

MELASTOMATACEAE

Bellucia pentamera Naudin *Jambu kerak* (Iban)

This is a small tree found commonly growing along river banks and secondary forests in Sarawak and is most common in the Batang Ai area. It has low branches and large rounded leaves. The showy white flowers are carried in clusters along the branches. The round fruits are shaped like pomegranate (*Punica granatum*) fruits but is smaller measuring about 3 cm in diameter. Young fruits are green in colour ripening to a light yellow colour. Ripe fruits are thin skinned with a soft white pulp containing numerous tiny dark seeds. It has a refreshing sourish sweet taste and pleasantly fragrant but is never sold in the *tamu*. It is a favourite fish food. A decoction of the leaves is drunk to cure stomach problems.

It is propagated from seeds.



Bellucia pentamera is a small tree with low branches



Bellucia pentamera has showy white flowers



The ripe fruits of *Bellucia pentamera* are light yellow while the unripe ones are green in colour

MELIACEAE

Lansium domesticum Corr.

Langsat, Duku, Duku-langsat, Dokong (Malay), Lensat (Iban)

The genus *Lansium*, which belongs in the family Meliaceae contains six or seven species native to India, Burma, Malaysia, Indonesia, Borneo and the Philippines. *Langsat* and *duku* are classified as a single species, *Lansium domesticum* but there are differences in tree form, fruit arrangement on the raceme, and the fruit itself. Another form, reported to be a hybrid, is called *duku-langsat* but appears to lack a precise definition. The *dokong* is similar to *duku-langsat* except that the pulp is more juicy and it originated from Thailand.

Langsat and *duku* are thought to originate in Malaya and possibly also in Sumatra and Borneo.

Langsat is a slender tree, 10-20 m high with a straight trunk, slender upright branches and an irregular or rounded crown. *Duku* tends to be less tall but has a wider crown. Leaves 30-45 cm long with 5-7 large, alternate stalked leaflets. Flowers are borne in racemes, 2 - 5 of these racemes grouped together directly on the trunk or large branches. These mostly ramiflorous racemes are erect at first but later droop after fruit set and during fruit development. Flowers have a sweet smell. In all studies conducted, pollen has been found sterile.



Lansium domesticum is a slender tree, 10-20 m high



Flowers of *Lansium domesticum* are borne in racemes grouped together in 2-5



The developing fruit of *Lansium domesticum* is pale green, ripening to pale muddy yellow of pale gold colour

Fruits are slight ovoid in *langsat* and round in *duku* and 30-50 mm and 40-50 mm in diameter respectively. There are commonly 15 - 25 fruits per raceme in *langsat* and 4-12 in *duku*. The developing fruit is pale green, ripening to a greyish buff, pale muddy yellow of pale gold but frequently with brown blemishes. The pericarp is thin in *langsat* and contains a sticky latex. *Duku* has a thicker pericarp (up to 6 mm) and no latex.

The skin of both fruit peels easily and cleanly from the clear, white, translucent and juicy aril. In *langsat*, taste varies from sweet to sour but *duku* is generally very delicate and sweet. The *duku* fruit consists of five separate segments up to two of which (usually the larger) contain soft green bitter seeds. *Langsat* has from 1-5 seeds which are firmly attached to the aril. Pollen grains of *langsat* are sterile and fruit and seeds are respectively autonomously parthenocarpic and apomictic in development.



Langsat fruit may be sweet to sour



Duku is generally very delicate and sweet



Dokong also known as *duku – langsat* from Thailand

The fruit may be preserved in syrup, by a short boiling, after removing the skin and confections are known to have been made in this way in Malacca. *Duku* preserved in syrup by a company in Singapore were shown in London at the Colonial and Indian Exhibition of 1886.

The timber is light-coloured, and not very hard; fine grained. Derived from wild trees, it is used in Java for tool-handles and sometimes for house-posts; it is durable, tough and elastic.

Langsat and *duku* can grow successfully in many soil types, but for best performance a well-drained sandy or clay loam rich in organic matter is preferred.

The long juvenile period of trees and low production are serious limiting factors to development of the crop.

Vegetatively propagated trees fruit in 3-4 years. Trees from seed commence bearing at 10-15 years. Yields are most often quoted as 5 kg in the ninth year from planting, and up to 30 kg per tree for 25-30-year-old trees. *Lansium* has been domesticated and commercialised and seedlings of specific good quality cultivars can be purchased from nurseries. It is not a particularly nutritious but popular fruit

Seeds can be planted but vegetative propagation is preferred. *Langsat* seedlings are generally preferred as rootstocks. Approach, cleft, whip or side veneer grafts, commonly give from 60-90% success. Air layers (large branches preferred) are usually made at the beginning of the wet season and detached 5-6 months later. Softwood or semi-mature terminal cuttings will strike under mist with a fair success rate.

Nutrient composition of *Lansium domesticum*

Nutrient composition per 100 g edible portion																	
Composition							Minerals						Vitamins				
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
34	90.0	0.4	0	8.2	0.9	0.5	10	20	1.0	12	230	0	0	0.05	0.02	0.5	13.4

*ppm

Sandoricum borneense Miq. *Kelampu ai* (Iban)

Sandoricum is a small genus of trees found in cultivation throughout Malaysia.

Kelampu ai are commonly found in nature growing along river banks with branches overhanging the river in Sarawak. It has strong penetrating roots holding the tree firmly on the precarious river bank especially during flooding. It produces an abundance of fruits which are small - the size of longan fruit. It ripens to a yellow colour with white pulp. It is also a fish food.

It is propagated from seeds.



Sandoricum borneense are commonly found in nature growing along river banks with overhanging branches



Flowers of *Sandoricum borneense* are small, hanging from loose panicles from leaf axils



A bunch of ripe *Sandoricum borneense* fruits



Sandoricum borneense fruits ripen to a yellow colour with a white pulp

***Sandoricum koetjape* (Burm. f.) Merr.**
***Sentul* (Malay), *Kelampu bukit* (Iban)**

Kelampu bukit or *sentul* is a well-known Asian fruit of the family Meliaceae and is lately described as *Sandoricum koetjape*. It is native to Malaysia, Indonesia, Borneo and the Philippines. It is found growing naturally in the lowland forest.

Seedling trees are quick growing, reaching 30 m in height with a smooth straight trunk. Asexually propagated trees tend to be smaller (to 20m) with a more bushy habit of growth. In the dry season just prior to flowering the tree becomes semi-deciduous, and mature leaves turn yellow or red before dropping.

Flowers are small, up to 12 mm wide in loose hanging bunches arising from axillary buds along the branches. The flowers are lightly scented. Fruits are round, slightly flattened, 50-100 mm across with a thick firm and downy rind and slight lengthwise indentation. The external rind colour varies from dull to golden yellow, sometimes with a tinge of pink. It is edible and has a sour taste. The aril is relatively thin (up to 15 mm) but white, juicy and translucent, and surrounding and attached to 3 - 5 seeds about 15-20 mm long.

The *sentul* does not appear to require a high level of soil fertility. However, well-drained soils are preferred. If soil pH levels exceed 7 the tree can suffer severe iron deficiency.

There is considerable variation in tree form, fruit size and aril quality amongst the various wild forms and also in seedlings from selected clones. Thailand appears to have been the leader in clonal selection and whilst there is still not a substantial amount of aril in the best selections, they are a vast improvement over selections in other countries. No yield data are available. The fruit has little commercial potential unless improved cultivars are selected with better tasting thicker aril.

Cultivars are propagated by air layers, approach, wedge, whip or side veneer grafts and by T or modified forkert budding. All methods give good results. It can also be propagated from seeds.

MORACEAE

Artocarpus anisophyllus Miq.

Bintawak (Iban)

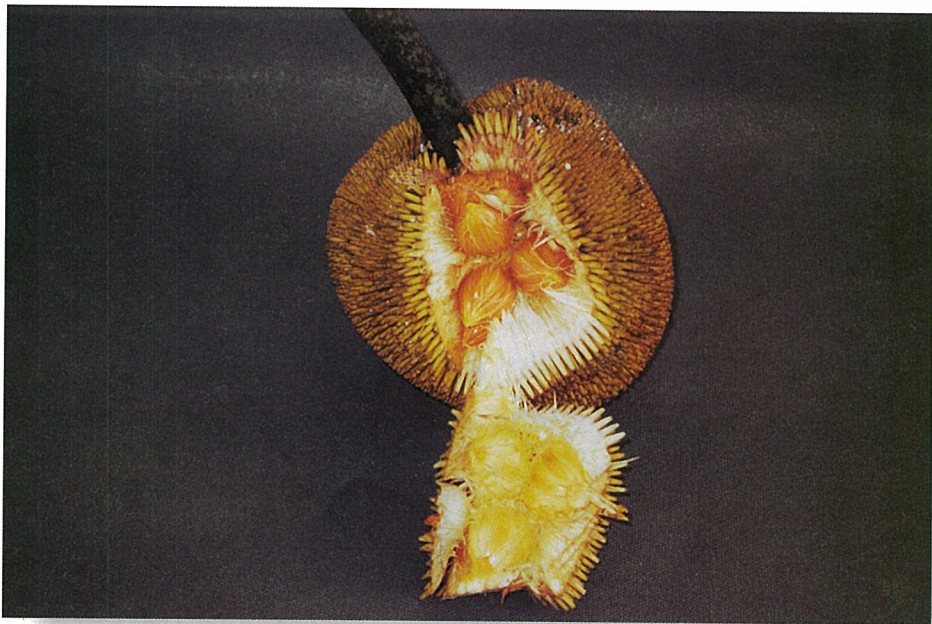
Artocarpus is a genus of trees found in south-eastern Asia and in the Pacific. *A. anisophyllus* is distributed in Indonesia and Malaysia. It is common in Sarawak. It grows in lowland and hill dipterocarp forests up to 600 m altitude. Tree up to 45 m tall, 90 cm diameter, buttresses spreading up to 2.5 m tall. Bark dark grey, smooth to dippled. Leaves spirally arranged, compound-imparipinnate. Leaflets oblong, ovate or lanceolate, 3.5-40 x 2-13 cm. Inflorescences axillary, males and females usually paired. Fruits subglobose, up to 11 x 8 cm, covered with cylindrical, rigid, minutely punctate, obtuse processes 6-8 x 1-1.5 mm, yellowish brown in colour, pulp orange, soft, sweet and with a mild aroma. Seeds ellipsoid, c.1.7 x 1 cm. The seeds can be boiled or roasted and eaten. It tastes like the chestnut. It is propagated from seeds.



Artocarpus anisophyllus is a large tree found growing wild in Sarawak



The *Artocarpus anisophyllus* fruit is medium-sized and yellowish brown in colour



The pulp of *Artocarpus anisophyllus* has a unique orange colour

Artocarpus camansi Blanco
Kemangsi (Malay), *Pulor* (Iban)

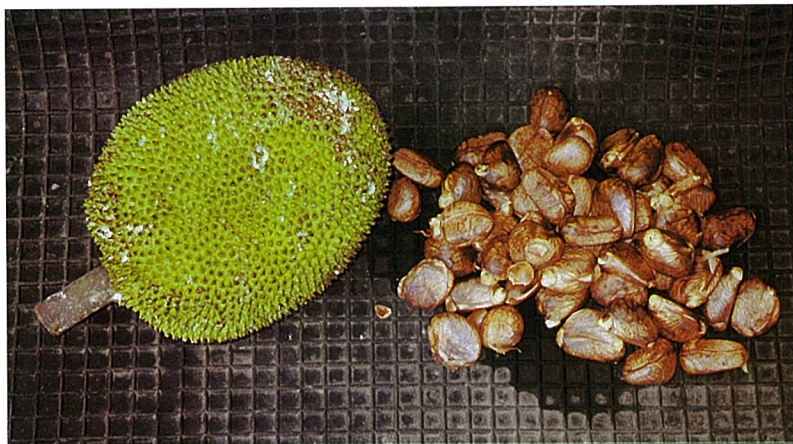
Pulor can be described as a seedy bread fruit or more simply breadnut. It is found in the lowland forest in the wild or is planted in rural villages in Sarawak. It is a medium-sized tree

reaching about 10 m. The flowers appear on terminal branches. The male inflorescences are club-shaped and drooping while the female inflorescences are rounded and upright. The oval fruits are about 20 cm in diameter and leaf green in colour. On ripening the rind turns to a brownish yellow colour. The young fruits are boiled, fried or roasted as a vegetable. The mature seeds are fairly large like a chestnut. The dark brown testa is removed and the seeds are boiled or roasted for food. It tastes like chestnut. It can be used as a starch substitute for making cakes and candies.

The seeds germinate readily and seedlings grow rapidly to produce fruits within four years.



Artocarpus camansi is a fast grower producing its first fruit within four years



Both the immature fruits (left) and seeds (right) of *Artocarpus camansi* are edible

***Artocarpus champeden* Spreng.**
***Cempedak* (Malay), *Temedak* (Iban)**

The *cempedak* is widely distributed in S.E. Asia including Borneo. It is common in Sarawak. This medium-sized tree reaches a height of 20 m, 60 cm diameter; bole without buttresses. Bark dark grey-green, dippled to somewhat scaly. Leaves simple, spirally arranged, elliptic to oblong or obovate, 5-25 x 2.5-12 cm. Inflorescences solitary, axillary or borne on short leafy shoots on older branches or from the bumps on the main trunk. Male heads cylindrical to club-shaped, 3-5.5 x 1-1.2 cm. Female flowers with simple thread-like styles c. 1.5 mm long. The flowers appear from the trunk and main branches. Each healthy mature tree is capable of carrying more than 100 fruits in a season. Fruit sizes range from 10-35 cm x 10-15 cm. Immature fruits are light green ripening to yellowish with brown patches. A fully ripe fruit is soft to the touch. The rind can be cut open to expose the pulp which ranges in colour from pale yellow to dark orange and is juicy, sweet and fragrant. It is eaten fresh or fried as in plantain. Each pulp contains a seed which can be boiled or roasted for food. In Peninsular Malaysia, the flesh ripe and unripe is salted and used as a pickle called *jerami*. The young fruits are used as vegetables. It is nutritious being rich in energy, calcium and Vitamin B. There is great variability in fruit characteristics and offers great opportunities for breeding and selection. It has been domesticated and commercialised.

It is propagated from seeds or vegetatively by budding.



***Artocarpus champeden* is a very productive tree carrying more than 100 fruits per season**



Immature fruits of *Artocarpus champeden* are light green in colour ripening to yellowish with brown patches



The pulp of *Artocarpus champeden* which ranges in colour from pale yellow to dark orange is juicy, sweet and fragrant

Nutrient composition of *Artocarpus champeden*

Nutrient composition per 100 g edible portion

Composition							Minerals					Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
117	66.7	2.5	0.4	25.8	3.4	1.2	40	5	1.1	25	246	80	13	0.16	0.15	0.5	17.7

*ppm

***Artocarpus elasticus* Reinw.**
Tekalong (Iban)

A. elasticus is found in S.E. Asia including Malaysia. It is common in Sarawak growing in lowland to lower montane forests to 1,500 m. Tree up to 45 m tall, 90 cm diameter, with prominent buttresses up to 3 m tall. Bark grey-brown, smooth to slightly scaly. Leaves simple, spirally arranged, ovate or elliptic or oblong, 15-60 x 10-35 cm. Leaves of juvenile trees 2-3 times pinnatifid, up to 200 cm long. Inflorescences solitary, axillary. Fruits cylindrical, up to 12 x 6 cm, yellow-brown, covered by fleshy, whitish, short-hispid processes. The ripe fruit has a nauseous rancid smell. Seeds with white pulp.

The fruits are eaten by monkeys and squirrels and it is said that children will eat the pulp round the seeds but ripe fruits have the extraordinary nauseating smell of the *mengkudu* (*Morinda citrifolia*).

The ripe seeds can be eaten roasted. A solid oil is present in them, in very small quantities.



***Artocarpus elasticus* is a tall forest tree reaching 45 m high**



The medium-sized *Artocarpus elasticus* fruit is cream yellow ripening to brownish, covered by shaggy woolly soft recurved spines

The bark is tough and strips readily in big sheets. It is used as clothing by jungle-folk, and by Malays for lining baskets and bins, for making house-walls and for string. The latex is most tenacious and is used for bird-lime. Various plant parts such as leaves, latex, bark have found uses in traditional medicine. The timber is used for boat making.

It is propagated from seeds.

***Artocarpus odoratissimus* Blanco**
***Terap* (Malay), *Lumuk amat* (Iban)**

The *terap* is a hardy plant found growing in primary and secondary lowland and hill mixed dipterocarp forests on sandy clay soils up to 1,000 m altitude in Sarawak. It is commonly grown in rural villages.

It is a fast growing tree that reaches heights of 30 m or more. Bark dark greyish brown, smooth. Leaves simple, spirally arranged, broadly elliptic to obovate, 16-50 x 11-28 cm. Leaves of juvenile tree pinnately lobed. Inflorescences solitary, axillary. Male heads ellipsoid to club-shaped, 4-9 x 2.5-3.5 cm. Female heads with pubescent peltate bracts; female flowers with exserted styles. After pollination, the female flower develops into a fruit while the male flower shrivels. Fruits subglobose, to 16 x 13 cm, greenish yellow, covered by closely set, rigid, cylindrical hispid-pubescent processes, 8-13 x 1 mm, fleshy part of perianth white, juicy, very sweet and aromatic. Seeds ellipsoid, c. 1.2 x 0.8 cm. It is monoecious producing both male and female flowers in the same plant. The small seeds are often boiled or roasted and eaten as a titbit. Fruits should be harvested when mature as ripe fruits have very poor keeping quality.

It is propagated from seeds.



***Artocarpus odoratissimus* is a fast growing tree that reaches heights of 30 m or more**



After pollination the female flower of *Artocarpus odoratissimus* develops into a fruit while the male flower shrivels



The young fruits of *Artocarpus odoratissimus* are yellow to green in colour



The ripe fruit of *Artocarpus odoratissimus* is light green to fig brown in colour

Artocarpus rigidus* Bl.**Tempunik* (Malay), *Pala munsoh* (Iban)**

Artocarpus rigidus is a medium-sized tree growing to 30 m height, found in Burma, Indo-China and Malaysia in lowland forest and open country. The stout trunk carries a dense, heavy, dark green spreading crown supported by several long stout erect branches. The leaf blade is obovate, elliptical, blunt or slightly tipped, stiff and rigid. Flower heads arise from leaf-axils.

Fruits 8-13 cm wide, round, thickly set with stiff conical spines (0.8 cm long), greenish yellow when immature turning to dull orange on ripening. The stalk is sunken as in apple. The pulp is orange and waxy containing seeds. The pulp has a pleasant sweet taste but is apt to give a rawness in the mouth. The seeds are edible. The fruit takes six months to ripen.

The timber is used for house beams, furniture and boat building. The latex is used in veterinary medicine for wounds

It is propagated from seeds.



***Artocarpus rigidus* is a medium-sized tree growing to 30 m height**



Immature fruits of *Artocarpus rigidus* are greenish yellow ripening to dull orange colour

***Artocarpus sarawakensis* Jarrett**
***Pingan* (Iban)**

A. sarawakensis is endemic to Borneo. Found in lowland mixed dipterocarp forest on ridges, up to 300 m in altitude and secondary forests in Sarawak.

Tree up to 25 m tall. Leaves large, simple, spirally arranged elliptic 30-50 x 18-25 cm. Female flowers with simple exerted styles c. 2 mm long. Fruits subglobose, c. 5 cm across, surface covered with hardened cylindrical, obtuse hairy processes c. 5 x 2 mm, peduncle up to 5.5 cm long, pubescent with scattered long hairs. Seeds ellipsoid, surrounded by a sweet white pulp that is less aromatic compared to *A. odoratissimus*.

It is propagated from seeds.



The sweet white pulp of *Artocarpus sarawakensis* is less aromatic compared to *A. odoratissimus*

***Artocarpus sericarpus* Jarrett**
***Terap bulu* (Malay), *Pedalai* (Iban)**

The *pedalai* is a large tree found commonly growing in the lowland dipterocarp forest in Sarawak. It bears medium- sized fruits covered with long rigid coarse hairs. Ripe fruits can be easily opened by removing the rind. The pulp is similar to *terap* in taste and aroma. The small brown seeds when fried results in a delicious crunchy titbit with a nutty aroma. The pulp is rich in energy and minerals while the seeds are rich in energy, proteins, fibre and minerals.

It is propagated from seeds.



***Artocarpus sericarpus* is a large tree found commonly growing in the lowland dipterocarp forest in Sarawak**



The fruits of *Artocarpus sericarpus* are covered with rigid coarse hairs



The white pulp of *Artocarpus sericarpus* is soft, very sweet and aromatic

Nutrient composition of *Artocarpus sericarpus*

Nutrient composition per 100 g edible portion

Composition	Minerals															
	Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
Fruit	119	69.3	1.7	0.3	27.4	0.5	1.7	33	322	22	25	8	1	2.5	7.4	1.8
Seed	241	42.9	7.2	7.7	35.7	5.5	0.9	100	159	119	57	31	6	2.6	24.0	-

*ppm

***Ficus obpyramidata* King**
***Ara lempong* (Malay), *Engkunoh* (Iban)**

A very large genus of trees, or shrubs of the family Moraceae found all through the tropics, with a great abundance of species in south-eastern Asia and Malaysia. In this part of the world many of them start life as epiphytes, and, if vigorous enough, smother their hosts, after they have established a connection with the ground by means of descending air roots. Sometimes the air-roots become so bunched together, that they make a compound trunk; sometimes they are scattered as in the Banyan, in which they stand under the branches as prop-roots.

In Peninsular Malaysia there are about eighty species. Most of them are called *ara* with a more or less distinctive adjective.

The figs vary enormously in palatability from the best, such as those of the Mediterranean *F. carica*, the Philippine *F. ulmifolia*, and *F. roxburghii*, which can be converted into a pleasant jam, to figs which seem to be untouched by any bird or animal. Fig-trees produce fertile figs and gall-figs, mainly on different trees. The gall-figs are perhaps always less palatable than the seed-figs of the same species. Observers, who in future occupy themselves with their food value, should not forget this. It is reported of some species that they bear figs, which though more or less inedible when ripe, can be used as food before complete maturity. The small figs of several species serve as famine foods in India. Four species contain carbohydrates to the extent of about one-third of their dry weight. The young leaves of several species are eaten.

In Sarawak, *Ficus obpyramidata* are common especially growing along river banks. It bears edible fruits. It is rich in energy, protein, fibre and minerals especially potassium. The green mature fruits are occasionally sold in the *tamu* and purchased for eating as *ulam*.

Figs (*Ficus* spp.) are prime food sources for birds especially the eight protected species of hornbills. *Ficus* species are also protected in Sarawak. It is also eaten by orangutans, other primates, small mammals and fish.

Nutrient composition of *Ficus obpyramidata*

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
176	50.9	6.3	4.8	26.8	6.8	4.4	192	1473	182	88	83	6	5.9	26.0	-

*ppm

Ficus obpyramidata is a small dioecious tree up to 10 m tall. Bark greyish brown. It is found commonly growing by streams and rivers in the forest and very abundant by rivers in open country as *belukar* and rice fields up to 1,300 m altitude.

The figs of this species is larger than those of other Malaysian species and most like the Mediterranean Fig tree. The leaves are abovate or nearly rhombic in outline 14-20 x 4.5-1.5 cm. The figs are 4-5 cm wide, pear shaped, massive stalked, the mouth sunk in the lower end, ripening yellow to dingy brownish ochre.

It is propagated from seeds.



Ficus obpyramidata is a small tree growing along rivers bearing fruits which serve as a fish food



Mature green fruits of *Ficus obpyramidata*



The immature fruits of *Ficus obpyramidata* are green ripening yellow to dingy brownish ochre



The green mature fruits of *Ficus obpyramidata* are occasionally sold in the *tamu* for use as *ulam*

MUSACEAE

***Musa acuminata* var. *microcarpa* Colla**
***Pisang kera* (Malay), *Lengki* (Iban)**

In Sarawak two species of wild bananas are commonly used as vegetables in rural communities. They are *pisang kera* (*Musa acuminata*) and *pisang lengki* or *gentu* (*M. hirta*). The parts eaten are the soft young pseudostem, rhizome, very young fruits and the male inflorescence. The bunch of male flowers, which tops the inflorescence, known to the Malays as *kelepak jantung* (leafy wrapped heart), is cooked and eaten. It has a slightly astringent and bitterish sweet taste but is relished as an *ulam* or boiled, roasted or cooked in coconut milk. It is rich in potassium. The female flower bud can be eaten as a salad but this is rarely done. The female flowers develop into fruits and are light green in colour, short, broad, flattened and hairy with a thick rind and little pulp which is seldom eaten. The fruit bunch is held vertically on a stout stalk.



A wild banana *pisang lengki* or *gentu* (*Musa hirta*) where the pseudostem, rhizome, very young fruit and male inflorescence are eaten

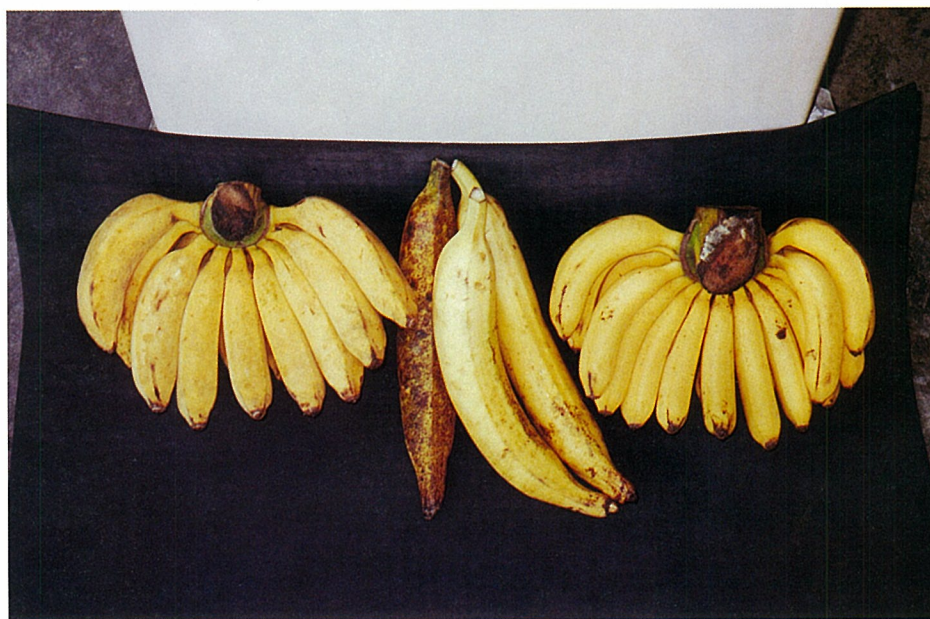
Nutrient composition of *Musa hirta* inflorescence

Nutrient composition per 100 g edible portion

Composition							Minerals								Vit C
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	Fe (ug)	Mn (ug)	Cu (ug)	Zn (ug)	(mg)
18	93.3	0.8	0.6	2.3	1.2	1.8	22	545	20	20	32	36	1.1	3.7	0.3

*ppm

The two main commercial uses of banana are dessert fruit and fibre. There are many races of dessert banana - close to a hundred but this number is inflated by local names of the same race in different languages. With the present technology of molecular biology the identity of banana species and races can be elucidated once and for all. *M. acuminata* is the Wild or Monkey Banana of the eastern part of Malaysia, mentioned above as having contributed perhaps towards the building up of the table banana. Kurz thought that forty-eight cultivated races had been derived more or less from it, including among them *pisang mas*, *pisang raja*, and *pisang susu*, but they are regarded here as races of *M. paradisiaca*.

Ripe fruits of three cultivars of *Musa* species

The Gros Michel or Cavendish is the most important worldwide and is the main variety generally traded. The Manila hemp (*M. textilis*) is one of the finest and strongest of structural fibres produced in the plant kingdom. It is very elastic, light and durable and is not damaged by salt or fresh water and thus find uses as ship's ropes and strong sacking and preparation of paper mache.

Bananas are by far the most important of the tropical fruits and are used daily by a large majority of the dwellers in the tropics. In some areas they are a staple article of diet, and bananas are found growing in almost every type of tropical environment; even in the more arid areas where other types of fruit are largely unobtainable. Bananas grow well under irrigation and provide a supply of fruit throughout the year. They must have been among the first plants cultivated and the origin of the crop is thus obscure. During the last 100 years or so an enormous export trade has been built up largely owing to post harvest technology which assured quality fruits reaching the consuming countries.

The fruits eaten as dessert, without any cooking process, are called bananas, whilst the more starchy types which need cooking before they can be used as vegetables are called plantains. There is no specific difference between these two groups of varieties. All the cultivated types are members of the genus *Musa*, a genus of between sixty and eighty species of monocotyledons, which belongs to the family Musaceae.

The origins of the cultivated types are not as yet fully worked out. Most of the cultivated bananas and plantains are triploid, producing their fruits parthenocarpically and hardly ever producing seeds. They must have been propagated vegetatively ever since they first originated and from an examination of the wild species it seems clear that all the cultivated types are most closely related to *M. acuminata* and *M. balbisiana*. These two wild diploid species have a wide range of distribution, occurring from Ceylon through India and Burma to Malaysia. They cross fairly readily and both in hybrids and in the two species, triploid forms could have been derived by the production of diploid gametes and their subsequent fertilization by a normal haploid gamete. The edible triploid varieties occurring throughout south-eastern Asia can be divided into three groups, those which show definite affinities with *M. acuminata*, those which have evidently been derived from *M. balbisiana*, and a third group which shows affinities with both these wild species. To those many varieties, both of plantains and bananas, which have been derived from *M. acuminata* the specific name *M. paradisiaca* should be applied. The name *M. balbisiana* is retained for those few varieties, mainly Indian, which have obviously derived from the wild *M. balbisiana*, and for hybrids between the two wild species which have developed as triploids the name *M. sapientum* is used. The dwarf type of banana grown in the Canary Islands, and known to the trade as the Canary banana, is often referred to in the literature as *M. cavendishii*, but since it is closely related to the main Central American variety, the Gros Michel, being merely a dwarf form, it must be considered as a variety of the species *M. paradisiaca*.

Bananas and plantains are large herbaceous perennials with a short underground rhizome producing aerial shoots from lateral buds on the rhizome. The rhizome produces a mass of adventitious roots which are not extensively developed either laterally or vertically. The aerial part of the plant consists of a number of large shoots forming a clump. The aerial shoot is called the pseudostem and grows to a height of 3 - 10 m, depending on variety and conditions.

New leaves are continually forced up through the centre of the pseudostem and expand at the top where the leaf blades form a handsome crown. Banana leaves are light green in colour, smooth and glossy and attain a very large size, often being used as temporary shade. The final leaf to emerge through the pseudostem is much smaller than the rest and curves to protect the developing inflorescence. The terminal bud of the aerial shoot, having produced a number of leaves, develops directly into the inflorescence which is carried up on a long smooth unbranched stem, through the centre of the pseudostem, emerging at the top and bending over under the weight of the large inflorescence. Banana fruits develop parthenocarpically from the female flowers and contain no seeds. Flowering takes place at any time from seven to nine months after the suckers have been planted. The fruit is elongated more or less round in cross-section but with the triangular form of the ovary still visible. Inside the skin lies the pulp, a tissue of large cells filled with starch which is partially converted to sugars during the ripening process. It is very nutritious being high in energy, vitamins and minerals especially potassium.

It is propagated from suckers or by tissue culture.

Nutrient composition of *Musa sapientum*

Nutrient composition per 100 g edible portion																	
Composition						Minerals						Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
100	73.0	1.4	0.3	22.9	1.7	0.7	0	3	0.2	10	342	380	63	0.04	0.08	0.5	8.3

*ppm

MYRTACEAE

Eugenia aquea Burm.

Jambu air (Malay), *Jambu ai* (Iban)

A small crooked fruit-tree, wild in southern India and eastern Malaysia, cultivated widely in south-eastern Asia for the sake of its slightly aromatic, white or rose-pink fruits, which are eaten to relieve thirst. Sometimes it is used for making *rojak*. Like it, *E. jambos* is equally a rose-apple, but with an elongated fruit, and a more distinct rose flavour.

The tree is small growing to 5-13 m in height with low branching with dark green glossy leaves 15 cm long. Flowers are axillary or terminal appearing in clusters, white or sometimes red in colour and fragrant. The fruits are pyriform, with diameters of 2-4 cm. The skin is thin, shiny, white, pink, red or green in colour and easily bruised. The flesh is watery, sour to sweet, or tasteless containing 0-3 seeds. It contains a fair amount of Vitamin C.

The fruit enters into a ceremonial salad used after childbirth. The bark is astringent, and is useful for thrush. The timber is hard, but only suited for quite small objects.

It is vegetatively propagated.



Eugenia aquea is a small tree growing to 5-13 m height with low branching



Flowers of *Eugenia aquea* are axillary or terminal appearing in clusters white in colour and fragrant



Eugenia aquea fruits exhibit great variability in appearance and quality



Ripe fruit bunch of *Eugenia aquea* (var. Bidor)



The flesh of *Eugenia aquea* is white, watery, sour to sweet or tasteless containing 0-3 seeds

Nutrient composition of *Eugenia aquea*

Nutrient composition per 100 g edible portion

Composition						Minerals						Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
17	95.0	0.8	0.1	3.1	0.8	0.2	2	5	0.2	1	48	7	1	0.04	0	0	16.7

*ppm

Eugenia malaccensis L.***Jambu bol* (Malay), *Jambu lipa* (Iban)**

A fruit-tree reaching 20 m in height, but fruiting freely at 7 m. A native of Malaysia apparently, though two of its Malay names - *jambu melaka* and *jambu kapal* suggest import, but they possibly only indicate an introduced race. A race has been found in the Philippine Islands with 90 per cent of the fruits seedless. At present it is grown in tropical America, Africa and the Pacific. Its dispersal is limited by its need of rain almost all the year round.

It is a low branching tree with large leaves of 15-35 cm length. The flowers are pink coloured and appear in clusters on the larger branches. Fruits have different sizes, shapes and colours. The ripe fruit may be white, red striped or red. The larger fruits have a large seed while small fruits are seedless.

The fruit is sour, sourish sweet or tasteless, but juicy, and is eaten raw as *rojak* or cooked. It may be used effectively with stronger tasted fruits in making jams.

The timber is hard, but usually too small or crooked for use.

It is propagated from seeds.



Eugenia malaccensis is a fruit tree reaching 20 m in height



The flowers of *Eugenia malaccensis* are pink coloured and appear in clusters on the larger branches



A bunch of ripening fruits of *Eugenia malaccensis*



The larger fruit of *Eugenia malaccensis* has a large seed and white flesh

Eugenia polyantha Wight

Jambu hutan (Malay), *Bunggang* (Iban)

E. polyantha is found in Burma and southwards throughout Malaysia; it is found from the Thai border to Singapore.

A moderate-sized tree to 25 m high, with cylindric, rather open crown. Leaf-blades 8-13 x 3-6 cm. Flowers 0.8-1.25 cm wide, tiny, faintly scented white. Fruits 0.8-1.0 cm wide, small, round, or transversely oblong, often rather flattened, ripening cherry red to purple-black, pulpy.

The wood is fairly hard, but splitting on drying. It is used for house-building and is durable. In Sumatra, it is the least valuable of those *Eugenia*s which are called *ubar*.

The bark is considerably used in the Dutch Indies for tanning fishing-nets, and for colouring mats. For the purpose, it is pounded in water; after straining, the split bamboos used for the matting are repeatedly dipped in the infusion over two days. Then they are immersed in mud to blacken. An extract of the bark is given in Java for diarrhoea, as, also alternatively an infusion of the leaves.

The bark, root, and leaves are used for poulticing for itch by the Malays. In the Dutch Indies, the young leaves are commonly used with food. They are aromatic from the presence of volatile oil; the leaves from cultivated trees are considered better than those from wild trees. In Sarawak it is used for cooking fish and meat in bamboo sections (*pansuh*). The fruit may be eaten but is small and insignificant. It is an important fish food.

It is propagated from seeds.



Eugenia polyantha is a moderate-sized tree growing to 25 m tall



The fruit of *Eugenia polyantha* is small ripening cherry red to purple-black

OLACACEAE

***Scorodocarpus borneensis* Becc.**

***Bawang hutan* (Malay), *Sindu* (Iban)**

Scorodocarpus is a monotypic genus of the family Olacaceae.

Found commonly in Thailand, Sumatra, Peninsular Malaysia and Borneo, on slopes in primary and secondary mixed dipterocarp forest on clay loam soils, and occasionally in seasonally flooded alluvial forest.

Medium-sized to large tree, to 40 m tall, 80 cm diameter, all parts with garlic smell especially when crushed or cut. Crown small, dense, bole straight, to 25 m, occasionally with small, low buttresses. Leaves coriaceous, shiny green above. Inflorescences racemose, to 4 cm, rusty to greyish puberulous. Flowers white, c. 1.5 cm long, solitary or grouped in clusters of 2-3 along the rachis. Fruits globose, green, c. 5 cm across, peduncle 1 cm, pericarp thin and fleshy, endocarp woody with numerous vertical fibre-like hard strands. Seeds subglobose.

The garlic smell, present in the timber, is present also in the leaves, flowers and fruit. The jungle tribes use the leaves as a seasoning, they also eat the fruit. The leaves are rich in potassium.

Among the Pangan of Kelantan the fruit or an infusion of the bark, is given as an antidote for *ipoh* poisoning. *Ipoh* is a poison obtained from a tree (*Antiaris toxicaria*) used as a blowpipe dart poison. It gives a first-class timber, which is heavy, hard, dark purplish red-brown with a garlic-like odour when fresh and a peppery odour when dry.

It is propagated from seeds



The fruits of *Scorodocarpus borneensis* are globose, green, about 5 cm in diameter, the endocarp is woody with numerous vertical fibre-like strands.

Nutrient composition of *Scorodocarpus borneensis* leaves

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
93	66.5	3.7	3.6	11.6	13.7	0.9	46	405	0	33	0	20	0	10.0	3.5

*ppm

OXALIDACEAE

Averrhoa bilimbi L.

Belimbing besi (Malay), *Belimbing masam* (Iban)

Averrhoa is a genus of two shrubs or small trees found now throughout the tropics but of Malaysian origin. It is a mistaken idea to regard it as American as some have done so.

Averrhoa bilimbi, a small tree, native of Malaysia, but not of the wettest part, as it likes a climate which has dry seasons it associates in a wild state with teak.

It is a sparingly branched tree with a short trunk reaching heights of about 10 m. It has compound leaves with between 20 - 40 leaflets each 5-10 cm long. The sweet scented flowers are small and coloured pink or red are carried on the main branches. The green fruit is five sided and shaped like a small cucumber. It is between 5-10 cm long. The thin skin contains a soft, juicy pulp which tastes very sour. Embedded in the pulp are small seeds 8 mm long.

It is commonly cultivated for its acid fruits, which are cooked with sugar, or made into seasonings for eating with curries. The Malays prepare a pickle (*sunti*) from the fruit. They take it half-ripe, wash it, dust it with salt, allow it to wilt in a hot sun, and then submerge it in brine. It keeps for about three months. To candy the fruit takes a rather long time. The fruit can be made into a jam or pickle. A Javanese preparation known as *rujak mricha* is made from the fruit with pepper, and is taken to induce perspiration.

It is propagated from seeds and air layering.

Nutrient composition of *Averrhoa bilimbi*

Nutrient composition per 100 g edible portion

Composition					Minerals							Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	Carotene (ug)	RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
26	94.2	0.7	1.3	2.8	0.7	0.3	12	1	0.4	4	80	229	38	0.01	0.08	1.2	15.7

*ppm



Averrhoa bilimbi is a small tree native to Malaysia



Red flowers and green immature fruits of *Averrhoa bilimbi*



The thin skin of *Averrhoa bilimbi* is yellow when ripe containing a white juicy pulp which tastes very sour

***Averrhoa carambola* L.**
***Belimbing manis* (Malay, Iban)**

A shrub, or small tree found wild in South East Asia, and cultivated widely. It likes a climate which has dry seasons, and it associates with teak in Java.

The 5-12 m high tree has compound leaves with between 2-11 leaflets each 2-9 cm long. It is not seasonal and flowers profusely with clusters of small purple flowers several times a year. Fruit set is excellent and fruitlets need to be thinned out before wrapping. The green fruits ripen to light yellow to yellow orange colour depending on the variety. The fruit has a characteristic five angles giving the fruit its name of star fruit. Large fruits may reach 15 cm long. It has a thin skin with a juicy but crispy pulp which may be sour to sweet. It contains 10-12 avoid seeds 1 cm long. It is one of the local fruits with high Vitamin C and A content.

It prefers well drained soils of light to medium texture with pH of 5.0 - 6.5. The budded tree is low branching and short with height further controlled by topping so that it is easy to wrap the fruits to protect against fruit flies. Sometimes netting is used to keep out the pest. Spraying using insecticides is not advocated as it may result in high pesticide residue in the fruit.

It has several imperfectly isolated, cultivated races, with sweeter and larger fruits than the wild plant, and it is these which have been taken overseas. This *belimbing* is best eaten stewed with sugar as it is sour, but some forms are sweet enough for dessert. It is roasted with food, in Goa and is called *carambola*. The fruit is very good for tarts, especially those of the sweeter races which may be distinguished as *belimbing manis*. It can be made into jams, confectionary

jelly and candy. The juice is a refreshing drink. It is also used in fruit salads or *rojak*. The Malays salt it as an *acar* and boil it in syrup as a *manisan* (sweetmeat), treating it as described under *A. bilimbi*. The flowers are pleasantly acid and are used in salads in Java.

With proper selection for high yielding and quality fruits and advanced post harvest technology dessert *carambola* has the greatest potential for development. In Malaysia, two cultivars known as B10 and B17 are among the best. The attractive yellow colour coupled with the unique star-shaped cross section make it very attractive on the serving table.

It is vegetatively propagated by budding or marcotting.

Nutrient composition of *Averrhoa carambola*

Nutrient composition per 100 g edible portion																	
Composition						Minerals						Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
24	92.0	0.7	0.1	5.0	1.8	0.4	5	12	0.3	6	99	293	50	0.07	0.07	1.1	25.8

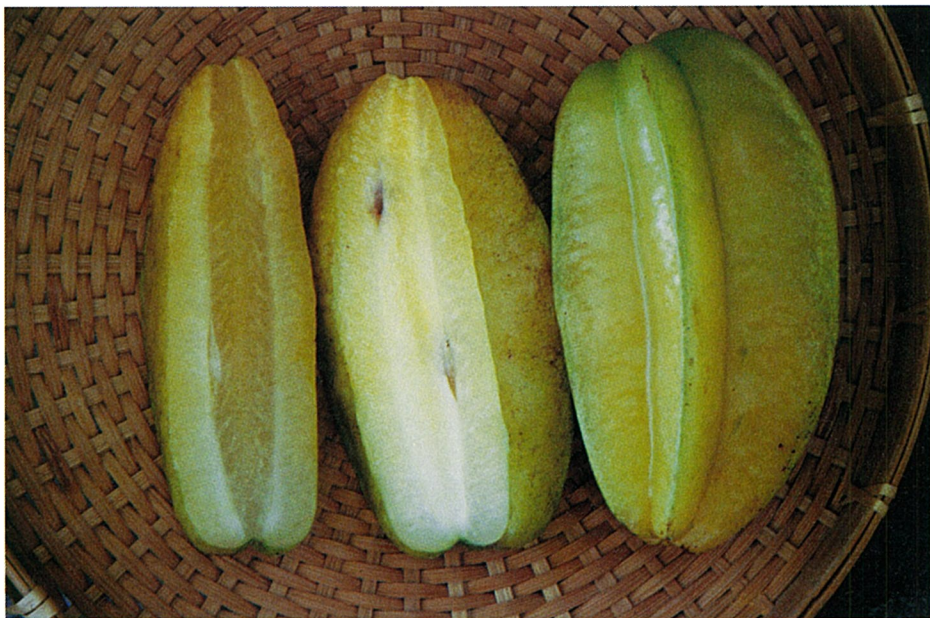
*ppm



Averrhoa carambola is a shrub or small tree found wild in South East Asia



Immature fruits of *Averrhoa carambola* are dark green in colour



On ripening the fruits of *Averrhoa carambola* turn light yellow to yellow orange in colour depending on the variety

PALMAE

Areca catechu L.

***Pinang* (Malay, Iban)**

Areca is a small genus of palms of tropical Asia, Malaysia, New Guinea and tropical Australia.

The *pinang* is an elegant palm, often rather tall, undoubtedly Malaysian in origin. It is widely cultivated in S.E. Asia and elsewhere including China and E. Africa.

The palm requires a considerable amount of moisture, and there is so great a demand for its nuts from countries where it cannot be grown easily, that countries favourable to it have large exports of it.

It can be grown everywhere in Malaysia except on the higher mountains; Malaysia is indeed in the region most suited to it.



***Areca catechu* is a tall elegant palm,
undoubtedly Malaysian in origin**

The palm is grown from seed and begins to bear at 5 or 6 years of age, bearing thereafter for 20 years, and then going off, but persisting sterile to the age of 60 years. The seeds which are miscalled “nuts” are chewed in both a ripe and unripe state.

There are many races of the palm, ill-defined, as the trees are cross-pollinated by insects. In the native cultivation no attempt is made to separate the good trees, though when a good tree is recognised, it is cared for. Roughly, the races can be classified into those with round nuts and those with long nuts.

The betel-nut contains the alkaloids arecoline, arecaidine (which has been called also arecaine), guvacine, arecolidine, guvacoline, isogovacine, and choline; the first two are the most important. Arecoline is toxic, acting like nicotine on the nervous system, and can produce paralysis, which may be preceded by convulsions and may cause death by arresting respiration. Arecaidine seems inert.

Tannin is present, and fat, and some sugars. The fat consists chiefly of the glycerides of lauric acid, then of oleic and then myristic acid, with small amounts of some others. Arecoline is apparently the substance which makes the nuts useful as a vermifuge.

The Malays make use of the astringency of the betel-nut by giving a decoction to cure diarrhoea. In fact all plant parts have innumerable medicinal and other uses.



Unripe fruits of *Areca catechu* are dark green and ripen to orange colour



The seeds of *Areca catechu* are miscalled “nuts” and are used for chewing in both a ripe and unripe state

***Arenga pinnata* Merr.**

***Kabong* (Malay), *Ijuk* (Iban)**

Arenga is a small genus of the family Palmae - palms found in south-eastern Asia, Malaysia, and northern Australia. *A. pinnata* is the largest and most important of the genus, being with *A. westerhontii* the only Malayan species.

A tall and useful palm, but as regards its service to man, now diminishing in importance. It occurs wild throughout the whole of Malaysia, but is more abundant about villages than in the deep forest. Civet-cats eat the fruits and spread the palm. The palm can be grown at greater elevations than the coconut and stands without that rival for toddy.

The most important product is sugar. When the palm has grown to the age of about 7-10 years, it begins to flower. The inflorescences, male or female, first appear at the top of the trunk, and the flowering progresses downwards. Female inflorescences to the number of 2-5 which as a rule are not tapped. It is the common peduncle of the male inflorescence which is to be tapped, but first it must undergo a light beating with a wooden mallet over three to seven days.

The juice - *nira* is carried away to be boiled down into a brown sugar in a sterilised vessel. The fresh juice - *nira* or in Sundanese *tuak* - converts itself into toddy, and this passes by further fermentation into acetic acid.

The starch is said to be a regular part of the diet of the Mangyans of the hills of Mindoro. The wood of the stem is very hard. A half-stem, hollowed out, makes a water-conduit which will last for a very long time. Very hard and showy walking-sticks may be made from the wood.



An *Arenga pinnata* inflorescence, male or female, first appears at the top of the trunk, and flowering progresses downwards

If the fruit-wall is removed with care from the nearly full-sized seeds, these can be boiled in syrup and converted into a very pleasant sweetmeat - *kalin*. It was exhibited in London at the Colonial and Indian Exhibition of 1886 as *atap* fruit.

In Java the roots are used to make a medicine for stone in the bladder. The fresh, sweet toddy is supposed to be good for chronic constipation, useful in phthisis and dysentery. It is thought to be a lactagogue. Over a large part of Malaysia the fresh toddy is drunk just as the French drink light wines - every day and everywhere, but it is also drunk fermented, and then can be very intoxicating. Many bitter barks are mixed with it in eastern Malaysia, the choice varying from place to place, turning it more or less into a beer.

Ijuk is the fibre which is found in large handfuls about the bases of the petioles. The harvest taken twice in the life of the palm, is about 4 kg. each time. It may be used for thatching roofs in which the roof is so durable as never to require renewal, the *ijuk* being of all vegetable substances the least prone in decay.

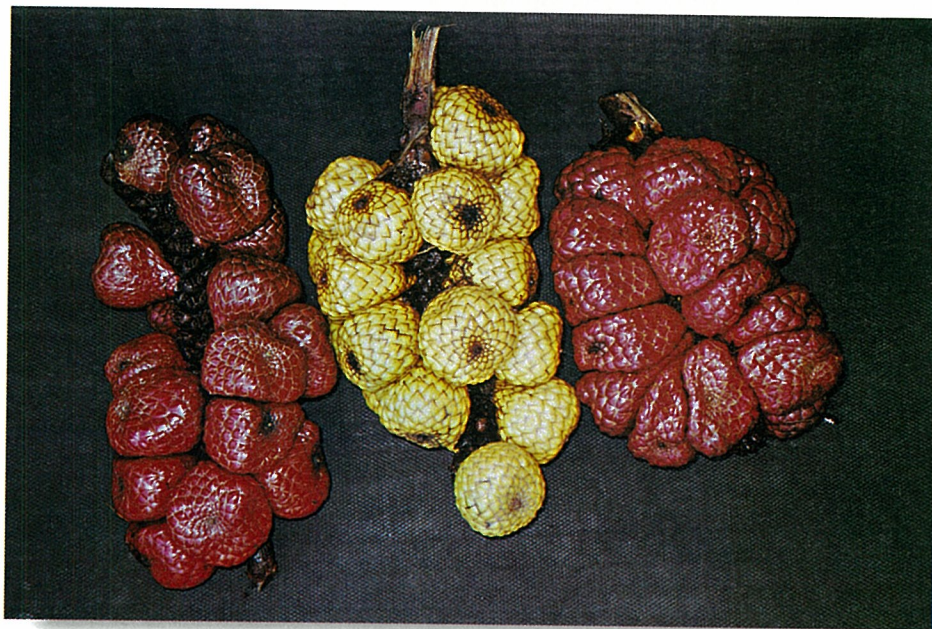
Cords of *ijuk* may be found in the markets generally. They are too stiff for many purposes, but are very durable for permanent, fixed ropes meant to stand strains only.

The *ijuk* is grown from seeds.

***Eleiodoxa conferta* (Griff.) Burret**
***Asam paya* (Malay), Buah maram (Iban)**

A slender palm found in Sumatra, Malaysia and Borneo.

Asam paya is a stemless palm found growing in fresh water and peat swamp forests in Sarawak. The dense fronds up to 7 m long are clustered to form impenetrable thickets made more so by sharp long thorns. It is dioecious. The female inflorescence is erect and forms bunches of 2-3 cm diameter fruits which are either maroon or yellow in colour. On breaking the tough scaly skin, a thick pulp encloses a seed. It is extremely sour and is used as tamarind or *kandis* for cooking sour dishes, *sambal*, *umai* and curry. It is non-seasonal and is found in the *tamu* all year round. It is pickled and used much like *sng boi* (sour plum) for making drinks. Dried sweet preserves have also been developed by SAD. The palm cabbage is eaten as a vegetable. The mature leaves are used for thatch, young leaves are woven into mats and the scaly skin or stem are made into a cough mixture. It is not cultivated.



Two varieties of *Eleiodoxa conferta* fruits are commonly found, the maroon and yellow coloured



The white pulp of *Eleiodoxa conferta* is extremely sour and is used much like tamarind for cooking sour dishes

Nutrient composition of *Eleiodoxa conferta*

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
78	82.8	0.8	3.1	11.8	0.8	0.7	10	227	26	22	55	5	2.9	8.9	0.6

*ppm

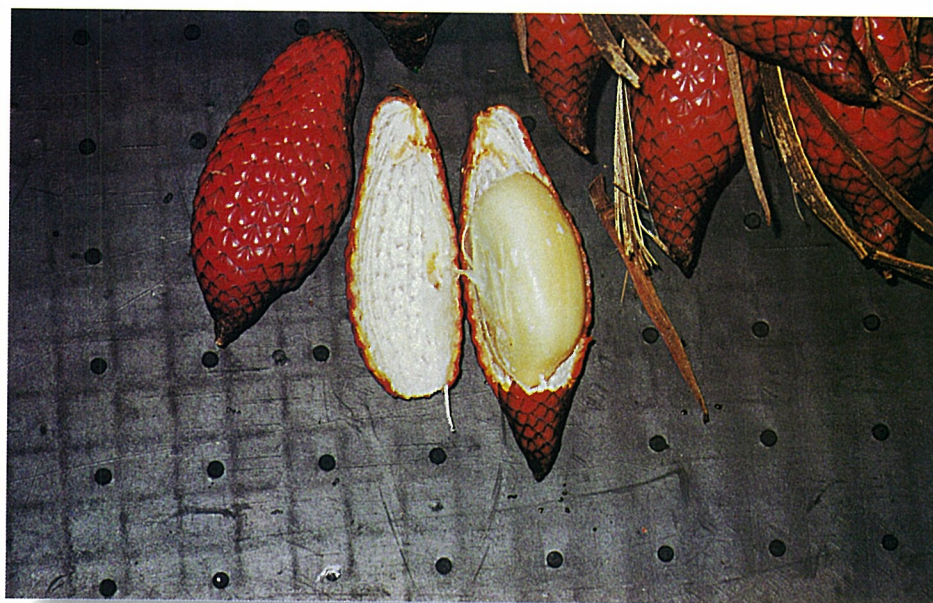
Salacca affinis Griff.

Salak hutan (Malay), *Ridan* (Iban)

A palm with a short, stout stem, found from Tenasserim and Thailand, southwards in Sumatra and Malaysia. In the Peninsula, it is recorded from a few widely scattered localities. The fruits are eaten as a substitute for *salak* but is of inferior quality though they are sweet when ripe.



Immature fruits of *Salacca affinis* are dark brown ripening to red



The pulp of *Salacca affinis* is creamy white and sweet when ripe but of inferior quality

Salacca edulis* Reinw.**Salak* (Malay)**

It is a stemless or almost stemless palm cultivated and occurring as if wild more or less throughout Malaysia. A number of varieties are available.

This small palm grows on a wide range of soils but prefers moist well drained soil with high organic matter content. Flat or undulating terrain is preferred. It requires shade and is best intercropped with banana, durian, rubber, oil palm, coconut and cocoa.

It is a small spiny palm that has a compact growth habit. It is about 3 m tall. The palm fruits at about 3 years after planting. It is dioecious. The female inflorescences appear in clusters of 4-25, while the male inflorescences appear in clusters of 4-12. Twenty percent of the male palms are retained as pollinators. The rest are removed. Assisted pollination is carried out to improve fruit set. Each bunch consists of up to 15 fruits depending on pollination. The scaled skin is thin and brown to dark brown in colour. Beneath it is a layer of cream coloured pulp which is crispy sourish-sweet to sweet, with a fruity aroma. Each larger segment contains a hard, shiny dark brown seed. Pickled *salak* is a favourite among local inhabitants.



***Salacca edulis* is a small spiny palm with a compact growth habit**



The cream coloured pulp of *Salacca edulis* is delicious with a sourish sweet taste and fruity aroma

Salak is usually propagated from seeds in which a proportion of the seedlings will be males. To ensure productive female plants, suckers can be used for propagation but the number of plantable suckers is very limited.

It is a non-seasonal fruit and produces all year round although less are produced during the rainy season.

Nutrient composition of *Salacca edulis*

Nutrient composition per 100 g edible portion

Composition		Minerals										Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
77	79.8	0.7	0.1	18.4	0.4	0.6	6	9	0.3	6	168	48	8	0.01	15	2.4	3.7

*ppm

***Salacca vermicularis* Becc.**
Ramayung (Iban)

This small palm of about 3 m height grows naturally in wet lowland forests in Sarawak. Like the *asam paya*, the rachis is covered with long vicious sharp thorns. It is a dioecious plant. The female palm produces fruits in bunches of 30 - 40 fruits. Each fruit has a thin scaly brown skin covered with long slender bristles. It has three segments each containing a fleshy creamy white pulp with a hard brown seed. The pulp is dry, crispy and only slightly sweet. It is considered an inferior fruit with little commercial value and is not cultivated.



***Salacca vermicularis* fruits have a thin scaly skin covered with long slender bristles**



The creamy white pulp of *Salacca vermicularis* is of poor quality compared to *S. edulis*

Nutrient composition of *Salacca vermicularis*

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
78	79.0	0.6	0.2	18.4	0.4	0.7	12	276	30	4	13	3	1.0	20.4	2.0

*ppm

POLYGALACEAE

Xanthophyllum amoenum Chod.

Langgir (Malay, Iban)

Xanthophyllum is a genus of trees and shrubs found from south-eastern Asia to Australia.

The fruits of *X. amoenum* are produced by a medium-sized tree that grows naturally in the forest in Sarawak. It is green when immature ripening to a greenish yellow colour. Each fruit is about 6 cm in diameter. The thin skin can be easily broken to reveal a thin white pulp surrounding large brown seeds. The pulp is mucilaginous and sweet with little flavour. It clings to the seed. The skin is often dried in the sun and used as a natural shampoo. When treated with hot water it produces a soapy shampoo. Use of the *langgir* shampoo is claimed to result in clean, shiny, black hair.

It is propagated from seeds.



Immature *Xanthophyllum amoenum* tree



Unripe fruits of *Xanthophyllum amoenum* are green



The thin white pulp of *Xanthophyllum amoenum* is edible

Nutrient composition of *Xanthophyllum amoenum*

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
124	71.0	2.3	2.9	22.1	1.6	0.2	29	139	20	9	6	11	8.4	33.1	1.2

*ppm



The dried rind of *Xanthophyllum amoenum* is sold in the *tamu* for use as a natural shampoo

RUTACEAE

Citrus maxima Merr.

Limau bali (Malay), *Janting tapah* (Iban)

Citrus maxima belongs to the orange subfamily Aurantioideae of the family Rutaceae. This species seems to be a native of Indo-China, Thailand and Malaysia. Races with fruits too acid to be eaten exist. It is particularly abundant in Indo-China and has without doubt been cultivated for a long time in Malaysia, and many races, by selection, have been produced. The pummelo was mentioned in Chinese literature in 2200 B.C.

The preferred common name in English is pummelo which appears to be derived from pompelmoes or pomplemoose - the name used by the Dutch in the East Indies (Indonesia). The name "pomelo" does not apply to this fruit but to the grapefruit which appears to be a hybrid of the pummelo and some other citrus.



Citrus maxima is a small tree with shiny dark leaves

A very fragrant perfume may be got from the flowers by enfleurage. The leaves are used medicinally in Malaysia. They are boiled to make a lotion, used hot on painful places, swellings and ulcers. The Chinese make various medicaments from the fruit.

The pummelo is a typical citrus with shiny dark green leaves and large fruit containing juice-filled pulp vesicles. It is one of the most distinct species of the *Citrus* genus and can be separated from other citrus species by its young shoots which are pubescent (covered in fine hairs), its huge leaves with very broad wings on the petiole and its very large fruit.

The flowers are large, 3-7 cm in diameter, and white or cream in colour. The fruits are also large, 10-30 cm in diameter and may be either globose, slightly flattened or pear-shaped depending on the variety. The apex may be round or slightly depressed and the style and stigma may persist on the fruit and grow with it. At maturity the fruit is light green to yellow.



***Citrus maxima* fruits are large, 10-30 cm in diameter and may be either globose, slightly flattened or pear-shaped depending on variety**

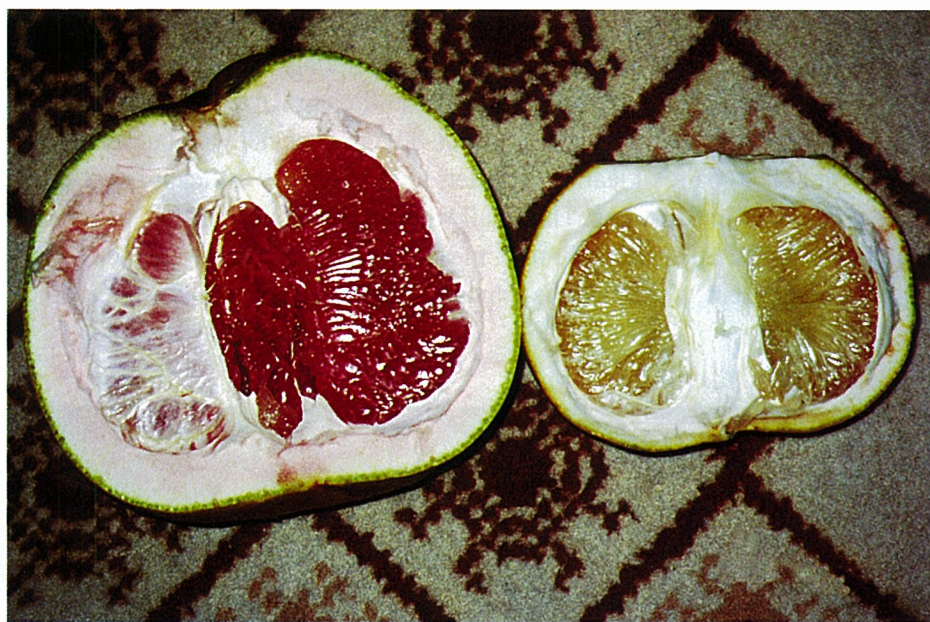
The rind is soft, pithy, pink or white and from 1-3 cm thick. The surface of some fruit is downy. The centre of the fruit may be solid but more commonly is open. The segment walls of the fruit are tough but can be easily separated from the large juice vesicles without bursting them and spilling the juice.

The pummelo has some similarities with the grapefruit. However the grapefruit is not pubescent on shoots, leaves or fruit and its seeds are polyembryonic (several embryos in one seed) whereas the pummelo is always monoembryonic.

The pummelo, like other citrus fruits grows best in deep well-drained sandy loams of moderate acidity. Poorly drained soils are likely to produce root rot problems.

Because the pummelo is monoembryonic, it does not come true to type from seed (as do the majority of citrus varieties which are polyembryonic). As well, most pummelos are self-sterile so that most seeds are produced by cross-pollination and the resulting seedlings are variable. Very few seedlings produce fruit of acceptable eating quality.

Many good pummelo varieties are available. Some have white flesh, others are honey and pink coloured. The taste may be sweet, sour, bitter or tasteless. It is rich in Vitamins A and C and potassium



The flesh of *Citrus maxima* fruit may be pink, honey or white in colour

Nutrient composition of *Citrus maxima*

Nutrient composition per 100 g edible portion

Composition						Minerals						Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
44	87.7	0.7	0	10.4	0.6	0.6	14	31	0.5	18	310	200	33	0.03	0.03	0.2	44.8

*ppm

In a hot tropical climate, pummelos bloom several times a year. The yield is at least 100 kg per year from mature trees. Marcots produce satisfactory trees and this is the main method of propagation in South East Asia. Budded trees are, however the most convenient using the standard T method of budding as for other citrus.

SAPINDACEAE

***Dimocarpus longan* Lour.**

***Longan* (Malay), *Guring, isau, kakus, sau* (Iban)**

Dimocarpus is cultivated in China, India, Malaysia and Thailand.

There are four varieties of local longan found in Sarawak. It is commonly found in nature in mixed dipterocarp forests especially along river banks where fertile alluvial soils are found. The varieties with the preferred quality fruits are commonly cultivated around homes and longhouses in the upper reaches and tributaries of the Rajang River. It is a medium-sized tree reaching 25 m with a dense canopy. The bole is 30(-80) cm diameter with buttresses to 2 m high. Leaves each with 2-4(-6) pairs of leaflets. Leaflets stiff, elliptic to ovate, 3-45 x 1.8-20 cm. It is seasonal and fruits once in two years. The small white scented flowers are borne on 10 - 30 cm long panicles. The fruits are small and round measuring 1.5 - 2.0 cm in diameter. On breaking the thin skin a translucent white flesh is exposed. It is very sweet and juicy with a distinct aroma.



The *Dimocarpus longan* is a medium-sized tree with a dense canopy



Isau



Kakus



Guring

Immature fruits of three varieties of *Dimocarpus longan* found in Sarawak



Very sweet and fragrant translucent white aril of *isau*

The four varieties have differing fruit characteristics and are easily distinguishable. The *isau* or green longan is considered the best quality. It has green skin with many protuberances on it. The fruits of the best quality have a thick flesh and small seeds and taste sweet and crispy.

The *kakus* has a brown skin and larger fruit. Its flesh however is thin, watery and very sweet with a large seed. The *sau* is an intermediate form between *isau* and *kakus*. The *guring* has a smooth skinned brown fruit like the Thai longan but the flesh is thin, watery and very sweet. It is rich in potassium and Vitamin C.

The ripe fruits are very prone to fruit bat attack. In a serious attack, the whole crop can be destroyed in a single night.

It is propagated from seeds but the Sarawak Department of Agriculture has made clonal selection and successfully inarched and marcotted plants to ensure productive female plants, fruit quality and reduce maturity period.

Nutrient composition of *Dimocarpus longan*

Nutrient composition per 100 g edible portion																	
Composition							Minerals						Vitamins				
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
70	82	0.8	0.3	16.0	0.3	0.6	14	5	0.4	10	234	0	0	0.03	0.11	0	72.1

*ppm

Lepisanthes alata (Bl.) Leenh. *Engkilili* (Iban)

Lepisanthes is a small genus of trees found in tropical Asia and throughout Malaysia.

The *engkilili* is a small tree of about 15 m found mainly along small rivers in the interior of Sarawak to 450 m. Leaves paripinnate, each with 3-5(-13) pairs of leaflets; lanceolate, 10-20(-45) x 1.8-4(-8) cm. It flowers and fruits in around two years after planting and is not seasonal. Inflorescences often drooping, purple to reddish brown, 20-25(-40) cm long. Flowers dark wine-red to purple. The fruits are borne in attractive bunches like grapes. Each fruit is oval in shape with a diameter of about 2 cm. The fruits are dark purple in colour when immature ripening to cherry red colour. The fruit has a thick skin which contains two large seeds surrounded by a thin sweet mucilage. It is grown mainly as an ornamental or fish food and has little commercial value as a fruit.

It is propagated from seeds.



Lepisanthes alata is a small fast maturing tree



Lepisanthes alata inflorescence often drooping, purple to reddish brown



The attractive cherry red fruits of ripe
Lepisanthes alata



Unripe purplish green
Lepisanthes alata fruits

Nephelium cuspidatum* Bl.**Rambutan gergasi* (Malay), *Sibau* (Iban)**

Nephelium is a genus of trees found from tropical Asia to the Pacific. *Sibau* is a medium-sized tree resembling rambutan in many ways growing to 18 m height in lowland forest preferring river banks in Sarawak. Leaves each with (1)-2-9 (-13) pairs of leaflets; elliptic to linear, 6-35 x 1.75-12.5 cm. Inflorescences mostly pseudoterminal in the axils of upper leaves, sometimes terminal or borne on leafless twigs or stems, often long pendulous racemes or spikes. The fruits are attractive red in colour, small-sized with rather short stiff hairs. The flesh has good flavour but is rather thin, soft, sour to sweet and sticks to the seed.

Medicinally it is used to cure infections in open wounds or cuts. The young leaves are boiled shortly and squeezed. The juice is dripped into the wound or cut. The wood is good for firewood. The leaves are used to colour rotan fibres black. The fibres are buried in mud for 1-2 weeks in swampy soil mixed with the leaves.

It is propagated from seeds.



Nephelium cuspidatum is a medium-sized tree growing to 18 m height



Young fruits of *Nephelium cuspidatum* are green in colour ripening to attractive red colour



The white aril of *Nephelium cuspidatum* is thin, good flavoured, sour to sweet and sticks to the seed

***Nephelium cuspidatum* var. *robustum* Leenh.**
***Gelurut* (Iban)**

Found in Borneo and Palawan. Common in Sabah and Sarawak.

Usually an understorey tree of primary or sometimes secondary mixed dipterocarp forest on well-drained land, mainly on ridges and slopes, to 800m, rarely on plains or river banks. Tree to 20 m tall. Inflorescences terminal. Immature fruits are light green in colour ripening to dark red. Fruits ellipsoid to sometimes globose. Fruit appendages dense, narrowly strap-shaped to filiform, gradually thickened and broadened toward the base, curled, c. 1.5cm long. Flesh soft, sweet with fibres attached to seed.

It is propagated from seeds.



Immature *Nephelium cuspidatum* var. *robustum* fruits
are light green in colour



Ripe *Nephelium cuspidatum* var. *robustum* fruits appear large because of the long curled hairs

Nephelium lappaceum L.

Rambutan (Malay), *Sanggau* (Iban)

Rambutan is native to Malaysia and Sumatra. Closely related species are found in Malaysia, Borneo, Sumatra, Java, Philippines, Thailand, Kampuchea, Vietnam and Burma. It is widely cultivated in Malaysia.

Under normal conditions, it is a tree of medium-size from 12-25 m high. Seedlings are mainly erect with a straight trunk and a dense head of branches. Leaves with up to 8 pairs of leaflets, ovate to obovate 5-28 x 2-10.5 cm. Inflorescences are both axillary and terminal, erect and widely branched. Flowers are small, greenish pubescent and numerous and usually functionally unisexual.

The fruit is classified as a nutlet, globose to ovoid, green in colour while developing and ripening to various shades of pink, red or yellow. Size (excluding spines) ranges from 30-80 mm long by 25-50 mm wide. The pericarp is thick and covered with closely spaced tubercles, each terminated by a soft pliable spine of variable length. The edible aril is translucent white to yellow-white. The aril thickness (8-15 mm) and eating quality vary according to the cultivar. In some races it is so sour that monkeys eat it unwillingly and others it is sourish sweet to very sweet. The seed is elliptic ovoid or oblong, 20-35 mm long by 12-22 mm wide. The aril may or may not peel cleanly from the seed. In "freestone" cultivars the aril usually detaches together with a somewhat objectionable seed testa. The race with a partially freestone is *rambutan lejang*. Most cultivars have high ascorbic acid content. Owing to a measure of separation of the sexes, some trees being entirely male, the races are liable to cross indiscriminately resulting in great variation and the opportunity for selection of superior clones.



**Under normal conditions
Nephelium lappaceum is a
medium-sized tree from 12-15 m high**



***Nephelium lappaceum* inflorescences are both axillary and terminal,
erect and widely branched**



The edible aril of *Nephelium lappaceum* is translucent white to yellow in colour

Deep, rich, well-drained sandy loams or clay loams, with high organic matter content are generally preferred. A pH range of 4.5 - 6.5 is considered optimal.

The seed derived tree fruits at 5-6 years, and it can be budded on its allies. Budded tree fruits earlier. Rambutan production has been reported to be 88 kg/tree in year six. The best storage temperature is 10°C at which the fruit remains marketable for in excess of 12 days in sealed polythene bags. Europeans in the Straits Settlements have at various times made rambutan jam, but the more generally available rambutans are not strong enough in flavour for such a purpose, the amount of sugar necessary to preserve the jam quite masking the flavour of the fruit. A wine made of rambutans was exhibited at the Colonial and Indian Exhibition in London in 1886 but nothing is recorded of it. There is present a fat, like cacao-butter, to the extent of 37 per cent of dry-weight. It is hard and white at ordinary temperatures, and turns, on heating into a yellow, pleasant smelling oil that may be suitable for edible purposes, as well as for the manufacture of soap and candles.

The timber is hard and heavy, red to reddish-white or somewhat brown, apt to split on drying, but useful for many purposes including firewood.

The fruit-walls are medicinal in Java, and stocked in a dry condition in the native drug-shops. It contains a toxic saponin but its chief component seems to be tannin.

The Malays use the roots in decoctions for treating fever, the leaves for poulticing and treatment of wounds, the bark as an astringent for diseases of the tongue. It is given after childbirth protectively. Various parts of the plant are used as dye.

Nutrient composition of *Nephelium lappaceum*

Nutrient composition per 100 g edible portion

Composition		Minerals										Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
59	84.7	0.7	0.1	13.9	0.3	0.3	22	6	2.5	5	49	0	0	0.01	0.04	0.1	38.6

*ppm

Nephelium maingayi Hiern *Serai* (Malay), *Mujau* (Iban)

The *serai* is a fairly large tree up to 40 m tall found growing in the lowland forest in Sarawak. Leaves each with up to 3(-5) pairs of leaflets. Leaflets elliptic to obovate, 5.75-22 x 2.75-9 cm. Inflorescences axillary to terminal. Young fruits are green maturing to yellow, orange and brilliant red when ripe. Each fruit is small about 1.5 cm by 3.0 cm. It has a thin glabrous rind (without hairs) with grooves and folds. On breaking the rind can be seen a soft white juicy aril, which is attached to the flat seed. The taste is from sour to sweet with a mild aroma. It is rich in energy and minerals.

It is propagated from seeds.



An immature *Nephelium maingayi* tree



The red fruit of *Nephelium maingayi* has a soft white juicy aril which is attached to the flat seed

Nutrient composition of *Nephelium maingayi*

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
200	64.6	3.5	12.8	15.5	1.8	0.9	53	283	103	46	22	7	3.6	19.1	2.0

*ppm

Nephelium melanomiscum Radlk. Mertapang (Iban)

Found in Philippines, Borneo, uncommon in Sabah and Sarawak in primary and old secondary forests on slopes, riverbanks, and hill tops on clay rich soil, and on fertile alluvial soil in mixed dipterocarp forest to 1,350 m. Tree to 25 m tall, 45 cm diameter, buttresses to 1.2 m high. Leaves elliptic to obovate, 3.5-14 x 1.5-6 cm. Inflorescences terminal, or sometimes pseudoterminal. Flowers : sepals less than 30-65% connate, 1.3-1.75 mm long, petals 2 or 3, reduced in size; ovary 2-3 locular. Fruits ellipsoid, c. 3.75 x 2.5 cm. Fruit wall fairly hard, c. 0.75 mm thick. The pulp is edible.

It is propagated from seeds.



Ripe fruits of *Nephelium melanomiscum* are dark red in colour and covered with dense hairs

***Nephelium mutabile* Bl.**

***Pulasan* (Malay), *Mak* (Iban)**

A tree found growing wild in the Philippines, Indonesia and Malaysia. *Pulasan* trees in the wild are found in lowland forests in Sarawak. The tree grows to about 20 m height with buttresses to 2.4 m high. It has a low bushy rounded crown. Leaves with 1-7 pairs of leaflets each narrowly elliptic 4-20 x 1.75-11 cm. The small flowers are greenish white in colour held in terminal panicles. The fruits are delicate, and the tree is much grown for them. The fruit about the size of rambutan has an oval shape and may be yellow or maroon in colour. The thick rind carrying short stumpy hairs can be easily peeled to reveal a translucent, juicy, sweet to sour aril with a fragrant aroma often considered superior to rambutan. The stone is large as a rule; but seedless races exist. They are propagated by marcottage in Thailand where apparently their selection has been greatest; seedless trees, though rare, exist in Malaysia. The fruits commonly seen agree most with the race known in Java as *kapulasan merah*. There are races with lighter coloured and darker coloured fruits.

Boiled, or roasted seeds may be used for the preparation of a drink like cocoa. The seeds contain an oil formerly used for lamps but has a sweet smell and is suitable for food.

The timber is hard, good for a great variety of purposes, but it is rarely used. It is harder and heavier than that of *N. lappaceum* and of a light reddish colour.

The roots are considered medicinal. It is propagated from seeds but budded plants are available.



Immature *Nephelium mutabile* tree



The aril of *Nephelium mutabile* is translucent, juicy, sweet to sour and fragrant



The yellow skinned variety of *Nephelium mutabile*

Nutrient composition of *Nephelium mutabile*

Nutrient composition per 100 g edible portion

Composition							Minerals					Vitamins					
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	Ca (mg)	P (mg)	Fe (mg)	Na (mg)	K (mg)	* Carotene (ug)	* RE (ug)	B1 (mg)	B2 (mg)	Niacin (mg)	C (mg)
71	81.2	0.9	0.1	16.6	0.5	0.7	54	9	0.1	6	94	0	0	0.02	0.05	0.2	10.8

*ppm

Pometia pinnata Forst.

Kasai (Malay, Iban)

In the family Sapindaceae, the genus *Pometia* includes some 10 tropical tree species originating in the region from Ceylon and the Andamans throughout South East Asia including Papua New Guinea and the Pacific to Fiji, Samoa and Malaysia. All the Malaysian species are known as *kasai*.

Pometia pinnata is most commonly found in Papua New Guinea, the Solomon Islands, Western Samoa and Fiji and the fruit used most significantly in Papua New Guinea and Fiji where it is known as *taup* and *dawa* respectively. In Malaysia it is widespread in low country. It is most common in poorly drained soils in river flats but occurs as well on open ridges and spurs in lowland rainforests.

As a forest tree *P. pinnata* is most commonly known for its timber, and trees vary in height from 25-40 m with a buttressed trunk diameter of up to 90 cm. The trunk is moderately hard, flexible and tough, light red, seasoning well and fairly easy to work. It can be bent well when



Pometia pinnata trees vary in height
from 25 - 40 m



Panicles develop to 50 cm with small cream-white flowers



Ripe *Pometia pinnata* fruits are purple, red or yellow in colour

steamed and might be good for coopeage. It seems to be sometimes used for house building, agricultural implements and furniture but is not durable. Trees tend to be erect even when planted in the open. Leaves are large and pinnate with leaflets 30 cm long by 7.5 cm wide. Leaflets are tomentose, light green and new flushes are deep wine red. As with some sapindaceous species, flower type is variable. Flowers are effectively unisexual. There may be trees entirely functional male, and others with predominantly functional female, but including some functional male flowers on the same panicle. Panicles develop to 50 cm, with small cream-white flowers. Newly set fruit may be vivid red, then change to green and then pale red when ripe. Other forms are light purple or dull yellow when ripe. Borne in clusters on the panicle, individual fruits have smooth pericarps and are round to oblong and up to 70 mm in diameter. The aril is semi-transparent, white and quite juicy. The seed is round, up to 25 mm in diameter. Fruits weigh from 45-80 g each. The pericarp is hard and approximately 4 mm thick.

P. pinnata is most common in poorly drained sites in river flats, but occurs as well on open ridges and spurs in lowland rainforests. There are few reports of the tree being selected on the basis of fruit quality and cultivated commercially. Various reports from Papua New Guinea suggest that there are quite a number of forms which can be recognised by the natives. Trees commence bearing in 6-7 years from seed in Fiji. Mature trees bear 700-1,000 fruits per season.

Kasai found in most parts of the world are of generally poor quality fruits except in Papua New Guinea, where some varieties are as good as lychee or rambutan. The north-west coast of Papua New Guinea has the best tasting forms.

The leaves and bark are medicinal. The Malays will boil them and use the decoction in a bath for fever. In Java the bark is applied to festering sores. The oily seeds may be eaten after roasting.

All trees in cultivation are seedlings but should clones be selected then grafting methods used for other sapindaceous species should be applicable.

ZINGIBERACEAE

***Etilingera elatior* (Jack) R.M. Smith**
***Bunga kantan* (Malay), *Kecala* (Iban)**

A genus of tall gingers found from Ceylon to New Guinea including Sarawak.

Etilingera are gingers with tall, leafy shoots and inflorescences on separate side shoots that may be long-peduncled or just appearing at soil level, or even partly covered in the ground, sometimes some distance from the leafy shoot.

The best diagnostic characters are the inflorescence that is surrounded by a conspicuous involucre of sterile bracts, and in the floral structures, where the bracteoles are always tubular and the distal part of the lip becomes stiffly incurved after flowering. Furthermore, the filament is very short, and the whole stamen much shorter than the lip. The flower colours range from pink, blood red to somewhat orange. One species is widely cultivated, as a number of varieties. *Etilingera elatior*, is known as the porcelain flower or torch ginger.

The torch ginger is both showy and useful. *Etilingera elatior* is a large ginger with stems growing to about 5 m height. The flower spike appears from the underground stem at ground level. The extremely ornamental flower is carried on a 1.5 m long scape. The showy petals are pink to deep red with white edges.



***Etilingera elatior* is a large ginger with stems growing to about 5 m height**

The flower is eaten raw, cooked or as a condiment to enhance the flavour of food just as in ginger. It has an aroma of ginger and lemon grass and is popularly used in fish and meat dishes including *pansuh*, curries, Penang *laksa*, *tom yam*, etc. It is extremely rich in potassium. The ripe fruits of *kecala* are eaten raw and has a sour taste.

It is claimed that various plant parts have medicinal value for treating ear-ache and cleaning cuts and wounds. The fibre from the stems can be made into a strong brown paper.

It is propagated from shoots and rhizomes.



Etlingera elatior flower (bottom) and shoots are used much like ginger. The fruits (top) are eaten raw and have a sour taste

Nutrient composition of *Etlingera elatior* inflorescence

Nutrient composition per 100 g edible portion

Composition							Minerals								
Energy (Kcal)	Moisture (%)	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Ash (g)	P (mg)	K (mg)	Ca (mg)	Mg (mg)	* Fe (ug)	* Mn (ug)	* Cu (ug)	* Zn (ug)	Vit C (mg)
32	90.8	1.3	1.0	4.4	1.2	1.4	30	541	32	27	40	62	1.2	0.6	0.0

*ppm

Etilingera punicea* Roxb.**Tepus* (Iban)**

This ginger is a native of Sarawak.

The inflorescence of *tepus* may appear through the ground a little away from the leafy shoots giving the impression of a bunch of flowers not connected to any plant. The lips are red and yellow. The shoot is used in cooking to flavour food. The white shoot is eaten as an *ulam* or cooked. The fruits are eaten raw.

It is propagated from shoots and rhizomes.



The lips of *Etilingera punicea* inflorescence is red and yellow in colour

Hornstedtia havilandii* Schum.**Panyun* (Iban)**

Hornstedtia is a genus of tall herbs found from the Himalayas to New Guinea and Malaysia.

Medium-sized or more commonly very tall gingers, some of the common species reaching a height of 7 m or more. The leafy shoot is coarse, often swollen at the base with a diameter of up to 6 cm. The underground rhizome is coarse in some species, just below the surface, in others deep in the ground. The inflorescence, arising on a separate side shoot from the rhizome, is

somewhat spindle-shaped on a very short peduncle. The involucre bracts are closely overlapping, stiff, often reticulate or ribbed, dark red. The flowers are red in some species with cream or yellow margins, emerging a few at a time from the tip of the spindle-shaped inflorescence. There are no lateral staminodes, and the corolla lobes and the labellum are about the same length. The most common species are recognised by the spindle-shaped inflorescence with striate or reticulate nervation, a character that remains even in the dried state.

Panyun is similar to *senggang* (*Hornstedtia scyphifera*) where the white shoots are used for cooking as a vegetable and to provide the flavour. The fruits are eaten raw.



Hornstedtia havilandii inflorescence is spindle shaped and develops into edible fruits

Hornstedtia scyphifera* M-Arg.**Senggang* (Iban)**

Hornstedtia scyphifera known as *senggang* are used as food much like *kecala* where the white shoots are cooked as a vegetable to impart a flavour and fruits are eaten without cooking.



Senggang fruits are small but taste sourish sweet and are sold in the *tamu*

Plagiostachys crocydocalyx* Schum.**Banjang* (Iban)**

It is a very small genus of herbs which occur in Malaysia and Borneo.

Tall herbs easily recognisable by the inflorescence breaking through the leaf sheaths and thus appearing lateral on the leafy shoot, while in fact it is terminal. The dense inflorescence in some species has a few branches at its base (i.e. somewhat similar to the panicle structure found in some *Alpinia*). It is a poorly known group of gingers due to the early disintegration of the inflorescence in many species into a mucilaginous mass that makes studies of herbarium specimens difficult or impossible. There are three species of *Plagiostachys* recorded for Peninsula Malaysia.

Banjang shoots are used in cooking to impart flavour. The white shoot is used as a vegetable raw or cooked. The fruits are eaten raw.

Plagiostachys subaequalis* Planch.**Munung* (Iban)**

Munung fruits are eaten raw. It is not as important as *banjang* as a food.

APPENDICES

Appendix 1 : Malay names to Latin names

Abaka;	<i>Musa textilis</i> Nee; Musa.
Apukado;	<i>Persea americana</i> Mill.; Laur.
Ara lempong;	<i>Ficus obpyramidata</i> King; Mora.
Asam jawa;	<i>Tamarindus indica</i> L.; Legu.
Asam kumbang;	<i>Mangifera quadrifida</i> Jack; Anar.
Asam paya;	<i>Eleiodoxa conferta</i> (Griff.) Burret; Palm.
Bawang hutan;	<i>Scorodocarpus borneensis</i> Becc.; Olac.
Belimbing besi;	<i>Averrhoa bilimbi</i> L.; Oxal.
Belimbing hutan;	<i>Baccaurea angulata</i> Merr.; Euph.
Belimbing manis;	<i>Averrhoa carambola</i> L.; Oxal.
Berangan paya;	<i>Castanopsis foxworthyi</i> Schottky; Faga.
Beruas;	<i>Garcinia hombroniana</i> Pierre; Clus.
Binjai;	<i>Mangifera caesia</i> Jack; Anar.
Bunga kantan;	<i>Etilingera elatior</i> (Jack) R.M. Smith; Zing.
Cempedek;	<i>Artocarpus champeden</i> Spreng.; Mora.
Dabai;	<i>Canarium odontophyllum</i> Miq.; Burs.
Delima;	<i>Punica granatum</i> L.; Lyth.
Durian;	<i>Durio zibethinus</i> Murr.; Bomb.
Durian isu;	<i>Durio oxleyanus</i> Griff.; Bomb.
Durian kuning;	<i>Durio graveolens</i> Becc.; Bomb.
Durian kura-kura;	<i>Durio testudinarum</i> Becc.; Bomb.
Durian maias;	<i>Durio acutifolius</i> Kosterm.; Bomb.
Durian merah;	<i>Durio dulcis</i> Becc.; Bomb.
Durian pulu;	<i>Durio kutejensis</i> Becc., Bomb.

Durian sukan;	<i>Durio grandiflorus</i> (Mast.) Kosterm. et. Soeg.; Bomb.
Engkala;	<i>Litsea garciae</i> Vidal; Laur.
Embang;	<i>Mangifera pajang</i> Kosterm.; Anar.
Getah;	<i>Hevea brasiliensis</i> Willd.; Euph.
Gerit-gerit;	<i>Willughbeia</i> sp. Apoc.
Ipoh;	<i>Antiaris toxicaria</i> Lesch.; Mora.
Jambu air;	<i>Eugenia aquea</i> Burm.; Myrt.
Jambu bol;	<i>Eugenia malaccensis</i> L.; Myrt.
Jambu hutan;	<i>Eugenia polyantha</i> Wight; Myrt.
Jiring;	<i>Pithecellobium jiringa</i> (Jack) Prain; Legu.
Kabong;	<i>Arenga pinnata</i> Merr.; Palm.
Kandis;	<i>Garcinia nitida</i> Pierre; Clus.
Kedaung;	<i>Parkia javanica</i> Merr.; Legu.
Kemangsi;	<i>Artocarpus camansi</i> Blanco; Mora.
Kembayau;	<i>Dacryodes rostrata</i> Bl.; Burs.
Kepayang;	<i>Pangium edule</i> Reinw.; Flac.
Keranji;	<i>Dialium indum</i> L.; Legu.
Kasai;	<i>Pometia pinnata</i> Forst.; Sapi.
Kuini;	<i>Mangifera odorata</i> Griff.; Anar.
Kundong;	<i>Garcinia parvifolia</i> Miq.; Clus.
Lamantan;	<i>Mangifera torquenda</i> Kosterm.; Anar.
Langgir;	<i>Xanthophyllum amoenum</i> Chod.; Poly.
Langsat, duku duku-langsats, dokong	<i>Lansium domesticum</i> Corr.; Meli.
Limau bali;	<i>Citrus maxima</i> Merr.; Ruta.
Longan;	<i>Dimocarpus longan</i> Lour.; Sapi.

Macang;	<i>Mangifera foetida</i> Lour.; Anar.
Manggis;	<i>Garcinia mangostana</i> L.; Clus.
Mengkudu;	<i>Morinda citrifolia</i> L.; Rubi.
Pelajau;	<i>Pentaspadon motleyi</i> Hook. f.; Anar.
Perah;	<i>Elateriospermum tapos</i> Bl.; Euph.
Petai;	<i>Parkia speciosa</i> Hassk.; Legu.
Pinang;	<i>Areca catechu</i> L.; Palm.
Pisang kera;	<i>Musa acuminata</i> var. <i>microcarpa</i> Colla; Musa.
Pulasan;	<i>Nephelium mutabile</i> Bl.; Sapi.
Rambai;	<i>Baccaurea motleyana</i> Muell.; Euph.
Rambai hutan;	<i>Baccaurea lanceolata</i> Muell.; Euph.
Rambutan;	<i>Nephelium lappaceum</i> L.; Sapi.
Rambutan gergasi;	<i>Nephelium cuspidatum</i> Bl.; Sapi.
Rengam;	<i>Salacca affinis</i> Griff.; Palm.
Salak;	<i>Salacca edulis</i> Reinw.; Palm.
Sengkuang dao;	<i>Dracontomelum dao</i> Merr. and Rolfe; Anar.
Sentul;	<i>Sandoricum koetjape</i> (Burm. f.) Merr.; Meli.
Serait;	<i>Nephelium maingayi</i> Hiern; Sapi.
Tampoi;	<i>Baccaurea macrocarpa</i> Muell.; Euph.
Tampoi paya;	<i>Baccaurea bracteata</i> Muell.; Euph.
Tempunik;	<i>Artocarpus rigidus</i> Bl.; Mora.
Terap;	<i>Artocarpus odoratissimus</i> Blanco; Mora.
Terap bulu;	<i>Artocarpus sericicarpus</i> Jarrett; Mora.

Appendix 2 : Iban names to Latin names

Bacang;	<i>Mangifera foetida</i> Lour.; Anar.
Banjang;	<i>Plagiostachys croxydocalyx</i> Schum.; Zing.
Bedulang;	<i>Ptychopyxis grandis</i> Airy Shaw; Euph.
Belimbing manis;	<i>Averrhoa carambola</i> L.; Oxal.
Belimbing masam;	<i>Averrhoa bilimbi</i> L.; Oxal.
Berangan lingkau;	<i>Castanopsis foxworthyi</i> Schottky; Faga.
Bintawak;	<i>Artocarpus anisophyllus</i> Miq.; Mora.
Buah maram;	<i>Eleiodoxa conferta</i> (Griff.) Burret; Palm.
Bunau;	<i>Garcinia caudiculata</i> Ridl.; Clus.
Bungkang;	<i>Eugenia polyantha</i> Wight; Myrt.
Dabai;	<i>Canarium odontophyllum</i> Miq.; Burs.
Empaung;	<i>Baccaurea lanceolata</i> Muell.; Euph.
Empelanjau;	<i>Pentaspadon motleyi</i> Hook. f.; Anar.
Engkudu benang;	<i>Morinda citrifolia</i> L.; Rubi.
Engkunoh;	<i>Ficus obpyramidata</i> King; Mora.
Engkala;	<i>Litsea garciae</i> Vidal; Laur.
Engkeranji;	<i>Dialium indum</i> L.; Legu.
Engkilili;	<i>Lepisanthes alata</i> (Bl.) Leenh.; Sapi.
Gelurut;	<i>Nephelium cuspidatum</i> var <i>robustum</i> Leenh.; Sapi.
Gentu;	<i>Musa hirta</i> Becc.; Musa.
Guring, isau, kakus sau;	<i>Dimocarpus longan</i> Lour.; Sapi.

Ijuk;	<i>Arenga pinnata</i> Merr.; Palm.
Jambu ai;	<i>Eugenia aquea</i> Burm.; Myrt.
Jambu kerak;	<i>Bellucia pentamara</i> Naudin; Mela.
Jambu lipa;	<i>Eugenia malaccensis</i> L.; Myrt.
Janting tapah;	<i>Citrus maxima</i> Merr.; Ruta.
Jelentik;	<i>Baccaurea hookeri</i> Gage; Euph.
Jiring;	<i>Pithecellobium jiringa</i> (Jack) Prain; Legu.
Kandis;	<i>Garcinia nitida</i> Pierre; Clus.
Kasai;	<i>Pometia pinnata</i> Forst.; Sapi.
Kecala;	<i>Etilingera elatior</i> (Jack) R.M. Smith; Zing.
Kejira;	<i>Baccaurea costulata</i> Miq.; Euph.
Kelampu ai;	<i>Sandoricum borneense</i> Miq.; Meli.
Kelampu bukit;	<i>Sandoricum koetjape</i> (Burm. f.) Merr.; Meli..
Kelampai;	<i>Elateriospermum tapos</i> Bl.; Euph.
Kemantan;	<i>Mangifera torquenda</i> Kosterm.; Anar.
Kembayau;	<i>Dacyrodes rostrata</i> Bl.; Burs.
Kepayang;	<i>Pangium edule</i> Reinw.; Flac.
Kubal ai;	<i>Willughbeia</i> sp., Apoc.
Kubal arang, kubal tusu;	<i>Willughbeia coriacea</i> Wall.; Apoc.
Kubal madu;	<i>Willughbeia augustifolia</i> ; Apoc.
Kubal tabau;	<i>Willughbeia sarawakensis</i> Pierre; Apoc.
Kuini;	<i>Mangifera odorata</i> Griff.; Anar.

Kundong;	<i>Garcinia parvifolia</i> Miq.; Clus.
Langgir;	<i>Xanthophyllum amoenum</i> Chod.; Poly.
Lanyat;	<i>Mangifera caesia</i> Jack; Anar.
Lengki;	<i>Musa acuminata</i> var. <i>microcarpa</i> Colla; Musa.
Lensat;	<i>Lansium domesticum</i> Corr.; Meli.
Lumuk amat;	<i>Artocarpus odoratissimus</i> Blanco; Mora.
Mak;	<i>Nephelium mutabile</i> Bl.; Sapi.
Mawang;	<i>Mangifera pajang</i> Kosterm.; Anar.
Merenti;	<i>Ostodes</i> sp. Euph.
Mertapang;	<i>Nephelium melanomiscum</i> Radlk.; Sapi.
Munung;	<i>Plagiostachys subaequalis</i> Planch.; Zing.
Pala munsoh;	<i>Artocarpus rigidus</i> Bl.; Mora.
Panyun;	<i>Hornstedtia havilandii</i> Schum.; Zing.
Pedalai;	<i>Artocarpus sericicarpus</i> Jarrett; Mora.
Petai;	<i>Parkia speciosa</i> Hassk.; Legu.
Pinang;	<i>Areca catechu</i> L.; Palm.
Pingan;	<i>Artocarpus sarawakensis</i> Jarrett; Mora.
Puak;	<i>Baccaurea macrocarpa</i> Muell.; Euph.
Puak burung;	<i>Baccaurea bracteata</i> Muell.; Euph.
Pulor;	<i>Artocarpus camansi</i> Blanco; Mora.
Ramayung;	<i>Salacca vermicularis</i> Becc.; Palm.
Rambai;	<i>Baccaurea motleyana</i> Muell.; Euph.

Rian amat;	<i>Durio zibethinus</i> Murr.; Bomb.
Rian isa;	<i>Durio graveolens</i> Becc.; Bomb.
Rian isu;	<i>Durio oxleyanus</i> Griff.; Bomb.
Rian kura-kura;	<i>Durio testudinarum</i> Becc.; Bomb.
Rian nyekak;	<i>Durio kutejensis</i> Becc.; Bomb.
Rian tutong;	<i>Durio dulcis</i> Becc.; Bomb.
Ridan;	<i>Salacca affinis</i> Griff.; Palm.
Salak;	<i>Salacca edulis</i> Reinw.; Palm.
Sanggau;	<i>Nephelium lappaceum</i> L.; Sapi.
Senggang;	<i>Hornstedtia scyphifera</i> M-Arg.; Zing.
Sengkuang dao;	<i>Dracontomelum dao</i> Merr. and Rolfe; Anar.
Sibau;	<i>Nephelium cuspidatum</i> Bl.; Sapi.
Sikup;	<i>Garcinia mangostana</i> L.; Clus.
Sindu;	<i>Scorodocarpus borneensis</i> Becc.; Olac.
Tasem;	<i>Antiaris toxicaria</i> Lesch.; Mora.
Tekalong;	<i>Artocarpus elasticus</i> Reinw.; Mora.
Temedak;	<i>Artocarpus champeden</i> Spreng.; Mora.
Tepus;	<i>Etlingera punicea</i> Roxb.; Zing.
Ucong;	<i>Baccaurea angulata</i> Merr.; Euph.

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