Gardenwise

THE NEWSLETTER OF THE SINGAPORE BOTANIC GARDENS, VOL IX, JULY 1997 ISSN 0129 - 1688

MESSAGE MESSAGE MESSAGE FROM THE CEO....

In July 1997, the National Parks Board celebrates its first birthday. Doubletake. Hasn't the Board been around for so long that it is now known by its acronym **NParks**? Yes indeed. The Board came into existence in June 1990. But, as the marketing men would say, the bigger, better, new and improved version only came into existence in July 1996.

We are still in the throes of adjusting to the merger of the Parks and Recreation Department and the former NParks to form the new National Parks Board. In fact, the bulk of the staff from the former Parks and Recreation Department not only have to adjust to the change of working in a government department to operating as members of a statutory body, but they must also become used to being part of a larger organisation which includes the staff of the former NParks. What we now have is a statutory board with a staff establishment totalling 591 permanent members and 468 day labourers. Our operating expenditure in the current fiscal year is S$79,300,000.00, with an additional S$31,168,190.00 for development projects. Translate these figures into re-apportioned work loads and responsibilities, and it becomes clear why the staff require some time to re-orient and settle down.

To speed up the process of adjustment within NParks, the senior staff held a staff conference in a modest retreat. Sequestered in the appropriately named Orchid Inn, a shared vision was forged, and a new mission statement agreed upon: **We make Singapore our Garden.** With this bold statement, we have set as our primary objective the creation of a garden environment in which the people of Singapore will live, work and play. To underline this commitment, the headquarters of the Board will be re-located within the heart of the premier garden of the nation. What better source of inspiration for the task at hand?

The Singapore Botanic Gardens in turn must fullfil its twin roles of a premier botanic institution as well as the flagship park and site of the Board. The physical attributes of the Gardens as a tranquil and aesthetically pleasing amenity wherein the fruits of the labour of tropical botanists and horticulturists are on display have long been enjoyed and admired by millions of visitors. Besides being the repository of important historical living, preserved and printed botanical reference collections, it is also the seat of botanical and horticultural research, education and training. Lay and professional botanists and horticulturists gravitate to the Gardens to meet, work and disseminate their expertise.

The unique situation of having the NParks headquarters in the Singapore Botanic Gardens is that here is gathered the very nourishment which is needed to sustain our staff in their work. Institutional knowledge and memory in tropical botany and horticulture can now be combined with that in tropical park and greenery development, management and maintenance, and stored for ready access. This motherlode will ensure that the quality of work of the Board is sustained at a high level. The newest equipment and products, the latest innovations and the freshest approaches can readily be made available to the staff. In sum, the headquarters is situated plumb centre where the many needs and requirements of professionals in tropical botany and horticulture can best be met.

The Gardens in turn must respond with renewed vigour in adhering to its dynamic re-development programme to transform itself from a pretty, tranquil green lung into the strong and vital heart of NParks. In so doing, it will surely blaze a trail as a new generation botanic garden of the future.

Dr Tan Wee Kiat

C O N T E N T S

Front Cover:
The spectacular ' Double Coconut' in the Gardens; the fruits in the foreground are one year old.

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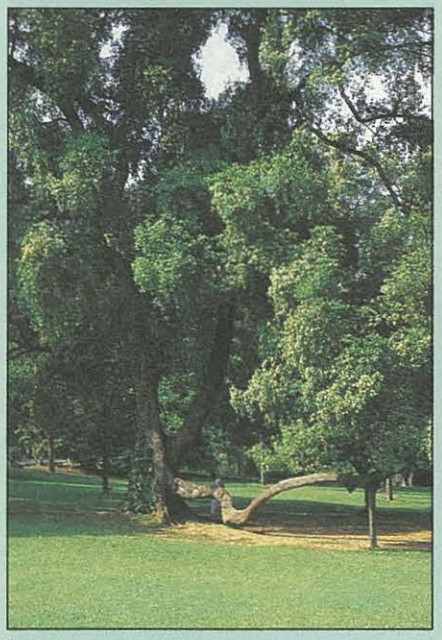
The Magnificent Tembusu

In The Beginning, 1840-1860

In 1859 when the Singapore Botanic Gardens was established at its present site, the southern area bordered by what is now Cluny Road, Tyersall Avenue and Holland Road, was under a relatively low scrubby vegetation. The area had been cleared of high forest and used for Gambir cultivation before being abandoned, probably in the 1840's.



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When man stopped cultivating the land, nature reasserted itself. From seeds stored in the ground, from seeds freshly deposited by birds and fruit bats and from those brought in by wind, the forest began regenerating. The seed of this tembusu tree, together with those of many other species, had been brought in by fruit eating birds. When they moved on after feeding and perch elsewhere, the birds had deposited the seeds which had passed through their guts unharmed. The nutrients in this tiny amount of waste served as nourishment for the fragile seeds as they pushed their first leaves into the air.

The heavy yellow clay soil was poorly drained and aerated, yet this tembusu thrived. Nourished by the bright sunshine and the frequent rains, its roots spread widely to gather scarce nutrient from a soil impoverished by multiple crops of Gambir. It developed a conical form typical of the saplings of this species. From its vertical stem many branches developed with upturned ends; towards the base many of the lower branches were horizontal before arching up. The tree was covered in shiny light green leaves almost to the ground. Around it, the forest grew denser and more varied as new plants established.

Rainstorms often lashed the area and small branches would sometimes be wrenched from the tree. But the tree, now firmly rooted, grew taller and stronger with the passing of the years. It grew slowly, producing a pair of leaves at a time, from the ends of its fine twigs where its young buds are protected from the burning sun by a layer of varnish-like exudate. The girth increased imperceptible as cell by cell, fibre by fibre, its substance was laid down. The woody tissue was a pale yellow and hard, very hard. Man found its wood most suitable for house and bridge building. It also became the most popular wood for chopping boards, and remains so still.

One day, after a drought period of two weeks, a carelessly thrown cigar butt, fanned by the warm breeze ignited the hot dry forest. The fire driven by a strengthening westerly breeze consumed much of the understorey ferns and shrubs. It singed most of the leaves of this tree and threatened its existence. But its thick bark saved the tree. Only a strip on one side where there was a particularly dense accumulation of dried litter was burnt through. Very soon after, the fire passed by, to gradually burn itself out. In the months to follow the young tree recovered. New twigs and new leaves clothed the tree again; the forest too recovered and was soon green. Eventually as the tree increased in girth, the scar was enclosed in wood, to become a permanent reminder, and record, of this fire.

1860-1970

In the early 1860's the secondary forest in this part of the Gardens was cleared to establish the roads and lawns. This bushy tembusu with a lovely compact form,

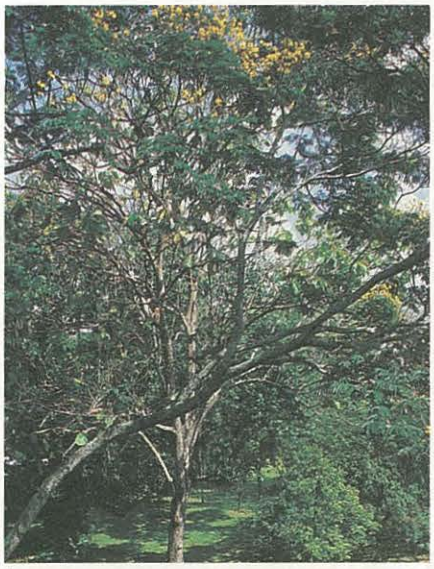
1. The Tembusu (*Fagraea fragrans*) in bloom
2. The branch that distinguishes this prized tree

continued on pg 16

A Room With A View

As you land your foot on the last step, you heave a sigh of relief and rest to catch your breath. Take a few more steps and enter the room to your right. Welcome to a room with a view and listen to the rhythm of life.....

Your eyes sweep casually across a panoramic view of a rich biodiversity of flora and fauna framed on the left by a *Baphia* fence that screens off the busy traffic and the hustle bustle of mundane life and on the right by the *Bauhinia* lawn.



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1. A vista from the room with a view.
2. The Common Flying Dragon scuttles up the Yellow Flame tree.
3. The Asian Brown Flycatcher eludes the vigilant Singapore Immigration Department to visit its favourite Yellow Flame refuge.
4. The White-vented Myna takes a rest from its untidy nest-building.
5. The Collared Kingfisher surveys from a vantage-branch.

As you telescope in from near to far, *Peltophorum pterocarpum* (Yellow Flame), *Pterocarpus indicus* (Angsana), *Tectona grandis* (Teak), *Calophyllum inophyllum* (Penaga laut), *Byrsonima crassifolia, Hevea brasiliensis* (Rubber), *Podocarpus rumphii,* and an elegant *Pometia pinnata* (Kasai daun besar) gradually come into focus.

Closer, framing the scene, a magnificent *P. pterocarpum* is decorated with yellow flowers, which constantly attract the Giant Honey Bee, *Megapis dorsata* and the Carpenter Bee, *Xylocopa latipes*. The sympodial structure of the crown gives the yellow flame an air of hospitality, providing a much welcomed shade for Singapore Botanic Gardens' visitors. In the meantime, you are distracted by the multiple activities at the different altitudinal levels. The Plaintain Squirrel (*Callosciurus notatus*) playfully dashes up and down the branches and trunk of *P. pterocarpum* deftly. The white, black and orange strips outlining both sides of its body add a touch of colour to its otherwise dull brown fur. Presently, in a demonstration of machismo in the Animal Kingdom, two male specimens of the Common Flying Dragon (*Draco volans*) try to outdo each other in the flashing of the conspicuous yellow flag. This structure protrudes from the reptile's throat. Its name is a misnomer — it is not a dragon but a reptile from the taxonomic family Agamidae. Surely Respighi could have been inspired by the cacophony of bird songs and sounds provided by a dawn chorus of the Common Koel (*Eudynamys scolopacea*), the Black-naped Oriole (*Oriolus chinensis*), the Yellow-vented Bulbul (*Pycnonotus goiavier*), and the Spotted Dove (*Streptopelia chinensis*). A pleasingly persistent *'ku-ku-kurr'* of the Spotted Dove is often interspersed with the bubbling sweet musical chuckle of the Yellow-vented Bulbul and the melodious fluty whistles of the Black-naped Oriole. The loud syncopated *ko-el*, repeated *ala crescendo*, of the Common Koel occasionally breaks the monotony of the day.

Singapore also plays host to tourist other than a human kind: the Asian Brown Flycatcher (*Muscicapa dauurica*) is a 13 cm greyish brown bird with a prominent white eye-ring. It makes its annual pilgrimage to Singapore from late August and

stays until April to escape the severe winter of Central Asia.

As you can see, the Yellow Flame is not just a tree: it plays host to humans and animals as it quietly goes about taking in carbon dioxide prodigiously produced by the greenhouse Earth and giving off the all too precious oxygen in the day time.

The Yellow Flame and the Teak, standing side by side, present a lesson in contrast. The bright cheerful yellow inflorescence of *P. pterocarpum* overshadows the inconspicuous white flowers of *T. grandis*. While the Yellow Flame is covered with brown flat pods, the Teak produces inflated lantern-shaped fruits. The delicately fine pinnate leaves of the *P. pterocarpum* contrast sharply with the enormous plain 'tobacco'-leaves of the *T. grandis*. Even in terms of economic botany, these two trees have different uses: in monsoon countries where the Teak thrives well, it is a valued timber species while the Yellow Flame's horticultural function cannot be understated.

A little further back, *Byrsonima crassifolia* and *Bauhinia racemosa* grace the lawn on either side of the road. *B. crassifolia* with its larger crown and a ramifying root system, serves as a shade provider and soil stabiliser. The smaller *B. racemosa* laden with lilac flowers forms a favourite prop for childplay.

The raucous harsh call of the White-vented Myna (*Acridotheres javanicus*) draws one to its nest on the tray beneath the air-conditioner. The White-vented Myna is an untidy nest-builder. It started to build its nest around February 1997 and its diligent collection of twigs has amassed the stockpile to a fair size now. Was this odd nest site chosen so that the little chicks could be rocked by the gentle vibrations of the air-conditioner?

The Collared Kingfisher (*Halcyon chloris*) announces its presence with its shrill staccato *krerk krerk krerk krerk* laugh. As it flies across the Yellow Flame, its bright turquoise plumage flashes by and one gets a quick glimpse of its distinctive white collar. Occasionally, it perches on a bare branch and waits for an opportune moment to swoop down to an unsuspecting insect or worm. It is usually found in the wetlands, occurring mostly at tidal mangroves, sandy beaches and coastal scrubs. But in recent times, it has been increasingly sighted at inland gardens and parks, probably due to the reduction of its natural habitat. It is one of the eight species of kingfishers found in Singapore.

After this feast for one's eyes, albeit a brief respite, it is time for us at the Nature Conservation Unit to return to the paper-work and the reports and the computer and the meetings.....until it is time again for another panorama from this room with a view.

Chew Ping Ting, Cheryl Chia Saifuddin and Lena Chan
Nature Conservation Unit
Singapore Botanic Gardens

5

"VIP ORCHIDS"

OF THE SINGAPORE BOTANIC GARDENS FOR 1996

As Singapore orchids gained fame internationally, the Government decided to use the opportunity to name new hybrids as agents to promote goodwill and closer ties between nations. Since 1957 the Singapore Government began to honour State Visitors and VIPs from within and outside Singapore by naming selected orchid hybrids after them. This prized collection of "VIP Orchids" has become an important attraction of the National Orchid Garden.

Preparations to name an orchid after a VIP start when a request is received from the Ministry of Foreign Affairs. New orchid hybrids that have not been named and that will be flowering during the time of the naming ceremony will be selected, described and photographed. Lastly, the orchid plants will be "groomed" for the final presentation, by being cleaned and neatly pruned and repotted.

To date the Gardens has named over 90 VIP orchids. The first VIP orchid was named ***Aranthera* Anne Black** in 1956, after Lady Black, wife of former Governor of Singapore, Sir Robert Black.

Last year four new members were added to the Hall of Fame:

***Dendrobium* Jean-Luc Dahanae 'Celia' (*Dendrobium* Alkaff Melissa White x *Dendrobium* Waianae Blush)**

This hybrid was named after the wife of the Prime Minister of Belgium on 26 February 1996 during her visit to the National Orchid Garden. This is a medium-sized *Dendrobium* which grows well in semi-shade. The arching sprays are about 40 cm long with 12 flowers each. The petals and sepals are white grading to peach at the base of the flower while the lip is an attractive peach.

The flowers measure 6 cm wide and 5 cm long.

***Dendrobium* Nursultan Nazabayer 'Sara' (*Dendrobium* Fairy Wong x Autumn Show)**

This hybrid was named after the wife of the President of Republic of Kazakstan on 30 May 1996 to commemorate her visit to the National Orchid Garden. This compact free flowering plant flowers at a height of 45 cm and grows well in partial shade. The semi-erect spray is about 40 cm long with about 14 flowers each. The flower is a phalaenopsis type with overlap between the floral segments. The flower is flat, round and bright pink with a darker pink lip. Each flower is about 7 cm wide and 6 cm long.

***Vanda* Takeshi Numata (*Vanda* Josephine van Brero x *Vanda* Suksumran Blue)**

This hybrid was named after the Governor of Chiba Prefecture, Japan during his visit to the National Orchid Garden on 14 August 1996. This Vanda grows and flowers well in full sun and is suitable for growing in pots or in beds. The flower sprays are about 25 cm long and each carries 8 to 10 flowers. The flowers are large and attractive with colours ranging from bluish to pinkish. The lip is eye catching because its darker shade contrast strongly against the lighter coloured sepals and petals.

***Mokara* WTO (*Mokara* Khaw Phaik Suan x *Ascocenda* Fortune East)**

This hybrid was named to commemorate the World Trade Organisation Conference held in Singapore in December 1996. This robust vandaceous hybrid flowers at 60 cm tall and bears sprays about 40 cm long, each carrying about 15 flowers. The flowers are a brillant yellow or orange with darker spots.

Whang Lay Keng
Assistant Manager/National Orchid Garden
Singapore Botanic Gardens

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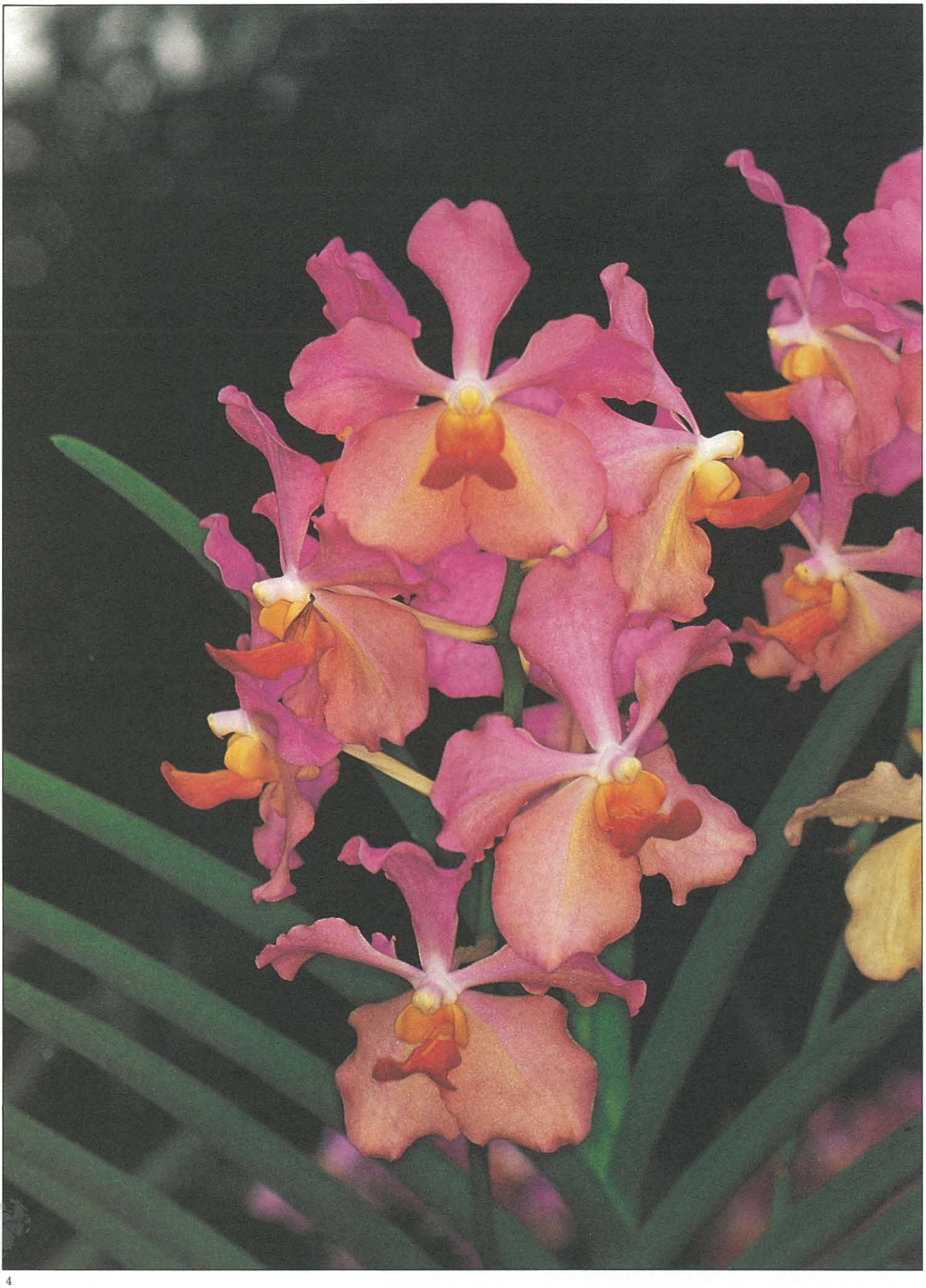
1. *Dendrobium* Jean-Luc Dahanae 'Celia'
2. *Dendrobium* Nursultan Nazabayer 'Sara'
3. *Mokara* WTO
4. *Vanda* Takeshi Numata



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forest plants in Singapore

Forest plant life is very fascinating. There are so many kinds of plants to start with that even a trained botanist may spend his lifetime learning only a portion of the subject. To experience the forest you have only to visit the Nature Reserves - " *one impulse from a vernal wood tells you more than what all books can* " (Wordsworth).

Vegetation / Forest Types

A rich diversity of plant species still exists in our tropical lowland evergreen rainforest. This original vegetation is solely confined to parts of Bukit Timah Nature Reserve, Nee Soon freshwater swamp and relic patches in the central water catchment around MacRitchie, Peirce and Seletar Reservoirs. The primary forest at Bukit Timah is typical of the coastal hill forest type because of the presence of Seraya (*Shorea curtisii*). This species, formally thought to be confined only to the Bukit Timah Nature Reserve, is also found at a primary forest site fringing the MacRitchie Reservoir at approximately 35m above sea level. In Peninsular Malaysia this species is usually restricted to altitudes above 250 metres, on isolated peaks and coastal hills. Seraya trees can be easily recognised by their bluish-grey crowns that stand out like cauliflowers in aerial photographs.

Besides the primary forest, there exists also the secondary forest which makes up the bulk of the forested areas in the nature reserves. This type of forest, simplified in structure and composition, is found at various stages of ecological succession. Secondary forest is the result of past disturbances by man through timber exploitation and various crop cultivation. In a primary forest the trees form a multi-layered closed canopy and the sunlight that filters through to the forest floor results in an environment of low light regime. Here you can walk through the forest amongst the big boles without difficulty. But in a secondary

◀ Emergents with majestic boles belonging to the family Dipterocarpaceae give the forest a primeaval ambience.

forest where there is no complex canopy, the resultant profusion of undergrowth will hamper one's movements.

Forest Stratification

Stratification is a notable feature of the rainforest. The forest typically exhibits three to five layers of vegetation. The uppermost or emergent layer is made up of trees which usually rise to a height of 35 to 50 metres or more. They form a discontinuous layer of wide crowns. The second layer of trees or main canopy below the emergent species is more closely placed and tends to form a continuous canopy. The third layer or understorey is composed of trees shaded by the canopy. The three tree layers are also associated with various populations of climbers, epiphytes and hemi-parasites, distributed according to their light requirements. Apart from the tree layers, there is the shrub layer consisting of shrubs and saplings. Finally, there is the herb layer consisting of seedlings or small, non-woody plants.

Trees

The whole organization of the forest is controlled by the tallest trees at both the emergent and main canopy layers. Although no single tree species dominates the forest community, the presence of giant individuals belonging to the Dipterocarpaceae e.g. **Meranti** (*Shorea spp.*), **Keruing** (*Dipterocarpus spp.*), **Mersawa** (*Anisoptera spp.*), **Merawan** (*Hopea spp.*) and **Resak** (*Vatica spp.*) is overwhelming. Other tree species of equally magnificent stature are **Kempas** (*Koompassia malaccensis*), **Sepul** (*Parishia insignis*), **Jelutong** (*Dyera costulata*), **Keledang** (*Artocarpus lanceifolius*) and **Keranji** (*Dialium platysepalum*). These trees have long, straight trunks and they do not branch till near the top.

▶ *Shorea curtisii* with its bluish-gray crown as seen from an aerial view over the quartz ridge of Klang Gates, Peninsular Malaysia.

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The understorey layer of trees consists of poles or immature individuals from the upper storey and small trees. Here the majority of tree species are of the Euphorbiaceae, Rubiaceae, Annonaceae, Lauraceae, Myristicaceae, and Guttiferae.

Shrubs

The vegetation at the shrub layer is equally diverse. Some of the species, e.g. the tall gingers, look like shrubs, but are not woody and are morphologically herbs. The slender shrub, **Kecubong hutan** (*Rothmannia macrophylla*) has fragrant trumpet-shaped white flowers with a purple-spotted throat. Another shrub, the **Jenjulong** (*Agrostistachys longifolia*) has a litter-collecting rosette of leaves which acts as a reservoir for the plant to trap and obtain additional nutrients. In this layer saplings of **Rengas** (*Gluta wallichii*) are commonly encountered. The sap/ resin of this species (from the mango family, Anacardiaceae, and related to the poison ivy of temperate countries) can cause irritation, rashes and even painful blisters to the skin on contact. Diminutive palms and screw-pines (*Pandanus spp.*) that look like small trees are also represented here.

Herbs

Below the closed canopy of the forest, the uniform environment is characterised by low light intensity, high humidity and a relatively constant temperature. The ground flora has a very controlled microclimate. Plants living in such conditions lose little water by evaporation and can only utilise weak light for photosynthesis. Some of their leaves have a tendency to be broad, thin and even variegated. The incidence of green or blue iridescent foliage demonstrates adaptation for survival in deep forest shade. The leaves of the **Peacock Fern** (*Selaginella willdenowii*) performs a selective function; they are structurally adapted to reflect harmful ultraviolet light while absorbing only visible light essential for photosynthesis. Many of the herbs are aroids, gingers, orchids and ferns.

Climbers, Epiphytes And Hemi-Parasites

It is common to encounter an assemblage of herbaceous climbing plants or woody ones called lianes that take root in the ground but use other plants as supports. They do this in order to reach for sunlight where their foliage and flowers can be exposed. Climbers have modified organs such as tendrils, hooks, twining stems and holdfast-like aerial roots to aid their anchorage and growth. The lengthy and flexible stems of climbers are composed of numerous wide xylem vessels for the translocation of water and mineral elements from roots to the leaves.

In the forest, the ecological role of climbers is a major one as they help to close the canopy and, together with the trees, stabilise the microclimate underneath. Arboreal animal movements and seed dispersal throughout the forest by these frugivores are also facilitated between vine-covered trees. On the other hand, climber-laden trees risk being pulled down by other trees in the event of a fall. Tree growth may be retarded when climbers smother their foliage from above. Climbing palms such as rattans have edible fruits but their prickly whips are things best avoided in one's path through the forest. One of the climbing ferns, **Paku akar** (*Stenochlaena palustris*) has pink and succulent young fronds that are sometimes eaten as a vegetable.

Epiphytes and hemi-parasites normally occur on tree trunks and branches at various levels of the forest structure. **Staghorn Fern** (*Platycerium coronarium*) and **Broad-leaved Hoya** (*Hoya latifolia*) are epiphytic plants which attach or perch on limbs of trees without taking any direct nourishment from their support unlike parasites. Some of the common partial parasites or hemi-parasites are those belonging to the mistletoe family (Loranthaceae).

One category of figs known as 'stranglers' actually starts life as epiphytes when birds or animals deposit seeds on the branches of trees. The aerial roots sent down from above will ramify and eventually coalesce to form a latticework constricting the growth of its host tree. Most roots are contractile and may "compress" the host tree to death.

Other Features Of The Forest

Among the interesting features of the rainforest are trees with spectacular buttresses and stilt-roots which serve as possible means of support. Stilt-roots are a common feature of the mangrove and fresh-water swamp forests where the substrate is soft and inundated by water and less common in the drier forest. Cauliflory or flowers borne on the trunk is one of nature's curiosities in terms of pollination biology. Dipterocarps with two- or three-winged fruits are adapted for wind dispersal. These wings are elongated, persistent flower sepals which cause the fruits to twirl as they fall.

Leaves with drip tips are most prevalent in understorey saplings where the relative humidity is high. These elongated and tapered tips serve to drain water from the leaves and to prevent loss of soluble nutrients by leaching and the formation of epiphylls (algae, fungi, lichens and mosses) which can interfere with the plant's biological functions.

Ants are known to form a symbiotic association with some plants. Within the stipules of **Common Mahang** (*Macaranga triloba*) are found starch grains on which the ants feed; they in turn help to keep predators away from the plant. These ants make holes in the internodes of hollow stems to serve as homes; they also 'excavate' the pith to enlarge their living space.

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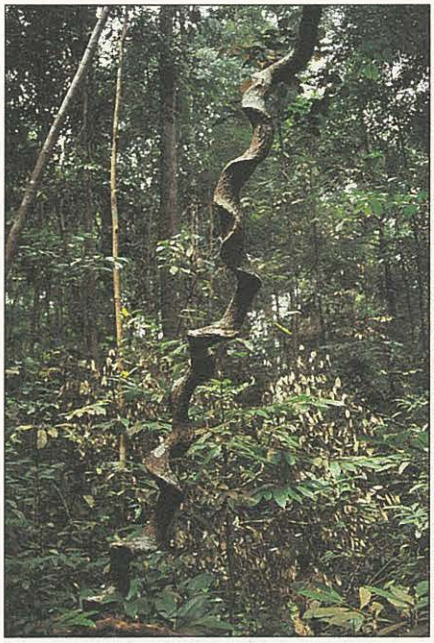

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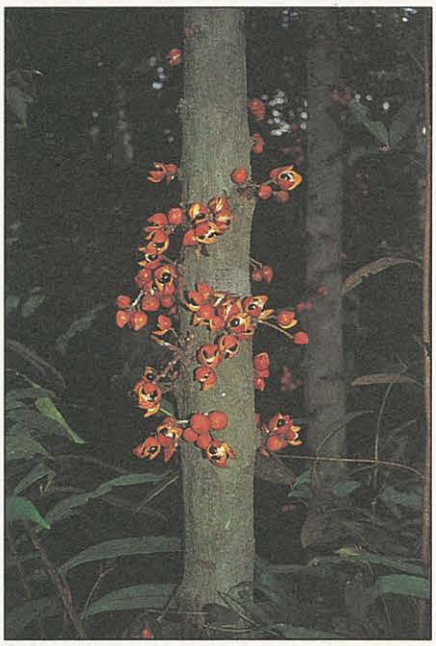

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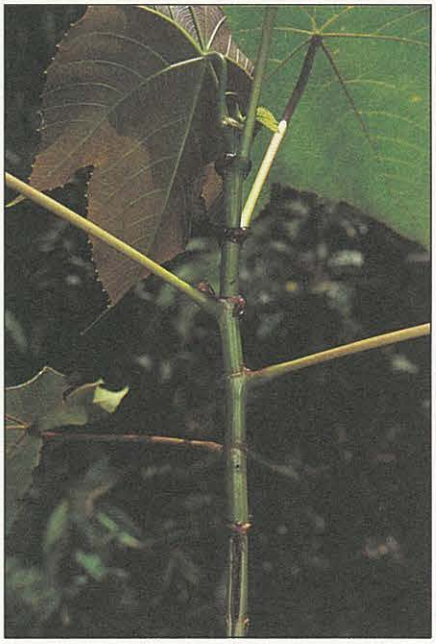

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Dynamics

The state of the forest is dynamic rather than static. Forest gaps are formed in the canopy when trees fall or die. A cycle of growth or regeneration follows. With the opening of the canopy, the increase in light to the forest floor stimulates the growth of seeds, seedlings and saplings. Fast growing pioneers of light-demanding species like **Mahang** (*Macaranga spp.*) **Silver Back** (*Rhodamnia cinerea*), **Balek angin** (*Mallotus paniculatus*) and **Tiup-tiup** (*Adinandra dumosa*) may grow first, to be overtaken and shaded by climax (primary) forest species which follow. Provided the conditions are favourable for regeneration, a virgin forest that is severely disturbed can take a very long time to revert back to a semblance of its original (or near original) state once it has been reduced to a secondary forest. Such is the complex nature of the forest ecosystem.

The forest and its ecosystem provide a unique dwelling for all its inhabitants. But Man is a constant and serious threat to the natural environment. The appreciation and study of forest plants and dynamics will help us to better understand the nature of the rainforest. Hopefully this will provide us with guidelines to protect, preserve and manage our forests for posterity. "*I am life that wills to live, in the midst of life that wills to live*," said Albert Schweitzer.

Ali Ibrahim
Istana & Conservation Management Division

1. A regenerated stand of matured secondary forest along the water margins of MacRitchie Reservoir.
2. *Rothmannia macrophylla* opening with an overpowering scent to lure its pollinators.
3. Winged fruits of *Gluta wallichii* with black-stained exudate.
4. A bluish shine resulting from light reflected off the Peacock fern (*Selaginella willdenowii*).
5. A climber of *Entada spiralis* resembling a celestial spiral-staircase.
6. *Dillenia grandifolia* exhibiting a unique display of stilt-roots.
7. The split fruits of the cauliflorous *Dysoxylum cauliflorum*.
8. *Macaranga triloba* living in harmony with an ant community.

1

Introduction

By whatever name it is called, this is a rare and fascinating palm. Those who have strolled on Lawn D next to Holttum Hall would have seen this beautiful and massive palm bearing its huge characteristic fruits. This is *Lodoicea maldivica,* or commonly known as the Double Coconut. It is not closely related to the common coconut at all but received its name because its immense fruits resemble a pair of coconuts joined Siamese-twin fashion.

Seychelles Nut, Coco~De~Mer, or Double Coconut,

A Spectacular Palm In The Gardens

History

As early as the year 1500, tales of strange nuts found washed up on the shores of the Indian Ocean were reported and as plants bearing such nuts were unknown, tales persisted that these fruits mysteriously grew on submerged trees. It was said that these trees were clearly visible on calm days but astonishingly disappeared when sailors dived for them.

Their mythical origin and rarity led to great medicinal values being attributed to the albumen, or the white meat, within the nut. The nuts were credited with being a positive antidote for all forms of poison. Thus, it is not surprising that Princes and potentates at that time were willing to pay a very high price for these mysterious fruits, since they, prone to use such poison on others, were constantly in fear of being made victims themselves of some wily poisoner. Rudolph II of Germany is said to have offered, unsuccessfully, 4,000 florins for one nut and A.M. Rothon in his book,

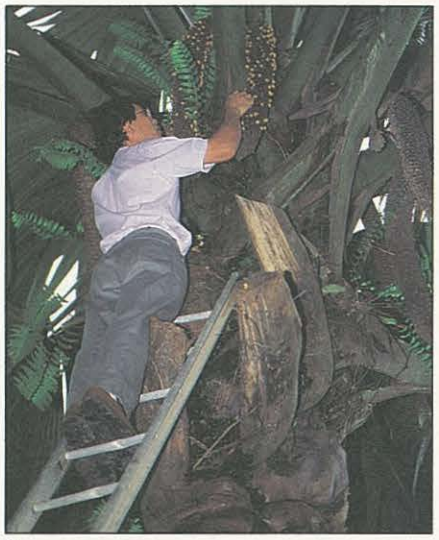
Voyage to Madagascar, stated that it was not uncommon to see these nuts sold for $400 sterling as late as the year 1759.

When Seychelles Islands were first explored in 1743, the true source of these nuts was at last discovered. And they were growing in thousands. Though the nuts have been widely scattered by currents of the Indian Ocean, surprisingly, for some unknown reason none was known to germinate on foreign shores.

2

The Plants

Lodoicea maldivica is a robust, solitary palm that can grow up to a height of 25 m in its native habitat. It is dioecious, which means that the male and female flowers are borne on separate trees. The male flowers are yellow and borne on massive sausage-like spikes 1 - 2 m long. The female flowers are borne from thick stalks, and consist of an ovary 5 - 10 cm across, covered on the lower half by broad overlapping envelopes.



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The enormous leaves of this palm are fan-shaped with stalks 2 - 4 m long and blades, 4 - 6 m long and 2 - 4 m across. The fruits are truly remarkable and are the biggest and heaviest in the whole vegetable kingdom. From the time the female flower is fertilised, the fruit takes 6 or more years to mature. The fruits are typically two-lobed, about 45 cm long and weigh 10 - 25 kg. They usually contain one seed but there are some which may contain 2 to 3 seeds and can weigh over 45 kg. Lodoiceas mature slowly and will begin fruiting only when about 25 years old.

5

1. *Lodoicea maldivica* in Lawn D of the Gardens.
2. Male inflorescence.
3. Chin See Chung collecting pollen from the male inflorescence.
4. Author in the process of pollinating the female flowers.
5. Ripe fruits eight years after pollination. Top left, a partially dehusked fruit with 3 seeds; bottom left, a cleaned seed.

continued on pg 15

BG-BASE : A CURATORIAL TOOL FOR THE LIVING COLLECTION IN THE SINGAPORE BOTANIC GARDENS

The Singapore Botanic Gardens manages a sizeable living collection of plants. Amongst other things, the careful documentation of this collection distinguishes the gardens from parks and display Gardens. To curate the collection effectively requires an institutional commitment and a realization of its importance to the Gardens. The value and importance of the living collection is arguably, underpinned by the set of plant records information that is kept on the collection. This set of information, therefore, is one of the most important sets of information that the Gardens possesses. A well kept system of plant records information serves as a central repository for all information about the collection. The more accurate and complete such information is, the more readily are we able to fulfill the functions of the Gardens in the areas of research, education and public display.

Managing plant records information is inherently a time consuming and complex task, made so by the fact a plant's name may change, it may have synonyms, a plant may have more than one valid family, and plant inventories are never static as plants are removed due to death or transplanting, and new plants are added to the collection all the time, and so on. Whereas a manual system of records, eg. using a system of catalog cards, cannot satisfactorily cope with such complications for obvious reasons, computerised plant records management solves many of the problems with ease and speed.

BG-BASE version 4.52 was acquired and installed in a standalone PC in Jan 97, making the Singapore Botanic Gardens the 83rd botanical institution to be installed with BG-BASE. Other botanical institutions using BG-BASE include the Royal Botanic Garden (Edinburgh), Brooklyn Botanical Garden, Royal Botanic Gardens (Peradeniya), World Conservation Monitoring Centre, Arnold Arboretum of Harvard University, Fairchild Tropical Garden, Royal Botanic Garden (Kew), National Botanic Garden (Dublin), etc. The software was selected for the Gardens' use after making numerous enquiries with existing users and reviewing and comparing with some plant records management software available in the industry, such as pcTropicos and Ness-plants©.

BG-BASE is a complex program that has been written on Advanced Revelation®, a relational database software. Work on BG-BASE began in 1985 at the Arnold Arboretum when the director of the arboretum foresaw the needs for a database management application (system support and development are now provided by The Holden Arboretum and Royal Botanic Garden, Edinburgh). As opposed to a conventional flatfile database (such as dBase®), records in BG-BASE are organised as *files* which are then related to one another using common information called *fields* (hence relational). In the Living Collections Module, which is the module installed in the system in the Gardens (at the moment), the files that are commonly used include:

accessions file : stores accession dates, propagule types, wild origin information, received dates, sources, etc.
names file : stores all taxonomic, nomenclatural information and, phenological information, common names, distribution, etc
plants file : stores information on current and previous locations, health, planting dates, and physical information, etc.
plant sources file : stores sources including contact numbers, addresses, fax, etc.
data sources file : contains bibliographic citations used to evaluate information entered into other parts of the system.

The advantage of such a design is that a plant name, or a plant source record needs only be entered once into the system. For example, if *Myristica maingayi* was introduced into the Gardens, then the name record needs only be created once. Subsequent introductions of the same species will use the same name record that has already been created. This reduces inconsistency and redundant data in the system, which is difficult to achieve in a flatfile database system.

The other key feature of BG-BASE is that Advanced Revelation® allows variable length field environment, compared to fixed length field environment used by FoxPro®, Paradox®, Access®, dBase®, etc. In the latter examples, it means that every field and record uses the same number of prespecified characters, regardless of the amount of information that is actually entered into each field. With variable length environment, fields will expand and contract to fit the amount of data captured, with a very high upper limit to the number of characters that can be entered (about 64 000 characters or 64k).

This feature greatly reduces the wastage of disk space.

The Gardens' computerised plant records database is now at the most crucial stage of its setup, that of data-entry, for BG-BASE is only as good as the data that it has captured. Data-entry is coordinated and undertaken by the newly formed Plant Records Unit of the Research Branch, and is expected to continue until the first quarter of 1998 for the basic plant inventory information to be captured. The information captured will enable the Gardens' staff to make enquiries on for example: number of taxa of cultivated plants in the Gardens; list plants found in any location(s); cultivated plants belonging to a particular genus/ family/ order/ special groups; accession information of a particular plant; locations where a particular plant can be found in the Gardens, etc. For the information captured to remain updated, a system of feedback on the movement, planting and removal of plants in the Gardens has also been implemented so that such information will be received by the Plant Records Unit on a routine basis. In fact, this systematic flow of information from the staff maintaining the plants is critical for the success of BG-BASE as a basic plant inventory monitoring tool.

Apart from being used on plants that have already been planted in the Gardens, BG-BASE is also used to track plants in the nursery at the Plant Resource Centre. The system is now networked using the four computers in the Research Branch in a Local Area Network, allowing multiple logging onto the system at any point of time. The use of BG-BASE can also be expanded further by capturing plant phenological information, thereby creating another database for interesting horticultural information on cultivated plants. In addition, the Public Access Module of BG-BASE is available. When purchased this can be installed in the future Public Reference Centre of the library for use by the public to make enquiries about the living collection in the Gardens. Output from BG-BASE can also be directed to an engraver for making plant tags and labels. Such a computerised engraving system will greatly reduce the time taken to tag plant with their accession numbers, which is currently done using aluminium strips. Finally, the design of BG-BASE also allows the exchange of plant records information between the Singapore Botanic Gardens and Botanic Gardens Conservation International* following the International Transfer Format for Botanic Garden Plant Records (ITF) #, thereby enhancing the role of the Gardens in the *ex situ* conservation of plant resources of the world.

Computerised plant information databases made possible by the use of information technology, indeed offer many promises, and are perhaps an inevitable move, comparable to the transformation of many operations in our workplace through the use information technology. BG-BASE, however, is nothing more than a tool, and cannot function to its fullest potential without the human input and cooperation from the many staff of the Gardens.

* The Botanic Gardens Conservation International is an independent charity registered in the United Kingdom with member botanic gardens all over the world. It was established in 1987 as part of IUCN's World Conservation Union, to encourage botanic gardens and arboreta of the world to work together as a global network for conservation.

The ITF is a set of standards for exchanging computerised data on plant records that was published in 1988.

Tan Puay Yok
Senior Research Officer/Plant Records
Singapore Botanic Gardens

continued from pg 13

In Seychelles, the leaves of the palm are traditionally employed for thatching, as well as for making hats, baskets and mats. The shells of the nuts are used for bowls, plates and other utensils. The sweetish, white, jelly-like contents of young nuts can be eaten as a delicacy.

Our Plants

In the Singapore Botanic Gardens, we have two plants of *Lodoicea maldivica* and we are fortunate that we have one of each sex. The male is located in Palm Valley and the female, on Lawn D next to Holttum Hall. Both were planted in 1955, making them 42 years old now.

Since they were planted so far apart, we have to hand pollinate in order to get fruits. To do so, the fresh pollen collected is brushed on to the stigmatic surface of the female at a time when there is a clear gummy secretion exuding. It may sound easy, but not so in the field. We have to monitor the female flowers very closely because the receptive period when the stigma is moist with the gummy secretion lasts only about 3 - 5 days. If pollination is successful, the ovary begins swelling visibly after about two weeks. It then grows rapidly reaching its maximum size after about a year. It is at this age that the fruits are apparently best for eating.

We are proud that we have these two spectacular plants in the Gardens, even more so now that we are successfully causing them to bear fruits. The first batch of eleven fruits pollinated in 1989, are ripening and we are looking forward to germinating them so that more trees can be planted. It will take many more years for these to mature, but the successful propagation of this palm will give great satisfaction and pleasure to all our horticultural staff who have been nurturing the parents ever so carefully over the years.

Alan Tan Chye Soon
Assistant Manager
Singapore Botanic Gardens Management

continued from pg 3

and shiny green leaves shimmering in the sun, together with several other selected trees, was retained; its location was designated as Lawn E. The rest of the vegetation was cleared, arranged in massive piles and after a drying period of some weeks, burnt.

The tree passed into maturity and developed its characteristic thick rugged bark with alternate ridges and fissures; however, it was still a very small specimen of its species.

In response to slight changes in the rainfall pattern, the tembusu flowers twice a year, a main season in May or June and a smaller one in October or November. The flowers are creamy white, almost 2 centimetres across and are arranged in clusters. They become yellow with age, before they drop after five or six days. At night the flowers exude a perfume that seems particularly heady on clear starry nights when the air is light. The scent carried by light breezes, spreads through this lawn and beyond, attracting moths. About three months later, the small globose berries, some 6 mm in diameter and filled with numerous tiny seeds, mature, first turning from green to orange and eventually red. Resident birds, singly and in flocks come to feed on these berries, spreading the seeds from where they next perch to propagate a new generation of trees. From further away, from islands to the south and from the swamps of the Peninsular and even from the coasts of Sumatra, flying foxes, the largest of bats, drawn by some mysterious signals, wing their way nightly to feed on the berries of the tembusu in the area, again helping to spread the species.

1970-Present

Over the decades the tembusu tree continued to grow, first losing its conical juvenile shape and then developing a large shaggy form with delicate end branches where slender twigs often dangled two to three metres long. Because its lower branches were not pruned, this tree was leafy to near the ground. Three of its lowest branches grew almost horizontally from the base of the now massive main stem, first bending down then arching upwards after several meters. Two branches actually touched the ground before turning up.

There were three such trees on the same lawn. Trios from the same era. Each had the same basic form with low arching branches, yet they were distinct. The trees became a landmark in the Gardens. Visitors made their choices and had their preferences as to which was their favourite tree.

The right of the trees to live did not go unchallenged. Storms whipped them and many a times lightning came threateningly close. Termites were always chewing away at the dead outer bark, but fortunately the bitter living bark was unpalatable even to termites and prevents them from doing real damage. Likewise few insects find their living leaves tasty. The trees remained sound; the very hard wood resisted decay. The many wood chewing insects that were always probing, trying to find a weakness, were deterred. Protective chemicals in the wood added to their durability.

But against the climatic forces of nature the trees had little defence. They had done well to achieve their majestic form and full height of 25 to 30 metres tall. First, one was struck and killed by lightning; soon after, the second of these great trees was killed. This tree was the last of the trio.

It became a focal point and a preferred site for posed photographs, for picnics and even for filming. Children and adults alike delight in frolicking on and around its very special branches. Daily, locals and tourists alike, make a beeline for this tree, to admire to touch and to climb; thousands of photographs have been taken. Even the very rough bark has been worn smooth, adding to its character.

However, the ravages of the decades and of the passing of a century and more, took their toll. With age, parts of the lower trunk became diseased. Starting perhaps from a little crack, decay-causing fungi and bacteria, attacking relentlessly, caused some wood to rot, forming a hollow. The great tree did not succumb, completely. The rot however weakened several of the low branches, and in the early 1970's they had to be reluctantly pruned off. In an act akin to tree dentistry, the hollow was filled with cement. Two of the branches removed were those that touched the ground. The tree however stubbornly prevailed, the remaining low branch became even more popular. By now a third generation of visitors could associate with this tree. Children who climbed this branch and the two others, now no more, decades ago, brought their children, and they in turn their children. Lovers who used to meet under this tree, returned with their families. The tree became, to the many who visited through the decades, a symbol, a part of their happy, fading, memories of the Gardens and for visitors from afar, of Singapore.

In the early 1980's an unusually fierce tropical storm swept through the Gardens. The raging wind shook this tree and strained every one of its massive roots; it tossed the end branches about and many were ripped off. Its main branches were unyielding and defiant. However a sudden change in the direction of the wind tore off two large branches from high up. As they came crashing down they took with them several smaller branches. But the tree endured.

The storm was a reminder of the fragility of this grand tree. The special branch still looked good, but it seemed impossible that such a great weight could remain supported at such an angle, and often with several visitors sitting astride. It was decided prudent to place a strong wooden prop at the far end.

A century and a half have passed, the tree has weathered the vagaries of climate, pests, and the demands of generations of visitors, its top is thinning, but it seems poised to entertain another generation.

Dr Chin See Chung
Director/Singapore Botanic Gardens