

# **NATIVE AND NATURALISED BIODIVERSITY FOR SINGAPORE WATERWAYS AND WATER BODIES**

## **NO. 1**

### ***Ficus microcarpa*, Malayan Banyan**



**Hugh T. W. Tan, C. K. Yeo and Angie B. C. Ng**

Raffles Museum of Biodiversity Research and  
Singapore-Delft Water Alliance  
National University of Singapore  
Singapore  
**2010**



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## INTRODUCTION

*Ficus microcarpa* L.f., the Malayan banyan, a native fig of Singapore, is a hardy tree or shrub that can grow in almost all habitats: mangrove forest, freshwater swamp forest, riversides, wasteland, forest edge, streets, gardens, in the ground or on buildings, rocks and other trees, and can be trained to grow as a bonsai, pot plant, bush, hedge, standard, topiary or tree. It can grow to a large tree up to 30 m tall and broad, bearing thick to thin, aerial roots from the branches of the dense crown which casts a deep shade to exclude growth beneath. Singapore specimens are wild or cultivated, with yellow-leafed cultivars most commonly grown as hedges, or topiaries. Plants may be grown at the water's edge in reservoirs or canals to drier sites further upslope and beyond, in phytoremediation

wetlands, or as fuel for power generation in short-rotation energy forestry of treated wastewater or sewage sludge-treated sites. Because some members of the wild population are always in fruit so providing a baseline food source, this species is considered a keystone species, as fruit-eating bats and birds feed on its ripe syconia containing its fruits.

## BASIC INFORMATION

**Scientific Name.** – *Ficus microcarpa* L.f.

**Pronunciation.** – FYE-kuss my-kro-KAR-pa

**Etymology.** – Latin *figus*, the edible fig (*Ficus carica*); Greek *micros* (μικρός), small; Greek *karpōs* (καρπός), fruit—referring to the small syconia borne on the twigs. Any *Ficus* species is called a fig.

**Synonym.** – Ridley (1924) mistakenly referred the Malayan banyan to *Ficus retusa* L., so this is the name in the older regional literature that this species is known by, e.g., Corner (1940).

**Common Species Names** – Chinese banyan, curtain fig, Indian laurel fig, laurel fig, Malay banyan, Malayan banyan (English); arbre de l'Intendance (French); Chinesische Feige, Indischer Lorbeer, Lorbeerfeige (German); chilkan, kamarup (Hindi); jejawi (Malay); róng shù [榕树/榕樹] (Mandarin); laurel de Indias (Spanish); icci, ichi, kallicci, kallicchi, kalluichi, malaiyichi (Tamil)

**Scientific Family Name** – Moraceae

**Common Family Name.** – fig family

**Natural Distribution.** – Sri Lanka to India, China, Ryukyu Islands, Bonin Islands, Southeast Asia, Christmas Island, Australia, Solomon Islands, Palau and Truk Islands and Cocos Island (Berg & Corner, 2005). In Singapore, it is found mostly in urban or suburban areas throughout the country, from Singapore Island to the offshore islands surrounding.

**National Conservation Status.** – Malayan banyan is a common, native fig species of Singapore.

## PLANT MORPHOLOGY, BIOLOGY AND ECOLOGY

**Habit, Crown, Branches and Roots.** – Malayan banyan is a fast-growing, usually evergreen tree to about 30 m tall and wide, with a flattened or rounded crown (Berg & Corner, 2005; Figs. 1–3) as well as highly variable habit ranging from dwarfed to trailing shrubs in windy sites to being an epiphyte on host trees (Weber, 2003). Branches are horizontal or ascending, with a dense curtain of aerial roots hanging from them, some of which becoming pillar-like to support the widespread branches (Figs. 3–7). These pillar-like roots from large trees can form impenetrable thickets (Weber, 2003; Fig. 5). White latex oozes from all cut surfaces (Fig. 8a), which may be a defensive adaptation to discourage herbivory as the latex gums up the jaws of the herbivore. Large trees may actually consist of a few genetically distinct individuals fused together (Chan, 2005–2006).

**Leaves.** – The stalked, alternate leaves have a slightly fleshy or leathery, elliptic, broadly elliptic to slightly obovate leaf blade 2–14 cm long and 1–8 cm wide, with matte, mid-green upper sides and lighter green below, and flat margins, and rounded tips (Berg & Corner, 2005; Fig. 8). The lanceolate stipule that protects the next leaf and shoot tip is up to 1.5 cm long (Fig. 8a). This sheds after leaf expansion, leaving a ring-like scar on the twig (Kochummen & Go, 2000; Fig. 8a).



a



b



Fig. 1. Habit of Malayan banyan. (a) A young tree near the Raffles Building, off Evans Road, with a round crown. (Photograph by: Hugh T. W. Tan). (b) Mature tree at Upper East Coast Road with a wide, flattened crown. The basketball hoop height (3.05 m) provides a scale. (Photograph by: Angie B. C. Ng).



Fig. 2. Massive mature tree along Rochor River, between Kampong Bugis and Kallang Riverside Park. The eight-storey building at its right provides a scale for its large size. (Photography by: Angie B. C. Ng).





Fig. 4. The horizontal branches develop aerial roots which grow into the ground, ultimately to become pillar-like with growth, to support the widespread branches. These can form impenetrable thickets because they are so strong and rigid. (Photograph by: Angie B. C. Ng).

Fig. 3. A dense curtain of aerial roots hang from the horizontal or ascending branches. (Photograph by: Angie B. C. Ng).



Fig. 5. Pillar-like roots can form impenetrable thickets like these of a tree at Sultan Gate, Kampong Glam. (Photograph by: Angie B. C. Ng).





Fig. 6. Pillar roots may also be widely separated, allowing long, horizontal branches that may span several metres across. (Photograph by: Angie B. C. Ng).



Fig. 7. Numerous branch roots grow from the cut end of a mature aerial root. (Photograph by: Angie B. C. Ng).





Fig. 8. Leafy twigs. (a) Twig tip showing from apex down a young leaf unfurling, with a stipule to its bottom and right, a new leaf, a mature leaf with its leaf blade broken to show the white latex oozing from the break. A stipular scar is seen at where the leaf stalk is inserted into the leaf. The scar is the point of attachment of the stipule before it was shed. (b) A leafy twig showing the shoot tip which is enclosed by the hood-like stipule, a young leaf with a pink leaf blade, and older leaves with leaf blades that have a slightly shiny, smooth surface. The shine will be lost as the leaf ages. (Photographs by: Angie B. C. Ng).

**Flowers.** – The tiny flowers grow inside, a round, 5–10 mm wide structure called a syconium or fig (Figs. 9–11). [That the flowers occur inside the syconium is why the Chinese call the figs, wú huā guǒ (无花果/無花果).] The syconia are stalkless (or stalked to 5 mm long,) and grow singly or in pairs at the leaf axils. The pollinator is a fig wasp (*Eupristina verticillata*; Hymenoptera, Agaonidae, Agaoninae) which has a complicated life cycle intertwined with that of this plant (Wiebes, 1994). Most fig species have one major pollinator fig wasp species with which each species co-evolves. This relationship in figs is described very well by Corner (1988).

**Fruits.** – The syconia turn dark pink to dark purple when ripe (Ng et al., 2005; Fig. 10b) and measure 10–12 mm across at this stage. Tiny flowers (Fig. 10a) are found inside the syconium, each of which may develop into a fruit that will contain one seed or one wasp.

**Confusable Species.** – This species is often confused with the Benjamin fig (*Ficus benjamina*). They are distinguished as in Table 1.

Table 1. Distinguishing characteristics between the Malayan banyan (*Ficus microcarpa*) and the Benjamin fig (*Ficus benjamina*). Based on our own observations, Kochummen (1978), and Ng et al., (2005).

<i>Ficus benjamina</i>	<i>Ficus microcarpa</i>
Leaf blade shiny dark green above	Leaf blade matte mid-green above
Leaf blade usually symmetrical	Leaf blade symmetrical to asymmetrical
Leaf blade margin wavy (undulating), or flat	Leaf blade margin always flat
Leaf blade tip prolonged into a drip tip	Leaf blade tip rounded to somewhat pointed
Branches drooping (like a weeping willow)	Branches horizontal to ascending
Aerial roots few from branches, usually string-like, not forming a dense curtain beneath the crown	Aerial roots many from branches, forming a dense curtain beneath the crown; may become pillar-like and form a thicket
Syconia become (1) orange-red, red then dull purplish red; (2) orange then cherry-red; or (3) pale pink then mauve-purple, when ripening	Syconia become pink, dull purple or purplish black when ripe





Fig. 9. Unripe, green syconia on leafy twigs. (Photograph by: Hugh T. W. Tan).

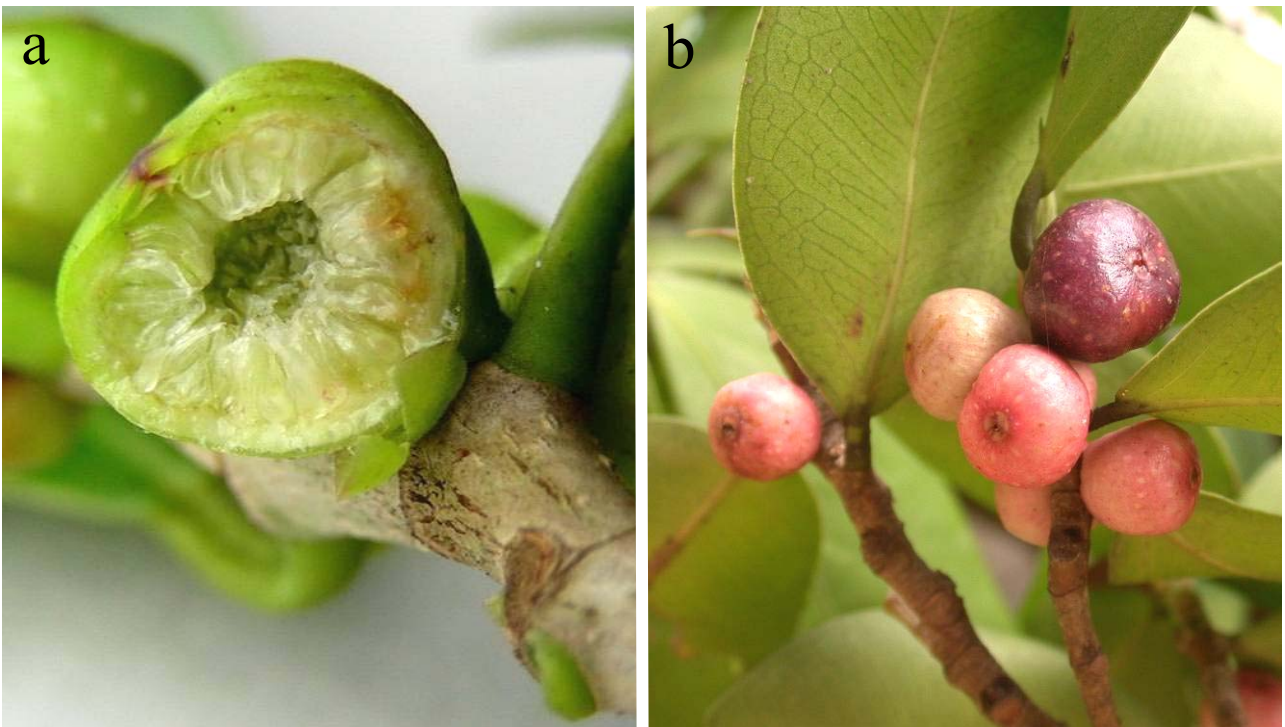


Fig. 10. Syconia. (a) Half-section of unripe syconium showing the ostiole at the tip (tinged purple) through which the female fig wasps enter and leave. Tiny flowers line the inside of the syconium. Male and female flowers line the cavity of the syconium. Note the two bracts at the base of the syconium. Width of syconium = 8 mm. (b) Semi-ripe, light pink to pink syconia and more ripened, purple syconia on leafy twigs. The ostioles are distinct at the distal ends of the syconia. Widths of syconia = 10–12 mm. (Photographs by: Angie B. C. Ng).



Fig. 11. Ripe syconia and a dead leaf.. The left syconium shows the basal bracts. The right syconium is sectioned to show the developing fruits. A good example of a developed fruit (arrowed) with an obovate, stalked structure, containing one seed. The leaf is shortly stalked. Syconium width = 10 mm. (Photograph by: Angie B. C. Ng)

**Habitats and Ecology.** – Its natural habitats are lowland rainforests, riverbanks (Fig. 12), tidal floodplains, coastal vegetation especially exposed rocky coasts, on cliffs, tidal freshwater swamp forest and other swamps, from sea level to 1,200 m altitude (Weber, 2003; Berg & Corner, 2005). In Peninsular Malaysia, it is common along coasts and in swamps (Kochummen, 1978). Ridley (1924) indicated its habitat as being coastal sites that are dry and that the Chinese planted this species near their shrines. Its localities were Bukit Timah and Changi (Ridley, 1924), and Botanic Gardens and Geylang (based on the only 19<sup>th</sup> century collections in the Herbarium, Singapore Botanic Gardens, and those by Ridley, 1892 and 1893, respectively). Keng (1990) reported its previous occurrence in coastal and riverine sites in Singapore, but now very common on ornamental trees and forest margins. When wild in Singapore, Malayan banyan trees grow in full sun or partial shade, in the ground, or as saplings on trees in streets, gardens and parks, growing from cracks in drains, walls, buildings (Wee, 1992; personal observations; Fig. 13), or any built structure with suitable conditions. Trees grow mostly in urban or suburban sites, and rare in the fringes of tall secondary forest, or primary forest. It also grows in the back areas of mangrove forest patches (Fig. 14), in mangrove forest patches (Chek Jawa) or along the banks of tidal rivers where the water is brackish (Sungei Khatib Bongsu). Examples of large trees in wetter ground can be seen along Jalan Anggerek, River Valley Close, and Upper Thomson Road, and in Nee Soon Swamp Forest, as well as in drier ground along Holland Road, and York Hill.

Malayan banyan is tolerant of roadside pollution and conditions in Singapore and elsewhere, from our observations (P. 15, Fig. 23). Li et al. (2005) reported its tolerance of roadside pollutants such as sulphur dioxide, lead and cadmium in Guangdong, China. Based on chlorophyll fluorescence parameters as an index for environmental stress, Wen et al. (2004) showed that Malayan banyan is highly resistant to air pollution stress in the Pearl River Delta, China.

Malayan banyan, tends to grow together with the Benjamin fig (native species) and the bodhi tree (*Ficus religiosa*; an exotic species from India), in urban and suburban environments in Singapore (Fig. 13).





Fig. 12. A Malayan banyan tree growing near Mawai, along the Sungei Sedili Besar, a tidal river in Johore, Peninsular Malaysia. (Photograph by: Angie B. C. Ng).



Fig. 13. Three of Singapore's most common urban fig (*Ficus*) species (with the larger leaves) growing as saplings from cracks in a wall, together with some weed species (with smaller leaves). Malayan banyan is the top right plant (a), the bodhi tree (*Ficus religiosa*) is at the bottom left (b), and the Benjamin fig (*Ficus benjamina*), the two saplings in between (c). (Photograph by: Angie B. C. Ng).



Fig. 14. A young Malayan banyan tree growing in a mangrove forest patch along the Sensory Trail, Pulau Ubin. (Photograph by: Angie B. C. Ng).





Fig. 15. Malayan banyan seeds in the faeces of a bird on the seal of a car window. (Photograph by: Angie B. C. Ng).



Fig. 16. Malayan banyan sapling growing from the crotch of a rain tree (*Albizia saman*, formerly called *Samanea saman*) host plant. In the early stages, most of the growth of the young plant is to develop roots that grow into the ground for a more steady supply of water and mineral nutrients (straight, cable-like roots seen here; arrowed). Subsequent growth would be to increase the stems and foliage of the plant as well as to develop more roots that will wrap themselves around the host tree to ultimately kill it. (Photograph by: Hugh T. W. Tan).

The ripe syconia or figs are eaten and the seeds dispersed by birds (Fig. 15), the seeds often germinating in branch forks of trees or cracks in built structures to grow as epiphytes which send their aerial roots to the ground (Weber, 2003; Fig. 16; see also ***Horticulture:Utilisation***). The host trees may be killed by the contractile aerial roots which crush the tree or wrap themselves round the trunk (Weber, 2003). These aerial roots are so tightly contracted that they can be strummed like the strings of a guitar (Fig. 16)!



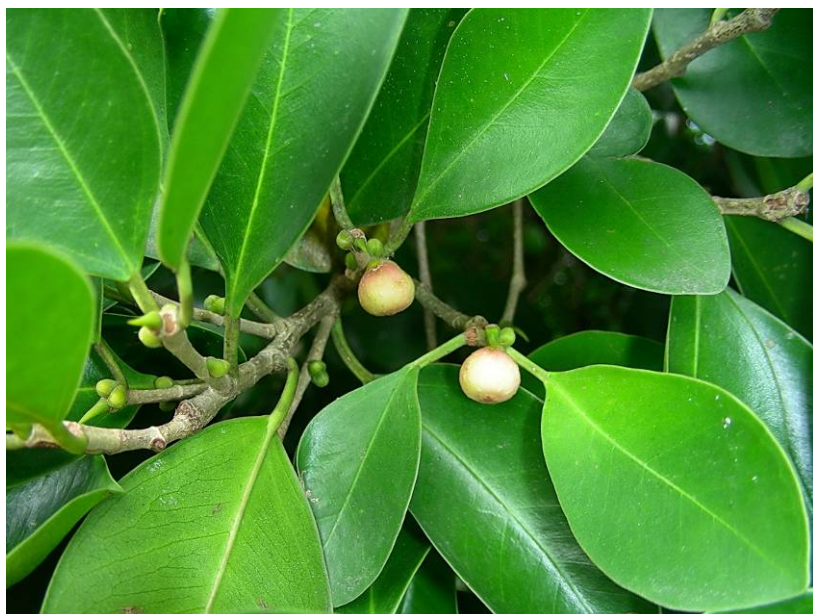


Fig. 17. Older (larger syconia) and newer (smaller syconia) crops of syconia developing in the leaf axils on leafy twigs. (Photograph by: Angie B. C. Ng).

**Phenology.** – Malayan banyan trees have two to six rather undefined crops per year (Fig. 17), with some intraspecific synchronisation and no relationship between phenology and rainfall could be detected (Corlett, 1984).

**Invasiveness.** – In the Global Compendium of Weeds, Malayan banyan is classified as a weed, sleeper weed, noxious weed, introduced species, garden escape, environmental weed (invasive, or species that invades native ecosystems) or cultivation escape (Randall, 2002). Malayan banyan has been introduced to various countries, and in Southeastern USA and Hawaii, it has become an invasive species in pine rockland, hardwood forests and disturbed sites (Weber, 2003).

## HORTICULTURE

**Growing Zone.** – The Malayan banyan is a tropical strangler or tree. It is frost-intolerant, so can only be grown in the tropics (USDA hardiness zones 10b and above).

**Soil, and Waterlogging, Salinity and Drought Tolerance.** – It will grow in acidic to alkaline soil and tolerant of wet ground. It has moderate drought-tolerance but high aerosol salt tolerance.

**Drawbacks/Advantages.** – This tree may not be desired by the superstitious, because Malay and Peranakan folklore of Southeast Asia associate spirits, ghosts, or the “pontianak” (see below under **Folklore**) with large trees, including those of *Ficus* species (Tan & Giam, 2008). Fruiting individuals through animal dispersers may be the cause of seedlings growing on walls, drains, trees, etc., but help maintain high urban biodiversity. Bird droppings under fruiting trees can cause a mess on driveways, pedestrian walkways or pavements. The windfall fruits may create a mess under the trees, if they are not removed by frugivores. However, this makes it easy to harvest seeds for planting. Its large, dense crown throws so much shade that grass cannot grow beneath. If areas are covered with gravel beneath to prevent soil erosion, weeding beneath such a tree is minimal, so saving labour costs. The roots of large trees may damage driveways, roads, drains, etc. However, these roots can stabilize slopes or banks of canals (Fig. 28, p. 18). If left untouched, it can grow so large that will take over small gardens! However, such a large tree can significantly shade and cool the area, reducing the need for air-conditioning. To get rid of unwanted plants growing on built structures, it is important to remove the whole plant. If these are cut to leave stumps, the stumps will sprout new growth. The advantage of this is that the plant which would normally grow into a



Fig. 18. Unidentified thrip (Thysanoptera) on a damaged leaf. (Photograph by: Angie B. C. Ng).

tree, can easily be trained to grow into a hedge or bush, to fit a smaller garden. Generally Malayan banyan is free from pests and diseases. Known pests of the plant include *Gynaikothrips ficorum* (Cuban laurel thrip; Fig. 18) and *Josephiella microcarpae* (Ficus gall wasp) have been reported to cause leaf deformation (Dreistadt et al., 2004). The caterpillar of the moth, *Asota plana*, eats the leaves of this and other fig species (W. F. Ang, pers. comm.; Figs. 19, 20). Although trees may lose most of their foliage from one such attack, they usually recover once the caterpillars pupate and emerge as adults to attack other trees.



Fig. 19. Caterpillars of *Asota plana* feeding gregariously on the leaves of a Malayan banyan tree. (Photograph by: Angie B. C. Ng).





Fig. 20. *Asota plana* adult individual.  
(Photograph by: Ang Wee Foong).

**Propagation.** – It is easily propagated by stem cuttings or seed. To prepare stem cuttings, the short stem pieces should be left in a container under a running tap, to drain away the white latex for a few minutes, after which the cuttings may be left in a container of water to root (change on a weekly basis to avoid breeding mosquitoes!), or, planted into suitable rooting media such as washed sand or potting mix. Place the cuttings in a shaded area till they root. For cuttings in potting media, growth of roots is generally associated with development of shoots on the stem cutting. When suitably large, transplant to a larger pot. Plants about 1 m tall may be planted out in the field. With suitable training Malayan banyan can be grown as a bonsai, topiary, standard (single trunk with small crown) in a pot or ground, or as a hedge. Trees may be kept small by regular pruning.

To germinate seeds, select ripe syconia (dark pink to dark purple). All Malayan banyan trees will produce seeded syconia, unlike some other fig species which have separate male and female trees. The tiny seeds are difficult to separate from the fruit pulp, but if these are pressed against the mesh of a strainer, the seeds will be retained and the seeds can be collected more easily. Plant the seeds using forceps in small seed trays under partial shade. Water with a hand sprayer. Once the seeds germinate within a few days or weeks, transplant individually using a small stick or scalpel to dig out the tiny root ball. This is the most dangerous stage, so extra care must be taken to ensure the tiny seedlings do not dry out after transplanting. In the wild, it is probably drying out at this stage which eliminates the seedlings and hence partly responsible for the significantly fewer numbers of adult trees compared to seed numbers produced. Once seedlings are about 10 cm tall, they will be tough enough to transplant to a larger pot and ultimately for planting out.

**Control.** – Unwanted plants are best removed completely, because of the ability to coppice from stumps (Fig. 22). If trees are too large, then triclopyr herbicides can be applied to the cut stump, or the base of the plant, as fig trees are sensitive to this herbicide (Weber, 2003). Care must be taken to



Fig. 21. Malayan banyan tree being felled with an excavator—possibly the most efficient way to deal with such massive pillar roots and trunk. (Photograph by: Angie B. C. Ng).



Fig. 22. Malayan banyan growing from the base of a clump of MacArthur palm (*Ptychosperma macarthurii*). This sapling has been cut down to a stump but has coppiced, by sprouting several new leafy branches. This species is difficult to eradicate because the whole plant, including roots, must be removed to ensure that it does not grow back. While this plant's ability to coppice presents problems for maintenance of streetscapes, as well as landscaped gardens and parks, the ability to vigorously regrow can be exploited for phytoremediation of pollutants in water, or as a fuel crop for power generation. (Photograph by: Hugh T. W. Tan).

ensure that the host tree is not also poisoned by the herbicide when eradicating hemiepiphytic Malayan banyan plants. Unwanted trees, if allowed to grow, are costly to remove because of their size (Fig. 21).

**Coppicing Ability.** – This species can be coppiced (Fig. 22). Trunks can be cut down and new shoots will emerge from the stump. Zeng et al. (2006) have shown for the Three Gorges Dam Reservoir region of China, annual removal of 20% of the branches is optimal for sustained harvesting.





Fig. 23. *Ficus microcarpa* 'Golden', a popular cultivated variety of Malayan banyan, grown as a standard (single-trunked tree, with aerial roots trimmed off) in George Town, Penang, Peninsular Malaysia as a roadside tree. This species is tolerant of roadside pollution. (Photograph by: Hugh T. W. Tan).



Fig. 24. *Ficus microcarpa* 'Golden'. (a) Plants grown as a hedge to surround the pillars of the MRT rail line along Commonwealth Avenue West. (Photograph by: Hugh T. W. Tan). (b) Grown as a topiary at Great World City, Kim Seng Road. (Photograph by: Angie B. C. Ng).

**Commercial Availability.** – In Singapore, this species is available in commercial nurseries, often as a yellow-leafed cultivated variety (cultivar)—*Ficus microcarpa* 'Golden' (Boo et al., 2006). This is often grown along roads as a short or tall hedge (Fig. 24a), standard (Fig. 23), or topiary (Fig. 24b). The degree of yellowness in its leaf blade is correlated with the degree of exposure (Yamasaki et al., 1995).





Fig. 25. Malayan banyan typical form grown as bonsai. (a) The swollen stem and roots signify abundance and prosperity. Unfortunately, the short stature of the bonsai plant signifies stunted growth and development, and is thus considered inauspicious! (b) Larger bonsai plants at an exhibition during the Lunar New Year. These are about half as tall as the roadside tree behind them. (Photographs by: Angie B. C. Ng).

The typical form of Malayan banyan, with green leaves, is often seen in nurseries as a bonsai plant (Figs. 25, 26), or topiary, but seldom sold as a sapling for planting. However, the ease with which stem cuttings will root, makes propagation from wild stock very easy.

Recently developed cultivars from Taiwan are *Ficus microcarpa* ‘Fu Pau’, *Ficus microcarpa* ‘Emerald’, *Ficus microcarpa* ‘Milky Way’, *Ficus microcarpa* ‘Reddish Petioles’, *Ficus microcarpa* ‘Shi Tzyy Wan’, *Ficus microcarpa* ‘Rotund’, *Ficus microcarpa* ‘Thick Golden Leaf’ (Lu, Cheng & Chen, 2001; Lu, Hu, Cheng & Ju, 2001; Lu et al., 2003, 2004).

**Utilisation.** – Malayan banyan can be planted at the water’s edge of reservoirs, because they can tolerate wet conditions. They can also be planted in remediation wetlands, especially of the subsurface flow kinds, or in generally waterlogged areas in landscapes. Owing to their profuse root production, they might be used to stabilise dykes and other earth works associated with artificial wetlands. As yet their potential for use in woody artificial wetlands in the tropics is overlooked. Their tolerance for salt aerosols, also means they can be cultivated in coastal parks, gardens, or streets, or even along seawalls. If canal banks cannot risk being damaged by the huge aerial roots that can develop over time, trees can be planted sufficiently distant from the canal (Figs. 26, 27), and the spreading branches can drop their aerial roots into canal waters and these can uptake nutrients or pollutants from the canal water as phytoremediation.

Malayan banyan can coppice easily (Fig. 22) so it can regrow repeatedly after harvesting of its wood, so it can be cultivated in short-rotation, energy plantations in the same way poplars (*Populus* spp.) and willows (*Salix* spp.) have been exploited in temperate countries as fuel for power generation by growing such plants using treated wastewater, landfill leachate and sewage sludge (Hasselgren, 1998; Lazdina et al., 2007; Zalesny et al., 2009).

Malayan banyan tree roots may also stabilise slopes because they form a dense network at the surface and help reduce soil erosion (Fig. 28).





Fig. 26. Malayan banyan tree growing next to Geylang Canal (intersection of Guillemard and Paya Lebar Roads) demonstrating one way of how this species may be used for phytoremediation. Aerial roots grow from the long, horizontal branches, so they can uptake water and solutes in the canal water. The tree grows far enough away that its larger roots do not damage the concrete canal embankment by their growth and development. We have observed variation in the amount of aerial roots amongst different individuals, and because Malayan banyan can be grown by stem cuttings, individuals with desirable rooting characteristics may be conveniently cloned for planting for specific purposes. (Photograph by: Hugh T. W. Tan).



Fig. 27. Aerial roots from overhanging branches and that grow into the canal water to uptake water and solutes. In the rear, finely branched roots (arrowed) grow out of the weep holes of the canal embankment. Inset, the enlarged view. (Photograph by: Hugh T. W. Tan).



Fig. 28. Malayan banyan roots, seen here at Astrid Hill, can stabilise slopes because they grow vigorously over the soil surface and help to prevent soil erosion. (Photograph by: Hugh T. W. Tan).

Malayan banyan trees, shrubs or hedges can provide fruits for vertebrate frugivores such as birds, bats, squirrels, etc. In fact this species is known to have 200 known frugivore species, the fig with the most in that review by Shanahan et al. (2001). In Singapore, birds known to feed on the species include the red-crowned barbet (*Megalaima rafflesii*) (see Lok et al., 2009b), lineated barbet (*Megalaima lineata hodgsoni*) (see Lok et al., 2009a), and coppersmith barbet (*Megalaima haemacephala indica*) (see Lok & Lee, 2009). The yellow-vented bulbul (*Pycnonotus goiavier*) has also been reported to nest in a potted plant of *Ficus microcarpa* (see Wee, 2009). The ripe syconium, containing the fruits and seeds of the Malayan banyan, is 10–12 mm across, and because of its small size, would match the gape size of all the native frugivorous birds in Singapore. So if the habitats overlap between this plant and any of these birds, it is likely that Malayan banyan will provide food for them. Planting this species in an area would make it a useful addition to the landscape because it provides food for many animals. However, if this species is used to phytoremediate areas with pollutants, e.g. heavy metals, then the fruits may contain these and not good for the frugivores, so it would be prudent to use this species with discretion, e.g. use for phytoremediation of water with high nutrient levels rather than for heavy metal pollutants.

Malayan banyan trees also provide food for herbivorous insects, despite the latex it produces which may deter insects. The effects of herbivory may be unsightly, but many native insects such as those mentioned above as pests, depend on plants for their food, so this is a necessary evil. Ecosystems include food webs, and plants being the primary producers are the bases of the webs.

Malayan banyan plants are already routinely utilised in tropical countries as an ornamental plant for bonsai, hedges, borders, topiaries and as large trees.

## PHYTOREMEDIATION

*Ficus microcarpa* var. *fuyuensis* was reported to remove benzene from indoor air by Liu et al. (2007). This species might be useful in phytoremediation. It is found to naturally occur at the landward side of the mangrove forest, which is indicative of a broad tolerance of salinity, and an anoxic, submerged root zone. It has been observed to coppice vigorously and roots easily from cuttings, allowing convenient mass propagation of material, and has no known serious pests. These are desirable qualities of a potential phytoremediator. Though not a known hyper-accumulator of metals, it may have properties similar to temperate, non-accumulator *Salix* species and *Populus* species in a tropical context. We have listed the usefulness for phytoremediation and wetland planting of Malayan banyan in Table 2. It is an excellent candidate because it scores “presence” in all categories.

Table 2. Usefulness qualities for phytoremediation and wetland planting of the Malayan banyan (*Ficus microcarpa*).

S/No.	Quality	Presence or Absence
1.	Coppicing ability	Presence
2.	Fast growing	Presence
3.	Pest tolerance	Presence
4.	Propagation by stem cuttings	Presence
5.	Salinity tolerance	Presence
6.	Salt aerosol tolerance	Presence
7.	Supporting frugivores	Presence
8.	Waterlogging tolerance	Presence





Fig. 29. A Malayan banyan tree at Dickson Road, off Serangoon Road that is considered sacred. Such trees are usually old and large, and designated with swaths of saffron-coloured cloth. Note the altar to the left of the trunk surrounded by aerial and pillar roots. (Photograph by: Angie B. C. Ng).

## FOLKLORE

**Spirit Abode.** – The Malays of Southeast Asia associate large trees, especially fig trees, as the abode of datuks (good, benign or evil spirits), ghosts or the “pontianak” (a woman who died at childbirth to become an undead, female vampire who terrorises the living) (Tan & Giam, 2008; Figs. 26, 27). The Malayan banyan’s dense, dark and shady crown, with aerial roots hanging from the branches and large tree size emphasize this darker aspect, especially because the “pontianak” is thought to use this tree’s aerial roots to swing from! Malaysian and Singapore tree cutters often offer prayers before felling large fig trees to appease the resident spirit, or if the tree is too large, they often refuse to fell it. On the other hand, some Chinese associate a large fig tree with good spirits and health-giving energy (“qi”), and can ask it to adopt a sick child to improve the child’s health!

**Sacred.** – In Singapore, a Buddhist shrine in Toa Payoh Central between Blocks 178 and 179 (Fig. 30), has a Malayan banyan tree growing in its compound with an altar set within its pillar-like aerial roots (Ng et al., 2005). Another example of a shrine is that seen in Fig. 29. It is also grown in the Chek Chai Long Chuen Temple, a Taoist temple, in Kranji Loop Road.

**Fengshui.** – Cultivated and sold are bonsai plants of the typical form (with green leaves) with swollen stems and roots which signify prosperity and abundance as in other auspicious plants cultivated by the Chinese (Tan & Giam, 2008). However, based on fengshui belief, bonsai plants are artificially stunted, so unfortunately signify stunted growth and development of business or any other venture the plant’s owner partakes! The dense and dark crowns of large Malayan banyan

trees, together with the numerous aerial and pillar roots make the plant appear gloomy and foreboding, so not an auspicious plant to grow. The dense crown also blocks the flow of qì allowing stale qì to accumulate.

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[http://rmbr.nus.edu.sg/raffles\\_museum\\_pub/ficus\\_microcarpa.pdf](http://rmbr.nus.edu.sg/raffles_museum_pub/ficus_microcarpa.pdf)

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Fig. 30. A large specimen of the Malayan banyan growing in the Buddhist shrine at Toa Payoh Central. The yellow and red altar is situated at the foot of the tree. A small tree with pinnate leaves grows in front of it. The trunk of this tree consists of numerous pillar roots. Its horizontal branches are thick and produce pillar roots that grow into the ground at the left of the altar. The aroid climber, dragon-tail plant (*Epipremnum pinnatum*), with dark green, pinnate leaves grows up the side of the tree. This species was once believed by locals to be a cure for cancer, but has since lost this reputation. (Photograph by: Angie B. C. Ng).



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