG between 2008 and 2010 in 32 boxes. I was Joe’s postdoctoral fellow and worked in his laboratory for almost three years before coming to SBG and have been his friend for more than a quarter of a century.

A beginning in the US

Joe was born in Bulgaria but later immigrated to the USA in the fall of 1954, arriving with no high school education and only US\$50 in his pocket. However, he managed to get himself admitted to the University of California at Los Angeles and earned a B.Sc. in Floriculture in 1960. As a student he supported himself by working as a gardener and eventually also worked for an orchid grower. In 1960 he started work for a doctorate in Plant Physiology at the University of Southern California (USC), in Los Angeles and received his Ph.D. in 1965. USC is still his favourite university! In 1966 he became an Assistant Professor of Biology at the newly established University of California, Irvine (UCI), and had the opportunity to start his literature collection.

The University of California (UC) has 10 campuses, all well known. Joe attributes this to their relentless pursuit of the famous (or infamous) “publish or perish” policy, which has pushed many UC professors to become world famous.



▶ A photocopy reprint of Hans Fitting's article entitled *Die Beeinflussung der Orchideenblüten durch die Bestäubung und durch andere Umstände*, and his signature obtained later by Prof. Arditti when Hans Fitting was 93!

Joe Arditti and Singapore

Joe's interest in Singapore was generated in his graduate school days when his department chairman, the late Professor Paul Saunders showed pictures of the Botanic Gardens and its orchids after visiting Singapore. Ten years after that, Joe, by then a Professor, visited Singapore for the first time and met Prof. A.N. Rao, then Chairman of the Botany Department at the University of Singapore and Dr. P.N. Avadhani. The three of them, all interested in orchids, bonded immediately and started joint research. They have been doing this ever since and are close friends. When the National University of Singapore or NUS was formed, Prof. Arditti met Prof. Hew Choy Sin. After that, Joe came to Singapore almost annually to work and publish with his friends. Joe's extended visits were possible because he could stay with his Indonesian friends, the late Ing. Soedionos and his wife Noes.

During his visits here, Joe met and became friends with Mr. Mak Chin On; Dr. Teoh Eng Soon; Mr. Syed Yusof Alsagoff; Dr. Kiat Tan; Drs. Chia Tet Fatt, He Jie, Jean Yong, Sek Man Wong and many others. Over time, Joe started to consider Singapore as his second home.

In 1981, Prof. Joe Arditti came to Singapore to attend a tissue culture meeting organised by Prof. Rao. Another participant at that meeting was Mastura Abdullah from the Forest Research Institute in Malaysia. They married in a civil ceremony at the Japanese Garden in Singapore in 1983.

Mr. Mak and his wife Jill and Dr. Avadhani and his wife Parvi attended. Their son, Jonathan, was born in California in 1984. Joe and Mastura divorced in 1991, but he and Jonathan continued to visit Singapore every year or two.

After I came to SBG and Avadhani, Hew and Rao retired, they and Joe started to collaborate with me. Joe continued to stay with the Soedionos, but his scientific base in Singapore moved from NUS to SBG. On one of his visits to SBG several years ago, Joe told me that he wanted to donate his reprint collection to SBG. He contacted Dr. Tan who made arrangements at SBG and also then CEO of NParks, Mr. Ng Lang, enabling the gift.

The Collection

When UCI was established, the plan was to make it a well-known university very quickly and with a small budget. To accomplish this, UCI hired young and promising assistant professors, demanding research and many papers in major journals before granting them tenure. This approach worked. UCI is now one of the top 50 American universities. Many of its professors are well-known (for Prof. Arditti's reminiscences, see Arditti 1997a, 1997b, 1998, 1999, 2000, 2002.)

The kind of research required by UCI required a large library it did not have. Therefore UCI established an active Interlibrary Loan (ILL) service for professors to request literature from other libraries which was obtained mostly as copies. Prof.

Arditti made full use of it. Whenever he received a paper on orchids, he requested all of its orchid references. The ILL was unhappy with the large volume of requests and established limits for him. However, he went around them by having associates and students make requests!

Joe also arranged for regular printouts of recent orchid publications. On receiving each printout, he immediately requested reprints. Later, as he became known, researchers sent him reprints without requests. I estimate the number of reprints in the collection to be in the tens of thousands, organised according to major topics, for example, Anatomy/Morphology, Biochemistry/Physiology, Cytology, Genetics, History, Pollination, Seed Germination and others. All are stored in library boxes which are now at the SBG library. Dr. Chin See Chung, the former Director of SBG, named the collection after Prof. Arditti and his son Jonathan. The collection is unique for its size, diversity, breadth, and also because numerous papers are signed by the authors (some famous like Bernard, Dodson, Kamemoto, Knudson), and many are classic.

Yam Tim Wing

Orchid Breeding and Micropropagation Laboratory

All photos by Yam Tim Wing

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► *Mycena* sp. forming small clumps on a rotten *Oncosperma horridum* palm trunk.

NIGHT ENCOUNTERS WITH BIOLUMINESCENT MUSHROOMS

► The emission of light by living organisms, a phenomenon known as bioluminescence, is the result of a chemical reaction where an enzyme 'luciferase' reacts with oxygen and a substrate 'luciferin', producing little or no heat but, instead, releasing energy in the form of a cold light. This natural phenomenon is found in at least 17 phyla of living organisms, but has never been observed in plants, birds, reptiles, amphibians and mammals. Bioluminescence is relatively rare in terrestrial organisms but is very common in organisms adapted to live in the depths of the sea, where light is completely absent even during daytime. Still, the most familiar bioluminescent organism is probably the firefly.

The production of light by animals and its possible explanation has been relatively well studied. In the case of fireflies, the most common advantage of light production is the attraction of mates and prey, as also observed in many deep-sea organisms or

in animals inhabiting caves, such as glow-worms. The light may not only be needed to attract a prey but just to locate a food source. Specific light emission patterns are adopted by insects as a means of communication. Additionally, light can be a means of camouflage and defence against predators that can be temporarily blinded or distracted by the sudden emission of light by prey.

The evolution of bioluminescence in natural organisms required millions of years of adaptation but in the past few decades researchers have been able to transfer the ability to emit light to other organisms, bringing new tools to bioengineering and biomedical research.

Among terrestrial organisms capable of emitting light, fungi are some of the more easily observable. They are made of tiny filaments, called hyphae, that together form a mat, the mycelium, that is commonly visible on rotting material

such as on the surface of decaying wood and leaves, but which can also grow deep in the ground. The mycelium is able to degrade these materials releasing the nutrients locked in their tissues. Some fungi develop reproductive structures easily visible to the naked eye, the mushrooms, that are usually above-ground. More than two millennia ago the roman naturalist and natural philosopher Pliny the Elder documented the presence of mushrooms emitting light, an observation that was also made in SE Asia by Rumphius more than 16 centuries later. After Pliny, for centuries much more attention was given to the phenomenon of luminous wood instead of luminous mushrooms. Only in the early nineteenth century it was realised that the luminescence of the wood was caused by microscopic fungal hyphae growing on it.

It is now recognised that some fungi are able to emit light in their sterile stage only (the hyphae), or in their fruiting stage (the mushroom), or in both stages. The



► *Mycena* sp. forming small clumps on a rotten *Oncosperma horridum* palm trunk.

possible ecological and biochemical role of the light emission and how widespread this phenomenon is in fungi has only been recently studied. Recent taxonomic research brought an increase in the number of known bioluminescent fungi. New species are discovered often and the bioluminescence of previously described species is also subsequently documented.

Up to now, at least 40 species of bioluminescent fungi are known, in nine genera, with a dominance of *Mycena* spp. (at least 26 species). All are basidiomycetes. The emission of light is variable and can be produced at night only, or during the whole day, but can only be detected if the fungi are transferred to a dark place. The reason for the emission of light is unclear: it is commonly associated with the attraction of invertebrates that could increase spore dispersal, but recent hypotheses suggest otherwise. It is possible also that this mechanism evolved to attract predators of fungivores (fungus-eating organisms); alternatively, it may have no ecological significance and may simply be the end product of oxidative reactions such as those used by wood-decaying fungi.

Bioluminescent fungi are scientifically interesting but may also be the subject of an enjoyable night walk. In Singapore, the best chance to encounter these mushrooms is after heavy rain, more commonly between November and January when the rainfall is more intense.

In that period, at daytime, it is common to observe thriving colonies or isolated mushrooms of a striking variety of fungi, easily noticeable for their size, strange shapes, bright colours or, sometimes, foul smell. Bioluminescent fungi usually go unnoticed during the daytime. They are small (maximum 5 cm high but often much smaller), do not occur in big clumps and present a pale cream colour.

“More than two millennia ago the roman naturalist and natural philosopher Pliny the Elder documented the presence of mushrooms emitting light, an observation that was also made in SE Asia by Rumphius more than 16 centuries later.”

Moonless overcast nights, shortly after heavy rain, give the best chances to

encounter these fascinating organisms. Bioluminescent mushrooms can provide a real show, dotting the ground and moist rotting matter with little green umbrellas.

The fungal diversity in Singapore is still little investigated and no recent revision is available. Even scarcer data is available on bioluminescent mushrooms. Nonetheless, at least three bioluminescent species, *Filoboletus manipularis*, *Oudemansiella* sp. and *Mycena* sp. have been recently found.

Michele Rodda

Herbarium

with identifications by Serena Lee (Herbarium)

All photos by Michele Rodda

► In April 2007, an opportunity for a small adventure in the form of the French-sponsored conservation project "Restoring and developing the natural forest heritage of Dong Nai province, Vietnam" presented itself. Its aim was to produce a CD that would help visitors to identify the plants they encounter along the two trails that wind through Tan Phu forest. Just a 2-hour drive north-east of Ho Chi Minh City, it is nowadays a favourite haunt among birdwatchers. At 120 m elevation and covering an area of about 140 sq km, Tan Phu is a tropical lowland forest dominated by members of the Dipterocarpaceae and Fabaceae. It has a monsoonal climate with a rainy and a dry season. The forest is surrounded by La Nga River, a tributary of Dong Nai River which is the main water source for Ho Chi Minh City.

Together with Tuấn, my friend from university, our role in this project was to help collect and describe the more interesting plants found in this forest. With an extremely modest budget for transport, the iconic Land Rover or even a Ssangyong, the local equivalent, were luxuries beyond us. So we settled for my trusty Honda Cub, ubiquitous in the streets of all Vietnam!

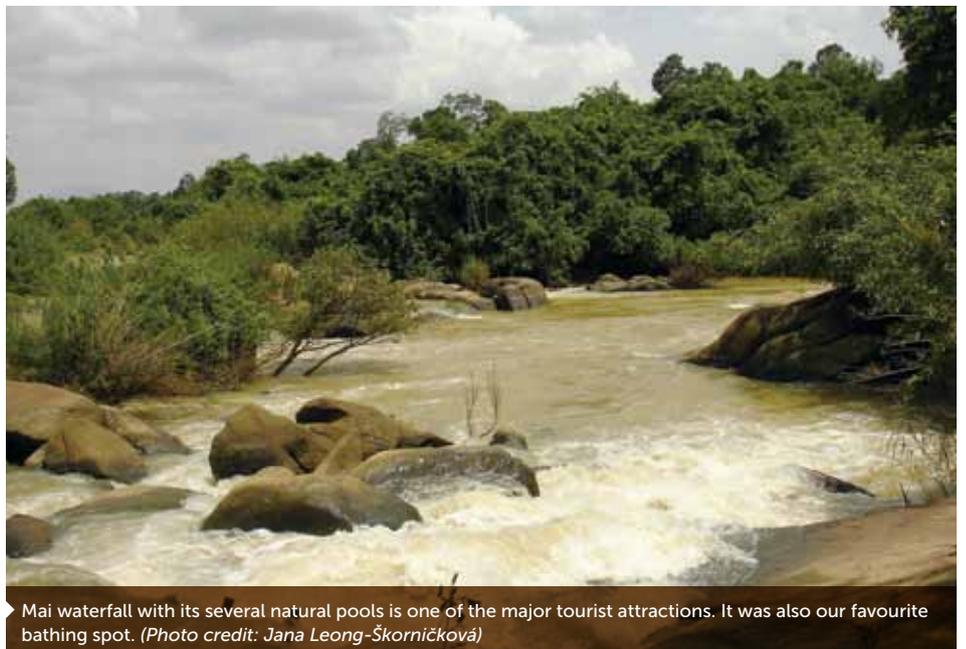
"Close to the waterfall, the Botanical Trail has conservation and biodiversity messages put up to help visitors better understand and appreciate the value of the forest and its importance."

On our first trip to Tan Phu forest, once we were out of Ho Chi Minh City's ever expanding suburbs, we passed villages and hamlets that seemed to have changed little. But one look inside the basic structures they call home, we can see flat screen televisions, computers and the usual trappings of 21st century living. Between villages were sprawling rubber plantations. Riding past regimental rows and rows of these rubber trees, I could only guess what the original forest looked like. Still, sharing a motorbike with my friend Tuấn riding pillion, zipping through the countryside, with our hair blowing in the wind and the roar of our 125 cc engine in



HERITAGE OF TAN PHU FOREST

► *Livistona saribus* growing at Hot Lake. This is the largest population found in south-eastern Vietnam.



► Mai waterfall with its several natural pools is one of the major tourist attractions. It was also our favourite bathing spot. (Photo credit: Jana Leong-Škorničková)

our ears, I could not help but imagine we were Che Guevara and his friend Alberto, rediscovering our own country on two wheels.

On our way to Hot Lake, we stopped at a slightly flooded junction where an army

hospital once stood. Some of the most common and diverse plants here during the rainy season are gingers. We found two *Elettariopsis*, two *Globba*, two *Zingiber*, two *Amomum* and a single *Etlingera* growing happily together along the roadside, covering most of the ground area. The



► Member of the ginger family (Zingiberaceae) commonly found in Tan Phu forest. 1. *Etlingera megalochelios*; 2. *Amomum uliginosum*; 3. *Globba pendula*. (Photo credits: Jana Leong-Škorničková)



► Some of the climbers used by local people. 1. Flower of *Tetracera scandens*. Its stems are used as a source of fibre, while the leaves with rough undersides are used for polishing in the lacquer industry. 2. The bark of *Spatholobus harmandii* is rich in medicinal compounds. When cut, it produces bright red liquid, hence the common name dragon's blood. 3. Chewing the fresh stem bark of *Abrus precatorius* is said to alleviate sore throats.



► Fruits of endangered species are collected for propagation and the plants raised will be re-introduced back to the forest. 1, 2. Seedlings and fruits of *Dipterocarpus dyeri*. 3. Fruit and seeds of *Azelia xylocarpa*. (Photo credits: Jérôme Millet)

man-made Hot Lake's water springs from an underground stream, and we couldn't resist soaking our legs before setting off on yet another round of botanising. The swamp around the lake was dominated by *Livistona saribus* (taraw palm), some with erect trunks over 25m tall. This species with its large crown is a beautiful ornamental and is easy to propagate as they produce lots of fruits.

At the edge of the forest, where a large population of the woody liana *Tetracera scandens* creeps all over the place with their white-pink flowers, an Ethno-Botanical Trail was established to display information on plants used by the local people for medicine, food, or handicrafts.

Our final destination for the day was Mai Waterfall. It is at the eastern edge of the forest, where we put up base camp from which we would set off on our daily excursions. The way from Hot Lake to Mai waterfall is through secondary forest with big trees over 40m tall. We were amazed to see critically endangered species belonging to the Dipterocarpaceae, such as *Dipterocarpus dyeri*, *D. turbinatus* and *Shorea guiso*. There were even several endangered species of the high-quality timber trees *Azelia* and *Dalbergia*, in the Fabaceae.

Mai Waterfall was a fantastic choice as base camp. Swimming in the natural pool by the falls was the first thing we did at the end of each tiring day of plant hunting, followed by dinner with the ever helpful and friendly rangers. Sleeping in the forest under the starry night sky definitely offered a more enjoyable atmosphere than



► Apart from plants, we had encounters with all sorts of caterpillars. (Photo credit: Jana Leong-Škorničková)



► Tan Phu V 1.2 interface: By matching easily observable characters of a plant such as leaf shape or habit, the programme will ultimately offer one or a few species, which fit all criteria.



► Though many trees in Tan Phu forest were collected for timber, there are still many tall trees growing in the forest classified as critically endangered and endangered.

the guest rooms available. It was here at Mai Waterfall that I met a reptile specialist. We agreed that he would help me collect plants for one day, and in return I would help him hunt for snakes and lizards that night. What a difference the forest is by day and by night!

“Besides timber, many non-timber products are collected by the local people for their everyday use. Palms are some of the most common.”

Close to the waterfall, the Botanical Trail has conservation and biodiversity messages put up to help visitors better understand and appreciate the value of the forest and its importance. Besides timber, many non-timber products are collected by the local people for their everyday use. Palms are some of the most common. Leaves of *Livistona saribus* are used for roofing. The conical hat Vietnamese women wear that is globally recognised is made from leaves of the *Licuala spinosa* palm. Numerous plants are also collected for traditional medicine. *Spatholobus harmandii*, known as dragon’s blood, is a large woody climber in the Fabaceae. Its stems are cut into small pieces, dried, and in combination with other medicinal plants soaked in spirit. After several weeks it may be then applied as a poultice to relieve painful joints. Another member of the Fabaceae is *Abrus precatorius*, known as crab’s eye or rosary pea, with most of the medicinal content stored in the bark, which is collected and used to cure coughs and allergies. Its attractive bright red and black seeds are used as jewellery. Because of the seeds’ consistent weight they were in the old days used as a unit to weigh gold! But beware, these seeds are also one of the most poisonous in the plant world.

As ecotourism brings in more and more visitors, the need for information arises to satisfy their curiosity and answer questions they may have about the flowering or fruiting plants they have seen. What is the name of the plant? What is it used for? This project produced a CD with attractive interactive images that will answer these questions. It uses characters such as habit, leaves, flowers or fruits to help identify



▶ The typical conical Vietnamese hat is in this region made from leaves of the small palm species *Licuala spinosa*.



▶ Dr. Jérôme Millet, representative for Rhône-Alps Region and University of Lyon and coordinator of the project, launching the public computer with identification software ‘Tan Phu 1.2.’ in a shelter near Mai waterfall.



▶ Mr. Tuấn (right) investigating medicinal plants and gathering information about their uses from the local medicine man.

plants commonly found in Tan Phu forest. After users have input sufficient characters by selecting the most appropriate match from offered images, the software will suggest one or more matching species. The users can then compare the plant they have seen with images of the suggested species. A solar-powered computer with this plant identification software is set up within the shelter near Maui Waterfall, one of the favorite spots among visitors. In all, botanical, ethnobotanical and biodiversity information of 200 most common plant species are included in the software, making Tan Phu forest a more interesting place for visitors.

In 2008, soon after this project was completed, Tan Phu forest became a protected forest, thereby maintaining a steady water supply for Ho Chi Minh City. Since then, harvesting of timber and extensive collecting activities targeting medicinal plants have been disallowed, consequently safeguarding its biodiversity as well.

Trần Hữu Đăng
Michael Leong (Volunteer)
Herbarium

All photos by Trần Hữu Đăng unless otherwise stated



RUDRAKSHA: THE BEAD TREE OF INDIA AND RELATED SPECIES

► The senescing red leaves of *Elaeocarpus angustifolius* are easy to spot. One can usually find them on the ground too.

Those interested in knowing more about *Elaeocarpus angustifolius*, the Rudraksha or bead tree of India, can visit the Singapore Botanic Gardens, which have some beautiful specimens. Below are brief notes and some other *Elaeocarpus* species that you may encounter while

taking a stroll in the Gardens.

- The genus *Elaeocarpus* is widely distributed in the Old World, ranging from Madagascar across Asia and southwards to Australia and the Pacific Islands, with Borneo and New Guinea as the centres of species diversity. There are about 300 species. The name *Elaeocarpus* was given by Linnaeus, in which *elaion-* means oil and *-karpos* means fruit, probably derived from the olive-like fruits of some Indian *Elaeocarpus* which were the first recorded in his *Species Plantarum*.

Discovery of the Early Tertiary fossils in Australia, New Zealand, India and South America, the landmasses of which were previously part of the ancient Gondwana supercontinent, suggest that *Elaeocarpus* was probably a part of the Gondwanan

flora. However, the origin of *Elaeocarpus* in Southeast Asia remains a mystery at this stage. An investigation of Southeast Asian *Elaeocarpus* is currently undertaken in the Australian Tropical Herbarium. The project uses molecular phylogenetic studies which are expected to offer greater understanding on biogeography and evolutionary history through building a phylogenetic tree (a diagram of genetic lineages) that shows relationships and evolutionary rates within and between species.

Elaeocarpus angustifolius

The bead tree of India (*E. angustifolius* Blume) produces the beads for the rosary used in Hindu society. These beads are the woody fruit stones which develop from the inner mesocarp (fruit wall). They are called *rudrak* or *rudraksha* in Sanskrit and have significant religious value, especially for Hindus, showcased by various interesting legends.



► A Rudraksha rosary commonly used in Hinduism, as well as Buddhism to aid worshipping. (Photo credit: Serena Lee)

“The project uses molecular phylogenetic studies which are expected to offer greater understanding on biogeography and evolutionary history through building a phylogenetic tree (a diagram of genetic lineages) that shows relationships and evolutionary rates within and between species.”



► The blue fruits of *Elaeocarpus angustifolius*, part of the diet of cassowaries in Australia.

One of the legends recorded in the ancient Hindu holy scriptures mentioned the god Shiva, who is also known as Rudra, going into a long period of meditation upon the suffering of all living beings on earth. He shed a tear after waking up, which fell on earth and took the form of a seed that grew into the Rudraksha tree, *E. angustifolius*. Therefore, it is believed that the beads of Rudraksha contain the secrets of the universe within it and also symbolises a link between heaven and earth, so whoever wears the *rudraksha* rosary will experience spiritual, emotional and physical freedom. There are also other similar legends with slightly different background stories, but mostly incorporating the teardrop of Shiva. More information can be gained from websites, such as www.rudraksha-ratma.com/rudraksha.htm.

According to Burkill's *Dictionary of the Economic Products of the Malay Peninsula*, prior to the independence of Singapore, ethnic Indians living there developed a custom of taking *E. angustifolius* fruit stones with them when returning to India, presumably related to their belief in Hindu traditions. Today, some Chinese-Buddhists in Peninsular Malaysia also treat *E. angustifolius* as a sacred tree and collect its beads, probably for rosary-making too.

Elaeocarpus angustifolius is widely distributed from northeast India eastwards to Southeast Asia, and southwards to Papua New Guinea, Australia and the Pacific islands (New Caledonia and Vanuatu). In India and Nepal, it is commonly found at the foothills of the Himalayas. *Elaeocarpus angustifolius* is common in secondary forest and often grows into large tree at higher elevations. Leaves of *E. angustifolius* are usually long and narrow and senescing ones often turn red before shedding. The leaf shape reflects its epithet, *angustifolius*, which in Latin means narrow-leaved. Fruits of *E. angustifolius* are edible, but taste sour or astringent. Therefore, the main interest is not due to its edible fruits, but rather because of its fruit stones, or the beads, which have important religious value. *Elaeocarpus angustifolius* also has a wide range of common names, such as Northern Silver Quandong in Australia and New Guinea Quandong, probably used in Australia to refer to the New Guinean form. Some other names are not well-known, e.g. Blue Marble Tree, Blue Fig and Snowdrop Tree. In Peninsular Malaysia, it is known as *mendong* (Malay), a name that applies to all *Elaeocarpus* species.



► Fruiting twigs, *Elaeocarpus mastersii*.

Taxonomically, this is a complicated and not well-understood species. Both of its vegetative and reproductive characters are very varied as the species is widely distributed across many regions as well as ecological habitats. In addition, there is also confusion between the wild species and the cultivars due to poor herbarium records (according to Mark Coode, the current specialist, 2010).

You can easily see trees of *E. angustifolius* in front of the Singapore Botanic Gardens' (SBG) Visitor Centre or, if you like a bit more challenge, try to spot the species in the SBG Rainforest. Remember, look for the senescing red leaves on the ground before looking up at the tree crown, as this will ease your search.

Elaeocarpus grandiflorus

There is an apparent dwarfed form of *E. grandiflorus* Sm. growing at the SBG Jacob Ballas Children's Garden. The mature tree is about 2 m tall, with branches in *Terminalia*-like branching system. The simple leaves are spirally clustered at branch ends. The young leaves are bright green with red petioles, but the leaves turn yellowish orange when senescing. The ovoid flower buds are red in colour, dangling downwards on yellowish green inflorescences. *Elaeocarpus grandiflorus* is distributed in Thailand, Peninsular Malaysia, Sumatra, Borneo (Sabah), Java, the Lesser Sunda Islands (Lombok), Philippines and possibly occurs in Indochina too. This species

occurs from lowland to oak-laurel montane forest and is usually found along riverbanks. Its epithet was given by the English botanist, James Edward Smith (1759–1828), who was also the first president of the Linnean Society of London; *grandis* means large and *florus* means flower in Latin.

In Burkill's *Dictionary of the Economic Products of the Malay Peninsula*, a poultice of leaves and seeds of *E. grandiflorus* is recorded as a treatment for ulcers and women's illnesses and the extract is drunk as a tonic, presumably in Peninsular Malaysia. In Java, leaves and seeds of this species are sold as *anjang-anjang* or *anyang-anyang* (Javanese) in local traditional drug stores.

Elaeocarpus mastersii

Elaeocarpus mastersii King is a medium-sized tree growing in the Gardens. In the wild, this species can be a shrub or large tree that grows up to 20 m tall. *Elaeocarpus mastersii* produces flowers and fruits throughout the year. The small olive-like fruits are often presented upward rather than hanging downwards. They are green when young and turn bluish-green when mature, due to surface reflectance properties rather than a special pigmentation. The embryos are curved, broad and white in colour, while the endosperm is ruminant and filled with a scanty yellow oil. Like *E. angustifolius*, *E. mastersii* also produces the bead-like sculptured fruit stones, but

they are not well-appreciated as those of *E. angustifolius*. *Elaeocarpus mastersii* is named after Maxwell Tyndall Masters (1833–1907), who was an English botanist and editor of *Gardener's Chronicle*. *Elaeocarpus mastersii* is a highly variable species distributed throughout Peninsular Malaysia, Singapore, Sumatra, Bangka Island and Borneo. It occurs in both primary and secondary forest, from lowland forest to oak-laurel montane forest and is common in swampy areas, disturbed vegetation or along riverbanks. There is a mature tree of *E. mastersii* planted next to the walking path in the Evolution Garden.

“Like *E. angustifolius*,
E. mastersii also
produces the bead-like
sculptured fruit stones,
but they are not well-
appreciated as those of
E. angustifolius.”

Elaeocarpus nitidus

Elaeocarpus nitidus Jack is a medium-sized tree growing in the National Orchid Garden that provides good shade for visitors. Its trunk has dark brown and rugose outer bark. The leaf colour changes at different stages of maturity. The new leaf flush is coppery red, gradually changing to coppery green, followed by bright green and dark green, and finally red before shedding off from the tree. Ng, in his revision for the *Tree Flora of Malaya*, recorded that *E. nitidus* has the smallest flowers among *Elaeocarpus* species in Peninsular Malaysia. *Elaeocarpus nitidus* is widely distributed in western Malesia, extending northwards to Thailand and probably Myanmar too. This species covers a wide range of habitat, both primary and secondary forest, from lowland forest to oak-laurel montane forest. It is also common in *kerangas* forest. In Latin, *nitidus* means shining, but it is not clear to which part it refers.

Elaeocarpus palembanicus

Elaeocarpus palembanicus (Miq.) Corner (synonym *E. hullettii* King) is usually a small tree, rarely up to 28 m tall. The species occurs in Peninsular Malaysia, Singapore, Sumatra and Borneo and is usually found in the lowland forest. Although widespread, this species is not commonly seen in the wild. *Elaeocarpus palembanicus* was first described as *Monocera palembanica*



► Cut fruit of *Elaeocarpus mastersii*, showing ruminant endosperm and yellow oil drops.

which carries the meaning of “inhabiting Palembang” by the Dutch botanist, Friedrich Anton Wilhelm Miquel (1811–1871). A mature tree of *E. palembanicus* can also be found along the path in the Evolution Garden, a few steps away from the *E. mastersii*.

Elaeocarpus eumundi

Elaeocarpus eumundi F.M. Bailey is an endemic species of Australia. There is a young tree of *E. eumundi* growing beside the Visitor Centre near the Au Jardin restaurant. Mature trees often develop a dense crown rather than the typical sparsely layered *Elaeocarpus* crown. The new leaves of *E. eumundi* are red in colour and covered with dense silky silvery hairs. This species occurs in the warm temperate rainforest ranging from northern Queensland southwards to the north-eastern New South Wales. *Elaeocarpus eumundi* was first described by the Australian botanist, Frederick Manson Bailey

(1827–1915), based on a specimen found in Eumundi town in Queensland, after which it was named. The species is commonly known as Eumundi Quandong or Smooth-leaved Quandong.

Now that you have an idea of this interesting genus, *Elaeocarpus*, do take a trip down to the Gardens and admire the beauty of these trees!

Phoon Sook Ngoh

*Australian Tropical Herbarium/
James Cook University
Queensland*

Nura Abdul Karim

Muhd. Fadli Baharudin
Plant Records

All photos by Phoon Sook Ngoh unless otherwise stated

LAUNCH OF THE HEALING GARDEN

"I go to nature to be soothed and healed, and to have my senses put in tune once more"

John Burroughs
(1837-1921)

American naturalist
and writer

- ▶ The Singapore Botanic Gardens (SBG) launched their latest attraction, the Healing Garden, on 21st October 2011. This attraction was officially opened by President Tony Tan Keng Yam, who at the same time unveiled the Gardens' 2012 calendar depicting a series of botanical drawings of medicinal plants by Kiyohiko Watanabe, an assistant to Professor Kwan Koriba, the Gardens' Director from 1942 to 1945. The S\$8 million Healing Garden took three years in the making and is one of a number of new attractions that SBG will showcase over the next couple of years.

The theme of healing plants was chosen for the latest attraction because it allowed the creation of a garden that would be a mosaic of the Southeast Asian traditions and plant sciences and hark back the original motive behind the creation of early botanical gardens that initially served as medicinal or physic gardens. The Healing Garden was thus developed to be more than a mere collection of medicinal plants, meant to also awaken the senses, create an oasis of calmness, as well as to educate visitors on the traditional and modern usage of plants for health and well-being. Medicinal and aromatic plants (MAP) have been an important resource for human health care from prehistoric times to the present day. According to the World Health Organization (WHO), the majority of the world's human population, especially in developing countries, depends on MAP for their traditional medicines. Between 40,000 and 50,000 plant species are



▶ With the strike of the gong, President Tony Tan Keng Yam officially launched the new Healing Garden.

known to be used in traditional and modern medicine systems throughout the world. Relatively few MAP species are cultivated. The estimated global trade in medicinal and aromatic plant materials was more than US\$60 billion in 2000, and is expected to reach US\$5 trillion by 2050, according to the World Bank. Therefore, it is not surprising that there is a global resurgence of interest in medicinal plants and plant extracts.

Spread over 2.5 hectares, the Healing Garden is aimed as a tranquil sanctuary showcasing some 500 species of medicinal plants traditionally used in Southeast Asia as its main focus. The Healing Garden serves as a plant bank where many species will continue to thrive as their natural environment dwindles. This garden will remind us that plants are like 'organic chemical factories' that have always served, in more ways than one, the health and well-being of humans.

The Healing Garden landscape is creatively designed and shaped like a crouching or seated human figure and the medicinal plants are laid out thematically relating to component parts or systems of the

body, such as "Head, Neck, Ear, Nose and Throat", "Respiratory and Circulation Systems", "Digestive and Related Systems", "Reproductive System", "Muscles, Skeleton, Skin and Nervous Systems" and "Toxic Plants".

Visitors will find many well-known medicinal plants growing in this garden, like the Madagascar periwinkle (*Catharanthus roseus*) which provides an active substance useful in cancer chemotherapy; the nutmeg (*Myristica fragrans*) whose essential oils are used in the treatment of aches and pains; the clove (*Syzygium aromaticum*) which has been used for centuries to treat toothache and mucosal inflammations of the mouth and throat; the famous neem tree (*Azadirachta indica*) used widely in Ayurvedic medicine for treating skin infections and wounds, as well as in the manufacture of soaps, lotions and toothpastes. Along with these well regarded plants, many other species are also planted here, the extracts of which have been applied in the production of many traditional and conventional medicines.

Also planted in abundance is the *Melastoma malabathricum* (Senduduk or

Singapore Rhododendron), a native plant that has traditional curative uses in this region, whose beautiful vibrant purplish-pink flowers with bright yellow anthers have been selected as the emblem of the Healing Garden.

“While the garden is not meant to help prescribe herbs for treatment or cure of ailments, it is hoped that it will inspire visitors to be more aware and appreciative of some rapidly fading traditional healing knowledge of the region, and marvel at the many useful properties that plants possess.”

Visitors will also get to view many common household or garden plants as well as exotics from other tropical regions, like the *Pentadesma butyracea*, *Dieffenbachia* species, *Euphorbia tirucalli*, *Nerium oleander*, etc., that have traditional or folk medicinal application. The well laid out garden has many interpretative signages to help visitors discover the various healing properties of a diverse range of plants. They can and learn about the toxicity and benefits of these plants to health and beauty. This garden is enclosed and is open daily, except on Monday, from 5 a.m. to 7.30 p.m.

While the garden is not meant to help prescribe herbs for treatment or cure of ailments, it is hoped that it will inspire visitors to be more aware and appreciative of some rapidly fading traditional healing knowledge of the region, and marvel at the many useful properties that plants possess.

The launch of the Healing Garden also coincides with the release of the very first iPhone application for a botanic garden in the Southeast Asian region. This helps our outreach programme by providing additional information on the healing



The President receiving the Singapore Botanic Gardens 2012 calendar from Mr. Gerard Tan, Asia Pacific Basic Chemicals Commercial Director, Exxon Mobile Asia Pacific Pte. Ltd. The Singapore Botanic Gardens Calendar is a community project by ExxonMobil, a staunch supporter of this programme since 2002.



The distinguished guests were all eyes and ears, as staff members expounded the healing properties of the plants before them.

properties and interesting features of the plants found growing here. The application known as Healing Garden is free and was developed by Codigo Pte. Ltd. with inputs from the Gardens Plant Records Unit, and will soon be made available for android phones.

The Healing Garden marks another milestone for the Singapore Botanic Gardens, as it merges old knowledge with new ones. And in the coming months, more new attractions will be developed for visitors including tourists to keep them informed and educated about the fascinating world of plants.

Nura Abdul Karim
Plant Records

All photos by Lim Yaohui



► Prof. Dr. Koyama explaining the exhibits to President and Mrs. Tony Tan Keng Yam. (Photo credit: Lim Yaohui)

► In conjunction with the launch of the Healing Garden, a special exhibition was staged in the Singapore Botanic Gardens by our sister garden, the Kochi Prefectural Makino Botanical Garden. The theme of the exhibition was *Illuminating Ben Cao Gang Mu – Achievements of Three Japanese Herbal Botanists in the Edo Era*. The Edo or Tokugawa period is a time of Japanese history which was ruled by the *shogun* of the Tokugawa family, running from 1603 to 1868. The three noted early Japanese botanists that had their monumental works displayed here were Eiken Kaibara (1630-1714), Yokusai Iinuma (1783-1865) and Kanen Iwasaki (1786-1842), along with illustrative works by renowned botanical artist, Untei Sekine (1804-1877).

Fifteen digital scans of illustrations from the various rare books were sent ahead of the exhibition to the Gardens' Library of Botany and Horticulture for printing and framing. Ten rare books valued at S\$89 000 were hand carried by Dr. Nobuyuki Tanaka of the Makino Botanical Garden Herbarium. These rare volumes were part of a huge collection of books and exquisite illustrations amassed by Dr. Tomitaro Makino (1862-1957), whose name the botanical garden honours. Dr. Makino's complete literary collection donated by his family is kept safely in the Reference Library of the Makino Botanical Garden. It was befitting that in conjunction with the Healing Garden launch, our Japanese counterpart showcased their antique and well preserved rare volumes on the medicinal plants of Japan, as this exhibition reinforced the theme of the beneficial healing properties of plants used over the centuries.



► The President taking a close look at coloured plates of the antique books that were still in excellent condition. (Photo credit: Lim Yaohui)

The Director of our sister garden, Professor Dr. Tetsuo Koyama, along with his wife and Dr. Tanaka, were among the many distinguished guests during the opening of the Healing Garden. President and Mrs. Tony Tan Keng Yam were personally guided through the exhibition by Prof. Dr. Koyama.

Nura Abdul Karim
Plant Records



TREES OF THE WORLD

▶ Little notes of well wishes written on pieces of logs form part of the decoration on the tree decorated by colleagues from CUGE.

▶ After a two-year hiatus, the Gardens returned with the *Trees of the World* series and a stunning comeback of 300 tropical trees decorated by the local and expatriate community. *Trees of the World 2011* kicked off on 3 Dec 2011 with a melodious repertoire presented by Singapore Lyric Opera Children's Choir. The Minister for National Development Mr Khaw Boon Wan officially launched the month-long display that illuminated the Gardens until 1 Jan 2012. Joining us in the celebration were corporate partners, embassies, schools, associations and community groups, all of whom contributed effort and resources to realise this magical event.

"...all 300 trees will be subsequently replanted to provide shade and greenery as we work towards establishing world-class parks and gardens."



▶ Participants from Bukit Merah CC and SCEC put in commendable effort to construct renowned landmarks around the world out of recycled materials for their tree.

When decorating the trees, many participants made use of re-usable materials. One hung slips of motivational quotes printed on recycled paper to inspire visitors to step closer to admire their creation, while others used materials such as old mopping pails, plastic bottles and leftover stickers. Not forgetting the notion of caring and sharing, useful items such as brand new water bottles were left below the trees as mementoes.

In achieving National Parks Board's *City in a Garden* initiative, all 300 trees will be subsequently replanted to provide shade and greenery as we work towards establishing world-class parks and gardens.

Joanna Lim
Visitor Services



▶ Guest of Honour, Minister Khaw Boon Wan (second from right) officially launched the *Trees of the World Light-up*.



FORESTS, PEOPLE, ENVIRONMENT SINGAPORE BOTANIC GARDENS CELEBRATES THE INTERNATIONAL YEAR OF FORESTS

► The United Nations designated 2011 as the International Year of Forests to celebrate the valuable services and resources forests provide globally to humanity, and to highlight the problems facing the planet's forests. Singapore joined the global occasion with an exhibition in the Botany Centre from 2–24 July. While the Botanic Gardens staged the event, it was truly a collaborative effort with all divisions of NParks working together to create an exhibit that was educational, enjoyable, and offered an array of forest-themed talks and activities.

Entitled 'Forests, People, Environment' the exhibition was opened by Minister of State BG (NS) Tan Chuan Jin on Saturday morning July 2. A series of 11 text panels liberally illustrated with photographs, diagrams, and satellite imagery explained the role and significance of forests on planet earth, and more particularly the history and current state of forests in Singapore. The marked increase of green space on our island home might come as a surprise to many residents, yet Singapore's forest cover has increased from 36% in 1986 to 47% in 2007.

The text panels throughout Botany Centre and the enclosed walkways and



courtyard were enlivened by living plants, forest-themed decor, water features, and recorded forest sounds. Visitors could get a feel for walking in a Singapore forest as they made their way through the luxuriant greenery and read the panels. A short video about hornbill conservation efforts added to the biodiversity aspect of the Singapore forest story.

In addition to the exhibition itself, there was a series of talks by speakers, self-guided tours in the SBG Rainforest and selected parks around the island, a nature photography contest, and an array of activities to help people celebrate forests throughout 2011. So the celebration continued after the exhibition came to its close.



While much of the exhibition text highlighted the tangible and practical side of forests and their vital role in human existence, there were appropriate quotes to illustrate the intangible contribution that forests make to human life. Forests are a metaphor in various religious and spiritual practices and they symbolise rebirth, renewal, and the continuity of life in societies and cultures everywhere. Several smaller panels featured forest photographs with uplifting quotations to bring home the point that not all benefits derived from forests have a tangible, monetary, or practical purpose.

“While much of the exhibition text highlighted the tangible and practical side of forests and their vital role in human existence, there were appropriate quotes to illustrate the intangible contribution that forests make to human life.”

G. Staples

Herbarium

Benjamin Aw

Visitor Services

All photos by Brice Li



ONCE UPON A LUNCH... LAND PLANARIANS

► Lunches in the Gardens could turn out to be interesting affairs when interesting visitors attend and you throw in some photography. A planarian had stealthily slid up the pile of leaf litter gathered around the pots of begonias, orchids and *Amorphophallus* for concealment purposes. The surprise upon seeing a glistening trail of slime soon turned to delight when it led to a flat worm instead of an ever-hungry snail!

Flatworms are a large and diverse group comprising both parasitic and free-living species. The non-parasitic species can be found in marine, freshwater and terrestrial habitats. Terrestrial flatworms, or land planarians, prefer moist, cool habitats and are often found in the soil, or hidden under rocks and decomposing logs.

A total of 12 species of terrestrial flatworms have been recorded from Singapore (S.H.Tan, pers. comm.). However, the list is probably not exhaustive and more records may turn up as the local land planarians are not well studied.

Known terrestrial flatworms in Singapore including the following species:

Bipalium bergendali (von Graff, 1899)
Bipalium gracile Loman, 1890
Bipalium habelandti von Graff, 1899
Bipalium javanum Loman, 1883
Bipalium kewense Moseley, 1878
Bipalium robiginosum von Graff, 1899
Bipalium strubelli von Graff, 1899
Diversibipalium engeli (den Hertog, 1968)
Diversibipalium rauchi (von Graff, 1899)
Diversibipalium ridleyi (von Graff, 1899)
Dolichoplana striata Moseley, 1877
Rhynchodemus vejtdovskyi von Graff, 1899

After some checking, it was concluded that our slimy friend was likely to be *Diversibipalium rauchi* (previously known as *Bipalium rauchi*) which was first described from specimens collected in Singapore during 1899. Our specimen had characteristic horizontal black and white bands along its body and a



► *Diversibipalium rauchi*. (Photo credit: H.W. Choy)

hammer-like head of an orange hue. Photo documentation of this species around the world has revealed variation in the banding pattern and the colouration of its head. Like all terrestrial planarians, its body is covered in a layer of mucus, which leaves behind a slime trail. It is apparently not uncommon in Singapore, and has been spotted in forest trails around the island and reportedly feeds on snails or earthworms, much like other terrestrial flatworm species do.

Little else is known about this colourful resident as the genus *Diversibipalium* is not a natural group — it contains some 95 species (Family Bipaliidae) where a proper classification is not possible due to the lack of morphological data (Kawakatsu et al. (2002), *Bull. Fuji Women's University*, No. 40, Ser. II: 157-177). As positive identification is based on genitalia characteristics, the absence of sexual specimens remains a challenge for the study of this group, as does the fact that these soft-bodied organisms do not preserve well. Some species of marine flatworms are purportedly rather famous for disintegrating upon removal from their habitat!

“As positive identification is based on genitalia characteristics, the absence of sexual specimens remains a challenge for the study of this group, as does the fact that these soft-bodied organisms do not preserve well.”

What will subsequent lunch breaks in the Gardens bring? Perhaps there will be more surprise visits from Garden inhabitants, which we hope will offer better glimpses into our rich biodiversity.

Keith Lin
National Orchid Garden



MATCHMAKING PALMS— DOUBLE COCONUTS FIND LOVE ACROSS THE SEAS

► Single male flower showing pollen grains.

WANTED: *2 lovely ladies in the prime of life and living in Paradise seek possible mate. We are elegant Seychellois lovelies, rooted in the soil of Hawai'i, longing for a tall, virile male to share good times. Desire for offspring +++.* If qualified please respond to Honolulu Botanical Gardens, via Box 973.

► If palm trees wrote personal ads, this might be what the double coconut palms in Honolulu Botanical Gardens (HBG) would be saying. Growing in Foster Garden, near the central business district in Honolulu, these two elegant trees are now in their prime and bear female (pistillate) flowers every year between April and September. But there is no male tree of reproductive age in the HBG, or any other botanical garden in the Islands. So, how? This note explains how Singapore Botanic Gardens (SBG) assisted our colleagues in Honolulu to match-make their lovelorn double

coconuts. First, some background about these fascinating palms.

The double coconut (*Lodoicea maldivica*), is one of the world's rarest palm species and is native only to the remote Seychelles islands, tiny granitic outcrops in the Indian Ocean. Also known as *coco-de-mer* in French, this palm has several distinctions: it produces the largest female flowers of any palm; the fruits, largest of any palm, take as much as 6 years to develop and ripen; and the seeds are the largest seeds of any plant. The palms reach 30 metres tall at

maturity, have separate male and female individuals, and the leaves are gigantic: the stalks up to 8 m long, the blades as much as 4 m long and 2 m wide. Aside from the natural populations in the Seychelles, a few tropical botanical gardens are able to grow the double coconut successfully, but reproduction is impossible unless palms of both sexes are present.

Long before the Seychelles were discovered by explorers, the empty seeds of double coconut washed up on beaches throughout the region and they became highly desired items of commerce as well as the stuff of myth and legend. Because the shape of the seed has a vague resemblance to the lower part of the human anatomy, the seeds were thought to have some aphrodisiac properties, and the empty shells were often carved, decorated, and used as elaborate boxes. Since no one knew where they came from, a story took form that these seeds grew on massive plants growing on the sea floor, and great storms would wrench them loose from time to time, whence they appeared



► **Top**, drying of harvested male flowers on clean waxed paper.

Middle, pollen remaining after the floral parts were removed.

Bottom, vial packed with pollen. The cotton plug allows oxygen to enter; pollen is alive and must have oxygen to remain so. The vial is next packed in the fabric sleeve it is resting on, with a few grams of silica gel to keep the pollen dry during transit.



► Female flower newly dusted with pollen. (Photo credit: W. Singeo)

on sea beaches. Even today, people have a curious fascination for these enormous seeds and displaying one typically generates interest, particularly if the history is explained. The vegetable ivory is extracted for sale throughout Asia as a medicinal and aphrodisiac and the empty shells are sold to tourists; a major source of revenue for the tiny Seychelles (Gollner, A.L. (2008) "The Lady Fruit" pp. 108–122, in *The Fruit Hunters*; Scribner, 279 p.).

When this palm species was first named, the botanist J.F. Gmelin assumed they might originate in the recently discovered Maldives, and he gave the species the epithet *maldivica* accordingly. This guess proved to be completely false, but the rules of nomenclature require that the name be kept because it was the first valid name given to the species.

Singapore Botanic Gardens is fortunate to have three mature double coconuts, one female and two males, plus several younger trees. In order to get fruits, it is necessary for staff to hand pollinate the female trees (located behind Holttum Hall) with pollen gathered from the mature male tree (in Palm Valley). As this male tree is now too tall to reach the inflorescences by ladder, it is necessary to rent a crane truck to collect the pollen. Over many years the staff successfully pollinated the female tree on numerous occasions and there are a number of developing fruits on it, plus a growing number of young palms in the nursery and grounds.

Honolulu Botanical Gardens acquired its double coconuts as seeds and planted them out in 1937; the two female trees now growing in Foster Garden are thus about 75 years old, still young

"Over many years the staff successfully pollinated the female tree on numerous occasions and there are a number of developing fruits on it, plus a growing number of young palms in the nursery and grounds."



► Romel Silva pollinating the female flowers with paint brush. (Photo credit: W. Singeo)

as these palms go. The records do not indicate where the seeds came from or who obtained them, but in 1937 Joseph Rock, a famous plant explorer and botanist, was active in the Islands, and it is possible that Rock had a role in obtaining these rare seeds. The two female trees have been flowering annually for more than 20 years now. Pollination was tried three times, using different sources, but all attempts failed. In 2007, male flowers from SBG were sent whole to Honolulu; these moulded in transit, so the pollen was not viable when it reached HBG.

Knowing of the SBG successes, the Director of Honolulu Botanical Gardens expressed a desire to again try and obtain pollen from SBG to hand pollinate the female trees in HBG. In 2010, a fourth attempt was decided on and some research in the Library turned up a technique for collecting and shipping palm pollen that had worked well for other palm species, but had never been tried for double coconut.

This technique involves gathering the male flowers, drying them over low heat, removing the pollen from them, cleaning

away all floral debris, drying the pollen and packing it in small vials, then shipping the vials enclosed with silica gel as a desiccant via express courier. First developed in the 1970s (Read, R.W. (1979) Live storage of palm pollen; *Principes* 23: 33–35.), the method has been used successfully for many palms growing in dryer climates, but there was no literature to suggest the method worked for palms growing in the ever-wet tropics. Still, this was the best procedure available, so we tried it.

“Knowing of the SBG successes, the Director of Honolulu Botanical Gardens expressed a desire to again try and obtain pollen from SBG to hand pollinate the female trees in HBG.”

In May 2011, the crane truck was contracted to do various maintenance works in SBG and while it was on site, the flowers were collected from the male double coconut in Palm Valley. The fresh flowers were used to pollinate flowers on the SBG female tree that same day. Extra flowers were passed to the Herbarium for removal of pollen and drying it in preparation for sending to Honolulu. The process took two days and then on a Friday

afternoon, 27 May, two vials of cleaned and dried pollen were despatched via courier to Honolulu, where they safely arrived five days later (so much for paying extra for overnight delivery!).

Staff members from Honolulu Botanical Gardens took care to keep the pollen dry and cold and attempted pollination over the next several weeks, each time a female flower became receptive. Results are encouraging: it looks as though ovaries for several pollinated flowers are enlarging and in a few more months it should be possible to say for certain whether these will become fruits. Development of a double coconut fruit takes five to seven years and the slow development can abort at any time, so patience is required. Still, with a little luck, the lovely *Lodoicea* ladies in Honolulu might have found love at last and soon be in the family way. The first double coconuts produced in the Islands would be just cause for a botanical celebration. Keep fingers crossed!

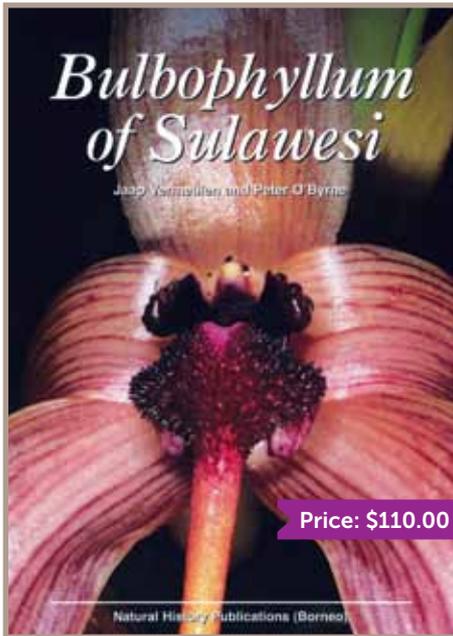
G. Staples
Herbarium

Aung Thame
Living Collections and Development

All photos by G. Staples unless otherwise stated

NEW IN THE LIBRARY SHOP

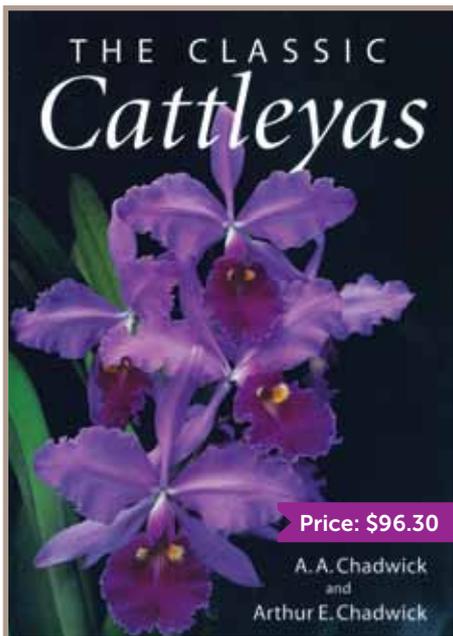
► "Orchid fever", a term to describe an abnormal craze for orchids, hit Singapore last November 2011, when the nation hosted the 20th World Orchid Conference. In relation to that, about 200 multi-discipline orchid-related books were brought in especially by the Library Shop for sale. Listed below are some of the highlights up for grabs while stocks last:



Bulbophyllum of Sulawesi
by Jaap Vermeulen & Peter O'Byrne

Bulbophyllum is a large genus of about 2000 species, which occurs mostly in tropical regions in South America, Africa, and Southeast Asia. This 300-page account on *Bulbophyllum* marks a major breakthrough in orchidology as about 123 species, and 4 subspecies of the genus from 24 sections were enumerated for Sulawesi. Amazingly, about 60 species (47%) of the total enumerated were named while preparing for this book. This is not surprising as the orchid flora of Sulawesi is poorly documented, the island being under-explored botanically. All 127 taxa enumerated are described methodically, and each taxon is supplemented with a detailed illustration and also sometimes with striking colour photographs. Most importantly, taxonomic keys to sections and species are provided. This will generally aid identifications. Apart from that, an interesting chapter that touches on the biogeography of Sulawesi is discussed. This book is a "must have" for *Bulbophyllum* enthusiasts, orchidologists, and naturalists keen on the natural history of Sulawesi.

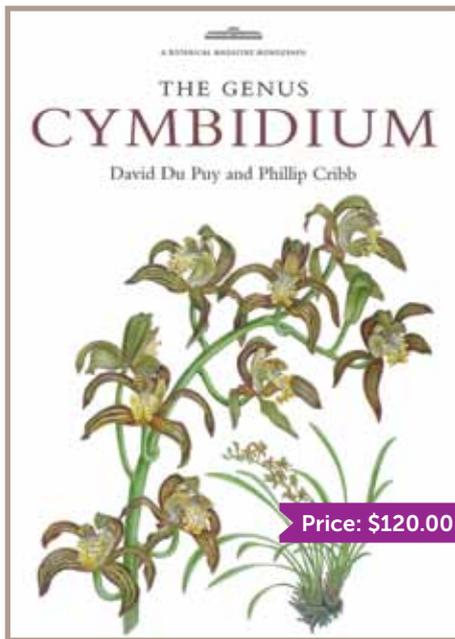
Year Published: 2011
ISBN: 978-983-812-137-8



The Classic Cattleyas
by Art A. Chadwick & Arthur E. Chadwick

Cattleya orchids, sometimes known as the royal flowers of Imperial Europe, have long been cultivated and hybridised since their introduction to Europe about 200 years ago. At present, about 100 odd-species of *Cattleya* are recognised by orchid taxonomists, and all are native to South America. This beautifully illustrated account features 23 large-flowered *Cattleya* species and their hybrids that are popularly cultivated. The first chapter of the book is an elaborate, and yet interesting chapter on the introduction and cultivation history of *Cattleya* species in Europe. Apart from that, two other important chapters, namely *Cultivation*, and *Pest and Diseases* were also provided in great detail. This well produced book is co-authored by a father-and-son team, who also operate an orchid nursery together in Virginia that specialises mainly in *Cattleya*. Besides that, the first author (also the senior author) has been actively publishing research articles on cultivation and hybridisation of *Cattleya* spp., as well as the general history of orchids in the *Journal of the American Orchid Society*. This book is highly recommended for *Cattleya* enthusiasts and all orchid lovers.

Year Published: 2006
ISBN: 978-0-88192-764-1



The Genus Cymbidium
by David Du Puy & Phillip Cribb

A publication from the well recognised *Botanical Magazine Monograph* series, published by the Royal Botanic Gardens, Kew, *The Genus Cymbidium* is a well illustrated account that describes 52 species (11 sections) of *Cymbidium* with a distribution from East to South Asia, through the Malay Archipelago and extending to the North and East of Australia. This *magnum opus* covers all important aspects that include conservation, cultivation, breeding notes and hybridisation, distribution and biogeography, and phylogeny. Most importantly, taxonomic keys to sections and species are provided to aid identifications. This monograph is highly recommended for *Cymbidium* enthusiasts, orchidologists, botanists and naturalists at large.

Year Published: 2007
ISBN: 978-1-84246-147-1

Price: \$120.00



The Essential Guide to Growing Orchids in the Tropics
by Chia Tet Fatt & David Astley

This well illustrated guide book should be every beginner's and hobbyist's essential companion. It is small and light, meant to be carried around as a handy reference, either in your orchid nursery or garden. An extremely useful book, there is a chapter that deals with the basic anatomy of orchids, and also others on selection and caring for your orchids. Besides that, a chapter on known pests and diseases is also provided to better equip budding orchid growers for potential threats. Most importantly, a list of 79 tropical orchid genera with indications on growing requirements for cultivation in the tropics is given. One very interesting chapter that is worth highlighting here provides *Do-It-Yourself Recipes for Disease and Pest Control* that environmentally conscious orchid growers can adopt to avoid using commercially available pesticides or fungicides that can be harmful to the environment.

Year Published: 2011
ISBN: 978-981-4351-39-3

Price: \$30.00

Low Yee Wen
Herbarium



KAEMPFERIA CANDIDA: CURCUMA IN BRILLIANT DISGUISE

► A small bee trying hard to get to the nectar, which seems to be way too deep to reach. The small bees did not seem to carry any pollen on their back when leaving the flowers.

► “Oh, my candida!” The catchy line from Tony Orlando of 70s’ fame, which I am fortunately too young to know first-hand, slipped out of my mouth when I first saw *Kaempferia candida* in the bamboo forest of Kanchanaburi. So, what was so exciting about finding this ginger with huge white flowers? Well, once we found it, I knew that together with my colleague Jiranan Techaprasan from the National Center for Genetic Engineering and Biotechnology (BIOTEC) in Bangkok, we would be able to crack the puzzle: whether this species is — or is not — a *Kaempferia*.

This enigmatic ginger was first found by the Danish botanist Nathaniel Wallich in Myanmar. The large white flowers, which appear at ground level before the leafy

shoots, indeed remind of other *Kaempferia* species, e.g., *Kaempferia rotunda*, and Wallich seemed to have no doubt that this is where this species belongs. He described and depicted the inflorescence and flowers in his monumental work *Plantae Asiaticae Rariores* and deposited the original specimens of this species in several herbaria, including the Royal Botanic Gardens, Kew. Other botanists since, not having access to additional material, seemed to have accepted Wallich’s identification without question.

During the early years of my ginger studies in India, Wallich’s drawing of this species attracted my attention. The superficial similarity as observed by Wallich aside, the rather closed shape of the flowers and well

exposed anther, the bright yellow centre of the otherwise white flowers did not really fit any *Kaempferia* I have ever seen and actually resembled some of the *Curcuma* species in South India and Sri Lanka. But to re-collect the species in Myanmar was not something convenient then and therefore put on hold. Meanwhile, legendary Danish ginger specialist Professor Kai Larsen and Dr. Thaya Jenjittikul, his colleague from Mahidol University in Bangkok, discovered this species in Thailand very close to the Burmese border, not far from the place of Wallich’s collections. This find represented a new record for Thailand and was published in 2000 in the Thai Forest Bulletin with a detailed description, line drawing and several photographs. But after a long, hard look at the shape of the anther, which did not match any *Kaempferia*, but is reminiscent of that in *Curcuma*, and its well-developed leafy shoot, which is rare in *Kaempferia*, my suspicion and curiosity about this ginger deepened.

“Even though they were not overly excited by the prospect of this beautiful plant (their favourite *Kaempferia* as they said) falling out of the genus *Kaempferia*, they agreed, for the sake of science, to embark on a collaborative project to uncover the truth.”

When I met Dr. Thaya at an international symposium, I shared my suspicions with her and her student Jiranan, who was working on the molecular phylogeny of the genus *Kaempferia*. Even though they were not overly excited by the prospect of this beautiful plant (their favourite *Kaempferia* as they said) falling out of the genus *Kaempferia*, they agreed, for the sake of science, to embark on a collaborative project to uncover the truth.

We located all specimens of this species from various herbaria to confirm that this species was rather rare and restricted in its distribution. Dr. Thaya then led us on a field trip to find flowering material, so



► Mission accomplished: Dr. Thaya (far right) and the rest of the team are all smiles after finding about 15 plants of *Curcuma candida* in flower.



► Jiranan Techaprasan dissecting a flower of *Curcuma candida*.

“Moreover, some of the plants we have brought back in pots for more observation opened their flowers during the late evening, which brings in the possibility of a nocturnal pollinator. So that would be a beginning of yet another exciting story to be told.”

that all aspects of morphology could be examined. The timing of such a trip is always tricky as these plants flower just before the monsoonal rains for only a short period sometime between late March and early May. We placed our bet on the second week of April. On our way to the forest, we were assured that our timing was spot on, as we learned from locals that young inflorescences, cherished as a seasonal vegetable, had already appeared in the village markets for sale during the previous week. Yet, when we stepped into the completely dry bamboo forest, there was no sight of the pale flowers on the forest floor, which was covered by silvery-beige dried bamboo leaves. We spread out and went on all fours so as not to miss the precious flowers and before long, the first find was accompanied by cheers from everyone. We spent the next two hours photographing and dissecting the flowers, taking notes and looking for more plants, before rewarding ourselves with lunch and local *durian*.

Soon after Jiranan started work on molecular analyses, she reported that *Kaempferia candida* did not seem to belong to the genus *Kaempferia*. We then decided to add more samples from various ginger genera into new analyses including several *Curcuma* species and as we suspected, ‘our dear candida’ nestled comfortably among other *Curcuma* species. The last step was to write this exciting little story for the Nordic Journal of Botany in order to establish the new, correct name, *Curcuma*

candida, for this species. The paper was published in the December 2011 issue and there is now one *Curcuma* more and one less ginger puzzle. What remains a mystery is what pollinators tend to these very large flowers. Although we have seen several visitors to the flowers, including small bees and ants, they all seemed too small to effectively transfer the pollens. Moreover, some of the plants we have brought back in pots for more observation opened their flowers during the late evening, which brings in the possibility of a nocturnal pollinator. So that would be a beginning of yet another exciting story to be told.

Jana Leong-Škorničková
Herbarium

All photos by Jana Leong-Škorničková



► The type of *Begonia aberrans*, collected in Sumatra by the Italian naturalist Odoardo Beccari and housed in his herbarium in Florence. (Photo credit: Mark Hughes)

“Rather than being an average or particularly representative specimen, they are nomenclatural types, designated from material seen by the person who described a particular species for the first time.”

► All living plants with a name will have (or should have!) a *type specimen*. This is a preserved fragment or entire individual, usually held in a museum collection or herbarium. The Gardens’ herbarium has around 6,800 types. These special specimens, despite their name, are not always ‘typical’. Rather than being an average or particularly representative specimen, they are *nomenclatural types*, designated from material seen by the person who described a particular species for the first time. Types help us to fix the usage of names to plant species (and also subspecies and varieties) by being a single reference point. At one time, it was permissible for a botanist to publish a new species without designating a type specimen. Although it was possible for other botanists to look at the written description, this was sometimes not enough to discriminate between species, particularly when they are not very well known or have complex variation. Although in such cases we could refer to the specimens identified by the author for further information, in more cases than you might think such collections contain specimens of what later turn out to be two species. What is the name of the plant then? In order to avoid such confusion, the International Code of Botanical Nomenclature states that from 1 January 1958, a newly published plant name will not be accepted unless a type specimen is designated. The rules were given further rigour at the meeting of the International Botanical Congress in Berlin in 1988, and from 1 January 1990, the institution housing the specimen chosen as the type must also be named, thus further narrowing down the reference point.

What about names published prior to 1958? In cases where no single specimen was clearly designated as a type, it is up to modern botanists to go through the material seen by the original author (*syntypes*) and choose a single *lectotype*. This can mean a considerable amount of detective work, particularly for names described in the 1700’s or 1800’s, when botanists were not always as careful with numbering and annotating their collections as we are now. If syntypes cannot be found, then an illustration published by the author can also serve as a holotype. However, confusion could arise due to inaccuracies in the drawing, which could either be drawn from mixed specimens or be tainted with too much artistic licence. Also, sometimes the original specimens from which the lectotype must be chosen are poorly preserved or fragmentary.

In such cases an *epitype* can then be designated, to help clarify the application of the plant name by reference to a single, good collection. If no original material can be found, then designating a *neotype* is necessary. When selecting material for either epitypes or neotypes, great care must be taken to ensure that the specimens fall into the same species as that intended by the original author, which is not always a simple task.

Types of types:

Holotype: The single specimen designated by the author of a plant name as the type. This is usually a single herbarium sheet, but can be more in the case of larger plants such as gingers and palms, as long as they are clearly labelled as being part of the same specimen. From the Greek *holo-*, meaning entire or whole.

Isotype: Any duplicate of the holotype. From the Greek *iso-*, meaning equal or like.

Lectotype: A type chosen by a later author from material seen (usually cited) by the original author to serve as the single nomenclatural type, in cases where a holotype was not designated or where the holotype was subsequently found to be a mixed gathering of more than one species. From the Latin *lectus*, meaning chosen or selected.

Kleptotype: An unofficial term denoting a type specimen stolen from the institution where it was originally housed. Not used in polite botanical circles. From the Greek *kleptes*, a thief.

Merotype: A small portion of a holotype taken and mounted separately and held in another institution. More specific than isotype, and more polite than kleptotype. The specimens in the Berlin herbarium used by Irmscher for his studies of begonias are a good example. From the Greek *meros*, to share.

Neotype: A specimen chosen as the type where no original material exists. From the Latin *neo-*, meaning new.

Epitype: A specimen chosen as an interpretative type when the original material is not good enough to ensure the correct application of a name. From the Greek *epi-*, meaning on top of or added to.

Syntype: Any of the specimens that an author of a plant name cites in their original description if none is specifically called a type. Even if a single collection number is

cited, if there are 2 or more duplicates then the separate sheets are syntypes unless one is specifically designated a holotype. From the Greek *syn-*, meaning with or together.

Paratype: Any specimens cited in the original description in addition to types. From the Greek *para-*, meaning by the side of or near. Perhaps best not considered as a kind of type at all.

“When selecting material for either epitypes or neotypes, great care must be taken to ensure that the specimens fall into the same species as that intended by the original author, which is not always a simple task.”

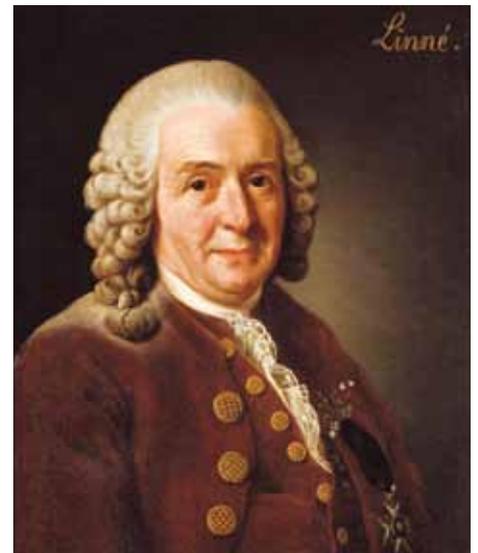
All living things have type specimens. That represents a LOT of cupboards full of plant and animal bits, plus a large pile of petri dishes for the bacteria. Even our own taxon, *Homo sapiens*, has a type. The name was coined by the Swedish naturalist Carl Linnaeus, although in common with all his names he didn't designate a holotype. Hence, as Linnaeus was one of the original specimens undoubtedly present when he coined the name, W.T Stearn designated him as the lectotype in 1959, a fitting tribute to the father of naming!

Mark Hughes

Royal Botanic Garden Edinburgh/ SBG
Research Associate



► An example of a merotype in the Berlin herbarium. A careful line drawing by the German botanist Edgar Irmscher replicates the type of the same species in Florence, in addition to a single leaf shared from the original collection. (Photo credit: Mark Hughes)



► The lectotype of *Homo sapiens* L.; the great man himself.

HEALING FLORAS THAT ENHANCE BEAUTY AND HEALTH



► The beautiful *Melastoma malabathricum* flower, which is used as the logo of the Healing Gardens. (Photo credit: Koh Sin Lan)

► The newly opened Healing Garden showcases a wide variety of medicinal plants that are used by many different cultures to heal or cure various ailments. Visitors who have strolled down the gentle slopes of this garden would have noticed many plants that were in bloom, gracing the recent launch of our new attraction. Here is a selection of three notable species.

Melastoma malabathricum

This beautiful plant is also known as the *Senduduk*, Singapore Rhododendron or Straits Rhododendron. The flower of this very species is the one stylised and used as the emblem of the Healing Garden.

Melastoma malabathricum is a native shrub that can be found distributed in tropical and temperate Asia as well as the Pacific Islands. It belongs to the family Melastomataceae. It is a hardy plant and can thrive almost anywhere, such as in disturbed terrains, on fallow lands or in grasslands from sea-level up. It is not a very large plant and can grow

up to 1 m in height, with dense foliage. It produces pinkish-purple flowers with 5 petals and clawed stamens with bright yellow anthers. The fruits are globular, succulent and edible and can stain deep purple when crushed.

Since *Senduduk* is native to tropical Asia, locals from countries like Malaysia, Indonesia and Thailand have utilised different parts of this plant for health purposes for years. The leaves are widely used across this region for treatment of various ailments. A decoction of leaves is used as a remedy for diarrhoea and dysentery. In Malaysia, the leaves and roots are ground into powder and used to compress swellings, wounds and cuts, while its decoction is given to women after childbirth. It is also said to be applied for haemorrhoids. In Indonesia, a decoction of the leaves is applied externally on arthritic joints. A decoction of the ground leaves are applied on sores caused by stinging insects. The roots are also commonly used to treat

toothache when sucked or gargled. If roots are unavailable, bark is also used to treat toothache.

The young shoots can be eaten fresh or cooked as a vegetable. However, *M. malabathricum* has been reported to be an aluminium accumulator and there is some concern this could lead to neurotoxicity when large amounts of the leaves are consumed.

*“Since *Senduduk* is native to tropical Asia, locals from countries like Malaysia, Indonesia and Thailand have utilised different parts of this plant for health purposes for years.”*

Allamanda cathartica

Another interesting flowering plant that can be found in the Healing Garden is *Allamanda cathartica*, also commonly known as the Common Allamanda or Golden Trumpet. This is a well-known ornamental plant that has graced many residences and roadside planting beds in Singapore and abroad.

Allamanda cathartica belongs to the family Apocynaceae (the frangipani family). It is a woody shrub that can grow up to 4 m tall. It has simple, glossy, leathery and glabrous dark green leaves which are mostly arranged in whorls of 4 with oblong-lanceolate leaf blades. Like most Apocynaceae, the stem emits a milky white sap when bruised or cut. The flowers are showy, large, bright yellow and trumpet-shaped and hence earning its common name, Golden Trumpet. *Allamanda* is native to South America and widely cultivated in



Tiny flowers of the unusual square-stemmed vine, *Cissus quadrangularis*. (Photo credit: Nura A. Karim)

China and India for its medicinal values.

In India, the leaves are used as a purgative to induce vomiting but may cause diarrhoea when taken in large dosage. An extract of the leaves is used to treat colic while a decoction of the bark is used as a hydragogue (a purgative that causes evacuation of watery stools) for ascites as well as a febrifuge (a medication that reduces fever). Vapour from boiling leaves is also inhaled to relieve coughs, clear nasal passages and soothe headaches. A decoction of the roots has been used as a remedy for jaundice and enlarged spleen resulting from malaria. Laboratory tests have shown that the dried roots contain antileukaemic iridoid lactone, allamandin and two other iridoids, allamandicin and allamdin. Allamandin or its derivatives can inhibit tumour, has molluscicidal properties and has potential uses in cancer treatment.

Although *Allamanda* contains medicinal components, every part of the plant is poisonous. The sap of the plant can cause irritation and slight nausea when sucked. If the sap comes in contact with sensitive skin, it can cause rashes or dermatitis. Therefore, the key that differentiates when a plant is medicinally beneficial or otherwise could very much depend on the dosage taken of the right plant parts or components. It is therefore essential for readers to consult qualified health care professionals before attempting any treatment for health and medicinal purposes from any of the plants they read or hear about.

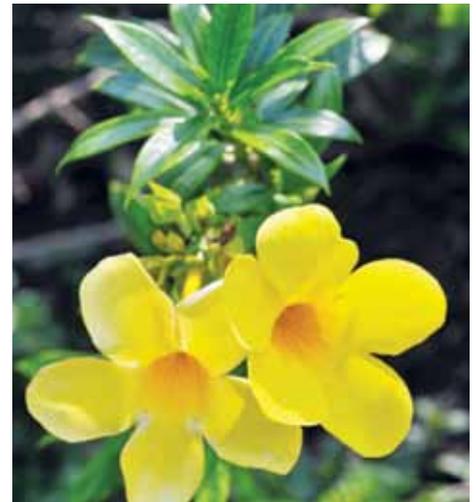
Cissus quadrangularis

Another worthy highlight of the flowering healing plants is the Veld Grape or Grape Leaf. This plant is known by its scientific name *Cissus quadrangularis* and belongs to

the grape family or Vitaceae. The Malays and Indonesians have a very apt vernacular name for this herb, *Patah Tulang*, which literally translates as "broken bones" that hint at its medicinal use as well as the stem structure of this unusual vine.

Veld Grape is a succulent vine with a thick quadrangular stem (very visible when young) that is constricted at regular intervals and is usually leafless when old. It has long, slender tendrils and its leaves have crenate-serrate edges. This odd-looking climber produces tiny pink and greenish-white flowers, often 2 mm long. It produces red succulent berries containing one or two seeds. Originating from Asia and the East Africa region, this vine can be seen growing on trellises in some gardens around Southeast Asia.

The most common part of the plant that is widely used is its stem. In Indonesia, the young stems are applied for arresting the development of boils and to cure wounds and burns. The juice or paste from the stem is applied to fractured bones to ease the pain and also for the treatment of rheumatism. This is a common practice among the Indonesians and in the Indian Ayurvedic medicine. There have also been reports of the use of the pulped stem for asthma treatment. Thais have used the fresh stem for treating haemorrhoids. In the Siddha system of medicine, apart from using the whole plant and roots to treat piles, abdominal pains and diarrhoea, the juice from the stem is also applied as an alternative treatment for irregular menstruation and nosebleeds. The leaves and young shoots are given in powdered form to treat indigestion. A decoction of the shoots, together with dry ginger and black pepper, is taken to relieve body pains. In some parts of India, the stem and leaves



The impressive bright yellow trumpet flowers of the poisonous *Allamanda cathartica*. (Photo credit: Lim Yaohui)

are pounded in water and given to women to relieve pain after childbirth.

An extract of the plant has been noted to exhibit cardiotoxic and androgenic properties. In southern India and Sri Lanka, the edible young green stems are fried or made into curries and chutneys while the ash of the plant is used as a substitute for baking powder. The herb is also fed to cattle to induce the flow of milk. Hence, this strange-looking squarish stem climber has many beneficial properties that people continue to use until today.

So, if you are looking to find a serene, quiet place to retreat to, and regenerate your senses, why not take a stroll into the new Healing Garden. Be mesmerised by the healing properties of so many flowering plants and the knowledge of the ancient healers!

Nura Abdul Karim
Siti Amalina Norazman
Plant Records

PUBLICATIONS BY GARDENS STAFF IN 2011

Book Chapters

Kurzweil, H. (2011) *Habenaria* (Pp. 79–149), *Peristylus* (Pp. 222–250) and *Satyrium* (Pp. 258–260). In: Santisuk, T. & Larsen, K. (eds) *Flora of Thailand* 12 (1). Bangkok: The Forest Herbarium.

Wong, K.M. (2011) A biogeographic history of Southeast Asian rainforests. In: Wickneswari, R. & Cannon, C. (eds) *Managing the Future of Southeast Asia's Valuable Tropical Rainforests*, pp. 21–55. Dordrecht: Springer.

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Khew G.S. & Chia, T.F. Determination of the parentage of *Vanda* Miss Joaquim using the chloroplast genes *rbcl* and *matK*. *The 18th International Botanical Congress, Melbourne, July 2011.*

Techaprasan, J. & **Leong-Škorničková, J.** *Kaempferia candida* (Zingiberaceae): *Curcuma* in disguise. *The 15th Flora of Thailand Meeting, Thailand, November 2011.*

Papers Presented

Khew G.S. & Chia, T.F. Determination of the parentage of *Vanda* Miss Joaquim based on the sequence of two chloroplast genes *rbcl* and *matK*. *The 20th World Orchid Conference, Singapore, November 2011.*

Leong-Škorničková, J., Lý, N.S., Poulsen, A.D., Tosh, J. & Forrest, A. *Newmania*, a new ginger genus from Central Vietnam. *The 15th Flora of Thailand Meeting, Thailand, November 2011.*

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compiled by **Serena Lee**
(Herbarium)

OUTREACH TO EDUCATORS

- Define the Objectives of your Field Based Learning
- Levels of your students
- Size of participants (students, teachers & parents)
- Duration of the excursion / outing
- Activities to occupy students
- Budget



▶ Winnie Wong sharing with educators some useful tips when planning a field-based learning programme in SBG during the Kindergarten Conference 2011. (Photo credit: Kelvin Lim)

Outreach to educators in JBCG and on-going collaboration with the Ministry of Education (MOE)

- ▶ Recognising that teachers hold the key to success for the Singapore Botanic Gardens' (SBG) school outreach, teachers' training programmes constitute an important strategy for reaching out to the students and strengthening ties with schools.

Since 2010, the SBG and the Jacob Ballas Children's Garden (JBCG) were recognised by the Ministry of Education (MOE) as important to this effort. We were invited thrice by the MOE to participate in the MOE Kindergarten Conferences in June 2010 and Sept 2011, as well as the MOE Kindergarten Briefing in March 2011, to share with pre-school educators our experience in field-based learning.

Kindergarten Briefing 2011

On 22nd March 2011, the MOE Pre-School Branch invited SBG Education to share on our nature programmes at the Kindergarten Briefing 2011 (K-Briefing 2011). The theme for this briefing was *Enhancing Pre-School Education: A Strong Start for Every Child*. The two half-day events reached out to

more than 1,500 pre-school educators.

Held annually, this briefing serves as a platform to share on how to provide a strong, early start for every child while enhancing the holistic development and well-being of young children.

Together with NParks' Communication and Community Engagement Division, SBG Education showcased our outdoor learning opportunities with special focus on play-based learning at the Jacob Ballas Children's Garden. A special highlight was the activity books under the *Sara the Botanicosaurus* series.

Kindergarten Conference 2011

On 22nd & 23rd November 2011, SBG Education Branch was once again invited to participate in the MOE Kindergarten Conference at Republic Polytechnic. Together with close to 20 MOE partners, SBG Education contributed in the conference by sharing with kindergarten teachers our experience through conducting concurrent sessions. Titled Singapore Botanic Gardens—Our Living Classroom, we addressed some common challenges that early childhood educators may encounter when planning and implementing field-based learning for young children in an outdoor environment, as well as sharing with them

recommendations that could enrich their outdoor teaching. Riding on the wave of the successful World Orchid Conference, educators were also given a sneak preview of a new teachers' training workshop on orchid hybridisation.

Teacher Training Workshops

To date, SBG Education has 6 thematic teacher training programmes available upon request. In December 2011, we successfully added another new teacher training workshop, *The Fascinating World of Orchids* to the current repertoire. Over a dozen educators ranging from Preschools to Secondary Schools attended the pilot run of *The Fascinating World of Orchids* workshop. It was an eye-opener for most of the educators when they were introduced to hands-on activities about orchid hybridisation. Some of the participants also commented that the workshop was informative which gave them useful tips on planning lessons and engaging students to learn more about orchids.

Winnie Wong
Education Branch

15TH FLORA OF THAILAND MEETING



▶ A group photo of symposium participants. (Photo credit: Thamarat Putthai)

▶ The 15th Flora of Thailand Meeting was held from 7th to 11th November 2011 in Chiang Mai, Thailand and attracted 208 specialists from 17 countries. The Singapore Botanic Gardens sent three senior researchers (Dr. George Staples, Dr. Hubert Kurzweil and Dr. Jana Leong-Skornickova) and a senior arborist (Mr. Lahiru Wijedasa), who in total presented three talks and two posters. Dr. George Staples also served on the Scientific Programme Committee.

While the first day of the meeting was merely reserved for registration, networking among participants and the Flora of Thailand Editorial Board Meeting, the second day was already fully packed with botany. After the opening ceremony and welcome speeches, 16 talks have been presented in four sessions and covered topics connected to Floristic Regions in Thailand and Regional Floras, Biogeography and Taxonomy & Systematics. The poster session was also scheduled for the afternoon. The area with nearly 60 posters has been located within the lecture hall and attracted much attention not only during the poster session, but throughout the entire meeting, especially during the lunch-time and tea breaks.

The Session on Taxonomy and Systematics continued on the third day, followed by Molecular, Morphological and Chemotaxonomic studies. During

the following session on Ecology and Conservation, Dr. George Staples presented a talk on *Conservation for Rare Thai Convolvulaceae* and the last session of the day, Flora of Thailand: Monocotyledons, was closed by Dr. Jana Leong-Skornickova's talk entitled *Newmania, a New Ginger Genus from Central Vietnam*.

...*"We all agreed it was a very successful meeting, perhaps the best yet. The standard of the presentations was outstanding and credit is due to all the hard work our Thai friends and colleagues are putting into the Flora."*

The fourth day of the meeting was reserved for the field excursion. In the morning we walked on the border of Jae Son National Park and then enjoyed an alfresco packed lunch while enjoying the views from Kieo

Phin (1517 m asl). In the afternoon we climbed through a nature trail along the waterfall in Khun Jae National Park, where we met not only with plenty of interesting plants but also with a green viper! The evening was equally exciting as we watched celebrations of the Thai traditional festival *Loy Krathong*, which is held as a tribute to the spirit of the waters to float away bad luck.

The last day of the symposium was dedicated to Dicotyledonous plants in the Flora of Thailand with 15 talks being presented, including Mr. Wijedasa's *Taxonomic Revision and Biogeography of Memecylaceae of Thailand*. The talk on ferns ended the scientific part of the symposium and was followed by the board report and the awards for the best oral and poster presentations.

In spite of the extensive flooding in Bangkok, the meeting was extremely well organised by the staff of The Forest Herbarium, Bangkok, under the auspices of the Department of National Parks, Wildlife and Plant Conservation, Ministry of Natural Resources and Environment. Dr. David Simpson from Royal Botanic Gardens, Kew commented on behalf of the Flora of Thailand Editorial Board: *'We all agreed it was a very successful meeting, perhaps the best yet. The standard of the presentations was outstanding and credit is due to all the hard work our Thai friends and colleagues are putting into the Flora.'* I am sure that everyone attending this event would join Dr. Simpson to echo these congratulations to the organisers for delivering such a wonderful and fruitful meeting.

More details about scientific programme and pictures from the meeting are available at:
http://web3.dnp.go.th/botany/Botany_Eng/FloraofThailand/FloraMeeting_Eng/flora_Eng_meeting15.html

Jana Leong-Škorničková
Herbarium



► Mr Craig Hilton-Taylor (standing) summarising the assessment results from his group. (Photo credit: Jack Regalado)

► The 2nd Red Listing workshop on Indochina plant species was held in Chiang Mai, Thailand on 1-5 November 2011. Organised by the Missouri Botanical Garden and supported by a grant from the Critical Ecosystem Partnership Fund (CEPF), this was the second in a series of three workshops, which are part of a three-year CEPF funded project to assess the status of selected plants in the Indochina biodiversity hotspot (encompassing Cambodia, Lao PDR, Viet Nam, Thailand and southern China) and to identify important plant areas for conservation. Thirty-two botanical experts from ten countries (Cambodia, China, Denmark, Lao PDR, Russia, Singapore, Thailand, United Kingdom, United States and Vietnam) attended the workshop. They represented botanical and academic institutions as well as government and non-government organisations. The Singapore Botanic Gardens was represented by two ginger specialists: Dr Jana Leong-Škorničková and Mr Trần Hữu Đăng.

The assessment datasheets for each species, which were prepared by designated specialists prior to the workshop, were discussed with other researchers until agreement and justification of final IUCN evaluation

were reached. These were supported by mapped distribution records, specimen data and plant images. The participants worked in four groups, each focusing on certain plant families and facilitated by a red listing expert. Mr Craig Hilton-Taylor (IUCN Species Programme) worked with specialists on Araceae, Dipterocarpaceae and Zingiberaceae. Ms Maiko Lutz (IUCN Species Programme) led a group focusing on Apocynaceae, Balsaminaceae and Gesneriaceae. Dr Jack Regalado (Missouri Botanical Garden) worked with orchid group while Ms. Sara Oldfield (Botanic Gardens Conservation International) worked with taxonomists and foresters focusing on legumes and other various woody taxa.

During the five-day workshop, 317 species from 30 plant families were evaluated. The assessment indicated that 162 species (51%) are threatened, specifically, 49 critically endangered species, 60 endangered species and 53 vulnerable species. For example, two species from a recently described ginger genus from Central Vietnam, *Newmania serpens* N.S. Lý & Škorničk. and *Newmania orthostachys* N.S. Lý & Škorničk., were assessed as critically endangered and endangered, respectively. Over-exploitation, habitat loss and

degradation were identified as the principle threats to these species. The results of the workshop will be eventually published in the IUCN's Red List of Threatened Species available online (www.iucnredlist.org).

The workshop was successful in gathering and sharing information among botanists from the Indochina floristic region and specialists for particular plant families engaged in Flora of Cambodia, Laos and Vietnam. The workshop also improved the knowledge of participants on how to prepare more accurate species assessments and presented a new mapping tool GeoCAT endorsed by Kew Gardens, ViBRANT and IUCN, freely available at <http://geocat.kew.org/>.

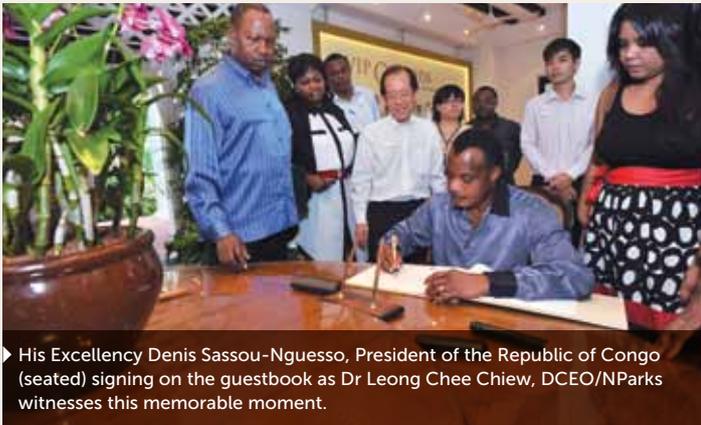
Trần Hữu Đăng
Herbarium

Jack Regalado
Missouri Botanical Garden



KEY VISITORS TO THE GARDENS

(JULY-DECEMBER 2011)



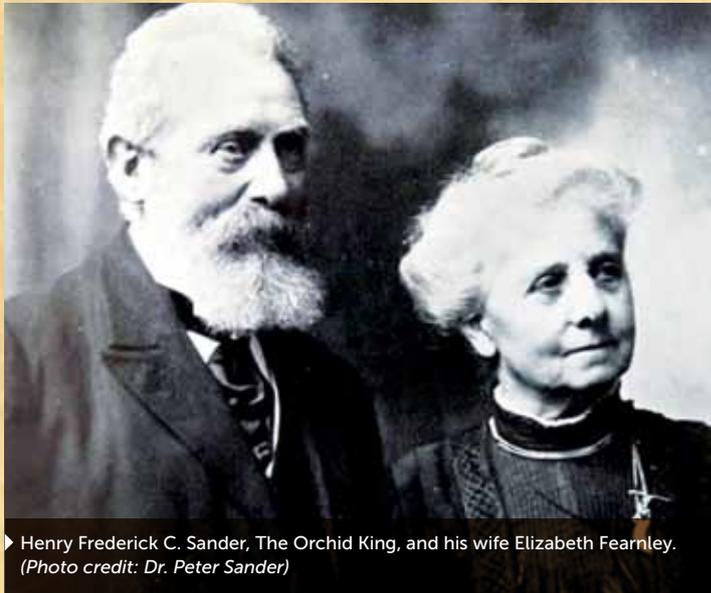
▶ His Excellency Denis Sassou-Nguesso, President of the Republic of Congo (seated) signing on the guestbook as Dr Leong Chee Chiew, DCEO/NParks witnesses this memorable moment.



▶ His Excellency Truong Tan Sang, President of the Socialist Republic of Vietnam (second from right) and First Lady (fourth from left) admiring the beautiful hybrid named after the president with Minister Khaw Boon Wan (first from left) and Mr Poon Hong Yuen, CEO/ NParks (first from right).

Dr Max van BALGOOY	NCB Naturalis Leiden, The Netherlands
Mr Kamaluddin BILAL	University Tun Hussein Onn, Malaysia
His Excellency Jejomar BINAY & Spouse	Vice President, Republic of the Philippines
Ms Kanokon BUNPA	Prince of Songkla University, Thailand
Ms Elena BUTTER	Universiti of Malaysia Sabah, Malaysia
Mr CHEN Shi Chao	Deputy County's Head Commisioner, People's Republic of China
Prof Margaret COLLINSON	Royal Holloway University of London, UK
Mr DAI Guangwei	Head of Town Government, Weishanzhuang Town, Economic Technological Development Area, People's Republic of China
Dr Vincent DEMOULIN	University of Liege, Belgium
Dr Arvind S. DHABE	Dr. Babasaheb Ambedkar Marathwada University, India
Mr Federico A. EDOS-MEDIA	Specialist V & Division Chief, Cultural & Public Affairs Division, Philippines
Dr Tomáš FÉR	Charles University, Czech Republic
Dr Stephan GALE	Kadoorie Farm and Botanic Gardens, Hong Kong, People's Republic of China
Ms Florence GINIBUN	University of Malaya, Malaysia
Ms GOH Wei Lim	University of Malaya, Malaysia
Dr Markku HÄKKINEN	University of Helsinki, Finland
Dr HONG Liu	University of Liege, Belgium
Mr HSU Han Ching	Director General, Department Agriculture, Tainan City Government, Taiwan
Mr Naser O. IHSAEEN	Universiti Kebangsaan Malaysia, Malaysia
Ms Priyanka A. INGLE	Dr. Babasaheb Ambedkar Marathwada University, India
His Excellency the Right Hon'ble David JOHNSTON	Governor General, Canada
Mr Foreting JUHONEWE	Papua New Guinea
Mr KHAW Boon Wan	Minister for National Development, Singapore
Dr Ruth KIEW	Forest Research Institute Malaysia, Malaysia
Dr Rajkumar KISHOR	Centre for Orchid Gene Conservation of the Eastern Himalayan Region, India
Mr Joel KOTKIN	CSC Senior Visiting Fellow, USA
Prof Tetsuo KOYAMA & Spouse	Makino Botanical Garden, Japan
Dr Pankaj KUMAR	Kadoorie Farm and Botanic Gardens, Hong Kong, People's Republic of China
Mr LEE Yi Shyan	Minister of State, Ministry of Trade and Industry & Ministry of National Development, Singapore
Ms Gwynne LIM	Cornell University, USA
Mr LIM Hng Kiang	Minister for Trade and Industry, Singapore
Dr Adrian LOO	Raffles Institution, Singapore
Dr NGUYEN Quoc Binh	Vietnam National Museum of Nature, Vietnam
Dr Henrik PEDERSEN	University of Copenhagen, Denmark
Ms Carmen PUGLISI	Royal Botanic Garden Edinburgh, UK
Mr Victor SANCHEZ	President of Cuernaraca Botanic Garden, Mexico
His Excellency Denis SASSOU-NGUESSO	President, Republic of Congo
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Her Excellency Yingluck SHINAWATRA	Prime Minister, Kingdom of Thailand
Mr Otakar ŠÍDA	Charles University, Czech Republic
Ms Nadhanielie SIMONSSON	Papua New Guinea
Dr Benito TAN	National University of Singapore, Singapore
BG (NS) TAN Chuan Jin	Minister of State, Ministry of National Development & Ministry of Manpower, Singapore
Dr Tony TAN Keng Yam & Spouse	President, Republic of Singapore
Dr Nobuyuki TANAKA	Makino Botanical Garden, Japan
Ms Naiyana TESANA	Prince of Songkla University, Thailand
Dr Paweena TRAIPEM	Mahidol University, Thailand
His Excellency TRUONG Tan Sang & Spouse	President, Socialist Republic of Vietnam
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Dr Hironori YOYAMA	Kyushu University, Japan
Ms Eliška ZÁVESKÁ	Charles University, Czech Republic
Mr ZHANG Junhui	Counsellor, European Affairs Department, Ministry of Foreign Affairs, People's Republic of China

Reichenbachia: Orchids Illustrated And Described By Henry Frederick C. Sander



▶ Henry Frederick C. Sander, The Orchid King, and his wife Elizabeth Fearnley.
(Photo credit: Dr. Peter Sander)



▶ The collection of rare books and botanical illustrations in the Botanic Gardens' library holds many scholarly treasures. Among them is one of the rarest items of orchid literature, *Reichenbachia: Orchids Illustrated and Described*, commissioned and authored by the "Orchid King" Henry Frederick C. Sander (1847-1920), a wealthy orchid grower of St. Albans, England. It is considered by orchidologists as the gem among orchid literature. As the name indicates, this special work was dedicated to the foremost German orchidologist of the 19th century, Prof. Dr. Heinrich G. Reichenbach of the Hamburg University, who devoted his entire life to the study of the orchid family. Initiated in 1886, the first volume appeared in 1888. Subsequently, the remaining three volumes were published at intervals of two years, viz., 1890, 1892, and 1894. These four volumes together make up the entire work; the first two volumes comprise Series One, and the other two, Series Two.

Reichenbachia was issued in two editions, the "Imperial Edition" (75 cm high by 60 cm wide), and the regular edition (55 by 41 cm). The "Imperial Edition" weighs about 20 kg, while the regular edition is about 7 kg. For the "Imperial Edition", 100 copies were printed using the highest quality biscuit

paper, and with hard leather-bound cover. Apart from that, each of the "Imperial" copies were numbered and signed. Furthermore, the chromolithograph prints of the paintings were also of the highest quality compared to the regular edition.

Perhaps testimony to how exclusive this work was, the volumes of *Reichenbachia* were each dedicated to a royal patron. Series One, Volume One was dedicated to Her Majesty Queen Victoria; and the following volume of the series to Her Majesty Augusta Victoria, German Empress and Queen of Prussia. Series Two, Volume One was dedicated to Her Majesty Maria Feodorovna, Empress of Russia; and the final instalment of Series Two was dedicated to Her Majesty Henriette, Queen of the Belgians.

This *magnum opus* also provides interesting snippets of natural history and recommends cultivation practices for selected orchids in three languages, English, French, and German. The species descriptions, however, were given in Latin, then very much the scholarly language of botany. Apart from that, it is also greatly admired for its life-size paintings by Sander's son-in-law, Henry G. Moon (1857-1905), a renowned botanical artist.

In every volume, there are 48 paintings, each reproduced by chromolithography using hand-made wooden blocks and using up to twenty different colour inks at a single time. At present, all the original watercolour paintings of the *Reichenbachia* plates are in the collections of the American Orchid Society.

In the Singapore Botanic Gardens' library, only two sets of Series Two (regular edition) of *Reichenbachia* are found. These have hard leather-bound covers and are in good condition. These are part of the Gardens' historical assets. The entire masterpiece can now be viewed and consulted online at <http://sandersorchids.com/> (officially launched at the 20th World Orchid Conference held recently in Singapore). This site is managed by the great-grandson of the "Orchid King", Dr. Peter Sander. Besides that, the production of a facsimile edition of *Reichenbachia* is in the planning stages and would make this extraordinary work available to everyone.

Low Yee Wen
Herbarium

All photos by Low Yee Wen unless otherwise stated