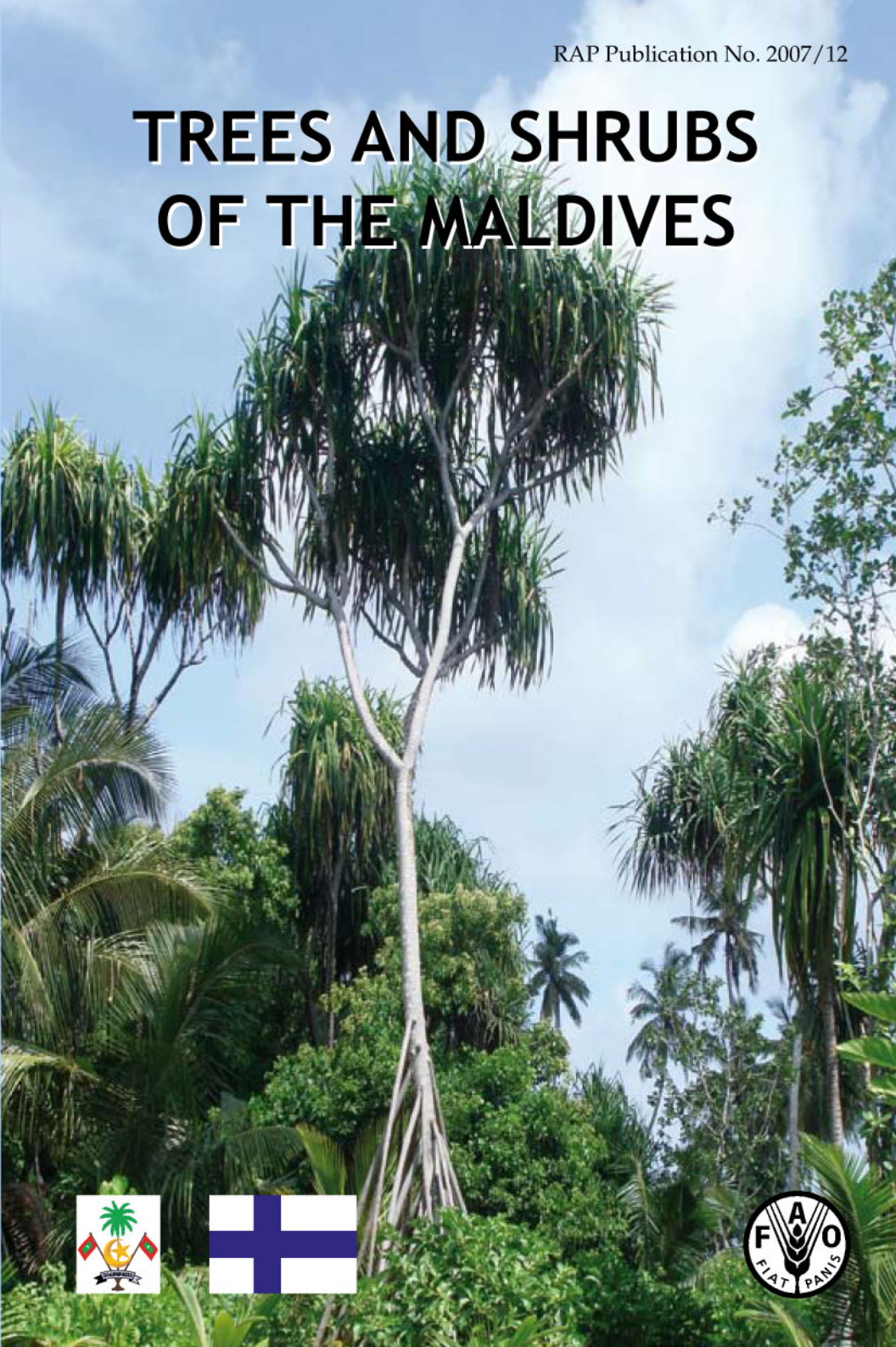
RAP Publication No. 2007/12

TREES AND SHRUBS OF THE MALDIVES



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Trees and shrubs of the Maldives

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Foreword

The Maldives is endowed with blue seas, green forests and rich island vegetation of which every Maldivian is proud. These forests and trees are used by the islanders primarily as a source of timber but also for medicinal and culinary purposes amongst many others. For their effective conservation and sustainable management it is essential for relevant information on the identity, ecology and use of each species to be catalogued and disseminated. The 'Forestry programme for early rehabilitation in Asian tsunami effected countries', which is supported by the Government of Finland and coordinated by the FAO Regional Office for Asia and the Pacific, took the initiative to publish this important book and we are sure it will be welcomed and used both by the people and residents of Maldives and by the many visitors the country receives each year.

The FAO Regional Office for Asia and the Pacific with funding from the Government of Finland, are particularly proud to have played a role in supporting production of this book and, more widely, to have provided support for the advancement of forestry and conservation in the Maldives. Recognition of the values of trees and forests and the environment is climbing the global agenda and through this publication we hope that awareness will be raised amongst Maldivians and others interested in studying the wide range of trees and shrubs present in this picturesque group of islands.

We would like to thank the author , Dr. Selvam Vaithilingam, for his meticulous and hard work and Dr. Ravishankar Thupalli, Chief Technical Advisor of the Maldivian component of the FAO Forestry tsunami programme, for his guidance and assistance in bringing this important book into being. Thanks are also due to Mr. Abdul Majeedh Mahir, Mr. Mohamed Naseem and Mr. Hussain Faisal of the Ministry of Fisheries, Agriculture and Marine Resources for their contribution.

This work is the first of its kind in Maldives and contains information on 100 species including broadleaves, mangroves, pandanus, palms and casuarinas. We believe this book, with its abundant and colorful pictures, will serve as a stimulus for Maldivian people and conservationists alike and will further promote the propagation and conservation of 'Forests and Trees for a Green Maldives'.

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Assistant Director-General and
Regional Representative for Asia and the Pacific
Food and Agriculture Organization of
the United Nations

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Minister for Fisheries, Agriculture
and Marine Resources
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Trees and Shrubs of the Maldives

Introduction

The human race depends on forests, trees and other vegetation for its survival and well-being. Women, men and children are attracted and attached to trees, shrubs, herbs and other vegetation for various reasons and purposes. Some trees are culturally valuable and some others are important in terms of social norms and beliefs as well as traditional systems but many of them are essential to satisfy basic human needs such as food, shelter, clothing and employment. They also play an important role in safeguarding environmental integrity. In an atoll environment like the Maldives, they are also important for reasons such as stabilization of sand and protection against salt spray. Trees and shrubs also play a critical role in reducing the impact of natural calamities, such as tidal waves and tsunamis on human lives and properties (Danielsen *et al*., 2005; Selvam, 2005).

As in many small islands, vegetation in the Maldives has changed both quantitatively and qualitatively over time due to overexploitation by increasing human populations, unsound land use practices, poor land tenure policies and intentional and unintentional introduction of exotics and commercial species (Wills and Gardiner, 1901; Zuhair, 1997). Such changes have made the islands of the Maldives, their ecosystems and human populations more vulnerable to natural calamities such as cyclones, tidal waves and tsunami and man-made calamities such as rising sea levels.

Taking these facts into consideration, this book on "Trees and Shrubs of the Maldives" aims to improve awareness of the trees and shrubs of the Maldives and their ecological importance; provide an overview of their local uses and potential role in increasing the economic security of Maldivian communities; and outline propagation and management techniques for their cultivation.

The Maldives

Geography

The Maldives is a large archipelago of 1190 coral islands, spreading over 860 km in a north-south direction in the Indian Ocean and covering an

area of 90,000 sq km. Only 202 of these islands are inhabited. The islands are grouped into 26 natural atolls and 19 atolls for administrative purposes (Fig. 1). These atolls are situated atop a 1600 km long undersea mountain range called as Laccadive-Chagos Ridge, which extends into the Central Indian Ocean from the south-west coast of the Indian subcontinent. Most of the atolls consist of a ring-shaped live coral reef supporting numerous islands. Most of the islands are small and vary in size between 0.5 and 5 sq km. They are flat and without hills or rivers. Nearly 80% of the land area is less than 1 m above mean high tide level (MHAHE, 1999).

Climate

The climate of the Maldives is equatorial, warm and humid with two pronounced monsoon seasons, the south-west and the north-east monsoon seasons. The temperature is fairly constant throughout the year with a mean annual temperature of 28°C. The average summer temperature ranges between 26.3 and 31.8°C and winter temperature between 25.1 and 30°C. The diurnal variation is very small, rarely exceeding 6°C. April is the hottest month with an average temperature of 30.8°C and October is the coolest with an average of 25°C. Relative humidity is high throughout the year, ranging from 73 to 85%.

The annual average rainfall in Maldives is 1890 mm. The rainfall in the southern atolls is greater with an annual average of 3050 mm, whereas it is only 1520 mm in the northern atolls. The south-west monsoon, which extends from the end of April to the end of September, brings heavy rain to the entire archipelago. The rainfall decreases considerably during the north-east monsoon season that prevails from December to March and during this season periods of drought may be experienced, particularly in the northern group of islands. However, the weather patterns of the Maldives do not always confirm to the monsoon patterns of South Asia. For example, heavy rain over the whole country has been known to occur continuously for up to one week even during the midst of the dry season.

The Maldives is outside the main area of tropical cyclones and therefore gales are uncommon and cyclones are very rare. However, during the south-west monsoon season strong winds and storms may hit the archipelago and can cause severe damage. On average, it is reported that thunder storms hit the Maldives on 23 days per year and strong winds on 12 days per year. In May 1991 tidal waves, created by violent monsoon winds, caused damage to thousands of houses, jetties and piers and flooded arable land with seawater. The damage caused was estimated at US $30 million.

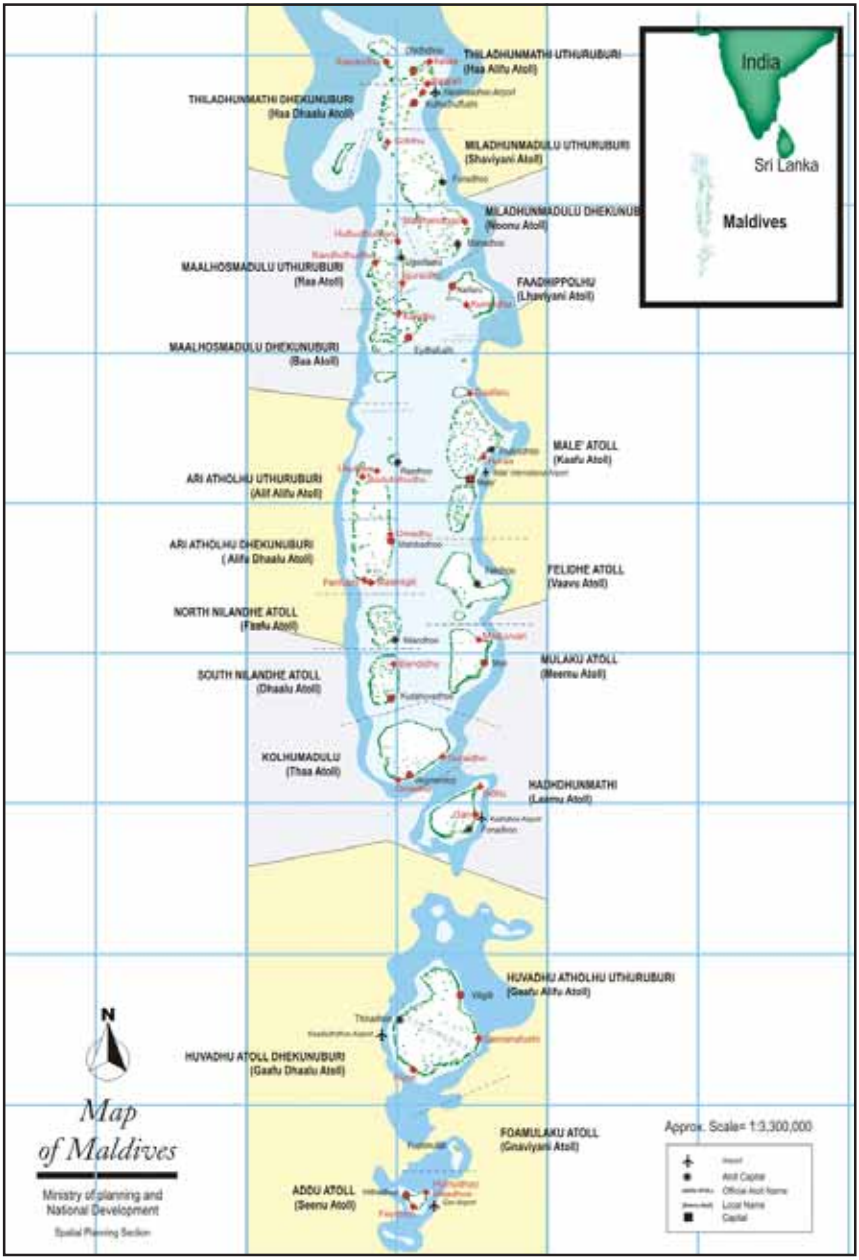


Fig. 1. Map of the Maldives

Soil

The soils of the Maldives are geologically young and consist of substantial quantities of the unweathered coral parent material, coral rock and sand. In most of the places, soils are coarse in texture and shallow in depth with a top layer of brown soil (0 to 40 cm in depth) followed by a transition zone on top of the underlying parent material of coral reef limestone (MFAMR, 1995). In some low-lying areas and areas subjected to significant mechanical breakdown from human activity, fine deep soils are found with accumulated deposits of clay. In a lagoon environment (locally called *kulhi*) the depth of the clay may be substantial due to the accumulation of material from marine and biological sources over a long period of time (MEEW, 2006). In many places, top layers of the soils have a weakly developed structure and at times a 30 cm thick hard-pan layer cemented with calcium carbonate is present, preventing penetration of the roots of most plants except large trees. The water-holding capacity of the soil is very poor due high porosity and very high infiltration rates.

The soils of the Maldives are generally alkaline with pH values between 8.0 and 8.8. This is mainly due to the presence of excess calcium and, soils containing higher levels of humus, as in depressions and lagoons, are less alkaline. The soils are generally poor and deficient in nitrogenous nutrients, potassium and several micronutrients particularly iron, manganese and zinc. Though the phosphorus content of the soils is high it is present mostly in the form of calcium phosphate and, thus, remains unavailable to plants.

Plant communities

Though the climate of the Maldives provides ideal conditions for luxuriant growth of tropical trees and shrubs, other factors such as salinity, the highly calcareous nature of soils and the salt-laden winds create harsh environmental conditions. This is one of the main reasons why the number of species in the Maldives, either native or naturalized, is limited.

The islands of the Maldives can, in general, be divided physiographically into three zones namely, i) the foreshore or lower beach, ii) the beach crest (beach top) and iii) the inner island. The foreshore can be further divided into high tide and high-storm levels. The high tide level is normally located at an elevation of 0.5 m above mean sea level and high storm level, which is beyond the reach of normal tides, is located at about 0.8 to 0.9 m. The storm level is affected by storm waves and is composed of gravel or shingle. The average elevation of the beach crest is about 1.2 m and the

inner islands are at about 1.45 m above mean sea level **(**Morner *et al*., 2003**).** Each of these zones provides relatively uniform environment with its own associated plant community. Plant community found in different physiographic zones of the Maldives is more or less similar to plant association reported in Nukunonu Atoll of Western Samoa (Parham, 1971).

i) Plant communities of the foreshore

The foreshore or lower beach zone, which includes the beach area between the high tide line and the beach crest, is totally exposed to wave action, wind and salt spray. It is unstable and composed mainly of coarse coral sand in the lower portion and shingle. As a result of the harsh environmental condition, this zone supports no vegetation except occasional creeping sand-binders such as *Ipomoea littoralis* and *I. biloba* along with a few individuals of *Launaea pinnatifida* and *Portulaca alata* in the upper portion.

ii) Plant communities of the beach crest

The beach crest or beach top rises gradually and sometimes abruptly to a height of 0.8 to 1 m above the high tide line and includes a stable beach frontage composed of coral sand and rubble. Like the foreshore environment, it is also exposed to winds and salt spray and its lower margin is occasionally or, in the case of an eroding beach, regularly inundated by seawater during spring tides. The beach crest may extend 5 to 20 m inland and provides a suitable environment for strand plant communities including a distinct association of trees and shrubs and a few sand-binding creepers and herbaceous plants. These strand plant communities include:

a) the *Scaevola taccada* scrub community, which forms an effective windbreak of about 3 to 4 m height on the seaward side of the islands immediately above spring tide level. It is normally found on sandy soils or soils dominated by coral rubble. It is the most common scrub community found on beach crests of both northern and southern islands of the Maldives.

b) the *Pemphis acidula* scrub community, which is commonly found on elevated reef rock, coral conglomerate beach rock or hard pan coral in open sites at or above the high tide level. Pure stands of closely growing *Pemphis acidula* trees, which are impenetrable, can be seen in

these areas and it is usual for the roots of these trees to be regularly wetted by seawater during high tide. In sandy areas *Pemphis acidula* can also be seen growing in association with a similar looking plant, *Suriana maritime*. These areas may have coral rock at very shallow depths.

c) the *Tournefortia argentea* community is found as a dominant strand community of the beach crest particularly in drier places in some of the northern islands. It is located very close to or just above the high tide line and may not form an effective windbreak as the trees do not grow closely together. It is sometimes associated with *Pandanus tectorius* and *Scaevola taccada.*

d) the *Guettarda speciosa* community is normally found only on highly elevated beach crests and is characterized by the presence of other species such as *Scaevola taccada, Pandanus tectorius* and a scattering of *Pisonia grandis* and *Cordia subcordata* trees.

iii) Plant communities of the inner island

The microclimate of the inner islands, protected by the beach-crest communities, supports the growth of a number of trees and shrubs, which occur either in pure stands or as a mixed forest (Forsberg, 1957). In many islands coconut plantations are present immediately adjacent to beach-crest vegetation and in moist areas the shelter provided by a complete coconut tree canopy supports the growth of under story tree species such as *Morinda citrifolia* and *Guettarda speciosa*. In some places, *Pandanus odoratissimus, Calophyllum inophyllum* and *Hibiscus tiliaceus* are also found in low numbers within coconut groves (Forsberg, 1957). In some other, particularly moist, areas small pure stands of *Hernandia nymphaeifolia*, *Cordia subcordata* and *Barringtonia asiatica* are present. In drier places including the northern group of islands, pure stands of *Hisbiscus tiliaceus* and *Premna serratifolia* are also seen. Where extensive coconut plantations are not present mixed species forest is the most common vegetation type found next to beach-crest scrub community. The principal tree species in these forests are *Pandanus, Hibiscus tiliaceus*, *Cordia subcordata, Hernandia nymphaeifolia, Calophyllum inophyllum, Barringtonia asiatica, Ochrosia oppositifolia, Guettarda speciosa, Adenanthera pavonina* and *Terminalia catappa.* These mixed forests also support good growth of under story species such as *Allophylus cobbe, Morinda citrifolia* etc. No regular features in terms of the dominance, frequency or density of tree and shrub species are prominent in the mixed forests. In many islands the original distribution of trees and shrubs has been greatly disturbed by the establishment of

extensive coconut plantations. As a result, beach-crest scrub communities and mixed forests are only found up to a short distance from the shoreline in many of the islands before merging into coconut plantations. As described in the species fact sheets, most of the trees and shrubs present in the beach scrub community and mixed forests are tolerant of salt-laden winds, salt spray, soil salinity and shallow nutrient-poor soils.

The above description of the plant communities of the Maldives islands and the overview of the ecology, propagation, management and economic uses of different species given in the following fact sheets provide a background to the opportunity that exists for the establishment of multi-tiered multispecies coastal bioshields or green belts. Such bioshields are essential for the ecological security of the Maldives islands and the economic security of the Maldivian people in light of future coastal hazards and predicted increases in sea levels.

How to use this book

How this book is organized

In this book 100 species selected on the basis of wide consultation are grouped as a) Broad leaved trees and shrubs, b) Mangrove trees and shrubs, c) Palm trees, d) Pandanus trees and shrubs and e) Narrow leaved tree - Casuarina. The fact sheets for each species include the following information:

i) Scientific name

ii) Synonyms

iii) Family name

iv) Common name(s) and Dhivehi name(s)

v) Species description

vi) Uses and

vii) Ecology, propagation and management.

Each species is illustrated with a combination of colour photos and drawings showing habit, bark, leaf structure, inflorescence, flowers, fruits and other characteristic features useful in identification. Under the heading ‘uses’, information on how the Maldivian community utilize different parts of the tree or shrub is given together with details relating to potential commercial use. Information on the soil types in which particular

trees and shrubs flourish and their tolerance to various environmental conditions such as salt spray, soil salinity, drought and wind, etc., is also given. Trees and shrubs useful in creating coastal bioshield are indicated and major methods of propagation are given for each species along with management information. References providing additional information on ecology, propagation and management of different species are given at the end of the book.

Technical terms relevant for the identification of trees and shrubs

To assist identification of featured trees and shrubs, plant physical attributes have been described with the minimum usage of technical terms. Some traditional botanical terms that may not be familiar to users have, however, been included and are explained here with illustrations provided to assist simple identification.

Leaves

Simple leaf: A leaf with a single leaf blade is called a simple leaf or a solitary leaf. The leaf blade may be entire or dissected into lobes or divided pinnately or palmately as shown below.

Entire: simple leaf that has no incisions

Pinnately lobed: simple leaf that has many lobes that are arranged on either side on the midrib

Palmately lobed: simple leaf that is divided into three or more distinct lobes, like the fingers of a hand

Bi-lobed: simple leaf that is divided into two lobes

Compound leaf: A compound leaf is a leaf where the incisions are such that the leaf is cut into distinct separate blades called leaflets. All the leaflets of a compound leaf are oriented in the same plane. When the compound leaf falls from the tree, it falls as a unit. In a compound leaf, the midrib is the rachis on which the leaflets are borne.

Pinnately compound leaf: leaf that has many leaflets, which are arranged in pairs on either side the rachis (looks like a feather)

Paripinnately compound leaf: pinnately compound leaf with no terminal leaflet

Imparipinnately compound leaf: pinnately compound leaf with a single terminal leaflet

Bipinnately compound: compound leaf that is twice pinnate with compound leaflets arranged on both sides of a central stalk

Palmately compound: compound leaf with many leaflets diverge from a common point (like the fingers of a hand)

Trifoliate: compound leaf that has only three leaflets, one at the tip and two below

Leaf shapes

Leaf shape refers to the outline of the leaf blade. The following are the main types of leaf shapes:

Linear: leaf that is long and narrow, with parallel or nearly parallel sides. Length of the leaf is generally more than ten times the width.

Lanceolate: leaf that looks like a lance, very long but narrow blade, widening about the base and tapering at the top, broadest point below the middle

Oblanceolate: leaf that is shaped like an inverted lance, broader at the top end than at the middle and tapering towards the base

Ovate: leaf that looks like a hen's egg, broadest point of the leaf is below the middle

Obovate: leaf that has an inverted egg shape

Elliptic: leaf that is longer than wide, narrow to round ends and widest at or about the middle. Leaf length is at least two times the width

Oblong: leaf that is longer than broader with the sides more or less parallel for most of the length of the leaf. The length is usually less than ten times the width

Cordate: leaf that looks like a heart, having two equal more or less round lobes at the base

Peltate: leaf like a shield with a flat leaf blade and a central leaf stalk

Leaf apices

This refers to tip of the leaves. The following are some of the major types of leaf tips:

Acute: sharply pointed tip

Acuminate: tapering to a long point

Apiculate: tip with a short, sharp, but not stiff, point

Obtuse: blunt, rounded tip

Emarginate: tip with a swollen notch at the apex

Mucronate: terminating abruptly by a short sharp point at the apex

Leaf bases

The following are the common types of bases noticed in many of the plants:

Attenuate: tapering gradually

Acute: pointed, forming less than a right angle

Obtuse: blunt, usually more than a right angle

Truncate: appearing as if the base is cut off, nearly straight across

Auriculate: having an ear shaped part at the base

Leaf margins

The following are the common types of margins found in leaves.

Entire: even and unbroken margin

Sinuate: margin with deep and rounded incisions

Serrate: margin toothed like a saw, with fine teeth pointing outwards

Undulate: margin which is wavy

Crenate: margin with shallowly round teethed

Leaf arrangement

Alternate: only one leaf is present at a node and leaves are on the same plane

Opposite: two leaves inserted opposite to each other on the stem

Spiral: leaves arranged singly but they arise all around the stem facing different planes

Whorled: three or more leaves radiating from a single point facing different planes

Flowers

Flowers are the most remarkable feature of angiosperms (flowering plants). They show striking variations in colour, shape and smell and therefore are considered as an important external feature of a plant that can be used for the identification of a plant species. The following is the cross section of a flower showing the different parts (Fig. 2):

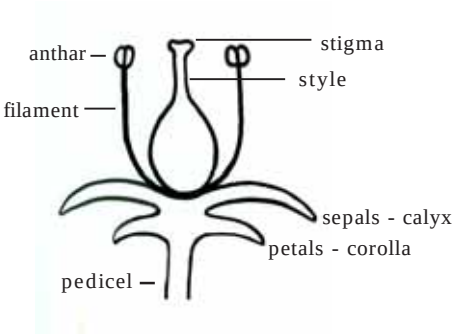


Fig. 2. Longitudinal section of a flower

Inflorescence

An inflorescence is a group or cluster of flowers on a plant. It is otherwise called a flower head or flower cluster. The stalk of the inflorescence is called the peduncle and the stalk of an individual flower is called the pedicle. Flowers arise in the axils of reduced leaf-like structures called bracts and a cluster of bracts is known as involucre.

An inflorescence is single when all the flowers are gathered in the same single pattern and it is called compound when a complex pattern is formed from other single patterns.

Single inflorescences

Main types of single inflorescences are as follows:

Raceme: a simple elongated inflorescence with stalked flowers; length of the stalk is equal in all the flowers

Spike: it is similar to raceme but flowers attached directly to the peduncle

Spadix: a thick fleshy spike, surrounded or subtended by a spathe (a large, often showy bract); flowers usually unisexual and minute

Corymb: it is similar to raceme but length of the stalk is unequal. It is flat topped with the oldest flower at the end of the main axis

Cyme: it is similar to corymb and flat topped with the youngest flower at the end of the main axis

Umbel: flowers are with equal stalk length and they arise from a single point from the top of the peduncle

Compound inflorescence

The following are the main types of compound inflorescences:

Panicle: it is formed by several racemes clustered together

Compound umbel: it is formed by several umbels clustered together

Fruits

Fruits are the seed-bearing organ of a plant, which display a wide range in size, shape and colour. It is another external feature that is used for identifying plants.

Pod: long dry fruit consisting of a seedcase, which splits open to release its seeds

Drupe: fleshy fruit having a single hard stone that encloses a seed

Berry: small, juicy fruit having the whole wall fleshy

Capsule: dry fruit that develops from two or more carpels (female reproductive unit of a flower comprising stigma, style and ovary)

Broad leaved trees and shrubs

Adenanthera pavonina - Madhoshi

Adenanthera pavonina L. MIMOSACEAE

Synonym: *Adenanthera gersenii*

Common names: Red bead tree, coral wood, red sandalwood

Dhivehi name: Madhoshi

Status: Common; found as a component of the closed forests of *Barringtonia asiatica* and coconut forests; occasionally grows amidst shrubs of *Hibiscus tiliaceus*

Description: A medium to large sized deciduous tree that grows up to 20 m tall. Trunk is straight with round but uneven and spreading crown. Multiple stems are common. Bark smooth with fissures, is brown or greyish in colour and has large number of lichens. Leaves are bipinnate with two to seven pairs of leaflets, which are pale green in colour, oval-oblong in shape with blunt tip and alternate in arrangement along the branches. Leaves turn yellow with age. Flowers are small, star shaped with five petals, yellow in colour, fragrant and are borne in slender, dense racemes, which look like rat tails. Fruit is a pod, curved, with slight constriction between seeds, black when ripen and twist upon drying to show seeds. Eight to twelve seeds are present in a pod. Each seed is about 0.9 cm wide, dark to bright red, shiny, lens shaped and extremely hard. Ripened pod remains attached to the tree for a long time.

Uses: Timber is hard, strong reddish and durable. In Maldives it is used to build any part of a boat (*dhoni*). It is also used in carpentry. Although raw seeds are toxic and may cause intoxication, roasted seeds are commonly eaten and are also powdered to make coffee. Young leaves are eaten as vegetables. Children love to collect the seeds to use them in two of their games, namely, *Ohvalhugondi* and *Thinhama*. According to some of the elders, seeds were used in the past to weigh gold since nearly all the seeds have a uniform weight of 0.25 grams. The species is a nitrogen fixer so can improve soil nitrogen content.

Ecology, propagation and management: *Adenanthera pavonina* is found growing on a variety of soils from deep, well-drained to shallow and rocky soils, but prefers neutral or slightly acidic soil. It is capable of quickly forming large colonies in moist closed forests, where the trunk grows very straight. It can be propagated from seed and the seedlings have epigeal germination. Since the seed coat is extremely hard, scarifying the seed surface or immersing the seeds in boiling water for one minute is required to increase the rate and reduce the time of germination, which otherwise may take up to 12 months. Nursery stock out-plants well. Growth rate is fast after the first year.

Albizia saman - Bodu gas

Albizia saman (Jacq.) F. Muell MIMOSACEAE

Synonyms: *Samanea saman, Entrolobium saman*

Common names: Rain tree, monkey pod

Dhivehi name: Bodu gas

Status: Occurs occasionally in nature; now it is widely planted

Description: A fast growing, semi-deciduous tree, which normally grows to 15 to 25 m in height but is capable of reaching up to 50 m. Crown is umbrella shaped; in open places the horizontal spread is greater than the height of the tree. Trunk is short and stout with grey, rough and fissured bark. Bark on younger tree is pale grey and smooth. Leaves are compound, arranged alternately along twigs with two to six pairs of pinnae. Each pinna has 6 to 16 pairs of leaflets, which are diamond shaped, shiny green on the upper surface and pale and finely haired on the lower surface. Leaflets are larger at apical end of the pinna. Leaflets fold during the night and sometimes on cloudy days. Flowers are pink in colour, numerous and clustered. Long stamens, which are red in the upper half and white below, give the whole flower head the appearance of a powder puff. Flowers bear honey. Fruit is a large pod, 10 to 20 cm in length, thick, black-brown in colour and filled with a sticky brownish sweet pulp. Each fruit contains 15 to 20 fatty, shiny, smooth and dark brown seeds.

Uses: Widely grown as shade providing and ornamental tree. Timber is light weight, durable and resistant to termites. It is used for carving, furniture, paneling and as veneer and plywood. It can be used for framing in boat building. It makes fairly good firewood but smokes a lot when burned. Tree yields a low-grade gum when wounded. Honey is also harvested from the tree. Pulp of the pod is edible but too astringent. In Maldives, it is mainly grown as an ornamental and shade tree. It is a nitrogen fixer.

Ecology, propagation and management: Rain tree grows on light, medium and heavy soils and also adapts to acidic and alkaline conditions. It can tolerate water logging for a short period and light salt spray but is intolerant to shade. It is propagated easily and commonly by seed but also by stem cuttings, root cuttings and stump cuttings. Seeds are placed in hot water for about three minutes and then soaked in cold water for 24 hours before sowing. Seedlings of about 15 to 30 cm can be used for outplanting. Seedlings of more than 1 cm stem diameter hold up better in wind and rain.

Allophylus cobbe - Dhon'moosa

Allophylus cobbe (L.) Bl. SAPINDACEAE

Synonyms: *Allophylus rheedii, Allophylus serratus*

Common name: Wild berry

Dhivehi name: Dhon'moosa

Status: Common in shrublands

Description: An evergreen, low branching small tree to shrub about 3 to 4 m tall. Trunk is straight with open canopy. In some old and larger trees buttress roots are found at the base of the trunk, which provide mechanical support to the tree. Bark is grey or brown in colour and rough and has a number of small swollen spot (pustular) and air pores. Outer layer of the bark is strongly aromatic and inner layer is fibrous. Branchlets are greyish brown in colour, slightly tapering and with numerous small orbicular air pores. Branchlets are hairy when young. Leaves are compound with three leaflets and each leaflet is 9 to 14 cm in length and 3 to 5 cm in breadth; upper surface is green and lower surface is pale green in colour. Terminal leaflet, which is larger than the lateral ones, is elliptic or elliptic-lanceolate in shape whereas lateral leaflets and ovate-lanceolate in shape. Leaf margin is sparsely curled. Leaves are arranged spirally along the branches and internodes are clearly visible. Inflorescence is axillary (between leaf base and branch), unbranched and its length is almost equal to that of the terminal leaflet. Flowers are small and white. Fruit is a small berry, round, fleshy and red in colour.

Uses: Fruit is edible and the flesh of the berry is eaten raw and tastes very sweet. Wood was occasionally used in the past for building traditional houses and to make bows. Leaves of the shrub, with other ingredients, are used in the treatment of bone fractures and other like ailments. The juice of the leaves is used to relieve rashes. Leaves ground with quicklime is applied with heat to relieve stomach aches. Roots are used to check diarrhoea.

Ecology, propagation and management: It is well adapted to grow in coarse and fine sandy and nutrient poor soil but prefers sandy loam with slightly high moisture content for better performance. It performs well in shade too. Its tolerance to draught is high. It is also tolerant to saline soil and salt spray. It is sometimes found growing as a minor constituent of strand vegetation. It is not cultivated but grows well in the wild. Seeds are normally dispersed by fruit-eating birds. According to some elders, it can be propagated by seeds. Seeds can be removed easily from mature fruits by squeezing them in water. Viable seeds will sink. These seeds are washed again and broadcasted on to the field. However, no attempt has been made so far to raise seedlings in the nursery.

Annona glabra - Kalhuthumeyvaa

Annona glabra L. ANNONACEAE

Synonyms: *Annona australis, Annona chrysocarpa, Annona peruviana*

Common names: Pond apple, bullock's heart

Dhivehi name: Kalhuthumeyvaa

Status: Common in home gardens. It has also become wild and naturalized along the border of open wetlands as in Fuvamulah Island.

Description: A semi-deciduous tree about 10 to 15 m tall. Normally with a single trunk but seedlings can grow in clumps giving the appearance of a multi-stemmed tree. Bark is grey, thin and fissured with prominent lenticels (involved in gas exchange and appear as raised spots). Mature trees have slightly buttressed roots. Leaves are leathery, simple, alternate in arrangement along the branches and oblong-elliptical in shape; upper surface of the leaf is dark green and underneath is pale. Foliage contains yellow leaves during the summer. Flowers are single, large, 2 to 5 cm in diameter, pale yellow to cream-white in colour and attractive with three leathery outer petals and three smaller inner petals with a red inner base. Fruit is mostly spherical in shape and looks like smooth-skinned sweetsop and mango in shape; some fruits look like bullock's heart. Fruit is green in colour when young but after falling from trees turn yellow and then black. Pulp is fleshy, pinkish-orange or orange, aromatic and pungent. Each fruit contains about 100 light brown coloured seeds, which are about 1 cm in length.

Uses: Fruits are delicious and eaten raw. They are also used in the preparation of a sweet drink. There is heavy demand for ripened fruit during the Ramzan season. Softwood and roots are used as fish floats. Bark is an excellent home for orchids and other air plants. Seedling can be used as a rootstock for custard apple and sweetsop.

Ecology, propagation and management: Pond apple requires ample soil moisture and sunlight. It can tolerate prolonged freshwater flooding but is intolerant to permanent inundation. Propagation is by seeds and stem cuttings. Both fruit and seeds can float and remain viable in fresh, brackish and seawater for many months. Once seeds settle in fresh or saline wet soil, they germinate quickly and growth is rapid initially. This species is suitable for coastal agroforestry because both seedlings and adult trees can tolerate high salinity and can survive root immersion by high tide. However, it can be an aggressive invader in open and disturbed wetlands where moisture and sunlight are plentiful.

Annona muricata - Anoanaa

Annona muricata L. ANNONACEAE

Synonym: *Annona bonplandiana*

Common names: Soursop, guayabano

Dhivehi name: Anoanaa

Status: Common in northern islands and found occasionally in southern groups. Grown in home gardens as a fruit tree.

Description: A small, low-branching (at the base of the tree), evergreen tree about 5 to 9 m tall. Trunk is straight. Bark is grey or greyish-brown, rough and fissured. Twigs bear large number of minute lenticels. Leaves are leathery, simple and arranged alternately; oblong, elliptic or narrow obovate in shape and pointed at both ends. Leaves are shiny, dark green on the upper surface, light green beneath; they produce a strong pungent smell when crushed. Flowers are large and single; emerge anywhere on the trunk, branches and twigs. Flowers are short stalked, plumb, triangular to conical in shape; have three outer petals that are fleshy, green or yellow-green and three inner petals that are pale yellow in colour. Fruit is covered with a reticulate, tender, inedible bitter skin with many stubby, curved, soft spines, whose tips break off easily when the fruit is fully ripe. Skin of the immature fruit is dark green in colour, becoming slightly yellowish-green in mature fruit. Flesh is whitish, fibrous and very juicy, smells like pineapple and subacid to acid in taste. Each fruit contains a few dozen to 200 or more seeds, which are shiny, hard, oblong and dark brown or black in colour.

Uses: Mature fruit, which is fragrant and delicious, is eaten fresh or used to make juices and sherbets. Fruit and fruit juice is taken to increase mother's milk after childbirth. Along with guava and passion fruit, soursop is considered promising for large scale marketing in the form of preserved pulp, jelly and syrup. Barks, leaves and roots are used in traditional medicine.

Ecology, propagation and management: *A. muricata* grows well in loose, fairly rich, and deep and acidic soil and can tolerate dry soil conditions and a coastal environment. It is commonly raised from seeds. Seeds may be sown directly in the field, nursery bed or containers and should be kept moist and shaded. Germination takes place with 15 to 30 days and seedlings can be planted out after six to eight months. Selected types can be propagated by cuttings or shield-budding. As a small and early-bearing fruit tree, it can be grown as intercrops with larger fruit trees.

Annona reticulata - Dhan'digandu atha, vilaathu atha

Annona reticulata L. ANNONACEAE

Synonyms: *Annona humboldtiana, Annona humboldtii*

Common name: Custard apple

Dhivehi names: Dhan'digandu atha, vilaathu atha

Status: Occasional; grown as fruit tree in home gardens.

Description: An erect, deciduous tree of about 4 to 10 m height with round or spreading crown. Bark is smooth, thin and grey in colour. Leaves are quite pretty, larger and darker than that of *Annona muricata*, alternate in arrangement and oblong or oblong-lanceolate in shape. Flowers are in groups of two or three on lateral peduncles, drooping and fragrant; there are three narrow, fleshy outer petals which are light green in colour externally and pale yellow inside with a red or purple spot at the base. Flowers never open fully. Fruits are pulpy of various shapes, ovoid, symmetrically heart shaped, lopsided, or irregular with deep or shallow notch at the base. Skin is thin and in ripened fruit it is yellow or brownish in colour with a pinkish, reddish or brownish-red blush and has a reticulate pattern of clear indentation on the surface. The flesh is creamy-white, thick and divided into juicy segments around a pointed, fibrous central core. Each fruit contains many seeds, which are hard, smooth, shiny and dark-brown in colour.

Uses: Fruits are edible; flesh may be scooped from the skin and eaten as is or served with a sprinkling of sugar. It is added to milkshakes to make a delicious drink. Fruit should be picked from the tree after it has lost all green colour and ripens without splitting. Leaves, bark and green fruits are all boiled together to prepare extremely potent decoction to cure severe cases of diarrhoea and dysentery. Decoction of leaves is used to relieve toothache. Seed kernels are very toxic.

Ecology propagation and management: It grows well in deep, rich soil with ample moisture and good drainage. It is also capable of growing in light sand but less drought-tolerant and prefers more humid atmosphere. Propagation is mainly by seeds. It can also be propagated by inarching, or by budding or grafting onto its own seedlings or onto soursop, sweetsop or pond apple rootstocks. Its seedlings are often used as root stock for soursop and sweet sop.

Annona squamosa - Dhivehi atha

Annona squamosa L. ANNONACEAE

Synonyms: *Annona asiatica, Annona cinerea, Annona glabra*

Common names: Sweetsop, sugar apple, custard apple

Dhivehi name: Dhivehi atha

Status: Common; grown in home gardens.

Description: A small, deciduous tree about 3 to 6 m tall with open crown of irregular branches. Bark is light brown in colour with visible leaf scars, smooth or slightly fissured into plates. Leaves are single; alternate in arrangement; oblong, oblong-lanceolate or narrowly elliptic in shape; thin; dull green on the upper side, pale blue-green and covered with bloom underneath. Young leaves are slightly hairy and are aromatic when crushed. Flowers emerge on slender branches singly or in groups of two to four and are oblong in shape. Sepals are hairy and pointed. There are three outer petals, which are fleshy, yellow-green on the outside and pale-yellow inside with a purple or dark-red at the base and there are three inner petals, which look like minute scales or are absent. Fruit is compound; round, ovoid or heart shaped; soft but with thick rind composed of knob-like segments; pale-green, grey-green or yellowish-green in colour and always with a bloom. Ripe fruit consists of conically segmented, creamy-white, glistening, and fragrant, juicy, sweet, delicious flesh. Each segment has an oblong, shiny and smooth, black or dark-brown seed.

Uses: Fruits are eaten fresh. Fruit flesh is also pressed through a sieve to remove seeds and is then added to ice cream or blended with milk to make a beverage. Seed kernels contain a whitish to yellowish, non-drying oil, which can be used as a substitute for peanut oil in the manufacture of soap. Bark and roots are highly astringent. Seeds are poisonous.

Ecology, propagation and management: Grows both in wet and dry soil but requires adequate moisture during the growing season. It is highly tolerant to drought, but requires adequate moisture during the growing season. It is intolerant to water logging. It grows on a variety of soils, including rich, well drained, deep rocky soils, but performs better on loose, sandy loams. It is shallow rooted and does not need deep soil. Trees are generally grown from seeds, which germinate better a week after removal from the fruit. Germination may take two to four weeks or more and the seedlings are ready for outplanting after six months. It is generally a slow growing tree. Vegetative propagation is preferred when sweetsop is grown as a commercial crop. Cleft-grafting, shield-budding, inarching are the common methods used. Trees grown by cuttings and air-layering have low rates of success.

Artocarpus altilis - Ban'bukeyo

Artocarpus altilis (Z.) Fosb. MORACEAE

Synonyms: *Artocarpus communis, Artocarpus incisa*

Common name: Breadfruit

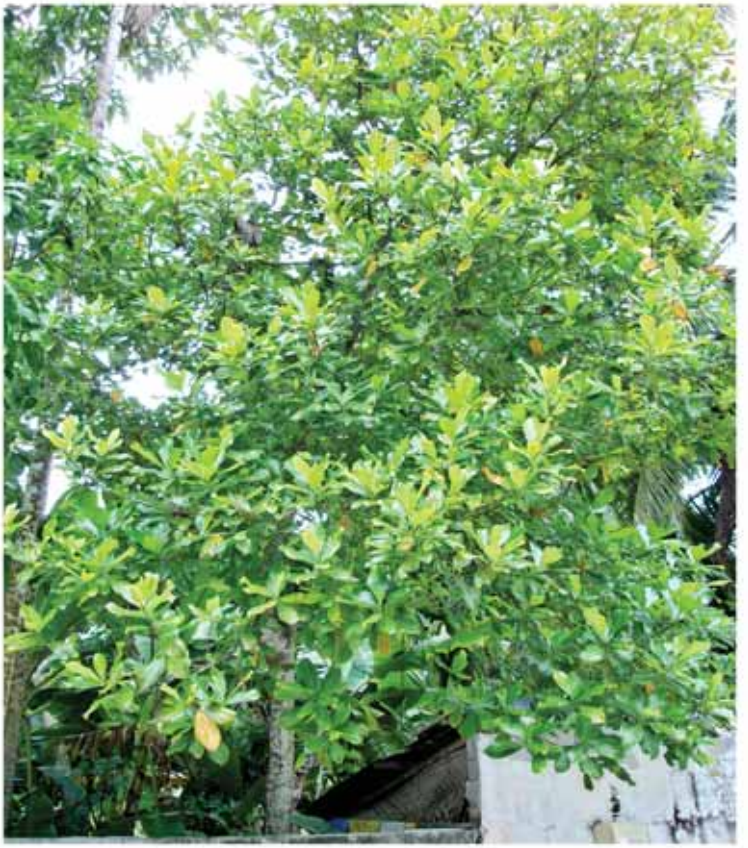
Dhivehi name: Ban'bukeyo

Status: Abundant; found in all places, except very near to beaches.

Description: A massive evergreen or semi-evergreen tree reaching a height of 30 m with often a clear trunk up to 4 to 6 m from the base. Bark is thick, smooth and light coloured. Branches are spreading, thick with lateral foliage bearing branchlets. Leaves are arranged alternately and they are thick, leathery and deeply cut into 5 to 11 pointed lobes; upper side is dark green and shiny with conspicuous yellow veins and underside is dull with elevated midrib. Flowers are tiny and clustered together. Female and male inflorescences are present separately on the same tree. Male flowers are arranged densely on drooping, cylindrical or club-shaped spike, which may reach a length of 25 cm. Female inflorescence stands upright, is round or cylindrical and about 8 to 10 cm in length with numerous green flowers embedded. Fruit is compound, ovoid to oblong in shape, may be 10 to 35 cm in length. Outer skin of the fruit is thin and patterned with irregular, four-six sided faces each of which has in the centre a sharp, black pointed, minute but flexible spine. Fruit is green in colour when young, turning to yellowish-green or yellow when ripe. All parts of the plant contain latex.

Uses: Breadfruit is a staple in the Maldivian diet. It can be cooked and eaten at all stages of its development. It can be eaten raw, boiled, steamed and roasted. Boiled breadfruit with fish broth of tuna and coconut forms an appetizing traditional food. A traditional delicious sweet, *bondibai*, is also made from breadfruit. Breadfruit can be roasted and made into chips, and both the traditional sweet and the chips have good market. Wood is very light, soft and durable and widely used in making doors, door and window frames and boats. Wood is also good for making surfboards. Gum from the tree is used for caulking boats.

Ecology, propagation and management: The cultivar found in Maldives has adapted to shallow, calcareous sandy soil but drainage is essential to avoid shedding of fruits. It is normally propagated vegetatively. It is often propagated by transplanting root suckers, which spring up naturally. Trees grown from root suckers will bear fruit in five years and will be productive for more than 50 years. Seedlings are also produced from root cuttings but it takes a long time to produce a seedling of about two feet to be outplanted. Other methods of propagation are air-layering, inarching, budding, stem cuttings and marcotting.



Artocarpus heterophyllus - Sakkeyo

Artocarpus heterophyllus Lam. MORACEAE

Synonym: *Artocarpus integrifolia*

Common name: Jack fruit

Dhivehi name: Sakkeyo

Status: Occasional; grown in home gardens.

Description: A gorgeous evergreen tree, 10 to 20 m tall with a straight large trunk. Canopy is dense and mostly dome shaped. Bark is greyish-brown, rough and somewhat scaly. Leaves are leathery, shiny and smooth; oblong, oval or elliptical in shape; and flat or wringled with sides curled upwards. In young plants leaves are lobed whereas in mature trees leaves are entire with pointed tip. Top of leaves is dark green, underside is pale green. Male and female flowers are borne in separate flower heads. Male spikes with tiny flowers are on new wood among the leaves. They are elongated, oblong, cylindrical or elliptical in shape and are hanging or drooping. Female spikes are solitary or paired, oblong or cylindrical and appear on short, stout twigs or even from the soil covered base of very old trees. Fruit is the largest of all tree-borne fruits; it may reach 90 cm in length, 45 cm in width and exceed 50 kg in weight. The outer skin of this compound fruit is green or yellow when ripe and is characterized by the presence of numerous hard, cone-like points. The interior contains large bulbs, which are golden-yellow or yellow-orange in colour, waxy, firm or soft, aromatic and sweet. Each bulb has a smooth, oval, light-brown seed covered by a thin white membrane. All parts of the tree, including fruits exudes copious, white, sticky latex.

Uses: Pulp, which smells pineapple and banana, is eaten fresh. The seeds are eaten boiled or roasted, are used to make curries, and sometimes dried and salted as table nuts. Timber is medium hardwood, resistant to termite attack and fungal and bacterial decay. It is lustrous when sanded and varnished. In Maldives, it is used in carpentry and sometimes for boat building. Latex can be used for caulking boats. Heartwood produces a rich yellow dye. Leaves, roots and sap are used in traditional medicine.

Ecology, propagation and management: Grows on a variety of soil but does not tolerate drought and flooding. It is moderately tolerant to saline soils and can be planted closely as windbreaks. It is propagated mainly from seeds; large seeds are selected, are washed thoroughly, the outer skin is removed, and seeds are sown fresh. Cuttings and air-layering can also produce seedlings. The seedlings should be planted by the time four leaves have appeared, after which it is difficult to plant out successfully due to the long and delicate tap root.




Averrhoa bilimbi - Bilamagu, bilimagu

Averrhoa bilimbi L. OXALIDACEAE

Common names: Bilimbi, cucumber tree

Dhivehi names: Bilamagu, bilimagu

Status: Common in home gardens.

Description: An attractive, strong but small tree about 4 to 7 m tall with a few upright branches. Bark is thick and brownish-red in colour. Leaves are compound, arranged alternately, have single terminal leaflet. Leaves are about 30 to 55 cm long and are clustered mainly at the branch tips. Each leaf has 15 to 21 leaflets, which are arranged alternately or slightly oppositely along a rachis. They are ovate or oblong in shape with rounded base and pointed tip and are medium green on the upper surface and pale on the under surface. Flowers are small with five red to dark red petals. Flowers emerge directly from the stem and on oldest branches. Fruit, "bilimbi", is 5 to 10 cm long, cylindrical and slightly five-sided with hair-like floral remnants at the lowest end. It is bright green when unripe and turns ivory or white when ripe; skin is very thin, soft and tender. Fruit is juicy and highly acidic.

Uses: Bilimbi is too acidic to be eaten raw but is used to make curry, chutney and salad. It is also cooked with chilli, which can be kept for a long time. To reduce acidity bilimbi is prickled and soaked in water overnight or boiled with salt for a few minutes. Fruit is also used to make jam and jelly. The fruit juice is used as a refreshing beverage and also used to clean metals and remove stain.

Ecology, propagation and management: It requires full sun for fast growth and prefers seasonally humid climates. It grows well in rich, moist, slightly acidic, well-drained soil but also grows and fruits well on sand and limestone. It does not tolerate flooding and salinity. Bilimbi is grown mainly from seeds. Stem cuttings are also used. It is a vigorous tree that requires no horticultural treatment. In Maldives attempts have been made to cultivate bilimbi on a commercial scale but with little success.

Averrhoa carambola - Kaamaranga

Averrhoa carambola L. OXALIDACEAE

Common names: Carambola, start fruit

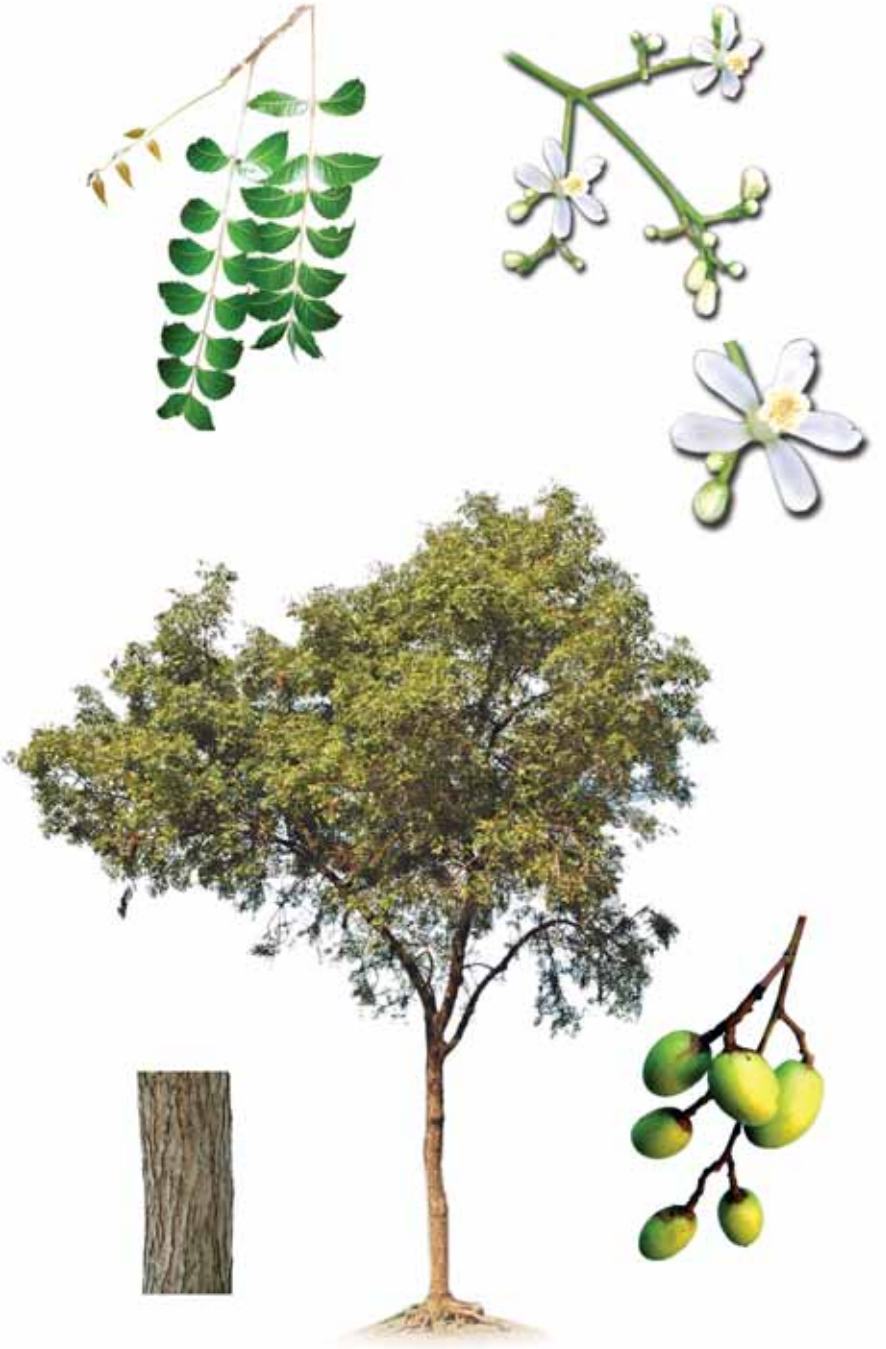
Dhivehi name: Kaamaranga

Status: Occasional; grown in home gardens.

Description: A small, evergreen tree 4 to 6 m tall with a dense, bushy, broad and rounded canopy. Trunk is short, multi-stemmed with many drooping branches. Bark is light brown, smooth or finely fissured. Leaves are compound and arranged alternately and spirally. Leaves have 7 to 11 nearly opposite leaflets (including a terminal single leaflet), which are ovate or ovate-oblong in shape, soft, medium green and smooth on the upper side, finely haired and whitish on the lower surface. Leaves are sensitive to light and touch; leaflets tend to fold together during night or when the tree is shaken or abruptly shocked. Inflorescence is a panicle borne in the axils of old branches, which are mostly without leaves or on young branches. Flowers are small, fragrant, downy, red-stalked with light-red or purple coloured jointed petals; calyx with five pink coloured sepals. Fruit is ovate or ellipsoid in shape, about 6 to 12 cm long, has five prominent longitudinal ridges (wings) so when cut, the cross sections of the fruit is star shaped. Fruit skin is thin, waxy, yellowish-green when young, becomes orange-yellow when ripe. Flesh is yellow, juicy and crisp with pronounced oxalic acid odour and taste ranges from sour to slightly sweetish.

Uses: Ripe fruits are eaten fresh, sliced and served in salads or used as garnish on seafood. They can be cooked with fish and shrimp. Underripe fruits are salted and pickled. Fruit flavour can be enhanced by removing the longitudinal wings, which contain most of the oxalic acid. Wood is whitish but becomes reddish with age and is medium hard and is used in construction and carpentry. Fruits, leaves and roots are used in traditional medicine to counteract fevers, headache and skin disorders and to relieve bleeding haemorrhoids. Carambola fruit is also used to quench thirst, stop vomiting and settle stomach disorders.

Ecology, propagation and management: Grows well on poor sandy soil, heavy clay and limestone but growth is faster and yield is higher in rich loams. It requires full sunshine and cannot tolerate flooding. It is widely propagated from seeds but also by budding and by grafting on to its own seedling rootstock. Flowering continues throughout the year and fruit is available most of the year. It is an ideal tree for landscaping.



Azadirachta indica - Hithi gas

Azadirachta indica A. Juss. MELIACEAE

Synonyms: *Melia indica, Melia azadirachta*

Common names: Neem, morgosa-tree

Dhivehi name: Hithi gas

Status: Occasional. Found mostly in home gardens and also in residential areas. It is considered as recently introduced into the Maldives but its presence was recorded in 1957 (Forsberg, 1957).

Description: A large tree that may grow up to 20 m tall but most trees found in the Maldives are less than 10 m. Canopy is dense with thick foliage and is round in shape. Bark is brown in young trees but with age turns to grey and develops deep furrows and scaly plates; inner bark is pink in colour. Leaves are pinnately compound, alternate and spirally arranged and fall during summer or drought. Each leaf has seven to nine pairs of 6 to 8 cm long leaflets, which are curved and lance shaped, have saw-toothed margins and pointed tip. Leaflets are smooth and dark green in colour. Flowers are small, white and fragrant, arranged in panicle flower heads, which arise from the corner of leaves. Fruit is a small drupe, oblong-ovoid in shape, green when young and yellow-green when ripe with white latex. Each fruit contains a single ellipsoid seed.

Uses: Multiple use tree; it can be grown as a windbreak, shade and fodder tree, used to improve soil condition and reclaim wasted land. It is also a timber tree. Wood is durable, seasons well but does not take polish well; highly pest resistant; used for construction, carpentry, toys, boards and panels. In some islands of the Maldives the wood is used for boat building. Oil is extracted from the seeds, which is used in soap industry. Leaves, kernels and oil cakes soaked in water can be used as a natural pesticide and pest repellent. Azadirachtin, a chemical extracted from the seeds and leaves affect the reproductive cycle of insects, nematodes, fungi, bacteria and even viruses and thereby control their multiplication. Leaves, bark, oil and roots are used widely in traditional medicine.

Ecology, propagation and management: Grows everywhere, on dry, stony, sandy, clayey, slightly acidic or alkaline, shallow soils. It is slightly saline-tolerant, can tolerate drought and high rainfall but cannot tolerate waterlogging. Propagated mainly by seeds; immediately after collection, fleshy part of the fruit should be removed, seed should be washed (not soaked) to remove casing and dried in shade for five to ten days. Seeds can be stored in well-aerated places for a short period, two to six months. However, it is recommended to sow the seeds as soon as possible to have a good germination. Seeds can be directly sown or seedlings may be raised in nursery beds or in containers. Transplanted wildlings also perform well.

Barringtonia asiatica - Kim'bi, Kin'bi

Barringtonia asiatica (L.) Kurz LECYTHIDACEAE

Synonym: *Barringtonia speciosa*

Common names: Sea putat, sea poison tree

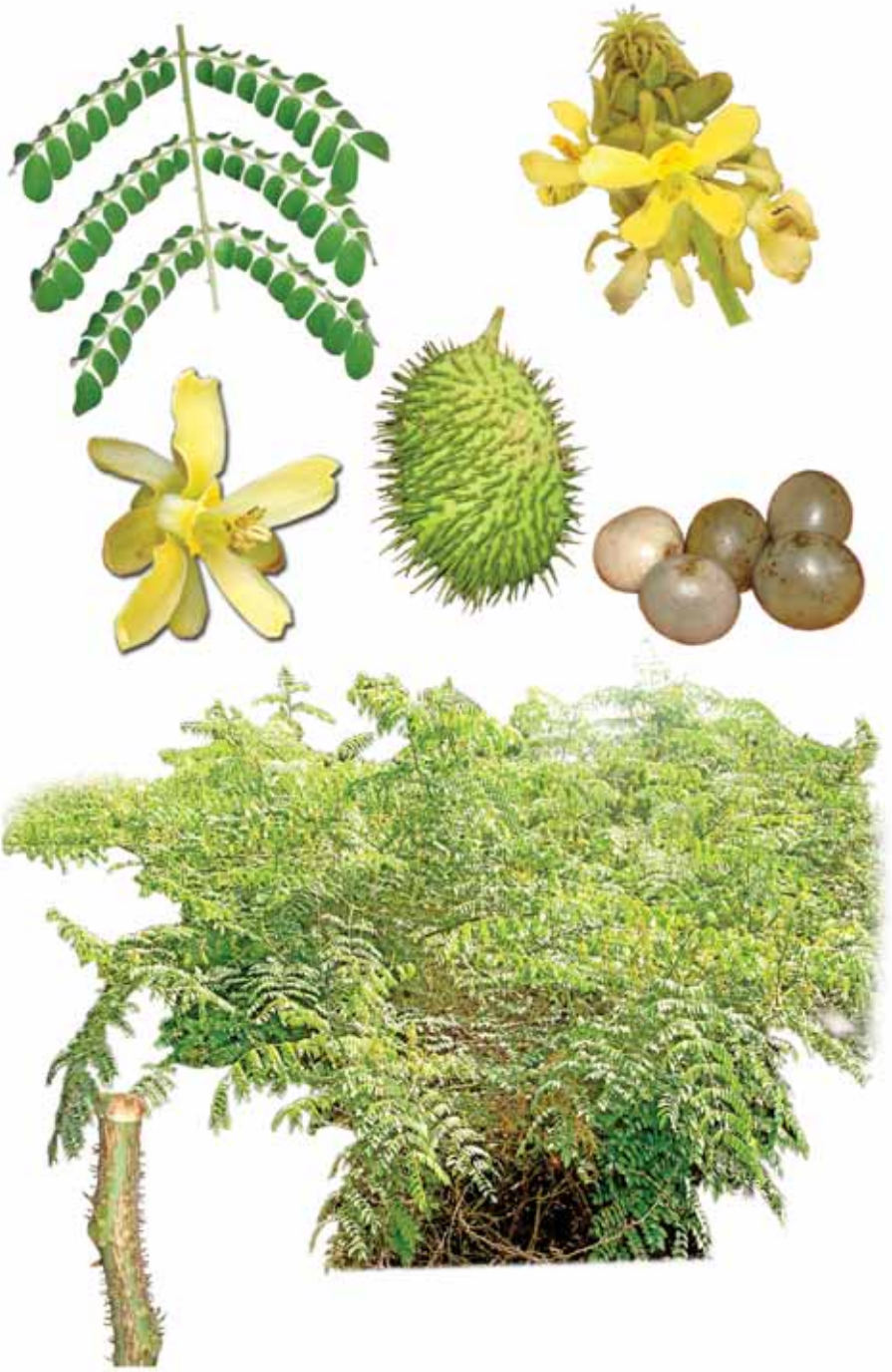
Dhivehi names: Kim'bi, Kin'bi

Status: Abundant in the southern islands but found only occasionally in northern islands.

Description: A huge tree about 20 m tall, with crooked often leaning trunk, often buttressed with low branches. Crown is dense and massive. Bark is thick, dark brown, slightly rough or somewhat scaly with elongated lenticels. Leaves are large and simple, terminal part is broader than the basal end, with entire margin and held in rosettes at the ends of branches; veins are prominent. Young leaves are bronze in colour with pinkish veins. Inflorescence is a raceme, erect and found at the tips of the branches. Flowers are large and attractive with stout stalk. Sepals and petals are small and distinctive, white or cream coloured. Stamens more than 100 in numbers and filaments are up to 15 cm long, which are white coloured at the base and pink at the tip. Flowers open in the night and attract large moths and nectar-feeding bats with their heavy scented and copious nectar. Fruit, called in Maldives as *kin'bi* or *kim'bi*, is large, four sided, lantern-shaped, about 10 to 15 cm long and 10 cm wide with persistent sepals and styles. Young fruits are green, turns to brown when mature. Middle layer of the fruit is spongy and contains air sacs, and inner layer is hard and thick and contain one seed.

Uses: It can be grown as a windbreak, and wave barrier and shade tree. Wood was once used in Maldives for boat building when there was a scarcity of boat-building timber. Wood is sometimes used for handicrafts and also as firewood. Local people apply well pounded seeds on the body for relief from pain and swelling. Water in which flowers were soaked overnight are used to wash face and eyes for relief from inflammation and discomfort resulting from reflection of sun light from white sand and sea. Fully developed fruit, which contains high amount of saponin, used elsewhere to stun fish in tidal pools and reefs.

Ecology and Management: *Barringtonia asiatica* is a typical littoral tree, forms thick forest in all types of soil even among boulders of rugged beach. In many islands of Maldives closed forests of *Barringtonia asiatica* with overlapping crowns is found behind *Scaveola* scrubland. In these places soil is rich and moisture content is relatively high. It grows in the wild from seeds. Fruits, after maturing on the tree, drop off and float in the sea for long periods, more than two years; they drift along the shore for long distances and finally washed ashore and sprout. *Barringtonia asiatica* is considered as one of the early colonizers of the islands of Maldives.



Caesalpinia bonduc - Kashi kaburan

Caesalpinia bonduc (L.) Roxb. CAESALPINIACEAE

Synonym: *Caesalpinia bonducella*

Common name: Grey nickernut

Dhivehi name: Kashi kaburan

Status: Occasional; it was once "common in whole archipelago" (Forsberg, 1957) but now it is found only occasionally mainly in some northern islands.

Description: A woody scrambling shrub growing up to 5 m tall with an irregular crown. Plant is covered with small 1 to 6 cm long recurved thorns (prickles). Leaves are 20 to 45 cm long with 4 to 11 pairs of pinnae and each pinna has five to ten pairs of leaflets, which are elliptic to oblong or ovate in shape with sharp or blunt tip. Spines are found scattered along the midrib (rachis) of leaf and pinnae. Leaves are more or less covered with short soft hairs both on the upper surface and underneath. Inflorescence is a raceme, produced in the axils of leaves, 12 to 20 cm long, and branched. Flowers are large, yellow coloured and pubescent. Sepals are shorter than petals and pubescent. Petals are about 1 to 5 cm in length and greenish-yellow to yellow in colour. Fruit is a pod, oblong-elliptic in shape, 4 to 10 cm long, 3 to 4 cm wide, turgid, thick and covered with bristly spines. Each pod has two hard, smooth, shiny seeds, which are ovoid or globose in shape. They have a distinctive attachment scar and faint concentric striations.

Uses: Seeds of the nickernut are called as "poor man's quinine" since they were once used as a substitute to treat malaria. The seeds are roasted, ground and boiled and used to control diabetes and hypertension. The seeds are used to treat mouth ulcers. In the Maldives, tips of the shoots are given to women as a medicine after child birth to hasten recovery. Seeds are widely used in many traditional indoor games.

Ecology, propagation and management: It is a hardy plant that grows well in sandy soil. It is saline tolerant and capable of forming dense thickets along the shoreline and thus, can used grown as a wind breaker and wave barrier. Not highly tolerant of stagnating water. Propagation is by seeds. Mature seeds are scarified and soaked in water for several days before sowing. It needs no special horticultural treatment. Seeds are very buoyant, have a hard imperious seed coat and can retain their viability after floating in sea for several months.

Caesalpinia pulcherrima - Fa'thangu

Caesalpinia pulcherrima (L.) Sw. CAESALPINIACEAE

Synonym: *Poinciana pulcherrima*

Common names: Peacock flower, dwarf poinciana

Dhivehi name: Fa'thangu

Status: Common

Description: An evergreen, low-branching and fast growing shrub that can grow up to 4 m tall. Canopy is round, moderately dense and wide spreading with smooth outline. Occasional pairs of thorns can be seen at nodes. Leaves are bipinnately compound and opposite or sub-opposite in arrangement and 20 to 30 cm long. Each leaf has four to six pairs of pinnae and each pinna has 7 to 15 pairs of leaflets, which are oblong or ovate in shape. They are 1 to 1.5 cm long and have smooth margin. Inflorescence is a corymb. Flowers are very showy, large, red, orange or yellow in colour. Each flower has five sepals and five petals and the fifth petal is far smaller than the other four. Fruit is a pod, which is flat, compressed, and green when young, brown when ripe. Each pod is about 10 cm long and contains five to six seeds.

Uses: Feathery foliage and brilliant scarlet and yellow flower and quick growth rate make *C. pulcherrima* a popular ornamental plant. It blooms all year round. In the Maldives, it is found grown commonly in home garden, parks and other public places. A variety of *C. pulcherrima* that has red flower with yellow margin is the National Flower of the Maldives.

Ecology and Management: Grows well in all kinds of soil including sand, clay, loam, acidic or alkaline soils. It is highly drought tolerant but is intolerant to flooding. It is moderately tolerant to aerosol salt and thus can be planted along the beach. Though it can grow in partially shaded places it requires full sun for flowering. Propagation is by seeds. Germination will be faster if the seeds are sanded slightly or soaked in hot water for hours. Wildlings that grow below the mother tree in home garden, parks and other public places can also be used for outplanting and they perform quite well. Tipping of the branches during the growing season creates a fuller shrub and more flowers. It needs pruning and normally grown with trainer, otherwise trees will droop as they grow.

Caesalpinia sappan - Bey's fathangu

Caesalpinia sappan L. CAESALPINIACEAE

Synonyms: *Caesalpinia minutiflora, Binacaea sappan*,

Common names: Indian redwood, sappan wood

Dhivehi name: Bey's fathangu

Status: Rare

Description: A small- to medium- sized sized, shrubby spreading tree that grows to 4 to 8 m tall. Bark is greyish-brown in colour with distinct ridges and sharp prickles. Young branches and buds are covered with soft small hairs. Leaves are bipinnately compound, 20 to 45 cm long and are alternately arranged. Each leaf has about 8 to 16 pairs of pinnae, which may be up to 20 cm long and with prickles at the base. Each pinna has ten to 20 pairs of oblong or oblong-rhomboid shaped leaflets, which are attached neither parallel nor at right angle to rachis and thus, give a distinctive shape to whole leaves. Leaflets are slightly shiny. Inflorescence is a raceme with long peduncle and located at the tips of the branches. Flowers are yellow coloured, 2 to 3 cm long with five shiny sepals and five haired petals. Fruit is a pod, which is shiny, thick, flattened, oblong and woody. Fruits are 7 to 8 cm long and 3 to 4 cm wide and dark-brown in colour with prominent recurved beak. Each pod contains two to five flattened brown seeds.

Uses: It is a multipurpose tree. Wood, which is known as redwood or Brazil wood, is dark red in colour, hard and lustrous and resistant to termite. It is of great value for making violin bows. It is commonly used for making walking sticks. It is also used for inlaying work and cabinet making. The heartwood yields a valuable dye, which is used in colouring leather, silk and cotton. This dye is also used to colour meat, wine etc., and has the potential to be used as a safe natural colouring agent. Leaves contain a pleasant smelling volatile oil. Decoction of the heartwood is used as a powerful agent to stimulate menstrual flow and a tonic for women for fast recovery after childbirth.

Ecology, propagation and management: It performs well in all kinds of soils and withstands any amount of drought but is less tolerant to wet soil. It requires full sunlight for better performance. Propagation is by seeds and stem cutting. Seeds are viable for about three months, which require scarification or soaking in warm water for about ten minutes before sowing. It is a fast growing species and within a year it reaches a height of 3 to 5 m. Stem cuttings, about 2.5 cm in diameter and 10 cm long are also used for propagation. Initially sappan wood grows straight, but after reaching a height of 2 to 3 m, branches start to droop and by means of this spine entwine with branches of nearby tree to form thickets. In commercial cultivation, tree is cut about 1m above the ground and stump sprouts profusely within two weeks.

Calophyllum inophyllum - Funa

Calophyllum inophyllum L. CLUSIACEAE

Common name: Alexander Laurel wood

Dhivehi name: Funa

Status: Abundant in the southern islands and common in the northern islands.

Description: A large- to medium-sized, slow-growing evergreen tree that grows 8 to 20 m in height but is capable of reaching 45 m in favourable environment. Crown is spreading with many large irregular branches and is round or pyramidal in shape. Bark is thick and light grey to grey in colour with alternately arranged diamond-shaped fissures and flat ridges. Leaves are stiff, shiny and oval, oblong-oval shaped. They are arranged oppositely along the branches and dark green in colour with close set of parallel veins. Both the tip and base of the leaves are round. Inflorescence is a stalked raceme. Flowers are white and small with four oblong, spreading petals. Stamens are golden yellow in colour and pistil is pink coloured. Flowers are fragrant and sparkling like stars against the dark green background of the leaves. Fruit, which grows in a cluster, is a round, ping-pong ball-like drupe with leathery skin. It is green when young, turning to yellow and then brown and wrinkles when ripe. Fruit skin covers a hard woody shell with corky inner layer, containing a seed. Trunk exudes a gum when wounded, which solidifies quickly.

Uses: It is one of the finest timber trees of the Maldives and widely used in boat building. Wood is hard, durable and fine textured with moderately dense and interlocked grain. It shrinks appreciably upon drying and thus is difficult to work with. Seed is roasted and made into a paste by grinding with the charcoal from the coconut husk and this paste is applied in between the plates in boats as waterproofing. Seed oil is poisonous but used to light lamps, as it lasts for a long time. The seed oil is also used in ayurvedic medicines. It is also a handsome ornamental and shade tree.

Ecology, propagation and management: It tolerates a wide range of soils but grows best in well-drained sandy soil in coastal areas. It is a hardy species, tolerates high wind, aerosol salt spray, drought and even brief period of water logging. It is also tolerant of shallow and saline soils. Propagation is mainly by seeds. Seeds may be sown directly or seedlings can be raised in nursery for outplanting. In order to increase the rate and timing of germination, ripe fruits may be soaked in water overnight, which will facilitate easy removal of skin and then shells can be cracked just prior to sowing. Nursery raised seedlings can be outplanted after one to three months. Seedlings should be hardened off before outplanting. Performance of transplanted wildlings is poor.

Calotropis gigantea - Ruvaa

Calotropis gigantea (L.) R. Br. ASCLEPIADACEAE

Common names: Giant milkweed, bowstring hemp

Dhivehi name: Ruvaa

Status: Occasional; found mostly in wasted land nearby residential areas.

Description: A medium sized shrub that may grow up to 3 m tall. Bark of the stem is yellowish- grey and has longitudinal fissures. Leaves are elliptic to oblong in shape, 8 to 10 cm long and 5 to 8 cm wide with pointed tip and heart-shaped base. Leaves are thick and feathery to touch, covered with soft white hairs. Flowers are arranged in auxiliary or sub-terminal simple or compound flower head. Flowers are drawn on the outside. Corolla is about 2 to 3 cm in diameter and dull purple or purplish-lilac in colour. In a variety of giant milkweed flowers are white in colour. Fruit is follicle, recurved, oblong in shape and about 7 to 10 cm in length. Seeds are ovate in shape, 5 to 6 mm long with bright, silky-white fibrous material (floss). Flowers are produced throughout the year.

Uses: Strong fibre can be extracted from the stem, which is durable under water. In the Maldives, giant milkweed stems are kept in the seawater till they become soft and then fibre is extracted from the softened stems. This fibre is so strong that it is commonly used to make loops in the fishing lines from which hooks are suspended. Fibre extracted from the stems was once used as bowstring. Wood is used to make fine quality charcoal and gunpowder. Floss obtained from the fruit is used to stuff mattresses. The plant as a whole can be allowed to mulch in the soil to provide protection to crops against soil-borne microbes. In the traditional medicine of the Maldives, five parts of the plant, namely, roots, bark, leaves, flowers and fruits are used to treat rheumatism. Leaves are considered as a good pain reliever. The matured leaves are smeared with sesame oil, warmed and pressed on aching body parts to provide relief from pain.

Ecology, propagation and management: *Calotropis gigantea* is normally considered as a wasteland weed. It is found growing in all types of soil including wet clay soil to dry coastal sands. It grows in a xerophytic condition also. It is not normally cultivated but in some countries it is grown as an ornamental plant. In nature, seeds with a parachute of hairs (floss) are easily spread by winds. Seeds are also spread by water over a long distance. Local stands of *C. gigantea* normally increase through root suckers.

Carica papaya - Falho, veyo falho, rangu falho, ran falho

Carica papaya L. CARICACEAE

Common names: Papaya, papaw

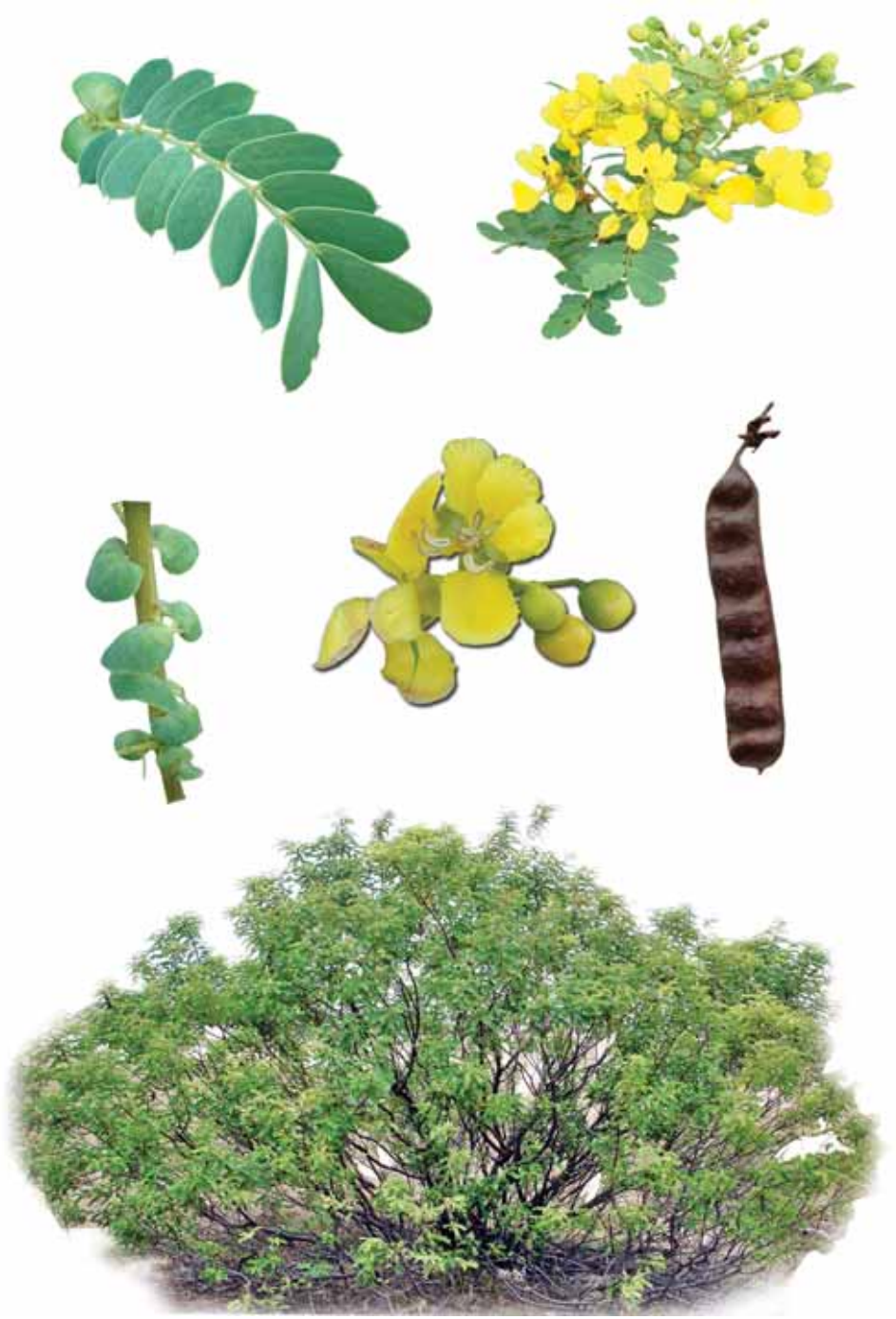
Dhivehi names: Falho, veyo falho, rangu falho, ran falho

Status: Commonly cultivated in home gardens both in the northern and the southern islands.

Description: A fast growing, woody, tree-like herb that grows up to 3 m tall. It normally does not branch but if the top is cut off or injured, it produces a few branches. Trunk is straight, hallow and green or deep purple in colour with prominent leaf scars. Leaves are arranged spirally and clustered at the top of stem. Leaf stalk is about 1m long, hallow and succulent. Leaf is divided deeply into five to nine segments with prominent yellowish ribs and veins. Flowers are fleshy, waxy and slightly fragrant. Some plants bear only short-stalked female flowers whereas some other plants may bear only male flowers, which are clustered on 1.3 to 1.6 m long panicles. Some plants bear bisexual flowers. Male or bisexual plants may change completely into female plants after being beheaded. Fruit is a fleshy berry, oval to nearly round or somewhat pyriform or elongated club-shaped. Fruit has thin, waxy skin, which is green in colour when young, becoming light or deep yellow as it ripens. Flesh is succulent, yellow or golden-yellow or orange-red in colour, aromatic and sweet. Seeds look like pepper, about 5 mm long, black or grey-black in colour and attached to the flesh by a soft, white, fibrous tissue. All parts of the plant are rich in white latex.

Uses: Ripe fruits, available throughout the year, are eaten fresh and widely used in salads. Papaya juice, prepared from peeled fruit, is a delicious drink. In the Maldives, unripe fruits are used to prepare spicy curry whereas a special dish called *"falho murubb'* is prepared by cooking young ripe fruit in sugar syrup. Fruits and leaves can be used to tenderize meat.

Ecology, propagation and management: Papaya grows well in hot places and requires light and porous soil rich in organic matter for better performance. It is also capable of growing in marl, scarified limestone and other types of poor soils. However, it is very sensitive to water stagnation and even well-grown plants would be killed by root rot in excess moisture. Papaya is normally propagated by seed. Seeds, extracted from ripe fruits, are washed to remove gelatinous seed covering (aril) and then dried. Dried seeds are dusted with fungicide to avoid damping-off, which is a common cause of loss of seeds. Rate of germination is high, if the seeds are planted as soon as they are extracted from the fruits. Papaya can also be grown from semi-hard woodcuttings, which need to be hardened off for a few days before planting. Air-layering is also practiced in a small scale to reproduce certain varieties.



Cassia auriculata - Ranauraa

Cassia auriculata L. CAESALPINIACEAE

Synonym: *Senna auriculata*

Common name: Mature tea tree

Dhivehi name: Ranauraa

Status: Occasional; once it was common in wild in many of the islands of the Maldives but now it is found only in a few islands.

Description: A profusely branched, evergreen shrub that grows up to a height of 4 m. Bark is smooth and reddish brown in colour. Leaves are bipinnately compound and are 5 to 10 cm in length. Each pinna has seven to nine pairs of leaflets; leaflets at the tip of the pianna are broadly ovate whereas lower leaflets are oblong-elliptical in shape. Stipules are auricle or lunar shaped and persistent, by which it can be easily distinguished from other shrubs of *Cassia*. No gland is present on the petiole but they can be seen along the rachis, opposite to leaflets. Flowers are yellow in colour, 2 to 5 cm long and 5 cm in diameter and arranged in terminal compound inflorescence. Fruit is a thin flat pod, pale brown in colour, about 15 cm in length and 1.5 cm in breadth and crumble easily. Each pod contains 6 to 12 small, compressed seeds.

Uses: *Cassia auriculata* has high medicinal value and is widely used in the preparation of different kinds of traditional medicines. Leaves and seeds are considered as natural laxative, frequently used to alleviate occasional and habitual constipation. Dried flowers are commonly used in the treatment of diabetes. In the Maldives, flowers are boiled and used as an ingredient in the preparation of a traditional medicine, which is given as a post-partum medicine to women after childbirth; this medicine is considered as a tonic for the young mother and also said to have properties to clean up the womb. It is also used to ease the discomfort in women during menstruation.

Ecology, propagation and management: This sun-loving plant grows well in all kinds of soil but the performance is good in porous soil, including coastal sands. It also grows well in dry areas. It is not cultivated in the Maldives but can be easily propagated by seeds. In the wild it often forms large clumps in open places.

Cassia fistula - An'malthassh

Cassia fistula L. CAESALPINIACEAE

Common name: Golden shower

Dhivehi name: An'malthassh

Status: Occasional; grown as an ornamental tree in public places.

Description: It is a medium sized, deciduous, fast growing tree, about 5 to 10 m tall. Crown is oval or vase shaped. Trunk is straight. Bark is smooth, slender and pale grey when young, turning to brown and scaly in old trees. Branches are well spaced and dropping. Leaves are bipinnately compound, 20 to 40 cm long with four to eight pairs of leaflets. Each leaflet is about 8 to 10 cm long, 2 to 4 cm broad with distinct petiole. No gland is present in the leaf. Leaves drop from the tree for a short period of time during the summer. Flowers are bright or golden yellow in colour, 3.5 to 4 cm in diameter, arranged in drooping racemes, which are about 30 to 60 cm in length. Flower bunches appear when the branches are bare, just before the new leaves emerge and during that time it looks like as if the entire tree is clothed with flowers. Fruit is a cylindrical pendulous pod, 40 to 70 cm long, smooth and purple in colour. Fruit has numerous transverse septa between the seeds and walls of the septa are with black, sweetish pulp. Each pod contains about 25 to 100 seeds, which are light brown in colour, hard, lustrous but poisonous.

Uses: In the Maldives, it is grown as a shade and ornamental tree. However, it has many other uses. Wood, which is red in colour, is hard and heavy, strong and durable and thus suitable for cabinet work, interior work, posts, wheels and mortar. It is also used in ayurvedic medicine to treat various kinds of diseases. Roots are used to treat various skin diseases and syphilis. Leaves are useful in alleviating rheumatism. Flowers are used as a mild laxative and as an antipyretic.

Ecology, propagation and management: Golden shower grows on clayey, loamy, sandy, acidic and alkaline soils but it performs well in well-drained sandy soil. It requires full sun. It is moderately drought and saline tolerant and also tolerates aerosol salts. Thus, it is suitable to be planted in the coastal areas. Propagation is mainly by seeds. Seeds can be soaked in concentrated sulphuric acid for 15 minutes and washed thoroughly and soaked in water for 24 hours before sowing and such treated seeds will germinate within a day. Manual scarification can also be done before sowing. It coppices vigorously and produces root suckers freely. Young trees need staking and pruning for the development of a well-shaped and structured crown.

Cassia occidentalis - Dhigu thiyara

Cassia occidentalis L. AESALPINIACEAE

Synonym: *Senna occidentalis*

Common names: Coffee senna, fedegoso

Dhivehi name: Dhigu thiyara

Status: Common; grown near houses.

Description: A much branched, smooth, half woody herb or shrub about 0.8 to 1.8 m tall. Stem is erect and without hairs. Leaves are bipinnately compound and about 20 to 25 cm in length. Each pinna has four to seven pairs of leaflets, which are 3 to 9 cm in length and 2 to 4 cm in width and arranged oppositely. Leaflets are ovate or ovate-lanceolate in shape with a long, fine pointed tip. Each leaf has a distinct spherical-shaped gland, which is located about 0.3 to 0.5 cm from the base of the petiole. This is one of the features that can be used to distinguish coffee senna from other related species such as *Cassia tora* (sickle pod) in the field. Inflorescence is a terminal or axillary raceme. Flowers are yellow coloured and about 2 cm long and 3 to 4 cm wide. Fruit is a pod, compressed, 8 to 12 cm long, 0.7 to 1 cm wide and curved slightly upwards. Each pod contains 20 to 30 seeds, which are ovoid in shape, smooth, shiny and dull brown to dark olive-green in colour.

Uses: Coffee senna has many medicinal value and is reputed as a tonic, diuretic and antihelminthic agent. In the Maldives, seeds are roasted and powdered to prepare strong coffee. It is given as a substitute to coffee and also as a tonic. It is also given to alleviate asthma and to persons suffering from hysteria. In the Maldives, the leaves, which are laxative and liver detoxifying, are widely used as a leafy vegetable and eaten either raw or mixed with coconut, chilly and onion.

Ecology, propagation and management: It grows on a variety of soils but prefers slightly acidic to neutral soil. It requires high soil moisture for better performance. It is not cultivated in large scale but grown near houses or even in home gardens. It can be easily propagated by seeds. Seeds can be collected from mature pods, which split upon maturity. Seed may be manually scarified to increase the rate of germination.

Cassia surrattensis - Ranuwia

Cassia surrattensis Burm.f. CAESALPINIACEAE

Synonym: *Cassia glauca*

Common names: Scrambled egg tree, galucocus cassia

Dhivehi name: Ranuwia

Status: Occasional; grown as dooryard ornamental plant.

Description: An evergreen, fast-growing shrub to small tree, about 2 to 5 m tall. Leaves are bipinnately compound, 9 to 15 cm long with eight to ten pairs of leaflets. Leaflets at the distal end of the leaf are larger in size and narrower, 2 to 5 cm long and 1 to 2 cm wide and obovate to elliptic-ovate in shape. Leaflets at the bottom of the leaf are almost round in shape. Upper surface of the leaflets are dark green in colour and usually without hairs but lower surface has sparely appressed hairs (pubescent). Tip of the leaflets is round and emarginated and the base is obliquely rounded. Nectar glands are present between the first, second and sometimes third pairs of leaflets. Stipules are linear, 0.5 to 1.5 cm long. Inflorescence is an axillary raceme. Flowers are bright yellow or orange yellow in colour, 1 to 3 cm long. Fruit is a pendulous pod, about 6 to 10 cm long, strongly compressed and with a stipe (spine like structure at the base of the pod) of about 0.5 to 0.8 cm length. Seeds are pale brown in colour, shiny and oblong-ellipsoid in shape.

Uses: Widely grown as an ornamental tree. It is attractive since the bright or golden yellow flowers are excellently offset by the dark green leaves. It is capable of blooming almost every day and blooms look like scrambled eggs.

Ecology, propagation and management: Scrambled egg tree is capable of growing on all kinds of soil including coastal sands. Like other species of Cassia it also loves full sun but is capable of growing in partially shaded places also. Initially it requires frequent watering but tolerates drought once established. Propagation is by seeds. Pods are allowed to dry on the plant itself and after that they are opened manually to collect the seeds. Seeds are sown directly and no pretreatment is required.

Citrus aurantifolia - Lun'boa

Citrus aurantifolia (Christm. & Panzer) Swingle RUTACEAE

Common names: Lime, sour lime

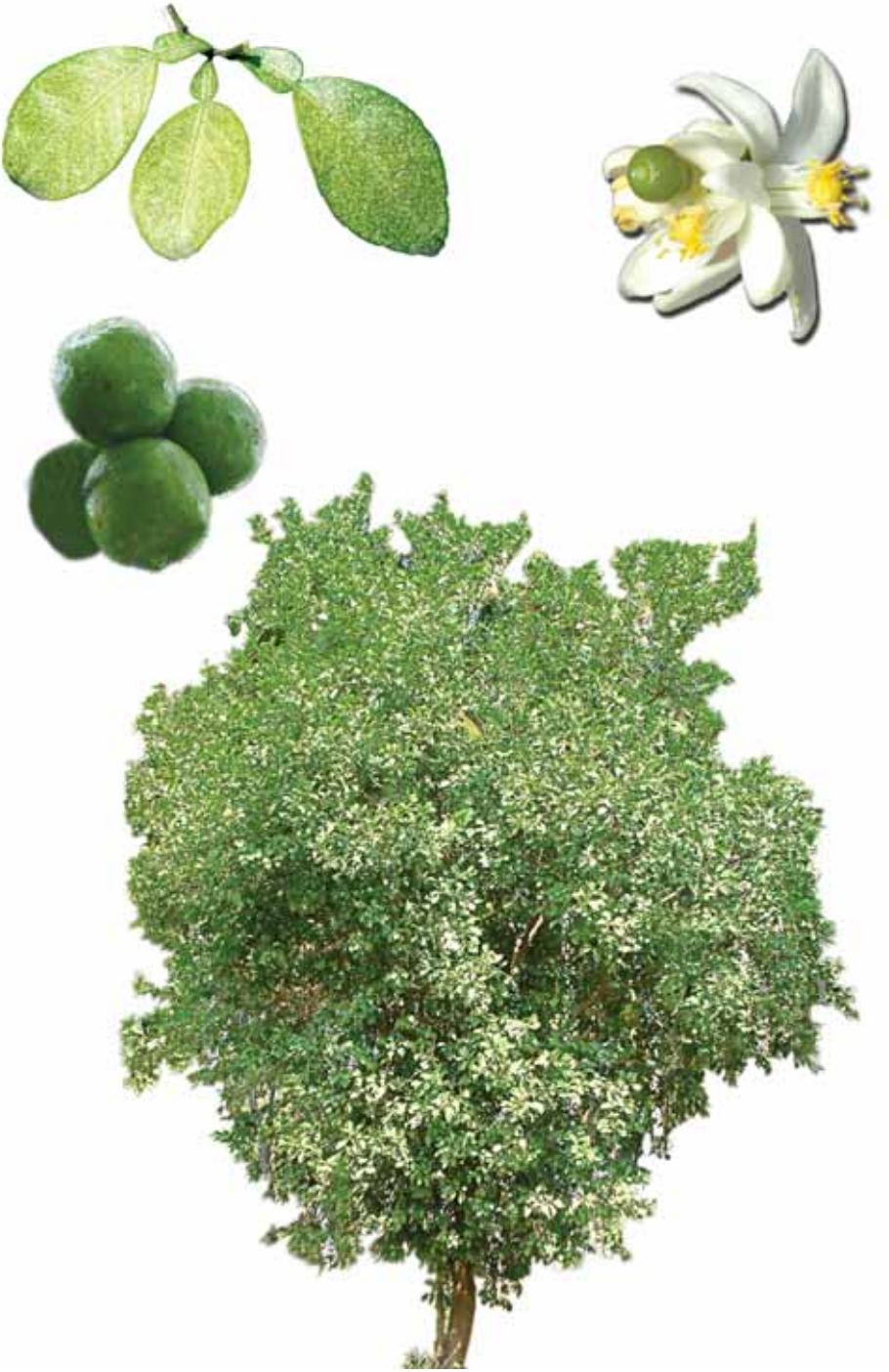
Dhivehi name: Lun'boa

Status: Common; grown widely in home gardens.

Description: A small, densely and irregularly branched, evergreen tree, about 3 to 4 m tall. Short, sharp, stiff spines are present in the branches and twigs. Leaves are elliptic to oblong-ovate in shape, 4 to 8 cm long and 2 to 5 cm wide and arranged alternately on the branches. Leaf stalk is narrowly winged and the leaf margin is crenulated. Leaf tip is variable, blunt in some and sharply pointed in other leaves. Leaf surface is dark green to pale green in colour. Flowers are small, white, with cup-shaped calyx, four to six lobed. Number of petals varies between four and six. Flowers are either perfect or male and they are seen in a cluster of ten flowers in the leaf axis of mature shoots. Sometimes single flower can also be seen in the axils of the shoots, which are just emerged. Fruit is a globose to ovoid berry, 3 to 6 cm in diameter with thin skin, which is characterized by the presence of a large number of minute glands. Fruit is green when young, turning to yellow when fully ripe. Flesh is yellow-green in colour, juicy, very acid and fragrant. Seeds are small in size, ovoid in shape and smooth. It bears fruit throughout the year. Root suckers are common.

Uses: Lime is widely used for flavoring a variety of food. Drinks are commonly prepared either with sugar or salt. It is also widely used in the preparation of pickles. In the Maldives, rice is mixed with "*garudhiya*" (tuna stock) and a dash of lime to make a delicious food. Another favorite item of Maldivians is "*lonu lumbo*" which is prepared by ripening the lime in salt water and drying them in the sun until the interior turns brown. It is also regularly used in the preparation of curries and chutneys. Leaves and fruits have many medicinal values.

Ecology, propagation and management: Lime is capable of tolerating very infertile and poor soil and is capable of growing well in sandy soils with proper drainage. It is affected severely by water logging. It is highly drought resistant but requires irrigation to produce quality fruits. Propagation is mainly by seed. Air-layering is common in South-east Asia. Suckers are prepared for air layering and layers are potted and nursed for about two to four weeks before outplanting.



Citrus aurantium - Naarin'gu

Citrus aurantium L. RUTACEAE

Common names: Sour orange, bitter orange

Dhivehi name: Naarin'gu

Status: Commonly grown in the home garden in some of the southern islands.

Description: An erect, much branched evergreen tree, about 3 to 9 m tall. Crown is compact and rounded. Bark is brown and smooth. Young twigs are angular, flexible and bear slender short spines. In older branches spines are stout and longer, about 8 cm in length. Leaves are simple and arranged alternately. They are broadly ovate to elliptical in shape with minutely toothed margin and obtuse or bluntly pointed tip. Upper surface of the leaf is dark-green and pale beneath. Leaf petiole is 2 to 4 cm long, upper half is narrowly to broadly winged and triangular-obovate in shape. Leaves are aromatic when crushed. Flowers are borne singly or in small clusters in the leaf axils. They are white in colour and have recurved, widely separated four to five petals surrounding a tuft of up to 24 yellow stamens. Fruit is round or oblate or oblong-oval in shape, 5 to 8 cm wide, with thick, smooth to warty and aromatic skin. Matured fruit is reddish-orange to yellow-orange in colour and central core is usually hollow. Fruits have ten to 12 segments with bitter walls containing acid pulp. Fruits have a few to numerous seeds. Sour lime has a number of well-established varieties.

Uses: An essential oil called *neroli* is extracted from the flowers of the bitter orange, which is an essential component of high-quality perfumes and of the toilet water 'eau-de-Cologne'. Bitter orange juice is considered as a digestive tonic, helps to relieve nausea and soothe stomach disorders. In the Maldives, sour orange is mostly used to prepare sweet or sour drinks. It is also used in the traditional medicinal system of the Maldives to treat kidney stones. The skin of the fruit is crushed and mixed with warm water and drunk regularly to get rid of the stones.

Ecology, propagation and management: It is adaptable to a wide range of soils including dry coastal soil. It does well in rich soils with high water table. It tolerates high temperature, provided soil moisture is adequate. Dry hot winds may reduce leaf size and may cause heavy withering during flowering. Propagation is by seed, grafting and budding. Seeds are planted in seed beds and then transplanted in containers before outplanting. It is generally grown for rootstock for sweet oranges. Seedlings are raised in nurseries for one or two years and then budded. During the first year after planting, pruning is necessary to keep the foliage off the ground.

Citrus limon - Dhoalhan'bu, Jambhoshi

Citrus limon (L.) Burm.f RUTACEAE

Synonym:, *Citrus medica var. limonium*

Common name: Lemon

Dhivehi names: Dhoalhan'bu (common), Jambhoshi in some northern islands

Status: Common in the northern islands and occasional in the southern islands.

Description: A large, low-branching, sometimes spreading tree, about 3 to 6 m tall. Some individuals have upright branches. Both the young and old twigs have sharp and stiff spines. Leaves are oblong, elliptic or long ovate in shape, 6 to 12 cm long with finely toothed margins. Wings on the petiole are narrower and slender. Leaves are dark green on the upper surface and light green below and sometimes young leaves are reddish in colour. Flowers are single or a cluster of two or more and borne in the leaf axils. Flowers have four to five petals, which are white inside and purplish outside. Flower buds are used to be reddish in colour. Fruit is oval with a nipple like protuberance at the apex, 6 to 12 cm long with thick, aromatic skin, which is dotted with oil glands. Skin is green in colour in young fruits, turning to light yellow in ripened fruit. Fruit has eight to ten segments, containing juicy, acid, pale-yellow pulp. Most of the fruits have only a few seeds, which are about 1 cm in length, elliptic to ovate in shape, pointed and smooth.

Uses: It is mainly grown for the fruit. Lemon juice, which is marketed fresh, canned, concentrated and in powder form, is mainly used for the preparation of lemonade. Lemon juice with ginger is commonly used as a cold remedy. In the Maldives, particularly in the northern islands, lemon juice is used as an alternative to lime juice and it is squeezed on cooked fish before eating. In some islands, leaves are boiled in the water used for bathing to get relief from skin allergies. In the traditional medicinal system of the Maldives, roots of lemon are used to treat rheumatism. Like *Citrus aurantium*, oil from lemon peel is used to blend perfumes and colognes. Wood is fine-grained and easy to work with to carve small articles including toys.

Ecology, propagation and management: Lemon grows both in dry and humid conditions. It tolerates a variety of soils, from silty-clay loam to fine sand. It is also capable of growing in very poor soil. Normally best quality lemons are produced only in the coastal areas. Defoliation is very common in high winds. Propagation is mainly by seed and also by cuttings and budding. Trees require pruning when young and it should be kept 3 to 3.5 m in height for easy harvesting. A number of varieties of lemon are cultivated in different parts of the world.

Citrus maxima - Ban'bulhabos

Citrus maxima (Burm.) Merr. RUTACEAE

Synonyms: *Citrus aurantium var. grandis, Citrus grandis, Citrus decumana*

Common name: Pummelo

Dhivehi name: Ban'bulhabos

Status: Occasional in the home gardens in southern islands.

Description: An evergreen tree, about 5 to 10 m tall with round but open crown. Branches start emerging on the lower part of the trunk and spreading. Bark is light brown in colour and smooth. Seed propagated trees have long spines, about 5 cm in length whereas vegetatively propagated plants are spineless. Leaves are large in size, 5 to 15 cm long and 3 to 8 cm wide and ovate to elliptical in shape, shiny, dark green in colour and dotted with minute glands. Leaf margin is smooth or shallowly toothed. Leaf stalk is broadly winged, which is up to 7 cm wide. Inflorescence is axillary, with single or a cluster of a few flowers. Flowers are large in size with 5 white petals and are strongly fragrant. Trees flower two to four times in a year, mainly in conjunction with shoot growth. Fruit is round or pyramid in shape, large, 10 to 30 cm in diameter with thick densely glandular dotted rind, which is soft and easy to peel away. Fruit segments are large containing yellow to coral pink flesh and vary from juicy to slightly dry and from spicy sweet to tangy and tart. The dull green coloured skin of the fruit brightens up upon ripening as the oil glands become more prominent and shiny. Seeds are few, large, heavy, ridged and yellowish in colour.

Uses: Fresh sweet juicy pulp vesicles are eaten out of hand and lesser sweet varieties are eaten with sugar. It is also used in fruit salads and in making sweet drinks. Flowers are used to make perfume and leaves are used in the preparation of aromatic baths. In some countries leaves, flowers, fruits and seeds are used in traditional medicines to alleviate cough, fevers and stomach disorders.

Ecology, propagation and management: It is adapted to grow in a variety of soils, from coarse sand to heavy clay. However, it performs well in deep, medium-textured fertile soils, which are free from injurious salts. Propagation is by seeds, air-layering and budding. Fleshy seeds with their thin coat dry out easily and require an ideal biophysical condition to germinate. A seedling progeny consists largely of a slender tree with long spines. In the initial stages of growth, shade and frequent watering is required for better performance of the seedlings. Young trees need to be pruned to prevent lower branches from touching the ground.

Citrus medica - Bodu Lun'boa

Citrus medica L. RUTACEAE

Synonyms: *Citrus aurantium, Citrus var. medica*

Common name: Citron

Dhivehi name: Bodu Lun'boa

Status: Found in a few places in some of the southern islands.

Description: A small, slow-growing evergreen shrub or tree, about 2.5 to 4.5 m tall. Twigs angled and purplish when young, becoming rounded quickly as the tree grows. Both branches and twigs are very stiff and have long stout spines in the leaf axils. Leaves are ovate-lanceolate or ovate-elliptic in shape, 6 to 18 cm long with rounded or blunt tip. Leaves are leathery, fragrant, dark green in colour with minutely serrated margins. Wing of the leaf petiole is slender and very narrow. Flowers are borne singly or in short clusters, most of them are bisexual while some of them are male flowers. Flowers are pinkish or purplish on the outside, whitish inside and fragrant. Fruit shape is highly variable; some are oblong or obovoid while others are oval. Pyramidal shaped fruit can also be seen. One form, called fingered citron or Buddha's hand is wholly or partially divided into five finger like segments. Size of the fruit is generally large, rough, bumpy with furrowed or smooth surface. Outer rind of the fruit is thin and green in colour in young fruits, turning to yellowish green in ripened fruit. Inner rind of the fruit is thick, white and tender. Each fruit has 14 to 15 segments, which are pale yellow to green in colour. Fruit pulp is firm, not very juicy and sour to slightly sweet in taste. Seeds are smooth, ovoid and numerous.

Uses: Fruit is used to prepare pickles and sometimes used as an alternative to lime. In Europe and the United States of America peel of the citron is an important part, which is processed in saltwater, candied in a strong sucrose or glucose solution and used as an ingredient in fruitcake, plum pudding, buns, sweet rolls and candy.

Ecology, propagation and management: Citron is adapted to a variety of soil but sensitive to intense heat and drought. Propagation is mainly by cuttings. Small cuttings with leaves are taken from the branches two to four years old trees and are quickly buried deep for better results. It can also be propagated by budding. There are two types of main cultivars; one cultivar possesses pinkish new growth, purple flower buds and purple tinged petals with sour pulp and dark inner seed coat and the other cultivar is with white flower, non-acid pulp and colourless seed coat.

Clerodendrum inerme - Dhun'gethi

Clerodendrum inerme (L.) Gaertner VERBENACEAE

Synonym: *Clerodendron neriifolium*

Common names: Seaside clerodendron, garden quinine

Dhivehi names: Dhun'gethi

Status: Common in all islands of Maldives; grown as a hedge plant.

Description: An evergreen, much branched, erect or somewhat straggling shrub, about 1 to 3 m tall with slender, dark green coloured terminal branches. Main stem is woody and smooth. Leaves are simple and opposite decussate in arrangement (as in the case of *Calophyllum inophyllum*) and vary in shape from ovate, oblong-ovate to elliptic-ovate. Leaves are about 4 to 8 cm long, 2 to 5 cm wide, green and shiny with smooth margin. Inflorescence is a cyme, three flowered and borne in the axils of the leaves. Flowers are erect and fragrant; calyx is green, narrowly funnel-shaped with five very short teeth. Petals are five and corolla is about 3 to 4 cm long and comprises a slender, purple coloured spreading tube with white or purple-tinged lobes. Stamens four, filaments long, reddish to purple in colour, protrude out and upwardly curved. Fruit is obovoid in shape and about 1.5 cm in length and split into four parts upon drying.

Uses: Fragrant white flowers that form in clusters and accented by purple-coloured delicate protruding stamens and green foliage and bushy habit make seaside clerodendron an attractive plant and are thus considered as a one of the candidate species for hedge. It is a versatile plant and can be grown as topiary or as a bonsai. In the Maldives, it is popularly grown as a hedge plant in almost all types of buildings. Its long twigs are used as purlins in roofing structures and side shades of timber built houses. It is reported that decoction of leaves are effective against intermittent and remittent fevers and also used as a substitute for quinine in controlling malaria.

Ecology, propagation and management: It grows in all kinds of soil but performance is better in sand. It grows well in hot sun and tolerates salt spray. It can be propagated by seeds and cuttings. Plants easily spread vegetatively and seeds may be dispersed by birds. It has aggressive growth characteristics and has the potential to form dense cover over other plants. It is also hard to remove as it roots at the nodes and produce large amount of biomass. It can be grown as an understory species in multispecies multi-tiered coastal bioshield.

Colubrina asiatica - Raarohi, raaruhi

Colubrina asiatica (L.) Brongn. RHAMNACEAE

Common names: Indian sankewood, latherleaf

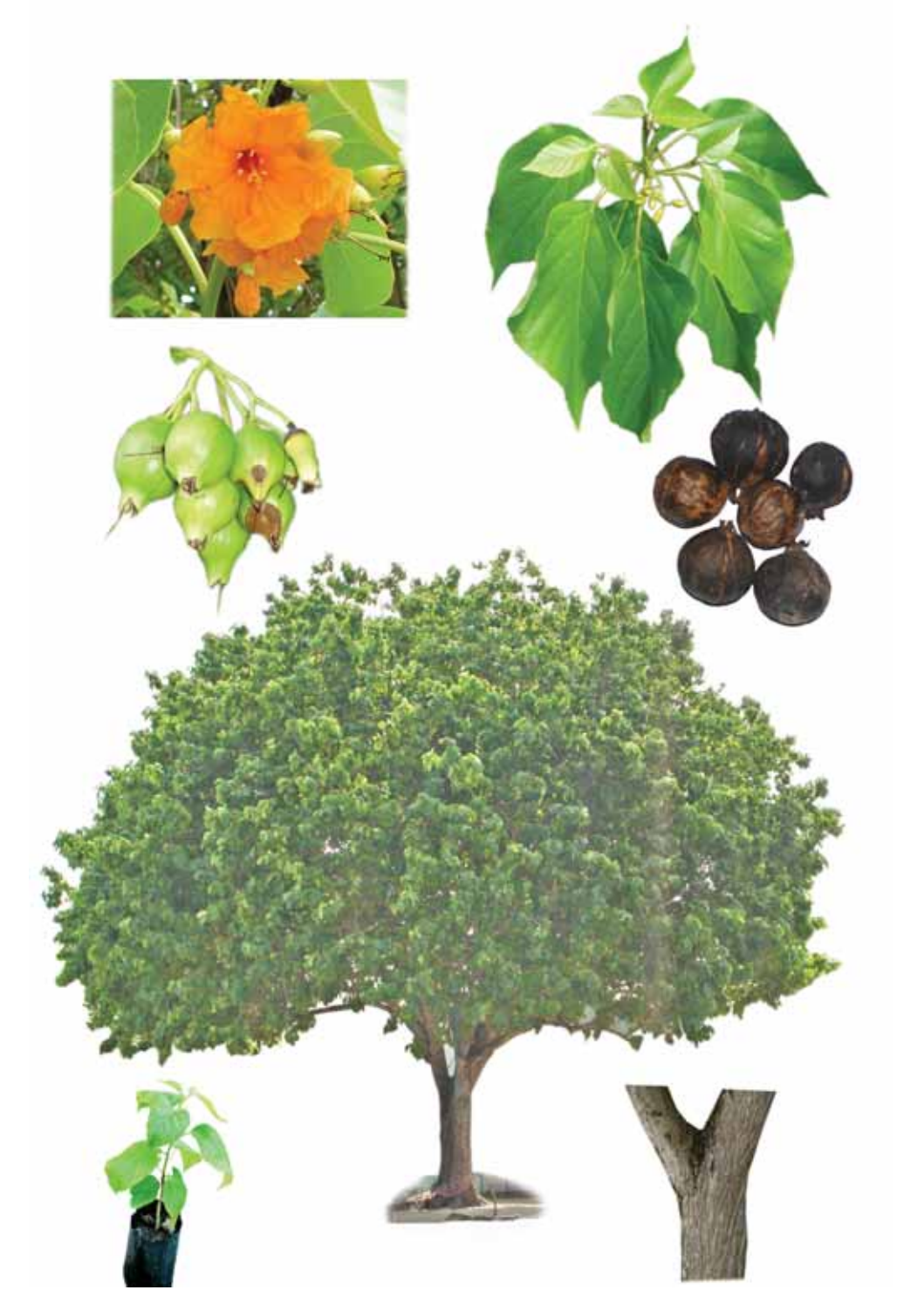
Dhivehi names: Raarohi, raaruhi

Status: Common in the forested areas and also found growing in wasted land near residential areas.

Description: A climbing shining shrub that normally grows up to 4 m tall but in the presence of a support it may grow up to 6 to 7 m. Branches are vine-like, climbing or drooping that can reach 10 m in length. Leaves are simple, thin, shining and arranged alternately along the branches and oval or broadly ovate in shape and 4 to 9 cm long and 3 to 5 cm wide. Leaves are dark green in colour with two to three conspicuous lateral veins that spring from the base of the leaf. It has toothed margin and pointed tip and rounded base. Inflorescence is a cyme, appears in the axils of the leaves. Flowers are small, about 0.4 cm in diameter and greenish-yellow in colour. There are five greenish sepals, which are ovately-triangular in shaped, giving a star-like appearance to the flower. Petals are five in number, rounded and hood shaped and yellow in colour. Fruits are small capsules, about 1 cm in diameter. Young fruits are green and fleshy, turning to dark brown with age. Each fruit contains three, small, greyish seeds.

Uses: As its name latherleaf suggests, leaves of *C. asiatica* have the ability to produce foam in water and thus, have long been used as a substitute for soap in the rural areas in some countries. Leaves and fruits are used as fish poison. In the Maldives, leaves are used to alleviate inflammations and boils. In order to alleviate painful swellings, leaves are crushed and juice is rubbed on the affected body. Young stems are cut into pieces and boiled in water, which is drunk to alleviate stomach disorders. Medicinal oil is prepared from seeds along with other ingredients, which is used to treat rheumatism and numbness in adults and also in treating weak legs in children.

Ecology, propagation and management: It is as a constituent of beach strand vegetation and found growing in slightly elevated areas. It establishes well in loose soil. Propagation is mainly by seeds. Its seeds are dispersed by currents and remain viable even after floating in seawater for many months. Seeds are also dispersed by birds. Germination is fast and growth rate is rapid in full sun. Latherleaf shows remarkable vegetative regeneration. Its stem grows upwards to the top of the canopy of supporting vegetation, fall back to the ground where they root (adventitious roots) and then grow upwards. Vigorous resprouting from cut or injured stems is also common. It may cause problem by overgrowing other shrubby vegetation near the coast.



Cordia subcordata - Kaani, kauni

Cordia subcordata Lam. BORAGINACEAE

Synonyms: *Cordia moluccana, Cordia orientalis*

Common names: Sea trumpet, beach cordia

Dhivehi names: Kaani, kauni

Status: Common; found in all the islands of the Maldives.

Description: An attractive medium sized, evergreen tree that is capable of growing up to 15 m. Canopy is broad and dense and may spread 8 to 10 m across, often as wide as the height of the tree. Bark is brown or grey, shallowly fissured and flaky. Leaves are light green in colour, somewhat shiny, broad, egg shaped or elliptical with pointed apex and arranged alternately along the branches. Flowers are showy, large and funnel shaped and 2 to 4 cm long, with five to seven slightly wrinkled lobes. Flowers, which are short-lived, are scentless. They are present in clusters at the terminal ends of the branches or in leaf axils. Fruit is almost round or egg shaped, 2 to 3 cm long, green when young, brown, hard and woody when mature. Each fruit contains up to four or fewer delicate, white, narrow, small seeds.

Uses: Wood is soft but durable. Heartwood is dark chocolate coloured, often with dark streaks. It is finely grained, easy to work with, shrinks little and takes a fine polish. In the Maldives, timber is widely used for boat building. It is a good craft wood and is used in handicrafts. It is also used for house construction and house poles, which may last for more than 100 years. Leaves are used to colour fish nets and lines to make them less visible to fish. It is also grown as a shade and an ornamental tree. In a multispecies coastal bioshield, it can be planted behind a row of sea lettuce tree (*Scaevola taccada*), nit pitcha (*Guettarda speciosa*) and beach heliotrope (*Tournefortia argentea*) to protect it from direct aerosol salt spray.

Ecology, propagation and management: It is adapted to a variety of soils including sandy and clay soils to rocky limestone. It is propagated by seeds and cuttings. Seeds are very small and very difficult to extract and hence, whole capsule is generally sown. Fruits may be soaked in water overnight or up to two days after clipping off the end of the hard, woody capsule to accelerate germination. Germination takes place within three to six weeks and seedlings may attain 40 to 50 cm height in about six to eight months, which can used for outplanting. Seedlings may be grown in partial shade to get better results. Stem cutting is also commonly used in propagation. Heavy branches often develop low on the stem and branches are slanted and look crooked in very old trees.

Delonix regia - Ginimaa

Delonix regia (Baj. ex Hook) Rafin CAESALPINIACEAE

Synonym: *Poinciana regia*

Common names: Flame of the forest, gul mohur

Dhivehi name: Ginimaa

Status: Occasional; grown as an ornamental tree.

Description: A small- to medium-sized sized, semi-deciduous tree, about 8 to 15 m tall. Crown is broad, umbrella shaped and spreading with long and nearly horizontal branches. Trunk is large but short, buttressed and angled towards the base. Bark is smooth, greyish-brown and with vertical lines of brown dots. Leaves are feathery, compound, long, 20 to 60 cm in length and arranged alternately along the branches. Each leaf has 10 to 25 pairs of pinnae and each pinna has 12 to 40 pairs of small oblong-shaped leaflets, which are stalkless, rounded at the base and apex. Flowers are very showy, large, 5 to 13 cm in diameter and borne in lateral dense clusters at the end of the twigs. Flowers have five petals, orange-red in colour and broadly spoon shaped. During bloom, flowers almost cover the entire tree top. Fruit is a flat pod, dark brown, hard and woody, 30 to 65 cm in length and 5 to 7.5 cm wide. It remains attached to the tree most of the year even when the trees are leafless. About 35 to 45 seeds present in each pod, which are hard, shiny, and grey in colour and oblong in shape. They look like date seeds.

Uses: Widely planted as ornamental and shade tree along streets, roadsides and in avenues. It should be planted 3 to 4 m away from pavement or sidewalks since large surface roots may grow beneath them and destroy them. Large pods and wood are used for fuel. Wood is soft and heavy but weak and brittle and may be broken by strong winds and storms.

Ecology, propagation and management: It grows on many types of soils but prefers well-drained sandy soil. Its tolerance to draught is high but limited to aerosol salt spray. It requires full sun for better growth. Propagation is mainly by seeds but hard and woody seeds take very long period to germinate. Seeds may lie in the soil for about two to three years without germination. Hence, pretreatment of seed is required before sowing. A portion of the seed coat can be clipped or seeds may be boiled in hot water and then allowed to soak for 24 hours and such pretreated seeds germinate within five to ten days. Growth in the initial stage is fast and nursery-raised seedlings should be outplanted within three to five months, beyond which seedlings may be too tall to handle properly. Trees can also be propagated by branch cuttings. To develop a strong, durable tree, major branches may be pruned.

Desmodium umbellatum - Haalhala, haulhala

Desmodium umbellatum (L.) DC. FABACEAE

Synonym: *Dendrolobium umbellatum*

Common names: Horse bush, sea vetch tree

Dhivehi names: Haalhala, haulhala

Status: Occasional in the forested areas along the shores of the southern islands; rare in the northern islands.

Description: A small, evergreen tree or shrub that grows to 3 m in height. Branches are stick like and young branches are densely covered with filamentous hairs. Old branches are hairless. Leaves are trifoliate (with three leaflets), feathery, alternate in arrangement and ovate-oblong or broad-oblong in shape. The middle leaflet, which is 6 to 8 cm long and 3 to 5 cm wide, is always larger than the lateral leaflets; upper surface of the leaflet is dark green and without hairs and lower surface is pale and somewhat hairy. Leaves are pointedly blunt at the tip. Inflorescence is an umbel, borne on short peduncle in the axils of the leaf. Flowers are small and covered with dense silky hairs. Corolla is about 1 to 1.5 cm long, bright white in colour and entire flower looks like a white butterfly. Fruit is a pod, 3 to 4 cm long, about 0.5 cm wide and curved, consists of three to five segments and constricted. A small beak is present at the base of the pod. Seeds are small, hard, oval or elliptical in shape.

Uses: It is a nitrogen fixing plant and excellent in controlling soil erosion. In the Maldives, straight sticks are used as beams along the length of the roof and also as sides of the traditional timber built houses. Straight branches are also used as handle for scoops used for drawing water from wells. Charcoal produced from the wood is widely used by blacksmiths. Leaves are used as post-partum medicine for women after childbirth for fast recovery. It is also grown as an ornamental plant.

Ecology, propagation and management: It tolerates a wide range soils, including limestone. It is able to grow in wet condition but it prefers well-drained soil for better performance. Propagation is by seed. Hard seeds need pretreatment such as pouring of hot water over the seeds 24 hours before sowing. Treated seeds are sown approximately 0.5 cm deep in water-permeable soil. It can tolerate moderate shading but growth is faster in full sun. Pods that break into one seed units are sticky and thus spread by animals and human. It is reported that seeds are dispersed by ocean currents also. It can be found growing well along the shores, where it forms dense stands. It also grows as an under story in low-elevation forests.

Dodonaea viscosa - Kudhi-ruuvaali