Gardenwise

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Front Cover:
Dendrobium x *usitae*
that flowered in the Cool House
of the National Orchid Garden

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Message from the Director

Many individuals have told us that they remember happy moments in the Gardens during visits long ago, when they were children. They are now bringing their children or grandchildren to the Gardens to places they loved. Places that are specially remembered fondly include the large lawn parallel to Swan Lake (Lawn E) and the large Tembusu tree in it, Swan Lake, Bandstand and the Plant House. The champion memory maker seems to be the Tembusu tree. This has a low-growing almost horizontal branch, eminently suitable for climbing. According to a late staff, Mohd Shah, it looked the same in the 1950s. Today, as then, children delight in climbing, sitting and crawling on this large branch, half to two metres above the ground.

Countless smiles in countless photographs, taken over the years, have documented many of the millions of visits to the Gardens. In thousands of homes, in albums, drawers, and chests, some long forgotten, there must be more photographs of the Gardens than any other happy place in Singapore. As if to formalize this distinction, the Tembusu tree on Lawn E is also immortalized on Singapore's five-dollar bill.

Singapore is a new city with much of its concrete and asphalt laid after independence in 1965. It continually changes at a rapid rate. As neighbourhoods and landscapes change, endearing places in memories are ripped up and erased. However, most parts of the Gardens have remained clearly identifiable. They have become familiar places for the very many visitors who make repeat visits over the decades. Happy memories of times spent in the Gardens during childhood are reinforced during courtship, parenthood and grandparenthood.

We have enhanced the Gardens as a memory maker with the opening of the new Children's Garden on 1 Oct 2007. This allows the Gardens to reach out to an extremely important group of customers. It is a fun place where children can develop their appreciation for plants, conservation and the environment. We hope all children will leave with happy memories. And plants and the environment may have nurtured another friend.

The many faces of the Gardens have captured the imagination and loyalty of its visitors, both local and foreign. Specific icons, trees and landscapes that provided happy moments are permanently etched into individual memories. They give many Singaporeans a comfortable sense of place of a piece of home.

The Gardens is a national treasure and heritage. The happy memories and sense of place it provides to Singaporeans, add immensely to its value. We who manage its hallowed grounds are temporal custodians for the generations to come. This, we should always remember.

Chin See Chung

A Very Happy Place
– Jacob Ballas Children's Garden

The entrance to the Children's Garden

Growing an Idea

By the late 1990s, it was evident that the demand for children's programmes run by the Gardens was very strong. At the 1st World Botanic Gardens Congress in June 2000 in Asheville, North Carolina, USA, the session on reaching out to children through specially crafted gardens generated tremendous interest. Presentations were made by the several Botanic Gardens with dedicated Children's Gardens. They included the New York Botanical Garden, Cleveland Botanical Garden, Ohio, and Red Butte Garden, Utah. The Cleveland Botanical Garden reported that their visitorship doubled after the opening of their children's garden.

One paper was entitled, "Managing a Children's Garden, Survivors Tale". It was clear, running a children's garden is not without frustrations and unusual challenges. But such a garden would be fun to run, well received and thoroughly enjoyed by kids. It will be a tremendous boost in fulfilling the botanic gardens' mission of reaching out to children with plant, gardening and conservation messages and information. It was also repeatedly emphasized that, "anything that can be broken, will be broken".

We immediately decided that we could move children's education to a higher plane with a dedicated garden for the children of Singapore. We then planned to visit selected gardens in the USA, as it was the only country we knew with children's gardens.

In September 2000, we visited Everett Children's Adventure Garden at the New York Botanical Garden, The Hershey Children's Garden at the Cleveland Botanical Garden and Egleston Scottish Rite Children's Garden at the Atlanta Botanical Garden. En route we visited Diana, Princess of Wales' Memorial Playground in London.

It was a tremendous learning experience; we were enthralled by what we saw. We were sure that we would all enjoy planning, crafting and implementing a children's garden. We would like to sincerely thank the managers of the gardens we visited for sharing with us their experiences, joys and frustrations.

The Concept

We developed our guiding philosophy, "creating happy memories for children in a fun and wonderful garden to develop their appreciation for plants, conservation and the environment". It will be a garden where children can explore and run and enjoy, and where creative play is encouraged. The design and plantings will be thoughtfully crafted so children will be fascinated and in their explorations develop a sense of curiosity and

wonder. It will be a garden where they will feel safe and comfortable, but it will be garden that will be visually stimulating and physically challenging. Children will be able to touch and investigate plant textures, forms, tastes and smells. We believe that exploration and play in such a garden will help the child develop intellectually, socially and physically. They could participate in guided programmes if they wished. The overarching theme will be "all life on earth depends on plants".

While the Children's Garden is a complex, living outdoor library and classroom, the emphasis is on fun. With these guidelines established, we drafted a concept plan. This gave in considerable detail all the different features we hoped to see.

A 2-ha plot of land in the Botanic Gardens was identified taking into consideration, access, parking and existing vegetation. Next, funding was sought and a development team that included educational specialists, botanists, horticulturists and an artist was formed.

We received a major donation with contributions from the Jacob Ballas Estate, Dr Rosslyn Leong and Reef Holdings Pte Ltd. With this and the budget we originally had, we were able to fully explore and develop our concepts for the garden. The Children's Garden is named for Jacob Ballas (1921 – 2000), who was a successful stockbroker and philanthropist.

The major challenge was balancing fun, adventure and creative play with safety concerns, and the freedom of unstructured exploration with elements of structured learning. Another challenge is the use of plants to tell their stories instead of using props and artificial models and science-centre type mechanical exhibits. The only exception would be a photosynthesis exhibit that would be designed to be interactive. Finally, the greatest challenge to us, our designers and contractors, was transforming ideas into form.

Features

Several main areas/sub-themes were created: (i) laughter and joy – including a small water-play area, some innovative play equipment, a maze, a suspension bridge and a floating platform, (ii) a fantastic forest – a place for exploration, adventure and stimulation, including a walk-behind waterfall, a 'mushroom shelter,' mysterious trees including two with low horizontal branches, unusual plants, a patch of forest, a tree house and a corner to demonstrate ecology and nutrient cycling, (iii) plants in our lives – with examples of plants used in children's daily lives, including fruit, fibre, dye and beverage plants and a potting garden where outdoor programmes involving planting and potting can be carried out (iv) interpretation and guided programmes and (v) amenities, including four classrooms. Some of these areas would overlap to maximise the space we have. We decided on using the butterfly form as a motif in the design of features in the garden. Butterflies represent change and life, activity, joy and beauty.

The physical elements in the Children's Garden may be conveniently divided into *fun features* and *plant features*. Important elements are outlined here.

Fun Features

Specific non-plant fun features, guided by our theme of "laughter and joy" are integrated into the "Fantastic Forest" and elsewhere. For the very young, there is a sand pit with several play equipment. Adjacent to this is a water play area with water jets that can be activated by kids. The area also has several mechanical pumps where children can collect water to give the potted plants placed on a rack nearby, a drink. Plastic watering cans are provided and children can have fun 'looking after' plants.

Children working together to collect water from one of the three manual pumps in water-play area...

…then they water the plants for us

Next to this is an innovatively designed maze. This maze of the dense growing *Syzygium campanulatum* has gates at nine junctions. Each gate can close off one of two paths. By changing how a gate is closed, this will also change the configuration of the maze. No kid will be able to 'memorise' the maze. Elsewhere, several tiered blocks allow kids to rotate and form pictures of plants and animals. A huge log drum allows children to beat as hard as they like to make the loudest noise possible.

Children walk under overarching fig trees and enter the Fantastic Forest by crossing a wobbly suspension bridge. They delight in bouncing and shaking this bridge; more adventurous kids cling on the ropes and cross along the outside edge of the bridge. Adult carers who find the bounce too much can walk on a gravel path along the bridge.

The entry to the Fantastic Forest is over a suspension rope bridge

Beyond the bridge, young explorers enter a walk-behind waterfall and can search for water creatures in the pond beneath the falls. Further on, they go under an arch of many old, gnarled Frangipani trees along a stream. They emerge to discover a small natural pond filled with aquatic vegetation and fish as well as a floating platform. Children can lie on their tummies to try and catch fish in the pond with their hands. Across the stream is a bridge of a single log.

Beyond this is a favourite - the tree house. This was built around several *Ficus benghalensis* trees transplanted here for this purpose. Their aerial roots are already developing supplementary trunks. Eventually this two-level tree house will be completely surrounded with pillar-like trunks, transforming the house into a surreal, magical place. Two slides descend from the tree house. Alternatively, children can climb down (or up) by two nets on another side of the house.

The tree house. Children go up or down using steps, a ladder, or nets. They can also slide down

Plant Features

To help us achieve our objective of creating a fun and memorable place, several 'indicator' species were planted. These include two species with very large and unusual fruits, the Calabash tree (*Crescentia cujete*) with its smooth green, melon-like fruits hanging from branches and the Cannonball tree (*Couroupita guianensis*) with its brown, football size fruits hanging from the main trunk. Another species that adds to happy memories is the Saga tree (*Adenanthera pavonina*) whose very hard, bead-like, shiny bright red seeds never fail to delight children (and parents) who pick them off the ground.

Two very special trees of *Bombax ellipticum* were transplanted here with great care keeping all their branches intact. This species has a stout stem and very low spreading branches described as octopus-like. We thought these would be excellent trees for climbing.

Bombax ellipticum, with its unique low-branching, multi-stemmed form, seems designed for climbing

Another conscious decision to help us generate happy memories is the planting of plant species that attract butterflies. These are either species that produce nectar for the adults or are those that caterpillars feed on.

We feel that the butterflies and these special trees would help the children to firmly anchor their happy memories, giving them a sense of place and love for the garden.

The interactive photosynthesis exhibit is an artificial tree. Cranks that the kids must turn activate major elements required in photosynthesis. Interpretative plaques and guides (on guided tours) will explain that plants, with their ability to photosynthesize, are the primary producers. They make food for themselves and for us and in the process give us oxygen and accumulate carbon in their wood. The magic of photosynthesis is the process that makes life possible for other living beings.

In the display on aquatic plants, children learn about adaptations to aquatic life. They will discover that they can never drown a floating aquatic plant. Elsewhere there are other specific displays on unusual plants that will specially stimulate the sense of curiosity and wonder. There are plants that live 'on air' without the need for soil. Others are carnivorous and can 'eat' meat. In the sensory garden, all senses are stimulated.

Touch-me-not, *Mimosa pudica*, at the Sensory Trail. Touch it and the leaflets fold up and the whole leaf droops

The beautiful and unusual blooms of *Aristolochia grandiflora* at the Sensory Trail. The open flowers stink of decaying meat, attracting flies as potential pollinators. Including the tail, the flower is about 60 cm long

Children will be able to touch hairy plants and those with rough leaves or thorns. They can smell and taste other plants and see a wide range of plant shapes, forms and colours.

In the Forest, there is a trail along which will be a display on decomposition and nutrient cycling. Plants that impact children's everyday life displayed in the Garden allow special programmes to be designed. Some examples of the plants include those used for dye (*Bixa orellana*, *Clitorea ternatea*, *Pandanus amaryllifolius*), fruit (*Ananas comosus*, *Annona muricata*, *Carica papaya*), beverage (*Camellia sinensis*, *Coffea canephora*, *Theobroma cacao*), herb and spice (*Capsicum frutescens*, *Cymbopogon citratus*, *Murraya paniculata*) and the sugarcane (*Saccharum officinale*).

Amenity trees for shade are also selected because each species have some interesting feature to show. Collectively, they will contribute to making the garden an interesting place.

Programmes

Learning is through several avenues: (i) informal creative play, exploration and discovery, (ii) informal learning from the exhibits, interpretive signs and brochures, and (iii) facilitated learning provided through organised programmes.

Programmes and other compatible activities to make the Garden a vibrant learning environment will complement the delights in the Children's Garden. The message of conservation will permeate all programmes and activities.

A Very Happy Place

The Children's Garden in the Singapore Botanic Gardens is a place for happy memories. And the children have given us their unanimous endorsement. A child said, "this is the happiest place in Singapore." A visit at any time will see a very happy place with an abundance of smiles, laughter and screams. With their creative energy, imagination, sense of adventure and innate ability to enjoy simple things, children were able to appreciate the many plants and features in the Garden. We hope that all children who visit will take away a seed that would grow in them an appreciation for plants and conservation.

Chin See Chung
Director

Photos by Chin See Chung

Curious About Convolvulaceae?

Have you eaten "*Chilli Kangkong*" lately? Did you per chance enjoy slices of sweet potato the last time you had Japanese *tempura*? If so, then you are acquainted, in a culinary way, with the Convolvulaceae, or the Morning Glory family. This family of plants is one of the most easily recognizable to non-botanists - twining stems, heart-shaped leaves, and trumpet-shaped flowers in bright colors, usually opening in the morning and lasting only a few hours. Most people familiar with cultivated garden plants would immediately recognize a morning glory with these characteristics.

But there is so much more to the story! Here's a brief overview of the plants included in this fascinating family. Convolvulaceae is a moderately large family, with 56 genera and more than 1,800 species, nearly all of which are native in tropical and warm temperate regions of the world. Most species are climbers, but not all - the family includes trees, some mat-forming creepers, low-mounding herbs, and erect shrubs. But by far the majority is climbers that manage to reach great heights by twisting their stems around trees, fences, wires, or any erect object. How the stems move was a subject that fascinated Charles Darwin, who conducted experiments to determine the direction, speed, and constancy of stem movements. Unlike other plants that climb, Convolvulaceae have no tendrils or other climbing aids. They depend entirely on movement of the young stem tips to move the growing shoot higher up towards the light.

Plant Morphology

How does one recognize a morning glory from other kinds of climbing plants? Briefly, the leaves are arranged alternately along the stem. There are no tendrils or other climbing aids. The sap is often (but not always) milky white, flowers are radially symmetrical, the parts often in 5s (5 sepals, 5 petals fused into a trumpet or bell-shaped corolla, 5 stamens) and the pistil typically has 1 or 2 styles, 2 stigmas (of varying shapes), 1- or 2-celled ovaries, and 2 or 4 ovules. A plant that has all or most of these characteristics will almost certainly be a member of the Morning Glory family. Other information that taxonomists get excited about are the pollen grains (the presence or absence of tiny spines) and the nature of the fruit, which varies quite a lot: a capsule that splits open by valves, a fleshy berry, or hard nut-like fruit, or a brittle papery fruit that shatters and releases the seeds.

Uses

What good are morning glories? There are many uses for these plants, both good and bad. Edible plants such as the Kang-kong (*Ipomoea aquatica*) and Sweet Potato (*I. batatas*) are well known on the plus side, but did you know that sweet potatoes are now a major source for livestock feed and industrial alcohol? China produces 83% of the world's harvest of this tuber crop. Medicinal drugs were formerly extracted from roots of *Jalap* (*I. purga*) and Turbith (*Operculina turpethum*), among others, but these drugs have now largely been replaced by synthetic medicines. On the minus side of the equation, crop pests in this family require millions of dollars to be spent on herbicides, mechanical removal, and post-harvest cleaning to get rid of agricultural weeds such as dodder (*Cuscuta* spp.) and bindweeds (*Ipomoea* spp., *Convolvulus* spp.) and their seeds. It is ironic that while gardeners want to know how to grow these plants, farmers would like to kill them.

Koh Sin Lan

Ipomoea aquatica, Kang-kong or Water Spinach plant and flower in close-up view

George Staples

Ipomoea batatas, sweet potato vines, tubers, and flower

All in all, the economic importance of Convolvulaceae is considerable on both the plus and minus sides of the balance sheet. However, beautiful ornamentals and landscape plants are today the most visible use for Convolvulaceae around the world. Rather few species are grown as ornamentals, but there is enormous potential for new ones to be introduced to the trade. Here in Singapore, the Elephant Climber (*Argyreia nervosa*) and the Messina Creeper/Railway Creeper (*Ipomoea cairica*) are well known ornamentals, though the latter is more of a weed. Blue Daze (*Evolvulus glomeratus*) is another, though many people don't realize this low ground cover is in the Morning Glory family. But these are by no means the most beautiful or desirable species, they just happen to be the ones that were moved around and are now widely grown.

Koh Sin Lan

Evolvulus glomeratus subsp. *grandiflorus*, Blue Daze plant and flower in close-up view

There are many more kinds of Convolvulaceae that have excellent potential as garden ornamentals, if they are introduced to the trade. Let's meet a few of them.

Ipomoea

Among the best-known species in gardens the world over are found in the genus *Ipomoea*, including *I. purpurea*, *I. nil,* and *I. tricolor*. All these are native in the American tropics but they are now cultivated and naturalized world-wide. *Ipomoea tricolor* has popular cultivars in the nursery trade with colourful names like 'Heavenly Blue', 'Pearly Gates', and 'Flying Saucers'. Some other *Ipomoea* species that can be seen in Singapore include the rich rose blossoms of *I. horsfalliae*, the dazzling red *I. quamoclit,* the crimson *I. hederifolia* and the hybrid *I.* × *sloteri*, as well as the unusual bi-coloured flowers of *I. lobata*. Distinctive in a group of plants that flower during the day is *I. alba,* known as moon-flower because it's pure white, sweetly fragrant blossoms open after sunset and last through the night, fading the next morning as the sun rises. The flower shapes in *Ipomoea* are typically bell or funnel-shaped, but the moon-flower and the red/orange types that are attractive to hummingbirds have a salver-shaped corolla - a slender tube topped by a flat limb at right angles to the tube. The color and shape of the flower are tied to the pollination syndrome of each species. With more than 600 species world-wide, the horticultural potential of the genus *Ipomoea* has scarcely been tapped.

Koh Sin Lan

Ipomoea purpurea

George Staples

Ipomoea horsfalliae

George Staples

Ipomoea quamoclit

Koh Sin Lan

Ipomoea lobata

Argyreia

Well suited for the tropical climate of Singapore and SE Asia, though scarcely grown, are the over 100 evergreen or deciduous species of *Argyreia*. Native throughout tropical Asia as far south as Queensland, Australia, this genus includes large woody climbers as well as smaller plants that trail along the ground. Flowers are showy and often large with colours ranging from pure white to red and purple. Some species of *Argyreia* have silvery or white hairs on the underside of the leaves, which adds an attractive feature to the plants in the garden. Indeed this silvery hair-coat is the source of the genus name (*argyraeus*, Latin for silvery). *Argyreia* fruits are fleshy yellow to red, or black to purple berries.This genus has considerable potential as a source of ornamental climbers for tropical regions. However, only one species (*A. nervosa*) is

presently grown in cultivation. One particularly desirable species is native in Peninsular Malaysia: *Argyreia sphaerocephala* has a long whip-like inflorescence that hangs down below the vine and bears at its tip a head of purplish bracts that cover the bright red, tubular flowers. The bracts spread apart when the fruits ripen to expose the rich lavender coloured berries.

George Staples

Argyreia nervosa, the Elephant Climber

Thamarat Putthai

Fruits of *Argyreia sphaerocephala*

Merremia

Gorgeous shades of yellow and gold are found in the flowers of several *Merremia* species. A genus found throughout the tropical regions, there are about 100 species known and some are spectacularly beautiful. The only *Merremia* widely cultivated is the Wood Rose, *M. tuberosa*, a plant that is too large and vigorous a climber for small gardens. However, many other species have not been tried as garden ornamentals. These plants are all twiners or trailers and several are stunning species.

George Staples

Fruits of *Merremia tuberose,* Wood Rose

Other Lesser-Known Genera

In damp, shady situations where lawn grasses won't grow, the creeping stems and kidney-shaped leaves of *Dichondra* species can advantageously be used as a groundcover in lieu of a lawn. Some species tolerate heat quite well while others, coming from the Andes Mountains, are better suited as cool-climate rock garden plants. Flowers are tiny and inconspicuous. Dichondras are grown for the foliage and their soil-binding abilities.

Other plants well suited for the rock garden, or perhaps a hanging container, are the more than 200 species of *Convolvulus*. These come mostly from dry climates with low humidity and few species will thrive in Singapore's humid environs - the ten or so species now in cultivation are suited for temperate climates with mild winters. However there are species from tropical Africa and India that have not been evaluated for ornamental purposes, some of them might be better suited for tropical environs. Flower colours include pinks, blues, lavenders, and pure white, or combinations of these. A few species are trailers or twiners, but many species form clumps or mounds of foliage that send up slender, erect stalks with blooms.

There are many other genera and species, too many to mention here, that could be grown as novelties by those interested in oddities and rare species. Succulents, wetland plants suited for water gardens, and of course many more climbers are among them. So the next time you are enjoying a plate of *Chilli Kangkong* or some delicious Tempura Sweet Potato, just remember that there is far more to the Convolvulaceae than the ones on the dining table!

George Staples
Herbarium

Footnote:
George joined the Gardens on 20 August 2007 as a Senior Researcher at the Herbarium. Prior to this, he was with the Herbarium Pacificum, Bishop Museum in Honolulu, Hawaii, USA. Equipped with about 30 years of work on Convolvulaceae, George is one of the leading authorities on this family.

From Poison to Food

The Experimenter and Innovator

Humans have always been gatherers and hunters. After the advent of agriculture some 10,000 years ago, hunting and gathering continued to be important activities. Humans would gather both plants and animals and probably hunted any animal that moved. It is unlikely they would be too fussy about what they ate. Humans are naturally experimenters and innovators.

When ingested, some plants are deadly poisonous; others are just nasty giving temporary pain and discomfort. Experimentation and accumulated traditional knowledge meant humans were able to detoxify poisonous plants or plant parts for food. This is normally by heat or leaching in water, or both. Typically, the food item would be pounded or sliced thinly when raw or after roasting. It is then boiled, often with several changes of water. Food could also be just leached before being cooked for eating, or boiled and then leached before cooking. However, one can imagine the trial and error and pain and grief, before methods were developed to render each poisonous material edible (and tasty).

For almost all traditional human communities living in rainforest areas, gathering, mostly a female activity, would be a significant contributor to the diet. Hunting, on the other hand, is often a risky and unproductive male activity. Apart from knowing how to make toxic plants safe to eat, gatherers would also know about poisons, medicines, gums, resins, dyes and plant-based technological materials for building, weaving, boats, weapons and tools.

From the tropics, many toxic plants are prepared for food. Leaves, often readily available, are an especially important source of protein, regulators of the digestive tract and an important source of vitamins and minerals. Toxic vegetables also include certain legume pods, some *Solanum* fruits, certain cucurbit fruits and palm hearts. Starchy foods that are toxic may be from *Dioscorea*, aroids, tapioca, fruits of various cycads and certain root and tuber crops. Toxic oil and oil-rich food could be from *Aleurites*, *Pangium*, *Hodgsonia* and other seeds and nuts.

Experimentation and innovation mean a greater efficiency in exploiting the natural environment for food. It means a greater diversity of foods to meet nutritional requirements and the addition of unusual delicacies to the human diet. These items of food helped developed cultural norms and behaviour with regards to dietary choices.

Keluak

Keluak is a delicacy from the seed of *Pangium edule* (from the latin *edulis* = edible), a tree also known as *Kepayang* or *Pangi,* which is highly poisonous in its unprocessed state. Once processed, the seed – a hard, irregularly shaped nut – is a key ingredient in some ethnic dishes. When the shell is cracked open, the edible portion is the black oily content that looks, and tastes, much like congealed soya sauce. The seeds, cut opened at one end are used whole in cooking or the contents scraped from the shells and used as an ingredient.

A Beautiful Tree

Pangium is a genus in the family Flacourtiaceae that has only one species. A beautiful tree native to the area from the Malay Peninsula to Melanesia and Micronesia, it can reach a lofty 40 metres tall with trunks that may be up to a metre in diameter. The species is not common but is found scattered in the more

The old tree in the Gardens

open lowland rainforest areas, often near rivers. Around villages, they are often found as semi-cultivated trees. Saplings have leaves that are three-lobed. In older saplings and matured trees, the leaves are broadly oval or heart-shaped. They are large, a rich dark green and shiny and are mostly 20 to 45 cm long by 12 to 25 cm wide. In saplings, they are larger and may reach 60 cm long by 40 cm wide. The leaves are clustered towards the end of robust twigs. On each twig, the leaf-blades are borne on stalks of varying lengths, from 15 to 60 cm long. The blades are also of varying sizes with larger leaves on longer stalks. There seems to be no apparent pattern of arrangement of the leaves, but the result of holding them at varying distances from the twig means a maximum exposure to the sun.

Well-grown young trees have the lush, rich green look of a verdant tropical environment and are relatively fast growing. Their colour, texture and shiny large leaves that reflect the sun add a refreshing dimension to any treescape. The trees start fruiting when they are about 10 to 15 years old. Their large fruit, however, prevents the use of this species as street trees.

The Fruit

Trees are mostly male or female, though hermaphrodite flowers are often found. The trees are most distinctive when bearing a good crop of fruits. The large fruits are ovoid with a rough brown skin. Both ends are bluntly tipped. They hang vertically like brown bombs from thick stalks of up to 15 cm long and are a wonderful contrast to the shiny large leaves. A large fruit measuring 15 to 30 cm long and 15 cm in diameter may weigh about 2.5 kg. Ripe fruits do not split but fall from the tree and would be a dangerous projectile if it lands on the head of the unwary.

Fruits on the tree

Fallen fruits

A squirrel gnawed the neat oval window in one of the fruits illustrated here. This fruit was 28 cm long by 13.5 cm diameter at the widest and weighed 2.3 kg soon after it fell. Twenty-five large seeds were neatly packed inside, each surrounded by yellow pulp 3 to 10 mm thick. The seeds cleaned of pulp weighed a total of 600 g. They are hard with a reticulate or ribbed shell (testa) with a linear hilum (the part of the seed that was attached to the placenta in the fruit). Most of the seeds are longer along the length of the hilum and are variously triangular or oval, mostly from 3 to 5 cm wide by 5 to 7 cm long. The hard shell takes a high polish and is made into ornaments and musical instruments like rattles.

A large fruit from the tree with a neat window opened by a squirrel. The stick is marked with 1-cm lines

A Risky Proposition

All parts of the plant contain the cyanogenic glycoside, gynocardine. When any part is damaged or crushed, an enzyme gynocardase is released which converts gynocardine to the very toxic hydrocyanic acid (cyanide). Because hydrocyanic acid is antibacterial, antifungal, insecticidal and toxic, humans, for purposes that require these properties, have used various parts of *Pangium edule*.

The pulp is reported to be edible. It does not have a very strong smell but tastes sweet and is fibreless, much like a good mango. This seems to be the part of the plant that is least toxic but it is uncertain if it is completely safe for human consumption. Tasting

a small amount from a ripe fruit of the tree in the Gardens did not result in any side effects. A colleague who reported he once ate the yellow pulp from about one quarter of a fruit (in Sarawak), subsequently had diarrhoea with 'food poisoning' symptoms. A friend, who ate this with him, thought he lost hair from his head as a result.

Fruits cut opened to show their contents. The hard seeds are surrounded by sweet yellow pulp

Squirrels regularly attack the ripening fruits on our tree. They bite a neat window through the fruit wall to feast on the yellow pulp. They have not been observed to eat any other parts of the tree. Perhaps this is the only inviting part of the tree, as it must have evolved to facilitate dispersal of the seeds. Ants that very quickly blanket fallen fruits already opened by squirrels eat the yellow pulp, leaving behind cleaned seeds.

Fresh leaves have been used as a wrapping for fish and meat to preserve them for up to several days. Crushed leaves have also been applied externally as an antiseptic or to kill body parasites. More alarming is that crushed leaves are also reported as taken for intestinal parasites. These same crushed leaves may also be prepared as food. Pounded bark, leaves and seeds have been used as a poison thrown into streams to stupefy fish. Fresh seeds and cold-pressed oil from the kernels have been used for criminal purposes.

From Poison to Food

The large and substantial fleshy seeds are the most important item for food. Inside the shell, each seed has a pair of flat cotyledons surrounded by a thick fleshy, oil-rich aril. In a fresh seed, they are a creamy white colour.

To render seeds or leave edible, the gynocardine must be removed. This is traditionally achieved by crushing the part to be eaten, followed by long washing or by soaking the part in flowing water to leach out the poison. Alternatively, thorough heating will destroy the production of the enzyme gynocardase. Sometimes, both heating and leaching are employed.

Seeds sold in markets as *keluak* have been boiled and buried in wood ash to ferment for about 40 days. This turns the kernels (cotyledons and aril) inside the seed into a black, oily mass, relished by many. The other ways of preparation involves first extracting the contents of the fresh seeds. This is boiled in lots of water, and then placed in a porous bag (typically a woven rattan basket) that is then immersed in flowing water and left overnight. It is then boiled again.

The seeds of *Pangium* from the tree in the Gardens. Those in the bottom row and the two in the extreme right are fresh seeds. Cracked fresh seeds show their white contents. All other seeds are prepared seeds from the market ready for use in the kitchen. Their contents are black

This oil rich delicacy is now ready for eating or used as an ingredient for cooking or left to ferment further by putting aside for several more days. In a method observed in Baram, Sarawak, the boiled and leached kernels are pounded to a paste with salt. This is then wrapped in leaves when it ferments somewhat and is eaten over weeks. The prepared kernels that are unfermented taste somewhat like boiled peanuts.

Oil may also be extracted from the treated kernels. This was a traditional source of oil in inland areas of Borneo.

In Sulawesi where *Pangium* is a common ingredient in food, old leaves are also eaten. After the main veins have been removed, the leaves are shredded and crushed, mixed with pigs' blood and salt and stuffed into joints of bamboo and boiled. A more appealing recipe from central Sulawesi is prepared by stuffing the contents of properly treated seeds mixed with pork and spices into bamboo joints for cooking.

Pangium is one of the numerous non-timber forest products that sustain live in many traditional communities. It contributes to nutritional needs and adds an element of interest to their diet.

Be Safe Not Sorry

Pangium is a poisonous plant that traditional methods of preparation have rendered acceptable (and sought after) in modern cuisine. For those who want to try this delicacy in Singapore, look for it in restaurants serving *Nonya* cuisine. Alternatively, buy the processed *Keluak* from markets. Unless you have traditional knowledge and experience, do not try cooking the raw seeds. The results could be extremely unpleasant.

Chin See Chung
Director

Photos by Chin See Chung

Begonias of Sumatra

The Indonesian island of Sumatra lies only a stones throw away from Singapore across the Malacca straits, yet contains some of the most remote and unexplored primary rainforest in the world. Its jungles harbour many remarkable species, including the world's largest flower, *Rafflesia arnoldii*, and an arum lily which produces the world's largest inflorescence, the Titan Arum (*Amorphophallus titanum*). The Sumatran Orangutan and the Sumatran Tiger are still found in the more inaccessible parts of the island. Allegedly, a strange, small ape-like creature (*Orang Pendek*, which literally means short or dwarf man in Malay) goes about its secretive business in the darkest depths of the forest. Therefore, during a plant collecting expedition to the north and west of Sumatra in early 2007, it came as no surprise that many new species were encountered.

The tropical genus *Begonia* was of particular interest during this trip, as we are working to produce a monograph of the Sumatran species. *Begonia* is one of the largest plant genera, containing about 1,600 known species but with hundreds more waiting in the wings to be discovered. It has long been a source of fascination to botanists and cultivators for its range of vegetative forms and leaf shapes. The high number of narrowly endemic species has also provided botanists with insights into the evolution and biogeography of tropical biodiversity.

Forty-five species of *Begonia* have been described from Sumatra, with 31 of these occurring nowhere else. The non-endemic species are mostly shared with Java, with only three species being in common with Peninsular Malaysia. During the expedition, less then half of the *Begonia* species encountered were known species. One new species found on the side of the smouldering volcano Gunung Sibayak in North Sumatra has sharply lobed, variegated leaves. This species belongs in the section *Petermannia*, which is a group with erect, often woody stems and terminal inflorescences.

A new species from Gunung Sibayak

In West Sumatra, another new species (also in section *Petermannia)* was found in the forests surrounding the city of Padang. It has fruits which dangle on very fine and delicate hair-like pedicels when they are ripe. A volcano near to Gunung Sibayak, known locally as Gunung Sinabung, harbours a new species with velvety patterned leaves of the section *Platycentrum*, whose members are characterised by fruits which form a small cup for rain-splash dispersal of their seeds.

The fruits of a new species from the forests around Padang

Another new species – and this beautiful begonia is found on Gunung Sinabung

Begonia areolata is a related species, which is widespread throughout the montane forests of Sumatra and Java. It got its name because its leaves are marked by many tiny bumps. Also in the same section and found in

Begonia areolata, from Gunung Sibayak, so named because of its bumpy leaves. Inset: Female flowers of *Begonia areolata*, showing the developing fruit behind

the higher altitude forests around Padang is *Begonia teysmanniana*, named after the Dutch botanist Johannes Elias Teysmann, who first collected this species from Gunung Talang in the 1850's. This is a statuesque species which can reach 1.5 m in height.

Begonia teysmanniana from Gunung Talang

At slightly lower altitudes, *Begonia atricha* (section *Petermannia*) can be found, which derives its name from the fact that it is completely without hairs. It has distinctive bell-shaped fruits and also occurs in different colours; the form illustrated here has almost black leaves which are red beneath. *Begonia stictopoda* grows along tracks cut through the forest, on either limestone or clay, where it displays its attractive, shell-pink flowers and fruits. Intermixed with it in localities in the Pasaman regency is a new species with claret-red young leaves.

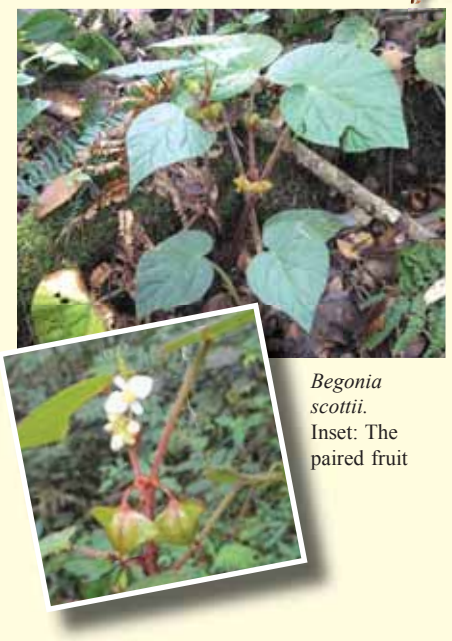
The black-leaved form of *Begonia atricha*. Inset: the distinctive bell-shaped fruit

The shell-pink flowers and fruits of *Begonia stictopoda*

A new species in section *Reichenheimea* from the Pasaman regency

Begonia longifolia (of section *Sphenanthera*) is one of the most widespread species of *Begonia*, occurring from China through to Indonesia. This section contains species with fleshy berry-like fruits probably dispersed by animals - this may explain the widespread nature of *Begonia longiflora*. Another species in this section which has been recently described is *Begonia scottii*, named after the plant collector Scott Hoover. It has distinctive tri-cornered fruit, usually carried in pairs.

Begonia longifolia from Gunung Sibayak. Inset: The axillary inflorescences of this *Begonia*



Begonia scottii. Inset: The paired fruit

The collections made during the trip, with the collaboration and assistance of the Indonesian Institute of Sciences and Indonesian Forestry Department, will help us to document and understand *Begonia* biodiversity on Sumatra. It is hoped that this will stimulate further interest in the conservation of the native, endemic and often threatened plants of this fascinating island.

Mark Hughes
Herbarium

Deden Girmansyah
Herbarium Bogoriense
Cibinong Science Centre
Bogor, Java
Indonesia

Photos by Mark Hughes and Deden Girmansyah

Footnote:
Mark Hughes has just recently joined the Gardens as Senior Researcher at the Herbarium. He hailed from the United Kingdom and was a botanist at the Royal Botanic Garden, Edinburgh, United Kingdom, researching on Asian begonias. Since 12 November 2007, Mark continues his focus on this plant family with the Gardens.

Birds of the Singapore Botanic Gardens

During the past decade our knowledge of birds within the Gardens has increased dramatically. Out of Singapore's 364 bird species (2007 data), more than one third has been known to occur here. I will skip the historic introduction as this is covered in two earlier articles on the same topic that appeared in Gardenwise (see *Gardenwise* **1**(1989): 6-7 and *Gardenwise* **13**(1999): 24-27).

Today the Gardens is well known by all naturalists in Singapore as probably the best place to find our garden birds and to see them well. Teams always visit the Gardens during the annual Singapore Bird Race (an island-wide competition to record as many birds as possible within 24 hours), simply because this is a convenient place to quickly see many different species. Foreign visitors can reach the Gardens in a few minutes by walking up briskly from the Orchard Road tourist hub. On a nice morning the Gardens is like an exotic bird park to them, minus the chicken wire!

Checklist Available

We now have a full checklist of all the species currently occurring within the Gardens. Local ornithologist and bird-book author Lim Kim Seng compiled a first, much shorter checklist. But it was never published. Later Dr Chris Hails (read his article in *Gardenwise* **1**(1989): 6-7) recorded nearly 100 species, but his list was also never published. More recently, wildlife consultant R. Subaraj (see www. subaraj. com for details) and I, have added new species. Also, Paul Huang, a bird photographer who has spent many days in the Gardens has recorded his amazing collection of bird photographs taken on location at www.naturestops.com.

New species are added to the list almost every year. Extensions to the Gardens, especially the Eco Lake area, have allowed more water birds to colonize. And with more birdwatchers visiting, more rare visitors are spotted and reported. Today the list numbers 137 (see Table 1 at end of article).

However, if you look closely at the list there are also some very scarce residents that I personally haven't seen for many years. Crested Goshawk, Crested Serpent-Eagle, Scarlet Minivet, both leafbirds, Abbott's Babbler, Purple-throated Sunbird and Little Spiderhunter belong to that category. These lowland rainforest birds might not be present any longer. With just 6 ha of primary rain forest in the Gardens, forest birds find it difficult to hang on. Striped Tit-Babbler and Greater Racquet-tailed Drongo can still be heard from the forest, but I suspect that there are just one or a few pairs present. A numeric inventory of the resident bird population (those species marked '*Resident*' on the checklist) might be an interesting project to initiate.

Some species only occur on the fringes of the Gardens, around the dense greenery of the secondary forest across Tyersall Avenue. Eight have been identified and these have been marked '*T*' on the checklist. Should this area be developed in the future they will most likely disappear altogether. Two of these species, the Straw-headed Bulbul and the Brown-chested Flycatcher are actually categorized as 'Vulnerable' to global extinction by BirdLife International.

Not included in the checklist are five species of waterfowl that have been introduced, intentionally or otherwise. These are: Mute (White) Swan, Black Swan, Radjah Shelduck, Mandarin Duck and Mallard (for details see *An Annotated Checklist of the Birds of Singapore* by L.K. Wang and C.J. Hails, NUS, 2007). The origin of the Lesser Treeducks and Wandering Treeducks around the Symphony Lake is more doubtful, some have been seen with rings marked JBP (Jurong Bird Park). However, I suspect that many of the Lesser Treeducks are in fact wild birds from the less developed areas of Singapore that have joined the escaped ones and learnt to feed on bread handouts.

Also not included in our checklist are a number of other birds released or escaped from captivity and roaming around the island. Many end up in the Gardens where there is shelter and plenty of fruiting trees for them. Since they do not establish viable breeding populations in Singapore, they are not included in the official checklist. Many visitors come to us and tell about the Great Hornbill (*Buceros bicornis*) they have seen, which is massive, noisy and conspicuous. We have had

several individuals living in the Gardens through the years, and I have even seen a female enter a potential nesting hole in one of the large trees!

We have two native parrot species that can be seen every single day in the Gardens, and we also have four additional exotic parrots that have been included in the Singapore species list as introduced. However, apart from these, there are many parrots found in the Gardens that are not be listed in the checklist or in any of the regional bird field guides, simply because they don't really belong. I have seen six to seven species of various Indonesian, Australian and even the occasional African and New Zealand parrots flying about, though I'm uncertain of their origin for lack of scrutiny. An Australian birdwatcher who spent a few months in this country told me he had spotted 20 different parrots in the Gardens.

New Studies

More people come to the Gardens now to watch birds. When a migratory Blue-winged Pitta turned up near the Ginger Garden last winter, local photographers invaded the area to take its picture evening after evening. And recently, when a beautiful white morph male Asian Paradise-Flycatcher spent a few days fluttering around the Symphony Lake area, word quickly got around within the local bird photography community, and you had to queue up if you wanted a photo of that one!

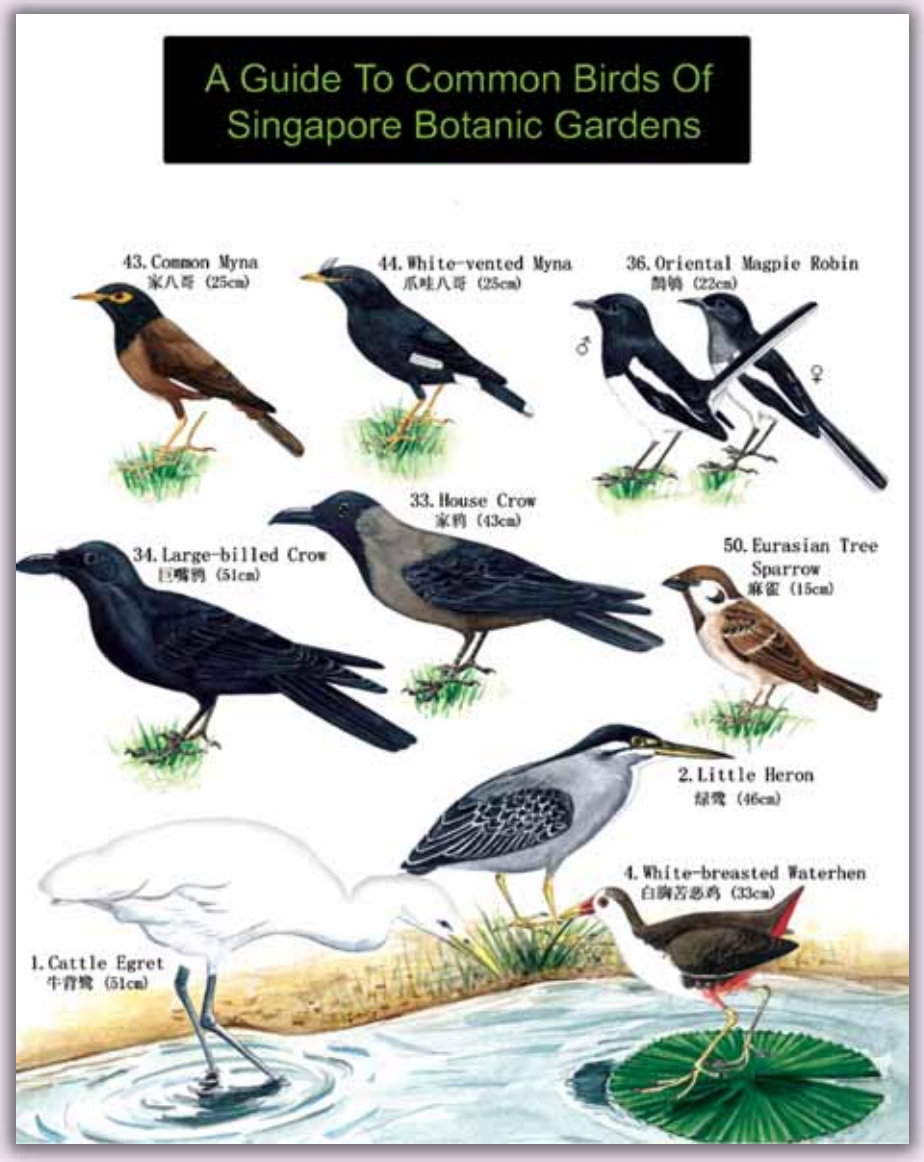
Every week big-shot birdwatchers and even some professional bird photographers from Europe and America visit the Gardens to find and ~~to~~ photograph birds. Many conspicuous and spectacular Asian garden birds are easy to see here, and they can be approached very closely, used as they are to harmless human traffic. The Gardens has a small population of Spotted Wood-Owl and of the much sought-after skulking and little known Red-legged Crake. From the Internet, overseas 'twitchers' (world travelling birders that twitch their necks to spot rare birds) know that this is the place to find them.

Ordinary casual visitors to the Gardens may not be twitching for rarities, but many learn the basic skills of birdwatching by looking at the White-vented Mynas jumping up on the tables at the Les Amis café, and by seeing the various species of kingfishers perching around the lakes. For the benefit of these beginners there is now a fold-out guide available, illustrating and describing the 50 most common and conspicuous birds of the Gardens.

Morten Strange
Bird Enthusiast and Photographer

Photos by Morten Strange unless otherwise indicated

Footnote:
Morten Strange has been watching birds in the Gardens for more than 25 years. He is currently Marketing Manager for Nature's Niche Pte Ltd, the company that operates the Botanic Garden Shop in the Visitor Centre. He would like to thank Dr Wee Yeow Chin who assisted with information and discussions for this article. Dr Wee visits the Gardens regularly to observe bird behaviour. Check his blog at http://besgroup.talfrynature.com for many interesting observations from the Gardens.



Many birds breed and raise their young in the Gardens. In the checklist, no less than 22 species have been positively identified with nest or newly fledged young. Here it is a female Scarlet-backed Flowerpecker, *Dicaeum cruentatum*, feeding chicks in a nest attached to an overarching branch of a *Horsfieldia* tree near the Fitness Corner in the Visitor Centre. The pouch-like nest is lined with plant fibres. The chicks are fed mistletoe fruits

The indigenous Long-tailed Parakeet, *Psittacula longicauda* (above), is the most numerous of the parrots in the Gardens. Here a flock flies over the Palm Court in the Visitor Centre, where they often land to feed on the oil palm fruits. However, the Rainbow Lorikeet, *Trichoglossus haematodus* (below) sitting nearby at the fountain's edge may look nice, but it is an escapee that doesn't even qualify for inclusion into the checklist!

Much harder to study at nest is the Grey-rumped Treeswift, *Hemiprocne longipennis*. This master flier is doing well in the Gardens. I have counted 35 individuals at one time, but they always move high, and the nest is a tiny cup placed about 20 metres up into a large tree. Notice the 2-day old chick looking out from under its father

Adam Strange

Several night birds do well in the Gardens. The Large-tailed Nightjar, *Caprimulgus macrurus*, calls every night during the breeding season and the nest has been found here. It is just a scrape among the leaves on the ground and you can see the egg partly exposed under this individual. The Collared Scops Owl, *Otus lempiji* (inset), has also been confirmed breeding in the Gardens and it often calls from the rainforest area around dusk

Australian visitors to the Gardens often ask us if there are any woodpeckers here, as this family of birds is missing from their continent and they are keen to find some. Luckily, we have five species in the Gardens and some are fairly easy to see, like the small Brown-capped Woodpecker, *Picoides moluccensis*, best located by its call, like all woodpeckers

Many of the rainforest-dependant birds on the checklist are not doing well in the Gardens. The Striped Tit-babbler, *Macronous gularis*, is still here, but in very low numbers

Adam Strange

The wetland areas are also favourite spots for both birds and birdwatchers. The Lesser Treeducks, *Dendrocygna javanica* (above), in the Symphony Lake are probably mostly wild birds that have adapted to the garden habitat. The wild White-breasted Waterhen, *Amaurornis phoenicurus* (below), which can be desperately shy in other parts of Singapore, here brings its chicks right up to you and almost takes bread out of your hand!

Adam Strange

With the many ornamental flowering plants available to feed on, Sunbirds are doing well in the Gardens and become favourite targets for all the bird photographers, especially around the Heliconia Walk where the low bushes are packed every morning with sunbirds chirping away constantly and fluttering quickly from flower to flower to pick up nectar. Here are the Crimson Sunbird, *Aethopyga siparaja* (above), and the Brown-throated Sunbird, *Anthreptes malaccensis* (below), both males

No less than seven different kingfishers have been recorded from the Gardens. This is the migratory Common Kingfisher, *Alcedo atthis*, ignoring the no-fishing sign

Table 1: List of Birds as sighted at the Gardens

No.	Species	Scientific Name	Status	Abundance	Notes
1	Grey Heron	*Ardea cinerea*	R	UC	
2	Purple Heron	*Ardea purpurea*	R	FC	
3	Little Heron/Striated Heron	*Butorides stratus*	R/B	C	
4	Cattle Egret	*Bubulcus ibis*	I	UC	
5	Little Egret	*Egretta garzetta*	M	UC	
6	Black-crowned Night-Heron	*Nycticorax nycticorax*	R	UC	
7	Malayan Night-Heron	*Gorsachius melanolophus*	M	R	
8	Yellow Bittern	*Ixobrychus sinensis*	R/M	FC	
9	Schrenk's Bittern	*Ixobrychus curhythmus*	M	R	
10	Cinnamon Bittern	*Ixobrychus cinnamomeus*	R/M	R	
11	Black Bittern	*Dupetor flavicollis*	M	R	
12	Lesser Treeduck/Lesser Whistling-Duck	*Dendrocygna javanica*	R	C	
13	Black Baza	*Aviceda leuphotes*	M	UC	
14	Crested Honey-Buzzard/Oriental Honey-Buzzard	*Pernis ptilorhynchus*	M	FC	
15	Brahminy Kite	*Haliastur indus*	R	FC	
16	White-bellied Sea-Eagle/White-bellied Fish-Eagle	*Haliaeetus leucogaster*	R	UC	
17	Grey-headed Fish-Eagle	*Ichthyophaga ichthyaetus*	R	R	
18	Crested Serpent-Eagle	*Spilornis cheela*	R	R	
19	Japanese Sparrowhawk	*Accipiter gularis*	M	UC	
20	Crested Goshawk	*Accipiter trivirgatus*	R/B	R	
21	Chinese Goshawk	*Accipiter soloensis*	M	R	
22	Shikra	*Accipiter badius*	M	R	
23	Common Buzzard	*Buteo buteo*	M	R	
24	Rufous-bellied Eagle	*Hieraaetus kienerii*	M	R	
25	Changeable Hawk-Eagle	*Spizaetus cirrhatus*	R/T	UC	
26	Red-legged Crake	*Rallina fasciata*	R/B	FC	
27	White-breasted Waterhen	*Amaurornis phoenicurus*	R/B	C	
28	Common Moorhen	*Gallinula chloropus*	R	R	
29	Common Sandpiper	*Actitis hypoleucos/Tringa hypoleucos*	M	UC	
30	Oriental Pratincole	*Glareola maldivarum*	M	R	
31	Thick-billed Pigeon/Thick-billed Green-Pigeon	*Treron curvirostra*	R	UC	
32	Pink-necked Pigeon/Pink-necked Green-Pigeon	*Treron vernans*	R/B	C	
33	Jambu Fruit-Dove	*Ptilinopus jambu*	R/M	R	
34	Spotted Dove	*Streptopelia chinensis*	R/B	C	
35	Peaceful Dove/Zebra Dove	*Geopelia striata*	R	UC	
36	Green-winged Pigeon/Emerald Dove	*Chalcophaps indica*	R	R	
37	Long-tailed Parakeet	*Psittacula longicauda*	R	C	
38	Rose-ringed Parakeet	*Psittacula krameri*	I	FC	
39	Red-breasted Parakeet	*Psittacula alexandrii*	I	UC	
40	Blue-crowned Hanging-Parrot	*Loriculus galgulus*	R	C	
41	Lesser Sulphur-crested Cockatoo/Yellow-crested Cockatoo	*Cacatua sulphurea*	I	UC	
42	Tanimbar Corella/Tanimbar Cockatoo	*Cacatua goffini*	I	UC	
43	Chestnut-winged Cuckoo	*Clamator coromandus*	M	R	
44	Indian Cuckoo	*Cuculus micropterus*	M	R	
45	Banded Bay Cuckoo	*Cacomantis sonneratii*	R	R	
46	Plaintive Cuckoo	*Cacomantis merulinus*	R	R	
47	Violet Cuckoo	*Chrysococcys xanthorhynchus*	R	UC	
48	Malayan Bronze-Cuckoo/Little Bronze-Cuckoo	*Chrysococcys minutillus*	R	R	
49	Drongo Cuckoo	*Surniculus lugubris*	R	R	
50	Common Koel/Asian Koel	*Eudynamys scolopacea*	R	C	
51	Greater Coucal	*Centropus sinensis*	R	UC	
52	Collared Scops-Owl	*Otus lempiji*	R/B	UC	
53	Buffy Fish-Owl	*Ketupa ketupa*	R/T	R	
54	Brown Hawk-Owl	*Ninox scutulata*	M	UC	
55	Spotted Wood-Owl	*Strix seloputo*	R/B	UC	
56	Grey Nightjar	*Caprimulgus indicus*	M	R	
57	Large-tailed Nightjar	*Caprimulgus macrurus*	R/B	FC	
58	Edible-nest Swiftlet	*Aerodramus fuciphaga/ Collocalis fuciphaga*	R	C	
59	Himalayan Swiftlet	*Aerodramus brevirostris*	M	UC	
60	Fork-tailed Swift	*Apus pacificus*	M	UC	
61	House Swift	*Apus affinis/Apus nipalensis*	R	FC	
62	Asian Palm-Swift	*Cypsiurus balasiensis*	R/B	FC	
63	Grey-rumped Treeswift	*Hemiprocne longipennis*	R/B	C	
64	Common Kingfisher	*Alcedo atthis*	M	FC	
65	Oriental Dwarf Kingfisher/ Black-backed Kingfisher	*Ceyx erithacus*	M/T	R	
66	Stork-billed Kingfisher	*Halcyon capensis/Pelargopsis capensis*	R	FC	
67	Ruddy Kingfisher	*Halcyon coromanda*	M/T	R	
68	White-throated Kingfisher	*Halcyon smyrnensis*	R	FC	
69	Black-capped Kingfisher	*Halcyon pileata*	M	UC	
70	Collared Kingfisher	*Halcyon chloris*	R/B	FC	
71	Blue-tailed Bee-eater	*Merops philippinus*	M	FC	
72	Blue-throated Bee-eater	*Merops viridis*	R	FC	

No.	Species	Scientific Name	Status	Abundance	Notes
73	Dollarbird	*Eurystomus orientalis*	R	UC	
74	Coppersmith Barbet	*Megalaima haemacephala*	R	FC	
75	Rufous Woodpecker	*Celeus brachyurus*	R	UC	
76	Laced Woodpecker	*Picus vitatus*	R/T	UC	
77	Banded Woodpecker	*Picus miniaceus*	R/B	FC	
78	Common Goldenback/Common Flameback	*Dinopium javanense*	R/B	FC	
79	Brown-capped Woodpecker/Sunda Woodpecker	*Picoides moluccensis*	R	FC	
80	Blue-winged Pitta	*Pitta moluccensis*	M	UC	
81	Hooded Pitta	*Pitta sordida*	M/T	R	
82	Barn Swallow	*Hirundo rustica*	M	FC	
83	Pacific Swallow	*Hirundo tahitica*	R	C	
84	Red-rumped Swallow	*Hirundo daurica*	M	UC	
85	Pied Triller	*Lalage nigra*	R/B	FC	
86	Ashy Minivet	*Pericrocotus divaricatus*	M	UC	
87	Scarlet Minivet	*Pericrocotus flammeus*	R	R	
88	Common Iora	*Aegithina tiphia*	R	C	
89	Greater Green Leafbird	*Chloropsis sonnerati*	R	R	
90	Blue-winged Leafbird	*Chloropsis cochinchinensis*	R	R	
91	Straw-headed Bulbul	*Pycnonotus zeylanicus*	R/T	UC	
92	Red-whiskered Bulbul	*Pycnonotus jocosus*	I	UC	
93	Yellow-vented Bulbul	*Pycnonotus goiavier*	R/B	C	
94	Olive-winged Bulbul	*Pycnonotus plumosus*	R	UC	
95	Crow-billed Drongo	*Dicrurus annectans*	M	UC	
96	Greater Racquet-tailed Drongo	*Dicrurus paradiseus*	R	UC	
97	Black-naped Oriole	*Oriolus chinensis*	R	C	
98	House Crow	*Corvus splendens*	I	FC	
99	Large-billed Crow	*Corvus macorhynchos*	R	UC	
100	Abbott's Babbler	*Trichastoma abbotti*	R	R	
101	Striped Tit-Babbler	*Macronous gularis*	R	UC	
102	White-crested Laughingthrush	*Garrulax leucolopus*	I	UC	
103	Siberian Blue Robin	*Luscinia cyane*	M	UC	
104	Oriental Magpie Robin	*Copsychus saularis*	R/B	FC	
105	Eye-browed Thrush	*Turdus obscurus*	M	UC	
106	Flyeater/Golden-bellied Gerygone	*Gerygone sulphurea*	R	FC	
107	Arctic Warbler	*Phylloscopus borealis*	M	UC	
108	Oriental Reed Warbler	*Acrocephalus orientalis*	M	UC	
109	Pallas's Grasshopper-Warbler/Pallas's Warbler	*Locustella certhiola*	M	R	
110	Common Tailorbird	*Orthotomus sutorius*	R	FC	
111	Dark-necked Tailorbird	*Orthotomus atrogularis*	R	UC	
112	Ashy Tailorbird	*Orthotomus sepium*	R	R	
113	Brown-chested Flycatcher/Brown-chested Jungle-Flycatcher	*Rhinomyias brunneata*	M/T	R	
114	Dark-sided Flycatcher	*Muscicapa sibirica*	M	UC	
115	Asian Brown Flycatcher	*Muscicapa dauurica*	M	FC	
116	Ferruginous Flycatcher	*Muscicapa ferruginea*	M	R	
117	Yellow-rumped Flycatcher	*Ficedula zanthopygia*	M	UC	
118	Pied Fantail	*Rhipidura javanica*	R	UC	
119	Asian Paradise-Flycatcher	*Terpsiphone paradisi*	M	UC	
120	Forest Wagtail	*Dendronanthus indicus*	M	R	
121	Brown Shrike	*Lanius cristatus*	M	FC	
122	Tiger Shrike	*Lanius tigrinus*	M	UC	
123	Philippine Glossy Starling/Asian Glossy Starling	*Aplonis panayensis*	R/B	C	
124	Purple-backed Starling	*Sturnus sturninus*	M	FC	
125	Common Myna	*Acridotheres tristis*	R	UC	
126	White-vented Myna/Javan Myna	*Acridotheres javanicus*	I/B	C	
127	Hill Myna	*Gracula religiosa*	R	FC	
128	Brown-throated Sunbird/Plain-throated Sunbird	*Anthreptes malaccensis*	R	C	
129	Purple-throated Sunbird	*Nectarinia sperata*	R	R	
130	Olive-backed Sunbird	*Nectarinia jugularis*	R/B	C	
131	Crimson Sunbird	*Aethopyga siparaja*	R	FC	
132	Little Spiderhunter	*Arachnothera longirostris*	R	R	
133	Orange-bellied Flowerpecker	*Dicaeum trogonostigma*	R	R	
134	Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	R/B	FC	
135	Eurasian Tree-Sparrow	*Passer montanus*	I	C	
136	Javan Munia	*Lonchura leucogastroides*	I	UC	
137	Scaly-breasted Munia	*Lonchura punctulata*	R/B	FC	

Sequence and nomenclature after Allen Jeyarajasingam and Alan Pearson, *A Field Guide to the Birds of West Malaysia and Singapore*, Oxford University Press, 1999.

Alternative names after Lim Kim Seng and Dana Gardner, *An Illustrated Field Guide to the Birds of Singapore*, Sun Tree, 1997.

M = Migrant (passage migrant, winter visitor, non-breeding visitor)
R = Resident (present all year, confirmed or presumed breeding in Singapore)
B = Breeding (nest or fledglings found within the gardens)
I = Introduced (breeding population from captive stock)
T = Found only or mainly at the Tyersall Avenue forest

C = Common (seen with more than 90% certainty)
FC = Fairly Common (seen with 50-90% certainty)
UC = Uncommon (infrequently seen)
R = Rare (only seen by a few observers)

Escapees (non-breeding captive stock) NOT included

Information correct as at November 2007

Botanical Research Fellows in the Gardens

Each year the Gardens offers several grants to botanists to carry out part of their research in our herbarium (SING) as Botanical Research Fellows. This is part of our research activity as a botanical institution contributing to the enormous effort needed to study and document the flora of the region.

The Gardens of course benefits. Fellows contribute to the buzz in the Gardens as a research centre and knowledge hub. They make possible dialogue and exchange with the resident botanists, horticulturists and other Gardens' staff. And some give lectures. They also correct and update identifications during the course of their herbarium research, making a direct contribution to herbarium curation. Information gathered by the research fellows ultimately goes towards scientific publications on the regional flora.

The grants provide a win-win situation as the researchers, the Gardens and botanical research in the region benefit. In same cases, grants allow scientists to carry out a necessary part of their research here, without which they would not have the opportunity to visit.

This article provides brief profiles of recent Fellows (see also *Gardenwise* **26**(2006): 12-13).

Serena Lee and Benito C. Tan
Herbarium

Photos by Serena Lee

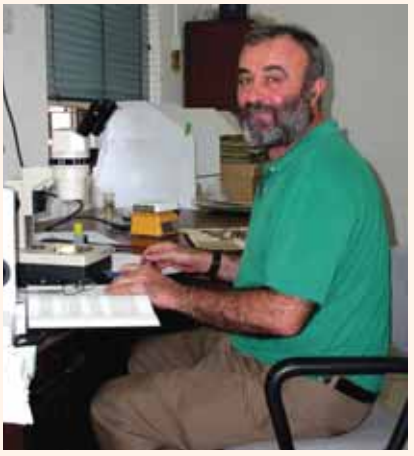
Dr George Staples

George, who visited us from the 15th July to 4th August 2006, was from the Herbarium Pacificum, Bishop Museum in Honolulu, Hawaii, USA. He is one of the leading authorities on the family Convolvulaceae, whose members include the Morning Glory. Whilst here, George curated over 350 herbarium specimens and uncovered many type specimens stacked amongst our general collection. He has since joined the Gardens as a full-time Senior Researcher in August 2007, working on… yes! Convolvulaceae.

Dr Livia Wanntorp

Livia, always seen with a smile on her face, hails from far-away Stockholm University, Sweden. She came with her family to Singapore to study our collection of the genus *Hoya* (Asclepiadaceae). While Livia was working hard at the Herbarium annotating many *Hoya* specimens mounted on sheets as well as those preserved in the spirit collection, her family enjoyed sightseeing and shopping. Livia visited us from the 18th to 22nd October, 2006.

Dr Vincent Demoulin

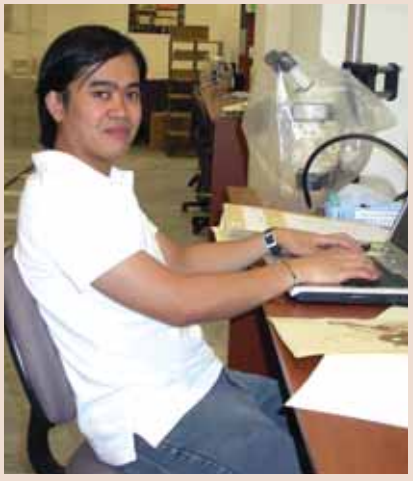


Vincent, from University of Liège, Belgium, is no stranger to the Gardens. He was here between 6th and 20th January 2007 to continue his studies on Corner's extensive fungal collections. E.J.H. Corner was the Gardens' Assistant Director from 1929-41.

Dr Rusea Go

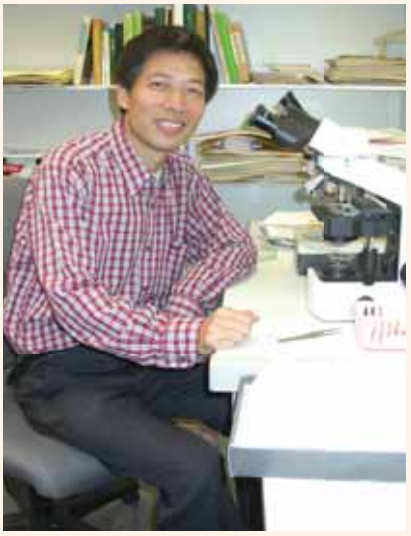
Rusea is from University Putra Malaysia. She was here from 20th to 26th November 2006 to study our specimens of *Teijsmanniodendron* (Verbenaceae).

Mr Vernie Garmica Sagun



Vernie is a Ph.D. candidate at the University of Illinois at Urbana-Champaign, USA, working on a revision of Malesian *Acalypha* (Euphorbiaceae). He was here for two weeks (12th to 26th January 2007) examining all our specimens of *Acalypha*.

Dr Zhu Rui-Liang



Zhu Rui-Liang is the first Chinese bryologist under the Fellowship programme. He is a Professor at the Biology Department of East China Normal University in Shanghai. Zhu is a specialist on liverworts that grow on leaves, and spent much of the time of his three-week stay (between 20th January and 10th February 2007) annotating many old and un-named collections of epiphyllous liverwort specimens from Peninsular Malaysia and Singapore. He even identified a type specimen.

Zhu also made several field collection trips in Singapore, visiting Nee Soon Swamp, Pulau Ubin, Bukit Timah, and the MacRitchie Tree Top Walk site. His efforts yielded a total of 47 newly collected liverwort specimens for the Singapore Herbarium. Of these, twelve were new records for Singapore and will be published soon in a bryological journal.

Dr Lindy Cayzer

Lindy is an active plant scientist from the Australian Quarantine and Inspection Services (AQIS) Plant Programs. She specializes in the systematics and ecology of *Pittosporum* (Pittosporaceae).

She commented that the Singapore Herbarium has an excellent collection of the three species complexes she is currently studying (*Pittosporum ferrugineum, P. moluccanum* and *P. pullifolium*), as well as a wide range of other *Pittosporum* species from the region. Aided by two NParks' staff (S.K. Ganesan and Ali Ibrahim), Lindy discovered a population of *Pittosporum ferrugineum* in full flower and fruit in a remnant patch of woodland behind the Changi Chapel, and another population in the Woodlands area. The specimens made from these two places are the first substantial collection of this species in Singapore, and for that matter, anywhere in this region, for over a decade. She was here from the 2nd to the 10th February 2007.

Events

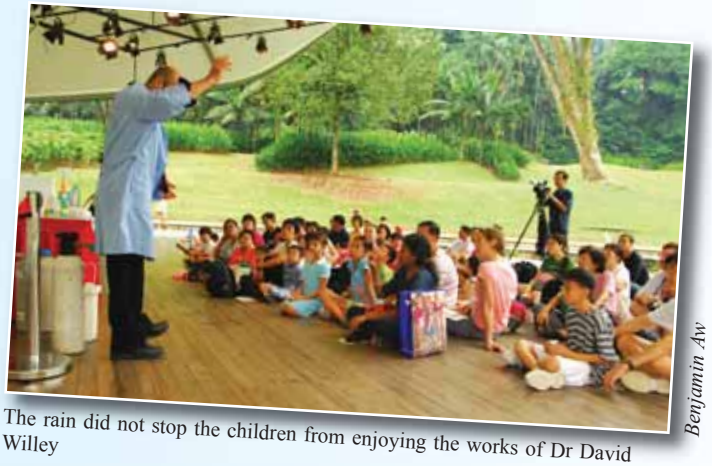
Nurturing Your Mind

"Nurturing your Mind" was an experiential talk series jointly organized with the Health Promotion Board to promote mental well being through talks and hands-on sessions on building mental and emotional resilience. Kick-started in June at the Botany Centre's Function Hall, members of the public were treated to an array of monthly talks and activities on '*Breathing Away from Stress', 'Uncovering the Secret to Building Positive Self-Esteem'* and *'Beating the Blues….Coping with Depression'*. In the hustle and bustle of life in today's world, it is increasingly important to maintain our mental health and physical well-being.

In October 2007, members of the public were treated to a talk on how to manage anger

Science in the Gardens

The beauty of science came into full bloom on 8th September. The Gardens' visitors had the opportunity to explore science in the midst of serenity and fresh air at "Celebrate Science 07", an event jointly organised with the Singapore Science Centre. On offer were activities like making an instrument that can mimic the sound of rain, calculating the height of trees with just a piece of paper, and more. There were also engaging science exhibits that intrigued the visitors' imagination. In attendance was Dr David Willey, a science celebrity from the United States who performed many fascinating science demonstrations and even walked on glass! Although rain accompanied the event, young visitors thoroughly enjoyed the experience. Everyone left with renewed enthusiasm for the sciences.



Benjamin Aw

The rain did not stop the children from enjoying the works of Dr David Willey

Launch of the National Healthy Lifestyle Campaign & Singapore Botanic Gardens Calendar 2008

The Launch of the National Healthy Lifestyle Campaign 2007 on 22nd September was officiated by Prime Minister Lee Hsien Loong. Focusing on mental well-being, the theme for this year's campaign was "Happy Mind, Happy Life". Numerous booths, exhibitions and classes were set-up all over the Gardens to provide information and suggestions on the various activities that one can take up to attain mental well-being.

The Gardens also launched its 2008 calendar at the event. This calendar showcases photographs taken by long-time patron of the Gardens, Lady Yuen-Peng McNeice, who had just celebrated her 90th birthday. It is her zest for life and passion for nature that has helped her keep active,

SBG Archives

Lady McNeice gifted Prime Minister Lee Hsien Loong with a copy of the Singapore Botanic Gardens calendar

both mentally and physically. Her photos of alpine plants were well received by all. The Gardens' calendar is a community project sponsored by ExxonMobil Asia Pacific since 2002. All proceeds from the sale of the calendar go towards our Public Exhibition Programme.

Official Opening of Jacob Ballas Children's Garden

The Jacob Ballas Children's Garden is Asia's first children's garden. Dedicated to all children of Singapore, it is designed to provide unique discovery and learning experiences on plants, conservation and environment. Launched on Children's Day, 1 October, guests at the opening ceremony were treated to a performance by a lion dance troupe of children, who amazed everyone with their skill and dexterity. Dr Yaacob Ibrahim, Minister for the Environment and Water Resources, graced the occasion as the Guest-of-Honour. Colleagues who had earlier attended classes on balloon sculpting and face painting also entertained our young visitors during the launch. The Jacob Ballas Children's Garden is developed with the support of the Jacob Ballas Trust, Dr Rosslyn Leong and Reef Holdings.

SBG Archives

Dr Yaacob was presented with a tray of peeled orange segments arranged in the Chinese character '乐' (meaning 'Joy' in English) after the lion dance

Linnaeus Film Screenings

Part of the Gardens' celebration for the 300th birth anniversary of Carl Linnaeus, organized together with the Embassy of Sweden, was the screening of "*Expedition Linné* – An Adventure on Seven Continents". Shown to a full house at the Botany Centre's Function Hall on 4th October, the audience included, His Excellency Pär Ahlberger, Ambassador of Sweden to Singapore. The event started with a talk on Linnaeus by Professor Bertil Andersson, Provost, Nanyang Technological University. His insightful speech sparked the crowd's interest and set the tone for the film that was to follow.

Expedition Linné brought the viewers through a journey of discovery and awareness of the problems facing our environment today and how we were responsible for its current state. The event closed with a panel discussion led by Professor Leo Tan, Chairman of the Garden City Fund Management Committee, NParks, Professor Peter Ng, Director of the Raffles Museum of Biodiversity Research, NUS, and Dr Benito Tan, the Gardens' Keeper of Herbarium and Library. A second screening was held on 18th October for Singaporean and Swedish exchange students.

Benjamin Aw

From left to right: Prof Peter Ng, Dr Benito Tan and Prof Leo Tan leading the discussion after the screening

Singapore Wildlife Stampede

The Gardens played host to the first ever Singapore Wildlife Stampede on 2nd November and brought together 700 children, youth and adults who dressed up as endangered animals or plants using recycled materials. The parade was a burst of colours and sounds. Participants proved their creative flair with their eye-catching costumes while they marched to the beating of drums. Amongst them were a group of butterflies, a lion and even a 6-legged camel! Themed "Save our Wild Habitats! Save our Species!", the event aimed to spread the message of nature conservation and protection of the environment.

Organised with the Jane Goodall Institute of Singapore, the kilometre-long parade started at the Jacob Ballas Children's Garden and ended at the Shaw Foundation Symphony Stage with performances by school and environmental groups.

Benjamin Aw

Dr Jane Goodall, renowned primatologist and conservationist, led the parade together with Dr Chin See Chung, Director of the Gardens

Yusof Nahrawi
Visitor Services

Celebration of the 300th Birth Anniversary of Carl Linnaeus

On 2nd Aug 2007, the Gardens in collaboration with the Swedish Embassy in Singapore, launched a 5-month long exhibition to celebrate the 300th birth anniversary of the remarkable Swedish biologist, Carl or Carolus Linnaeus. Launched at the Botany Centre, the exhibition focused on the life and works of Linnaeus. His most significant contribution to the scientific world was establishing the ranking system of classification and naming of living organisms using a binomial nomenclature system (two words, a genus and a species name as the scientific name of an organism) that is still much in use today.

Mrs Gertrude Looi and Dr Chin See Chung, Director of the Gardens, taking a closer look at the exhibits in the Library of Botany & Horticulture

The Guest-of-Honour for the event was Mrs Gertrude Looi, a Fellow of the Linnean Sociey of London and a keen student on all things Linnaeus. To commemorate the occasion, Mrs Looi presented the Gardens with a rare copy of the 4th edition of *Systema Naturae* (1748 edition), authored by Linnaeus, and two nicely mounted herbarium specimens of *Linnea borealis* (Caprifoliaceae), specimens she had personally collected for this occasion. The genus *Linnea* is described in honour of Linnaeus. And *L. borealis*, commonly known as the Twinflower, a temperate plant first described by Linnaeus himself, is said to be one of his favourite plants, taking it as his personal symbol seen in many of his portraits.

Guest-of-Honour, Mrs Gertrude Looi, FLS, launching the exhibition

Besides a series of posters to mark Linnaeus' achievements, the exhibition also included a display of botanical books written by Linnaeus, as well as plant specimens and botanical paintings of plants named by him.

As part of the launch, Professor Tomas Hallingbäck from the Swedish Agricultural University, Uppsala, Sweden, was invited to give a talk on "Linnaeus and His Garden". He presented the history, design, transformation, preservation and the scientific significance of the world famous garden as built by Linnaeus himself in Uppsala, Sweden.

Over 180 people attended the launch and talk. Apart from that, the Gardens and the Swedish Embassy also put together a series of activities which include guided walks conducted by SBG volunteers and staff, and screening of the film, "The Linnaeus and His Expeditions". The latter was shown again on 4th Oct and 18th Oct. On both occasions, more than a hundred people attended. The exhibition came to an end on the 31st Dec 2007.

Prof Tomas Hallingbäck, a guest speaker invited to give a talk and slide show on "Linnaeus and His Garden"

Benito C. Tan
Herbarium

Janice Yau
Education Outreach

Photos from SBG Archives

Footnote:
The Gardens would like to express their sincere gratitude to the Swedish Ambassador to Singapore, His Excellency Pär Ahlberger, and the Swedish Embassy for the kind collaboration and support in making this exhibition a success.

Mr Ng Lang, CEO, NParks (7th from the right), with the star designers for SGF 2008

"Stars" of Singapore Garden Festival 2008 Unveiled

It was a night of glitz and glamour as over 200 guests marked the launch of Singapore Garden Festival 2008 (SGF) at Burkill Hall on 30th October 2007. Graced by Dr Mohamad Maliki Bin Osman, Parliamentary Secretary for National Development, the evening saw the garden designers, the "Stars" of Singapore Garden Festival 2008 walking down the red carpet. The 20 garden designers come from 13 countries including Singapore. The foreign designers were in town for a familiarisation visit as well as to take a brief on the competition.

For Paris-based designers Mr Dimitri Xenakis and Ms Maro Avrabou who are co-designing a garden, SGF provides them with a much-awaited opportunity to work in Asia. "We are highly interested in the Singapore Garden Festival, in its cosmopolitan dimension, considering it is a place for exchange of new ideas and trends. We believe that our work can emphasize these aspects, by combining western and eastern cultures, techniques and plants. Being artists working in/with nature brings an original dimension to our garden designs where tradition and creativity meet", they said.

Added American designer John Cullen, winner of the 2007 Best of Show and People's Choice Award at the Philadelphia Show, "The opportunity of this Singapore Garden Festival provides a sense of pedigree and opportunity to collaborate with the best designers from around the world. I hope to establish a rolodex of people I could work with".

In addition to the awards for the designers, SGF 2008 will also recognise the talents of local contractors who work with the designers to implement the designs. The inaugural 'Implementing Partner Award' (Gold, Silver and Bronze) will be handed out to the winning implementing contractors.

Another new key component of SGF 2008 is the launch of the SGF Expo. The three-day trade and business event will kick-start on 24th July 2008, a day before the Singapore Garden Festival opens to the public. Targeted at landscape and horticulture professionals from around the world, it seeks to provide an international meeting place for industry players to network, exchange ideas and explore all facets of landscape design and horticulture in Asia. The event, which comprises a trade exhibition and conference, will also showcase new technologies and trends on innovative landscape designs.

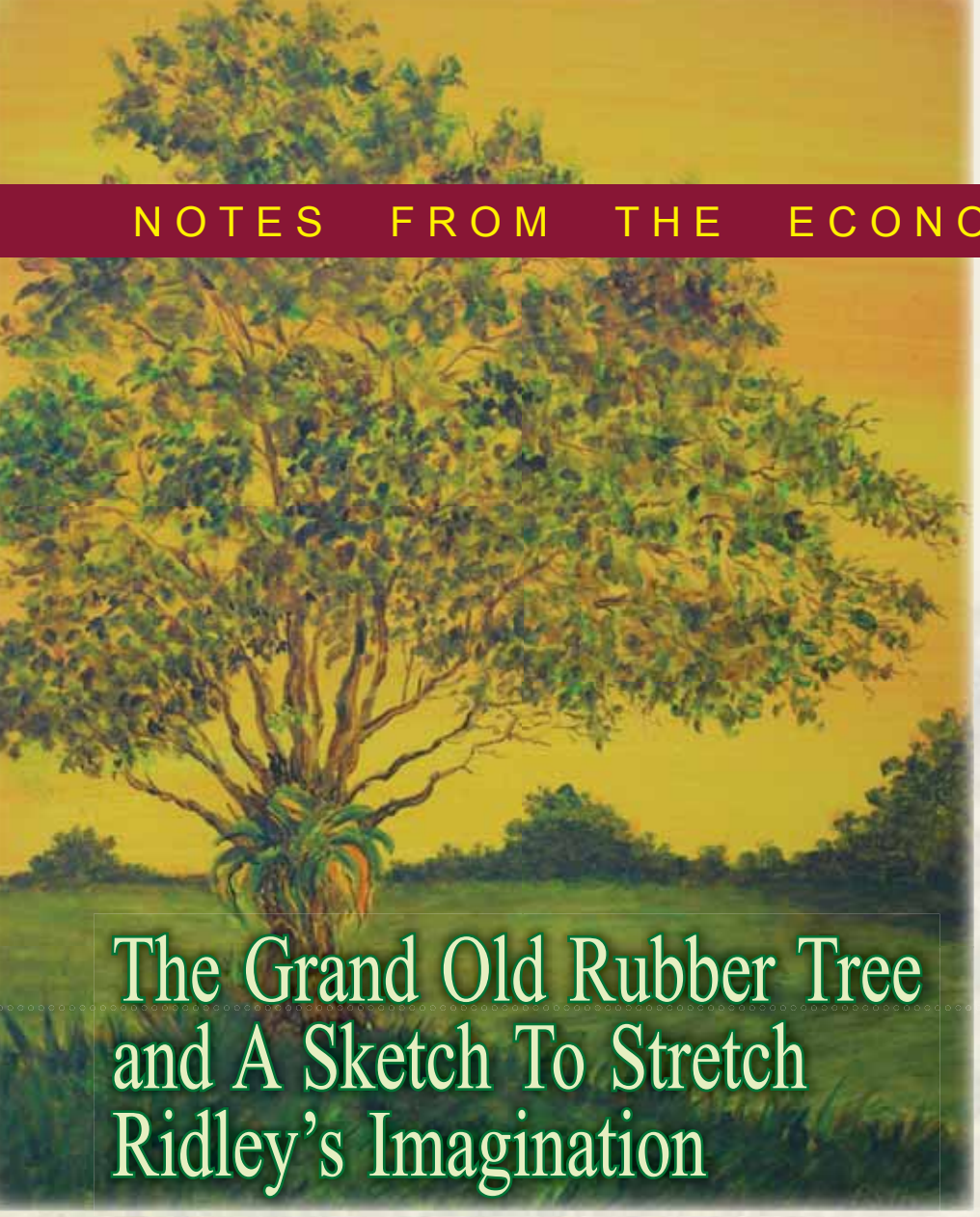
Nico Wissing will be making an encore appearance for SGF 2008

Of this trade component of the Festival, Dr Mohamad Maliki Bin Osman said: "The trade exhibition aims to boost the vast business potential of this industry, while the conference will bring together leading practitioners to share best practices and provide insights into emerging markets and trends driving the industry. The expanded Singapore Garden Festival will be the first international landscape and horticulture event of such scale in Singapore, reflecting our desire to develop Singapore as a centre for horticultural excellence."

Terri Oh
Singapore Garden Festival

Photos from SGF

Footnote:
The second Singapore Garden Festival, SGF 2008, will take place at the Suntec Singapore International Convention and Exhibition Centre between 25th July and 01st August 2008. For more information on this festival, visit our website *www.singaporegardenfestival.com*



The Grand Old Rubber Tree and A Sketch To Stretch Ridley's Imagination

Painting by Mr Tham Pui San of this grand tree

Roots of the Rubber Industry

An important historical arena in the Gardens was the Economic Garden of 41.3 ha, that formed the entire northern half of the Gardens. This occupied the area stretching from the current Visitor Centre vicinity to Bukit Timah Road and included the Sports Centre and the National University of Singapore's law campus. The Economic Garden was added to the existing Gardens of 34.4 ha in 1879 and would remain a part of the Gardens till 1924 when it was taken over for the building of Raffles College (precursor of the National University of Singapore).

A monumental success story related to the Economic Garden was linked to the cultivation of Para Rubber (*Hevea brasiliensis*, Euphorbiaceae). At the turn of the 19th century, rubber was a forest product, harvested in a manner damaging or destructive to trees. The cultivation of this wild crop tree from Brazil was experimented within the Economic Garden. H. N. Ridley, the Director of the Gardens (1888-1912), developed a technique of tapping the tree for its latex in a sustainable manner. He promoted the cultivation of this tree with such a passion that the Gardens became a major supplier of rubber seeds supplying over seven million seeds by 1917. This one crop generated great fortunes for the early planters and for the British Empire. The Economic Garden's position as the home of the rubber industry became entrenched. By 1920, Malaya was producing 50% of the world's rubber and Singapore was pre-eminently the rubber capital of the world.

Closure of the Economic Garden

Before the Economic Garden was closed, an attempt was made to save some genetic material of the historical rubber trees. Buds were taken from two trees identified as the best "milkers', before the trees were felled. These 'mother' trees were second-generation trees raised in 1884 from the original grown from Brazilian seeds.

At least two of the seedlings resulting from the graft of these second generation trees were planted at the Tanglin Core of the Gardens where they would be unaffected by the construction of Raffles College. It is not recorded from where the stock plant (that the buds were grafted onto) came from. The seedlings, genetically the second generation, were planted in 1923 and would be 85 years old in 2008.

Ali Ibrahim

The grand dame as it stands near Botany Centre

The Grand Old Rubber Tree

A grand old tree, from this planting, remains at the Tanglin side of the Gardens and is our only historical rubber tree left. It overlooks the Botany Centre and the Tanglin Gate. It is one of several trees that set the tone at the Botany Centre and provide a reminder of the enduring qualities of experimentation and scholarship. This tree, together with the giant *Calophyllum inophyllum* nearby, determined the boundary of the construction and character of the structures that could be built.

The tree is obviously looking its age. The trunk has a diameter of 80 cm at breast height and the tree is about 20 m tall. There is an abundance of shoots emerging from main branches with many showing the classic morphology of reiteration, where the shoots look like saplings. It is as if the tree is trying to reinvent itself, producing replicas.

It was almost sacrificed in the redevelopment of the Tanglin Core complex. But it endured, though it was severely traumatized when many roots were cut in the excavation works. It is now carefully monitored and nurtured and we hope it will remain a monument for many more years.

Ali Ibrahim
Pulau Ubin

Tham Pui San
Nature Artist

Footnote:
The authors would like to thank the late H. M. Burkill (Director of the Gardens, 1957-1969) for information on the tree provided in a letter to Ali Ibrahim in 1987.

N E W & E X C I T I N G

Duabanga grandiflora
Beremban Bukit, Lampati

A tree with a rather unusual and distinctive form, *Duabanga grandiflora* (Sonneratiaceae), can grow to more than 30 m tall. Its massive branches droop directly from the main trunk with big-leafed twigs dangling down. Each of the oblong leaves is about 25 cm long.

The clusters of big, white and showy flowers are found at the end of the twigs. Each flower is about 10 cm across and being night bloomers, they normally open in the evening at around 7 pm and by sunrise, the petals and stamens would have dropped off. The flowers face downwards and smell faintly of sour milk.

Flowers with petals about to drop off

The big style and fleshy, star-like calyx are persistent in the fruit. The calyx is edible though acidic. Upon maturity, the fruit turns leathery and splits open. The seeds are tiny but numerous.

This species is naturally found from India, Burma, south China (Yunnan), Indo-China to the western part of Southeast Asia. It occurs from the lowlands to about 1,000 m. It can withstand habitats that are occasionally wet.

It has been reported that an extract of the *Duabanga* leaves induces the production of collagen, a protein that is important in maintaining the youthfulness of the skin. This finding has triggered off much interest and this extract is now added to anti-wrinkle skin products. The seeds of this tree have been used in traditional medicine for stomachache, indigestion, food poisoning and heartburn. The wood is a general-purpose timber.

Duabanga grandiflora is a fast growing and elegant tree and is worth some consideration as a street and park tree. A specimen of this can be found in the Economic Garden.

Ants hovering around the young fruits

Duabanga grandiflora with its drooping branches

Andrea Kee
Gardens-by-the-Bay Development

Photos by Andrea Kee

The different shades of the Pink Cassia flower

Nura Abdul Karim

Close up of the striking Pink Cassia flowers

A Sight To Behold ...

Cassia javanica* ssp. *nodosa

This unassuming tree, hardly noticed, shows its splendour when it begins to blossom. Located within Eco-Garden amongst the coffee, rosentella and cocoa trees, *Cassia javanica* ssp. *nodosa* (Leguminosae) is commonly known as Pink Cassia, Apple-Blossom Cassia or Javanese Cassia.

The Pink Cassia thrives in full sun and grows to about 20 m in height–with a nice spreading crown of pale green leaves. This species is common in lowland forest and is naturally distributed in South China, Myanmar, Malaysia, Borneo and Indonesia. The true charm of this tree lies in its inflorescence showing masses of fragrant, rose-pink flowers that gradually fades to the palest pink. This is reminiscent of apple blossoms and hence explains its other common name. The flowers are each about 2.5 to 3.5 cm across and held in short dense clusters along downy branches. After flowering, the tree is still a spectacle to behold with its long cylindrical black pods each about 30 to 40 cm in length. The heartwood of this tree is said to be beautifully marked and is used in Java, Indonesia, in house building. This tree would cheer up any home garden with its blooms. As this plant will do better in a more seasonal climate, its blooming may not be predictable.

Nura Abdul Karim

Long cylindrical pods of the Pink Cassia

Bulbophyllum fletcherianum

Another spectacular bloomer is an orchid found in the National Orchid Garden's Cool House. Amongst the many orchid species grown on the mossy artificial rocks, is the rare orchid *Bulbophyllum fletcherianum* or Tongue Orchid. This specimen was gifted to the Gardens in 2006. Her previous owner had been growing her for over 20 years without ever seeing her flowering. This orchid has massive strap-shaped leaves that hang stiffly downwards, often over one metre in length. The large leaves are thick, dull green-purple on the upperside and purplish below, giving the orchid its unflattering common name. Native to the mountainous areas of Papua New Guinea, its cultivation has proved difficult. The Tongue Orchid prefers sunny rock outcrops or mossy tree branches to grow and requires high humidity and moist roots to thrive well. This relatively large orchid has a very stout erect flower spike that holds out about 20 finger-like furry, reddish and white flowers.

Bulbophyllum fletcherianum produces foul-smelling flowers that attracts blowflies and carrion beetles as its pollinators. So if you can hold your breath long enough than you just might be able to enjoy this alien-looking beauty up close.

Simon Tan

The incredibly long strap leaves of the Tongue Orchid

Simon Tan

The alien-looking and foul-smelling flowers of the Tongue Orchid

Nura Abdul Karim
Living Collections

Enticing Children to the Jacob Ballas Children's Garden

Children learn best when they are having fun. The Jacob Ballas Children's Garden (JBCG) is designed to be a fun place to give young visitors happy memories and is a wonderful garden to develop their appreciation for plants, conservation and the environment. Organised educational programmes therefore play an important role in facilitating these learning experiences.

Long before the opening of the JBCG on the 1st October 2007, we geared up in the planning and designing of new programmes for this garden. Ranging from short thematic-based tours to in-depth hands-on workshops and talks, a total of 21 different programmes have been designed. These have all been conducted in JBCG for the public since its opening. About 400 children have participated in these programmes, with majority of the workshops fully booked.

Thematic Nature Tours

Nine nature-guided tours were offered. Each is designed with a theme to allow young visitors to learn about the plants in the Children's Garden. To further interest our young visitors, one guided tour "*The Birthday Party. Sara At The Children's Garden*" is designed according to a storyline featuring Sara, a *Botanicosaurus*. This is the third in a series on Sara, an imaginative dinosaur who resides in the Gardens. In this story, her family and friends celebrate her little brother's birthday at JBCG. This programme has received particularly positive response, as the young participants learn about selected interesting plants found in JBCG when they go through the story and complete various tasks in the book.

Those who are familiar with the Sara series will find that two new characters, Sara's little brother and sister, appear in this new publication. A 6-year old boy commented during the tour, "Now that we know Sara's little brother and sister, what about Sara's father?" Perhaps, we will begin another story with Sara's father in the fourth publication of this series.

"*The Birthday Party. Sara At The Children's Garden*" story cum activity book

Thematic Workshops

Following our tradition, three school holiday workshops were conducted at the Children's Garden for our young participants, age 4 - 12 years old at the beginning of the

Jayce Chua

Young participants from the "*Colours in the Garden*" workshop studying the Peacock Flower at JBCG

November/ December school holiday. "*Plants & Me*" provided a comprehensive introduction to our Primary 1-3 participants about plants and their uses. "*Flower Power*" is a more in-depth workshop for Primary 4-6 children about the beauty of flowers as well as their magnificent role in reproduction and pollination. For the little pre-schoolers, "*Colour in the Garden*" introduced to them the colourful world of plants.

Winnie Wong

Young participants from the "*Colours in the Garden*" workshop with their mini gardens

Winnie Wong

A leaf bookmark made out of a Maidenhair Fern by a young participant during the "*Plants & Me*" workshop

In time for the Christmas festivities, our Living Classrooms were filled with children learning the art of making Christmas Dish and Bottle Gardens in our "*Christmas Planting*" Series. To greet the festive season

Winnie Wong

Trainers, William Chue (above) and Jayce Chua (below), showing samples of flowers to the participants during the "*Flower Power*" workshop

Winnie Wong

with the scent of flowers and spices, young visitors had another enjoyable time making nicely fragrant potpourris in "*Smells Like Christmas*".

More to come in 2008

A baking workshop on pineapple tarts, gingerbread boys and girls, 'Fruit'ful guided tour…. Here is just a glimpse of some of the fun-filled programmes for the Children's Garden this year. Do look out for more details at our website *www.sbg.org.sg*

Winnie Wong
Education Outreach

Mandarin Tour for Primary Schools – A First for the Gardens' Education

Friday, 3rd August 2007, marks a first for Education Outreach in the Gardens. Twenty-two students from Queenstown Primary School and a primary school from Suzhou, China, attended a "Flowers @ Work" tour conducted totally in Mandarin by Education Manager Mrs Koh-Low Neok Chein. This is our first attempt in running a programme in Mandarin.

Five educators including the Vice Principal of Queenstown Primary School, Mrs Foo-Ng Tze Leng, accompanied the students as part of the educational exchange between the two schools.

"Flowers @ Work" encourages students to take a closer peek at selected flowering plants. The objective is to enhance the students' understanding of the forms and functions of the various parts of a flower as part of the plants' adaptations to propagate the species.

Beginning at the Gardens' Visitor Centre (Nassim Gate), the group covered Heliconia Walk, Palm Valley, the Ginger Garden and Bandstand. They completed the tour with a visit to the Library of Botany & Horticulture in Botany Centre (Tanglin Gate). The students closely examined flowers that were commonly mentioned in their school textbooks. They studied in detail flowers of Heliconias, the Cannonball Tree (*Couroupita guianensis*), Yellow Creeping Daisy (*Wedelia trilobata*) and Spider Lily (*Hymenocallis speciosa*). They were also introduced to Singapore's national flower, *Vanda* Miss Joaquim. The group was extremely lucky to catch the Illawarra Flame Tree (*Brachychiton acerifolius*) in full bloom at the Sun Garden, as it flowers only once a year.

In the one and half hour programme, students benefited from the lively interaction that took place when they were filling up their worksheets and listening to Mrs Koh's explanation. Vice principal of Queenstown Primary School, Mrs Foo-Ng, commented that the students were impressed with the collection of plants in the Gardens and had developed a greater appreciation for nature after the programme.

David Liew
Janice Yau
Education Outreach

Photos by David Liew

Mrs Koh retrieving the pollinia from the flower of a *Vanda* Miss Joaquim while students look on

The group in front of a sea of *Vanda* Miss Joaquim, Singapore's national flower

FROM THE TAXONOMY CORNER

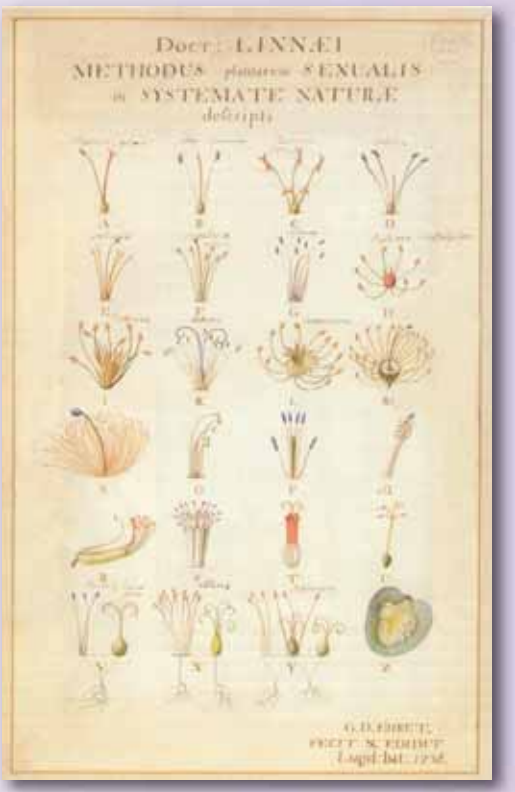
Linnaeus' Sexual System

Carl Linnaeus (1707 – 1778) made numerous lasting contributions to science, among them the binomial system for naming plants and animals that we still use today. This is where every named organism has a binomial name consisting of two words, a genus and species. But not all of his ideas were so long-lived. Consider his Sexual System for classifying plants.

In the early 1700s, naming plants and animals entailed describing them in Latin, then the language used by educated European men to communicate with one another. These early scientific names in Latin were often full sentences and as the number of new species increased rapidly during European exploration of the world, trying to remember and organize these names became more and more difficult.

Linnaeus devised the binomial system after realizing that his students had an easier time remembering names consisting of just two words than they did a long sentence. That took care of one problem: remembering long Latin names. But how could these shorter names be organized into a system that grouped plants with similar structures together? That is where things "got sexual" as it were.

As a young man Linnaeus was exposed to the ideas of Vaillant, who revolutionized scientific thinking about plants when he proposed that plants were sexual and the flowers contained the sex organs: the stamens were the 'male' parts and the pistils, the 'female'. Linnaeus took this idea and ran with it: in 1735 he published the *Systema Naturae* and the plants in it were organized according to a '*systema sexuale*' or sexual system. The method was brilliant and simple: count the number of male parts in the flower—this determined which of 24 Classes the plant belonged to—then count the number of female parts—this determined the Order—and the plant could then be classified. One year later (1736) the German botanical artist Ehret created a plate illustrating the 24 Classes, which provided an easy visual method for grasping the concepts of the Sexual System. Linnaeus used this system in all his publications about plants and it was widely adopted in Europe until the early 1800s.



Linnaeus' Sexual System with the 24 Classes (taken from the book *Order Out of Chaos* by Charlie Jarvis). Page scanned with permission from The Natural History Museum, London, UK

While it is hard to see now just what all the excitement was about, the Sexual System created a furor at the time. Linnaeus explained the Sexual System based on an analogy with marriage, where the stamens represented men or husbands, and the pistils represented women or wives. And his language left nothing to the imagination, for example *stamina tria in flore hermaphrodito* (three husbands in the same marriage with one woman). The analogy with marriage was something that every god-fearing Christian could relate to, and not every one of them appreciated the way Linnaeus' mind worked.

The Sexual System was described as a "lewd method" and one of Linnaeus' most bitter opponents, the Russian Johann Siegesbeck, wrote that "such loathsome harlotry" as several males to one female would never have been permitted in the vegetable kingdom by the Creator and wondered how anyone could teach "so licentious a method" to students. All of which did a great deal to make the name Linnaeus known through Europe. As a professor in the University of Uppsala, Sweden, his classes were filled to capacity. Sex sells, a fact that's just as true today as it was in the 1700s.

The Sexual System did not long survive it's originator. Linnaeus died in 1778 and within 30 years the Sexual System had all but disappeared from teaching and botanical reference books. As taxonomy advanced, other more scientific methods for classifying plants were devised, using all the plants' features rather then merely the number of stamens and pistils. Linnaeus knew his Sexual System was artificial and before his death, he published his early ideas about a better system for classifying plants in the *Fragmenta Methodi Naturalis* (Fragments of a Natural System). Today the Sexual System has been consigned to the dustbin of history, and is largely forgotten.

George Staples
Herbarium

A close-up view of the flowers of *Dendrobium* x *usitae*

Hubert Kurzweil

Leafless stem with clusters of flowers

Dendrobium x *usitae*

Dendrobium x *usitae*, an orchid with striking orange-red blooms recently came into flower in the Cool House of the National Orchid Garden. Discovered only 13 years ago on the northern Philippine island of Calayan, it was described as new by the Japanese botanist Tomohisa Yukawa and named after its collector Mr V.T. Usita.

However, Yukawa immediately realised that the plant is intermediate in most characters between two other dendrobiums growing in the same area, *Dendrobium bullenianum* and *D. goldschmidtianum*. It was consequently interpreted as a natural hybrid between them. *Dendrobium* x *usitae* is placed under the orchid section called *Pedilonum,* which also contains the common and widespread Toothbrush Dendrobium, *D. secundum*, regularly seen flowering in the Orchidarium of the National Orchid Garden.

Jassy Phua

The common *Dendrobium secundum*, falling under the section *Pedilonum,* as *D.* x *usitae*

The pendulous stems of *Dendrobium* x *usitae* can reach a length of 60 cm and bear densely packed clusters of widely open flowers. Like in several other *Dendrobium* species, the stems are leafless in the flowering season. Each individual flower measures about 1.5 cm across, and has brilliantly-coloured orange-red sepals and petals with reddish purple stripes. The flowers last about 2 to 3 weeks.

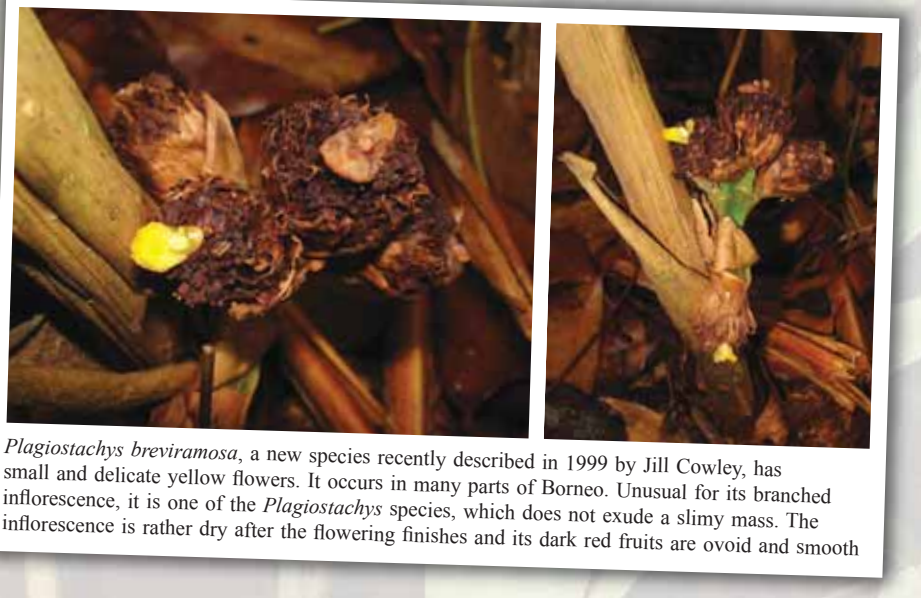
In its native habitat, *Dendrobium* x *usitae* is epiphytic, growing on trees at an elevation of between 500 and 700 m. It flowers from late winter to spring when the temperature drops to between 15 and 19 degrees Celsius. Due to the fairly high altitude, the plants are best cultivated in our Cool House, where they are grown under bright filtered light.

Hubert Kurzweil
Herbarium

Yam Tim Wing
Orchid Breeding and Micropropagation

The Genus *Plagiostachys*

This genus was first established in 1899 by the former director of the Gardens, H.N. Ridley. Since then, almost 30 species have been described from Indochina to Malesia, with its centre of diversity in Borneo. These stately gingers have usually rather small flowers. These are tightly arranged in dense slanting spikes, which break out from the leafy shoot usually somewhere in the middle or lower half of the pseudostem, and rarely close to the ground. Their inflorescences are often covered in a slimy mass. The peculiar position of inflorescence inspired Ridley to choose its botanical name based on the Greek words *Plagio* meaning oblique and *stachys* refering to the spike-like inflorescence.



Plagiostachys breviramosa, a new species recently described in 1999 by Jill Cowley, has small and delicate yellow flowers. It occurs in many parts of Borneo. Unusual for its branched inflorescence, it is one of the *Plagiostachys* species, which does not exude a slimy mass. The inflorescence is rather dry after the flowering finishes and its dark red fruits are ovoid and smooth

The study of this genus is particularly challenging as most flowers of *Plagiostachys* tend to quickly disintegrate into slimy thick mass. However modern molecular approaches may clarify the position of this genus especially in relation to the genus *Alpinia,* which seems closely related. Recent DNA-based studies of the tribe *Alpinieae* (where genera *Alpinia*, *Plagiostachys*, *Amomum* and several others belong) have shown that some members of the genus *Plagiostachys* may actually be closer to others in the genus *Alpinia*. Unfortunately, gardeners may have to put up with likely name changes in the near future.

Jana Leong-Skornickova
Herbarium

Photos by Jana Leong-Skornickova

Plagiostachys albiflora is one of the first species described. Found on Mt. Kukub in Johor State, Peninsular Malaysia in 1908 by Ridley, this species seem to be widely distributed. In Borneo, it is reported to grow abundantly in wet places on the edges of lowland forests. It displays a certain level of variability requiring detailed studies of living materials and molecular studies to elucidate this species complex. Under the magnifying lens, the tiny flower of *P. albiflora* (less than 1 cm long) reveals its beauty with its single stamen placed above the petal-like labellum. The specific name *albiflora*, means 'white flower'. Interestingly enough, with the yellow centre of the labellum and red lines at its edges, the flowers are not really white, as one would expect. Fortunately, Ridley's original description published for this species mentioned this colour pattern, removing doubts of the identity of this species

Plagiostachys crocydocalyx is one of the stateliest species widely distributed in Borneo. German botanist K. Schumann originally described it as a member of the genus *Alpinia* in 1899, but the species was transferred to the genus *Plagiostachys* in 1972. Its round fruits are full of aromatic seeds with sour-sweet aril. Local people often chew them

The Genus *Roscoea*

by Jill Cowley

Published in 2007 by The Royal Botanic Gardens, Kew. 190 pages, colour photographs, watercolour paintings & line drawings. Price GBP 35.

Gingers, though with splendid foliage and beautiful flowers, are better known as spices. Lately, they have become increasingly popular as ornamental plants, with many new books written about them.

Here is another new book dealing with the rather small genus *Roscoea* - a native to India, Nepal, China, Bhutan and Burma. These small, hardy and predominantly Himalayan gingers with rather large orchid-like flowers grow at an altitude of between 1,000-5,000 m above sea level. This makes cultivation in temperate climates possible as they can adapt to the outdoor conditions there.

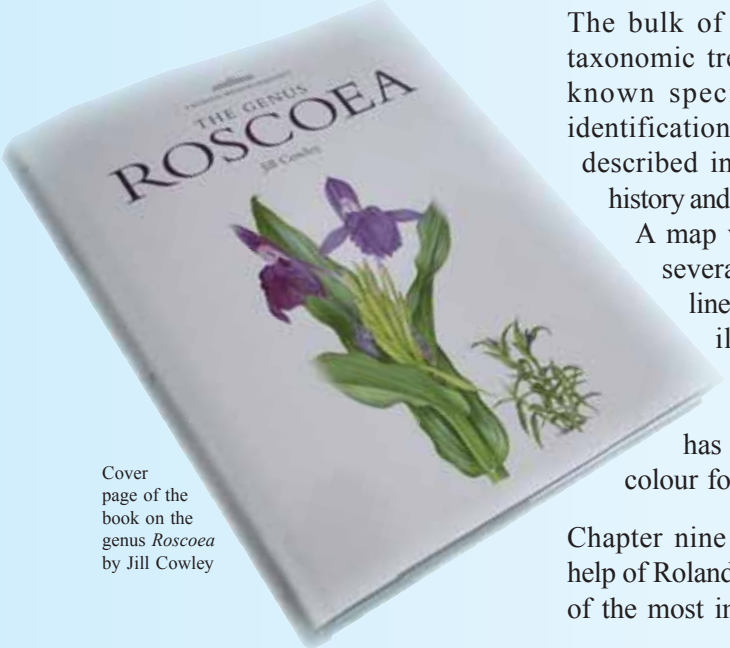
Jill Cowley started working on the genus in 1972. She has published a botanical revision of *Roscoea* in 1982, which forms the basis for this book. From three field expeditions to China, she had the opportunity to observe this group of plants in their natural habitats and their variability. She brings the beauty of *Roscoea* to readers through the many colour photographs.

The book, with ten chapters, is a proper scientific monograph of the genus. However, many of these chapters will also be of interest to the laymen and enthusiasts. Whilst the first chapters describe the history of the genus *Roscoea*, the third is dedicated to William Roscoe – the man in whose honour the genus was named.

The subsequent chapters introduce ginger morphology with an emphasis on *Roscoea* as well as a discussion on the latest information on cytology, anatomy, palynology and phylogeny. A section on ecology and conservation with an insight to its cultivation is also included.

The bulk of the book covers the taxonomic treatment of all twenty known species and includes an identification key. Each species is described in detail with notes on history and nomenclature provided. A map with distribution data, several colour photographs, line drawings and botanical illustrations have been included for almost every species. Cowley has also described ten new colour forms in this book.

Chapter nine was written with the help of Roland Bream, who holds one of the most important collections of *Roscoea* in UK. This chapter deals with hybrids and cultivars, which has appeared in the horticultural trade over the past 80 years. The last chapter was written by Richard Wilford and deals with the cultivation and propagation of *Roscoea* species in gardens as well as in glasshouses.



Cover page of the book on the genus *Roscoea* by Jill Cowley

A page showing one of the many striking botanical illustrations. Picture taken with kind permission from The Royal Botanic Gardens, Kew, London

This book is one of those you will love to just flip through the pages and enjoy even without reading. The gorgeous 20 full-page botanical paintings, mostly by Christabel King, makes the book worth having not only for horticulturists and botanists, but also to lovers of fine botanical art.

Jana Leong-Skornickova
Herbarium

Photos by Jana Leong-Skornickova

KEY VISITORS TO THE GARDENS (JULY TO DECEMBER 2007)

Name	From
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Mr Alven Lam	Director of International Affairs, Dept of the Housing & Urban Development, USA
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Mr Arvin C. Diesuos	National Museum of the Philippines, Philippines
DatukAzizah Datuk Seri Mohd Dun	Deputy Minister of Housing and Local Government, Malaysia
Dr Cao Tong	Shanghai Normal University, People's Republic of China
Ms Chang Ying	University British Columbia, Canada
Dr Charles Clarke	James Cook University, Cairns, Australia
Mr Chen Chia-Chin	Director, Parks & Street Lights Department of Taipei, Taiwan
Mr Chen Jianfu	Secretary General, Chinese People's Institute of Foreign Affairs, People's Republic of China
Mr Ch'ien Lee	Sarawak, Malaysia
Mr Chin Siew Wai	University of California, Davis, USA
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Ms Chua Siew Chin	Centre for Tropical Forest Science, Singapore
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Dr Don R. Reynolds	University of California, Berkeley, USA
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Dr Ed de Vogel	National Herbarium of the Netherlands, the Netherlands
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Mr Guy Lauwers	Vice Mayor, Antwerp, Belgium
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Mrs Hau Lung-bin	Spouse of Taipei City Mayor, Taiwan
Dr Helen Pang Yoke Kien	Universiti Brunei Darussalam, Brunei Darussalam
Dr Hernawati Akhriadi	Herbarium University Andalas, Indonesia
Ms Hgo Kang Min	Centre for Tropical Forest Science, Singapore
Mr Ho Boon Chuan	Bonn University, Germany
Ms Janet Gagul	University of Papua New Guinea, Papua New Guinea
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Mr Kazuya Kitamura	Chief Examiner, General Secretariat of Yamaguchi Municipal Development Corporation, Japan
Mr Khoo Ming Sheng	Centre for Tropical Forest Science, Singapore
Dr and Mrs L. Jan Slikkerveer	National Herbarium of the Netherlands, the Netherlands
Ms Lim Mei Ling	Royal Botanic Gardens, Kew, UK
Mr Lin Canling	Vice Mayor, People's Government of Fangchenggang, People's Republic of China
General Liu Dongdong	Commander of Ji Nan Military Region, People's Republic of China

Name	From
Mr Masaaki Nagamoto	Urban Landscape Div City Maintenance & Coordination Dept, Miyazaki, Japan
HE Dr Mehmet Mehdi Eker	Minister of Agriculture and Rural Affairs, Turkey
Mr Mohd Zamakhsyary Mustapa	Universiti Putra Malaysia, Malaysia
Honourable Murray Gleeson	Chief Justice of Australia, Australia
Mr Nasser Al-Ghamdi	Deputy Director General, Royal Commission Jubail, Saudi Arabia
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Mdm Tran Thanh Kiem	Spouse of the Prime Minister of Socialist Republic of Vietnam
Dr Weerachai Nanakorn	Director, Queen Sirikit Botanic Gardens, Thailand
Mr Zhang Fuli	Deputy Director, Huairou District of Beijing, People's Republic of China
Mr Zhang Jingyuan	Vice Mayor of Baoji City, Shanxi Province, People's Republic of China
Mr Zolkoplie bin Mustafa	Putrajaya Corporation, Malaysia

Madam Tran Thanh Kiem, spouse of the Prime Minister of Socialist Republic of Vietnam as she names *Dendrobium* NguyenTan Dung 'Tran Thanh Kiem' on the 14th Aug 2007

Species and *Genera Plantarum*

In the early to mid 18th century, scientists noted that naming species – not to mention arranging them according to a systematic hierarchy - became problematic as more and more were discovered. When Carl Linnaeus established the binomial system for naming and classifying plants, gone was the method to link long chains of adjectives and references used to describe species.

First published in 1753 and written by Linnaeus, *Species Plantarum* was a work to account for all the kinds of plants then known to the world, to classify them according to a simple system. Linnaeus devised a sexual system of classification based on the number of stamens (male parts) and pistils (female parts) – see article on Linnaeus Sexual System on page 33.

Though this artificial system has long been put aside for a more dynamic scientific methodology, the naming system is still used today where organisms are given a binomial name. This publication is arguably one of the most significant titles in plant taxonomy. Of prime importance is that it marks the starting point of naming of plants as it exists today.

Genera Plantarum is said to be the 'starting point of modern systematic botany'. First published in 1737, Linnaeus reworked the ideas of Joseph Pitton de Tournefort (1656 – 1708), who first defined the concept of genus for plants. This publication provides the generic descriptions which fit with species descriptions in *Species Plantarum*.

Both these publications have gone through many editions, continuing well after Linnaeus' death in 1778. A copy of the 3rd Edition of *Species Plantarum* and the 5th Edition of *Genera Plantarum* is kept within the Rare Book collection of the Gardens' Library.

Hassan Ibrahim
Library

Photos by Hassan Ibrahim

The two publications as displayed in the Library in celebration of Linnaeus' 300th birth anniversary
(see article on page 24)

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