

instead of the true oregano[238 ]. Many people find them preferable to the European oregano[301 ]. They are more pungent than European oregano[200 ]. The dried leaves can be used to make a herbal tea[301 ].

nrakta Central America from Costa Rica, north to Mexico and southern N. America. ksacta Dry areas[238 ]. Rocky slopes or damp thickets on plains at elevations of 350 metres or less[331 ].

propta Seed - Basal or nodal softwood cuttings[200 ]. Cuttings of semi-ripe wood.

nwatta Prefers a position in full sun in any moderately fertile, well-drained soil[200 ]. Prefers a light soil[238 ]. Flowering Time: Late Spring/Early Summer Mid Summer. Bloom Color: White/Near White. Spacing: 36-48 in. (90-120 cm).

## 9.2.23 Brassica carinata

Abyssinian Cabbage

9 tlin 12 cyuc 4 kcak 3 tcan 2 dwat 1 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwatli fyifxre7t hjonli

drutta Brassica carinata is a ANNUAL growing to 1 m (3ft 3in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9 and is not frost tender. The species is hermaphrodite (has both male and female organs) and is pollinated by Bees. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The oil contained in the seed of this species is rich in erucic acid which is toxic. However, modern cultivars have been selected which are almost free of erucic acid.

kcaakta Edible Parts: Flowers Leaves Oil Seed Stem Edible Uses: Condiment OilLeaves and young stems - raw or cooked[2, 52, 61, 141]. Used when up to 30cm tall[183]. A mild and pleasant cabbage flavour[K], the young growth can be cut finely and used in mixed salads, whilst older leaves are cooked like cabbage leaves[183]. Immature flowering stems - cooked. Used like broccoli[183], they make a nice vegetable[K]. An edible oil is obtained from the seed[183]. Oil from the wild species is high in erucic acid, which is toxic[141], though there are some cultivars that contain very little erucic acid and can be used as food[K]. The seed can also be crushed and used as a condiment[200].

tcanta OilAn oil that is high in erucic acid can be obtained from the seed[289 ]. Traditionally, it is used for oiling the baking plates of earthenware 'injera' stoves and also for illumination[299 ]. The oil finds wide application in the production of water repellents, waxes, polyesters and lubricants[418]. The seed oil is used to produce bio-diesel or special erucic acid derivatives[418]. This plant is also part of a research to develop an aviation biofuel for jet engines. Agroforestry Uses: The plant can be grown as a green manure[418].

dwatta The seed is used in the treatment of stomach aches[299].

nrakta N. Africa - Ethiopia. Occasional in Britain. ksacta An occasional bird-sown alien on waste ground in Britain.

propta Seed - sow in situ in succession from March to early September. The seed can also be sown under cloches in February when it will yield a crop in May.

nwatta Management: Standard Minor Global Crop Staple Crop: Oil Staple Crop: ProteinThis species is very tolerant of a wide range of climatic conditions and can be grown from the temperate to tropical zones. In cool temperate it is only suitable as a leaf crop, but in other areas it can also be grown for its seed. It grows best in areas where annual daytime temperatures are within the range 10 - 25°C, but can tolerate 5 - 35°C[418]

]. It prefers a mean annual rainfall in the range 1,000 - 1,500mm, but tolerates 800 - 1,700mm[418]

]. Succeeds in full sun in a well-drained fertile preferably alkaline soil[200]

]. Succeeds in any reasonable soil[52]

]. Prefers a pH in the range 5.5 - 8, tolerating 5 - 8.5[418]

]. Plants develop an extensive root system, larger than in other Brassica species[299]

]. There is a difference in first flowering date between oil types and vegetable types; oil types start flowering about 10 weeks after germination, vegetable cultivars after about 12

weeks, depending on cultivar and growing conditions. Flowering of vegetable cultivars is delayed by regular harvesting of the leaves or young shoots[299]

]. Plants grown in dry regions flower earlier and produce ripe seeds within 4 months from sowing[299]

]. Vegetable crops grown with adequate moisture produce seeds in 5 - 6 months[299]

]. An average leaf and shoot yield of 35 tonnes per hectare can be expected, but at research stations leaf yields of 50 - 55 tonnes have been reported[299]

]. In India and Canada farmers may get seed yields of 1,200 - 1,800 kg per hectare in a good year[299]

]. Some tall cultivars, when grown with adequate moisture, may develop new shoots after removal of the infructescences and become perennial, normally for one further season, but plants of up to 4 years old have been recorded[299]

]. Most Brassica species are cross-pollinating, which contributes to the great diversity within species. Brassica carinata is an exception as it sets seed very efficiently through self-pollination without insects acting as pollinators[299]

]. The plant does not need low temperatures for flower initiation, and seed production is therefore much easier in Africa than for most Brassica oleracea leaf cabbages except for Portuguese kale[299]

]. There are some named varieties. 'Texsel' is especially good for temperate climates, it is fast growing even at relatively low temperatures[141]

, 200

]. Research has produced a collection of lines with characteristics suitable for modern agriculture. Varieties are available, including different oil types, such as low erucic (0%) and very high erucic (+ 50%) content[289]

]. This plant is unknown in the wild. It arose as a natural amphidiploid hybrid of female B. Nigra and male B. Oleracea[289]

].

## 9.2.24 Celosia argentea cristata

Lagos Spinach, Common Cockscomb

9 tlin 12 cyuc 4 kcak 1 tcan 3 dwat 0.5 m hkuc hmimhtut cyutli hgatyuctup hwicli hrasjlutnyikfrip hpa7tli flatprikliwis hpa7tmwatli xre7t hjonli

drutta Celosia argentea cristata is a ANNUAL growing to 0.5 m (1ft 8in) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9 and is frost tender. The species is hermaphrodite (has both male and female organs) and is pollinated by Wind, Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

kcaakta Edible Parts: Leaves Oil Shoots Edible Uses: OilLeaves and young shoots - cooked[ 177 , 178 , 179 ]. An important and nutritious vegetable [ 46 , 272 ]. Used in soups and stews[ 300 , 418 ]. The leaves retain a pleasant green colour when cooked - they soften readily and should not be overcooked[ 298 ]. The texture is soft and the flavour very mild and spinach-like with no hint of bitterness[ 298 ]. An edible oil can be obtained from the seed[ 301 ].

tcanta Oil ParasiticideOther uses Rating: Low (1/5). Other Uses: Can be grown as an ornamental. Known for its very bright colors. Used in Africa to help control the growth of the parasitic Striga plant. It can also be used in soaps.

dwatta Antibacterial Astringent Dysentery Eczema Haemostatic Hypotensive Ophthalmic ParasiticideThe flowers and seed are astringent, haemostatic, ophthalmic, parasiticide and poultice[ 147 , 176 , 178 ]. They are used in the treatment of bloody stool, haemorrhoid bleeding, uterine bleeding, leucorrhoea, dysentery and diarrhoea[ 176 , 299 ]. As a parasiticide it is very effective against Trichomonas, a 20% extract can cause the Trichomonas to disappear in 15 minutes[ 176 ]. The seed is hypotensive and ophthalmic[ 176 ]. It also has an antibacterial action, inhibiting the growth of Pseudomonas[ 176 ]. It is used in the treatment of diarrhoea, bloodshot eyes, blurring of vision, cataracts and hypertension, but should not be used by people with glaucoma because it dilates the pupils[ 176 , 299 ]. The seeds are widely used in India for the treatment of diabetes mellitus[ 299 ]. A

then dried and ground into a powder to form malt, which is used as a substratum for fermentation in local beer production[299 ]. Stems - cooked[105 ]. Some caution is advised here, there are some reports that the leaves can contain the poison cyanide[4 ]. The stems of sweet sorghum types are chewed like sugar cane and, mainly in the United States, a sweet syrup is pressed from them[299 ]. Sap - raw or cooked. Very sweet, it is made into a syrup[1 , 2 , 46 , 57 , 257 ].

tcanta Biomass Broom WeavingThe flowering panicles, especially of cultivars specially bred for the purpose, are used as brushes, brooms, whisks etc[1 , 2 , 4 , 46 , 57 ]. Several non-edible sorghum cultivars are exclusively grown for the red pigment present in the leaf sheaths and sometimes also in adjacent stem parts. It is used as a dye for mats, textiles, strips of palm leaves and grasses used in basketry and weaving, ornamental calabashes, wool, as a body paint and to colour cheese and lick stones for cattle[299 ]. A similar dye can be extracted from the grain refuse (glumes and grain wall) of several red sorghum cultivars grown for food or for beer-making[299 ]. The red sorghum dyes were traditionally used as a funeral hanging, decorated with patterns made by thick threads added to the weft of the fabric. The fabrics in which the dominant colours were derived from sorghum were known as 'ifala'. Sorghum is also used to provide the violet colours decorating the masks worn during certain dances. Sorghum and other tannin-rich dyes are used in combination with mud to create the patterns of the painted cloths produced in the Korhogo region. The dye was extracted by squeezing out the juice, which was then fermented. Used with wool or silk mordanted with tin or chrome, the result was a colourfast red-brown. Recently the use of sorghum dye in hair dyeing products has been patented[299 ]. Sorghum flour is used to produce an adhesive that is used in the manufacture of plywood[299 ]. Stems are used for weaving fences, mats, wattle houses etc[178 ]. Sorghum plant residues are used extensively as material for roofing, fencing, weaving and as fuel[299 ]. The plant is an excellent source of biomass[269 ]. The stems can be used for the production of fibreboard. Danish scientists have made good panelling using stem chips of sorghum[299 ].

dwatta Astringent Demulcent Diuretic Haemostatic UrinaryThe decoction of the seed is demulcent and diuretic[4 ]. It is used in the treatment of kidney and urinary complaints[4 , 299 ]. The inflorescence is astringent and haemostatic[7 ]. The leaves and panicles are included in plant mixtures for decoctions used in the treatment of anaemia[299 ]. Decoctions of the twigs, combined with lemon, is used as a treatment against jaundice[299 ]. The red pigment is said to have antimicrobial and antifungal properties. It is used as a treatment for anaemia[299 ].

nrakta Original habitat is obscure. ksacta Not known in the wild.

propta Seed - sow April in a greenhouse and only just cover the seed. Germination should take place within 2 weeks if given a minimum germination temperature of 23°C[160]. Prick out the seedlings into individual pots once they are large enough to handle and plant them out after the last expected frosts. Consider giving them some protection, such as a cloche, until they are growing away strongly.

nwatta A fairly easily grown plant, though it is on the edges of its climatic zone in Britain. It requires a warm, sheltered and sunny position[160], preferring a slightly to moderately acid soil[160, 269], though some cultivars have succeeded with a pH as high as 8[269]. Plants are adapted to a wide range of soils varying from light loams to heavy clays, they thrive best on light, easily worked soils of high fertility, with moderate to high availability of water[269]. Moderately well-drained soils are suitable for sorghums[269]. Small amounts of alkali in sand reduces performance considerably[269]. Plants are moderately tolerant of saline soils[269]. Established plants are very drought resistant, they succeed in arid soils[171]. A nitrogen rich soil causes the plants to lodge[160]. Plants are reported to tolerate an annual precipitation in the range of 20 to 410cm, an annual temperature in the range of 7.8 to 27.8°C and a pH of 4.3 to 8.7[269]. Sorghum is widely cultivated in tropical and warm temperate zones for its edible seed, as well as for its panicles (which are used as brooms) and the syrup obtained from its sap. Yields of around 6 tonnes per hectare have been achieved, though yields as low as 200 kilos have been reported - yields below 2 tonnes are not considered financially viable[269]. There are many named varieties[4, 50, 61, 183]. Some cultivars

are short-day plants and are unlikely to produce flowers and seed away from the tropical zone[269]. Plants are adapted to tropical and subtropical summer rainfall climates with rainfall from 25 - 125 cm annually, they are of little importance in more humid areas with higher rainfall[269]. It is grown in Britain as a tender bedding plant but requires a long hot summer if it is to ripen its seed here[200]. In warmer climates it takes 3 months from sowing to seed harvest[160].

## 9.2.21 Musa balbisiana

Plantain, Plantain Banana  
9 tlin 12 cyuc 4 kcak 2 tcan 1 dwat 5 m hkuc  
hmimhtut cyutli tcup hwicli hrasjltutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Musa balbisiana is an evergreen Perennial growing to 5 m (16ft) by 3 m (9ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Birds, Bats. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant is not wind tolerant.

kcakta Edible Parts: Flowers Fruit StemEdible Uses: Fruit - raw or cooked[418 ]. The fruit is not often eaten raw, being unpopular because of its seediness[301 ]. The ripe fruit is boiled, baked, fried, or roasted[418 ]. Juice from the ripe fruits is mixed with sugar and then fermented into a type of vinegar[301 , 418 ]. Young fruits are used like green papaya in salads and pickles[301 ]. The green, yellow or brown fruits can be 10 - 25cm long. They can be seeded or seedless[418 ]. The underground stem can be eaten as a vegetable[418 ]. The inner stem is sometimes eaten in curries[301 ]. Male flower clusters - sometimes used as an ingredient in curries[301 ].

tcanta Containers Dye Fibre MiscellanyOther Uses The leaves are used for wrapping foods, for cooking and as plates[301 , 418 ]. Fibres can be obtained from the stem[317 ]. The plant yields a dye[317 ].

dwatta MiscellanyThe fruit has medicinal properties[418 ].

nrakta E. Asia - China, Indian subcontinent, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, Philippines, New Guinea. ksacta Forests, on forest edges, in ravines and on water sides[418 ].

propta Seed -  
nwatta A plant of the humid tropics, where it is found at elevations up to 1,200 metres. It grows best in areas where annual daytime temperatures are within the range 23 - 28°C, but can tolerate 16 - 38°C[418 ]. Mature growth can be killed by temperatures of 8°C or lower, whilst young growth can be killed at 12°C[418 ]. It prefers a mean annual rainfall in the range 1,300 - 3,000mm, but tolerates 1,000 - 5,000mm[418 ]. Prefers a position in full sun or light shade[418 ]. Succeeds in most moderate to fertile soils that are well-drained[418 ]. Requires a position sheltered from strong winds[418 ]. Prefers a pH in the range 5.5 - 7, tolerating 4.5 - 7.5[418 ]. Flowering Time: Mid Summer Late Summer/Early Fall. Bloom Color: Fuchsia (Red-Purple). Spacing: 36-48 in. (90-120 cm) 4-6 ft. (1.2-1.8 m) 6-8 ft. (1.8-2.4 m).

## 9.2.22 Lippia graveolens

Mexican Oregano  
9 tlin 12 cyuc 4 kcak 0 tcan 0 dwat 2 m hkuc  
htut cyutli kyuctcup hwicli hrasjltutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta Lippia graveolens is an evergreen Shrub growing to 2 m (6ft) by 2 m (6ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It cannot grow in the shade. It prefers dry or moist soil.

kcakta Edible Parts: LeavesEdible Uses: The leaves have an intense aroma of oregano and are commonly used, especially in central America, as a flavouring in tomato pastes and other dishes that require a strong oregano flavour[301 ]. The leaves are often used by the food industry

taste[2, 3, 46, 171], somewhat like an orange with a mixture of acid[4]. The ripe aromatic fruit is allowed to wrinkle and develop sweetness, it is then eaten raw, juiced, made into a syrup or used in sauces, cakes etc[183]. The fruit is about 5cm in diameter[200]. An edible oil is obtained from the seed[183]. Grown commercially in Australia and New Zealand.

tcanta Fencing OilA vigorous plant making a good screen on a fence or trellis.

dwatta Stimulant TonicThe pulp of the fruit is stimulant and tonic[240].

nrakta S. America - Brazil, Paraguay and northern Argentina. ksacta Not known

propta Pre-soak the seed for 12 hours in warm water and then sow late winter or early spring in a warm greenhouse. If sown in January and grown on fast it can flower and fruit in its first year[88]. The seed germinates in 1 - 12 months at 20°C. Prick out the seedlings into individual pots when they are large enough to handle. If you are intending to grow the plants outdoors, it is probably best to keep them in the greenhouse for their first winter and plant them out into their permanent positions in late spring or early summer, after the last expected frosts. Mulch the roots well in late autumn to protect them from the cold. Cuttings of young shoots, 15cm with a heel, in spring[1]. Leaf bud cuttings in spring. Cuttings of fully mature wood in early summer. Takes 3 months. High percentage[3].

nwatta Requires a well-drained soil with plenty of moisture in the growing season, otherwise it is not fussy[1, 3]. Plants are not very frost tolerant and are best grown in a greenhouse[3]. However, the roots are somewhat hardier and can survive the winter outdoors in many areas of Britain if the soil is prevented from freezing[88]. If plants are cut down to the ground by frost they can regenerate from the base[200]. There is also the possibility of growing plants on rootstocks of *P. caerulea* which might make them hardier[200]. This species is often cultivated in warmer climates than Britain for its edible fruit, there are some named varieties[46, 183]. The fruit can be freely produced in Britain in hot summers[166]. Roots of outdoor grown plants should be restricted to encourage fruiting[1]. Any pruning is best carried out in the spring[219]. If fruit is required it is best to hand pollinate, using pollen from a flower that has been open for 12 hours to pollinate a newly opened flower before midday[88, 200]. The flowers open in sunny weather and do not open on dull cloudy days[219]. The flowers have the scent of heliotropes[245]. A climbing plant, attaching itself to other plants by means of tendrils that are produced at the leaf axils. Plants in this genus are notably resistant to honey fungus[200]. Certain cultivars are light frost resilient surviving in warmer temperate climates.

## 9.2.19 Eugenia brasiliensis

Grumichama, Brazilian Plum

9 tin 12 cyuc 4 kcaak 2 tcant 2 dwat 8 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Eugenia brasiliensis is an evergreen Shrub growing to 8 m (26ft) by 8 m (26ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Birds. It is noted for attracting wildlife.

Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcaakt Edible Parts: FruitEdible Uses: Fruit - raw or used in jams, jellies etc [ 301 , 303, 310 ]. The deep crimson fruit has a thin and delicate skin, soft and melting pulp and a mild subacid taste[ 301 , 303 ]. The taste largely resides in the skin[ 303 , 310 ]. Excellent when eaten fresh[ 301 ]. The persistent sepals ('rabbit ears') and the modest flesh to seed ratio limit the appeal of the fruit[ 310 ]. The fruit is a globose to oblate berry, up to 3 - 5cm in diameter[ 303 ].

tcanta Containers Essential Furniture Tannin WoodOther Uses: The bark and leaves contain large amounts of tannins, reportedly among highest found in plants (34% in the bark)[ 303 , 310 ]. The bark and leaves contain 1.5% of an essential oil and have an attractive aromatic smell[

310 ]. The wood is cross-grained, compact, hard, moderately heavy, not very elastic, brittle, of medium durability when exposed[ 419 ]. Easy to work, it is used for lathe work, cabinet making, general carpentry, linings and boxes[ 419 ].

dwatta Antirheumatic Aromatic Astringent DiureticAn infusion of 10 g of leaves or bark in 300 ml water is used as an aromatic, astringent diuretic and as a treatment for rheumatism in Brazil[ 303 , 739 ].

nrakta S. America - coastal southern Brazil. ksacta A rare plant in the Atlantic rainforest, growing on alluvial plains and gentle slopes[ 416 , 419 ].

propta Seed - should be sown as soon as possible because it loses its viability in about 6 weeks[ 303 ]. Sow in a lightly shaded position in a nursery seedbed or in individual containers. Germination rates are usually low, with the seed sprouting within 30 - 60 days[ 419 ]. Seedlings grow away very slowly[ 419 ]. A spacing of 4 m between trees is suitable. Little pruning is necessary. Cuttings. Easy[ 303 ]. Air layering. Easy[ 303 ]. Grafting.

nwatta is a cultivated tree. The fruit are popular. The grumichama requires a humid, tropical to subtropical climate, growing best at very low elevations of 90 metres or less[ 303 ]. The temperature range for growth is reported to be 15 - 38°C with the optimum between 21 - 32°C[ 303 ]. Mature trees tolerate frost to -3°C for short periods, but young shoots are affected[ 303 ]. The annual rainfall range for growth is reported to be 800 - 3,500mm with the optimum between 1,200 - 2,500mm[ 303 ]. The plant is adversely affected by a long, dry season[ 303 ]. Succeeds in full sun or part day shade[ 200 ]. Adaptable to a range of soil types, but intolerant of alkaline soils[ 200 ]. Prefers high levels of organic matter in the soil[ 200 ], especially when grown on light soils[ 303 ]. Prefers a position sheltered from strong winds[ 303 ]. Generally slow-growing, the plants can commence flowering and fruiting when 4 years old from seed[ 377 ]. In the subtropics the trees flower synchronously in spring. The fruit ripens within one month and the harvest is over in a matter of days[ 303 ]. In the tropics flowering and fruiting extend over several months[ 303 ]. The fruits can vary considerably in colour and two distinct forms have been described. The species type has a black-skinned fruit; *E. brasiliensis leucocarpa* has yellow fruits; *E. brasiliensis erythrocarpa* has red-skinned fruits that are sweeter than the other forms[ 416 ]. Flowering Time: "Late Summer/Early Fall Mid Fall". Blooming Color: White/Near White. This plant is attractive to bees, butterflies and/or birds.

## 9.2.20 Sorghum bicolor

Sorghum, Common wild sorghum, Grain sorghum, Sudan-grass

9 tin 12 cyuc 4 kcaak 3 tcant 2 dwat 5 m hkuc htut cyutli hgatkyuctup hwicli hrasjlutnyik hpa7tli flatprik-hwis hpa7tmwatli xre7t hjonli

drutta Sorghum bicolor is a ANNUAL growing to 5 m (16ft 5in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 8. It is in flower from August to October, and the seeds ripen from September to October. The species is hermaphrodite (has both male and female organs) and is pollinated by Wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista The immature plant is poisonous, especially if slightly wilted, since it can contain the toxins hydrogen cyanide and the alkaloid hordenine[4, 142, 269]. These substances are destroyed if the plant is dried or made into silage[269]. In small quantities, hydrogen cyanide has been shown to stimulate respiration and improve digestion, it is also claimed to be of benefit in the treatment of cancer. In excess, however, it can cause respiratory failure and even death.

kcaakt Edible Parts: Seed StemEdible Uses: SweetenerSeed - raw or cooked. It is used as a whole grain in similar ways to rice, it can be popped much like popcorn, or can be ground into a flour and made into bread etc[2 , 4 , 57 , 162 , 183 ]. The ground seed yields a particularly white flour[7 ]. Sorghum is a staple food in some regions, where it is often fermented (lactic acid fermentation) before being eaten[183 ]. The sprouted seed can be eaten raw, and is sometimes added to salads[183 ]. The seed is germinated,

# Plants For a Future 2021CE Hardiness Zone 12, Wet

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## 1 Introduction

This is a book of plant information harvested from pfaf.org the goal is for future generations to have access to this valuable plant information. This book does Not contain any plant identification material, so you will need to use other references for actually identifying the plant. This book does contain information on how to grow the plants and their edible and other uses.

The plants are sorted by nitrogen-fixing ability, edibility, plant height, other uses, medicinal uses, and latin name. They start with nitrogen fixers because those are typically the easiest to establish pioneer plants.

Instructions for food forest design are in separate books. But basic idea is to have thorny plants on the border as a form of fence to keep out predators and animals that want to raid your food forest, with the shortest plants closest to the border, then gradually getting taller plants as you go in. For example starting with thorny herbaceous, then row of thorny shrub, the row of thorny trees. Afterwards can put in several rows of your staple crop, which typically is a variety of nut, acorn and bean producing tall trees. Then can put in a long rotation coppice of hardwood lumber trees you find useful, then a row or more of fruit trees, then a short rotation coppice to use for firewood, then some rows of berry, bean and

nut shrubs, with the closest circle near the community being vegetables and perennials that take more care than the others.

You need about a hectare of land (2.5 acres) per person if you have 6 months growing season (where average temperature is above 10C), at least half of which should be dedicated to food, the other half can be to lumber, but can also be food trees that are occasionally used as lumber. A general formula is 6/monthsGrowingSeason to see how many hectares you need. This assumes you have at least 600mm of rainfall per year, and only works if you have more than 3 months growing season, as very little you can grow in less than that.

If you live in a dry area, especially one prone to flash floods, then it is imperative that you spend you dry season digging swales and vernal pools, that will collect the rain water during the flash floods and keep it in place so that it enters the ground, then you can grow things downhill of your vernal pools and swales. It is generally more important that they be extensive than deep. You want to ideally catch every drop, so that none of it leaves your property.

By contrast if you live in a very wet area with more than enough water, then you want to have ditches to help the water leave the property and not waterlog your soil.

If you have a slope exceeding 30 degrees then you will want to reinforce with terraces any water catchment areas such as vernal pools or ponds, also can use terraces for growing tubers or anything that requires digging to plant or harvest, otherwise your soil is liable to wash away. You may wish to use terraces with smaller slopes as well if you are doing soil tilling or digging. In a food forest permaculture system generally you want to minimize soil disturbance and focus on getting your food from fruits, leaves, bark or other above ground sources.

In a medium wetness area you can use either method to create various microclimates for different kinds of plants.

In either case you want to start with about 1 in three plants being a nitrogen fixer (bwon), as it will help your food forest grow faster.

Summaries are given in the Cosmic Language (KsomPyash). Long descriptions are in English.

## 1.1 Pronunciation guide

a /a/, b /b/, c /j/ "sh", d /d/, e /e/, f /f/, g /g/, h /h/, i /i/, j /j/ "zh", k /k/, l /l/, m /m/, n /n/, o /o/, p /p/, q /q/ "ng", r /r/, s /s/, t /t/, u /u/, v /v/, w /w/, x /x/ /y/ "gh", y /j/, z /z/, 2 /1/ (low tone), 6 /ə/ "uh", 7 /ʌ/ (high tone).

## 1.2 vocabulary

tlin /tlin/ cold hardiness, cyuc /tju/ heat hardiness, kcaak /kjak/ food (rating), tcant /tjan/ other (uses rating), dwat /dwat/ medicinal (rating), hkuc /hku/ (adult) height, hsi2n /hsi.in/ (adult) width, ksan /ksan/ least (minimum).

pcim /pjim/ full (shade), hmim /hmim/ medium (shade), htut /htut/ no (shade), cyut /jut/ shade. li /li/ realis-mood (end of sentence). ta /ta/ topic-case.

hgat /hgat/ drought (tolerant), kyuc /kju/ dry, tcup /tjup/ damp, hja7n /h3a7n/ wet, hs6s /hsas/ puddle, hwic /hwij/ water (requirement).

hyis /hjis/ poor (soil), hras /hras/ sandy, jlut /jlut/ loamy, nyik /njik/ mud (silt/clay loam), frip /frip/ pottery (heavy clay), hpa7t /hpa7t/ topsoil.

frus /frus/ corrosive (very acid), flat /flat/ acid, prik /prik/ passive (neutral), lwis /lwis/ alkaline, slip /slip/ slippery (very alkaline), hsom /hsom/ salt (saline), hpa7tmwat /hpa7tmwat/ topsoil taste.

fyif /fyif/ self (fertile), xre7t /yre7t/, nyanhjen /nianh3en/ male-female (dioecious, distinct male and female plants), hjon /h3on/ sex.

hmuc /hmu/ purpose, pcis /pjis/ danger, trot /trot/ temperature, prop /prop/ fertile, tcan /tjan/ other, hyum /hium/ uses, dwat /dwa/ medicine, drut /drut/ description, kcec /kfej/ region, tfo2n /tfo2n/ nitrogen-fixing, xlutfam /xlut.kfam/ plant quantity, bwon /bwon/ bean, mran /mran/ corn/grain non-nitrogen-fixing plant, nrak /nrak/ continent (of origin), ksac /ksa/ circumstances/habitat.

12 hmucrotkcec, tcup hmucwic, 4 ksankcak, jlut hmuchpa7t, prik hmuchpa7tmwat, 224 xlutfkam.

## 2 1 tlin

### 2.1 bwon

#### 2.1.1 Phaseolus coccineus

Runner Bean, Scarlet runner

tfo2n 1 tlin 12 cyuc 4 kcak 3 tcan 0 dwat 3 m hkuc

htut cyutli tcup hwicli hrasjlutnyik hpa7tli prikklwis hpa7tmwatli fyifxre7t hjonli

drutta Phaseolus coccineus is a ANNUAL/PERENNIAL growing to 3 m (9ft) by 1 m (3ft 3in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. It is in leaf from May to October, in flower from July to September, and the seeds ripen from August to October. The species is hermaphrodite (has both male and female organs) and is pollinated by Bees. The plant is self-fertile. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcista Large quantities of the raw mature seed are poisonous[10, 65]. The toxins play a role in protecting the plant from insect predation.

kcakta Edible Parts: Flowers Leaves Root Seed Seed-podEdible Uses: Immature seedpods - raw or cooked[1, 2, 37, 46]. They have a pleasant mild flavour and are widely used as a vegetable in many areas of the world. They can be added to salads, cooked as a vegetable or added to soups, stews etc[183]. The immature seed is used like shelled beans as a vegetable[183]. The protein-rich mature seeds can be dried and stored for future use. They need to be thoroughly cooked before being eaten in order to destroy a toxic principle. They are soaked for 12 hours prior to use and are eaten boiled or added to soups etc. The seed can also be ground into a powder and added to cereal flours for making protein-enriched bread etc[183]. Flowers - raw. A bean-like taste[177, 183]. Young leaves - cooked and used as a potherb[183]. Root - cooked. Rich in starch[183]. Another report says that the root is poisonous[2]. Carbon Farming - Staple Crop: protein.

tcanta Nitrogen. Carbon Farming - Agroforestry Services: nitrogen. Attracts hummingbirds.

nrakta Southern N. America - Mexico. ksacta Not known propta Pre-soak the seed for 12 hours in warm water and sow in mid spring in a greenhouse. Germination should take place within 10 days. When they are large enough to handle, prick the seedlings out into individual pots and plant them out after the last expected frosts. The seed can also be sown in situ in late spring though it may not ripen its seed in a cool summer.

nwatta Agroforestry Services: Nitrogen Management: Standard Minor Global Crop Staple Crop: ProteinAs an annual suites hardness zones 1-12. Heat zone: 12-1. As a perennial hardness zones 10-12. Requires a warm sheltered sunny position in a rich well-drained soil with plenty of moisture in the growing season[1, 16, 37, 200]. Dislikes heavy, wet or acid soils[16]. Prefers a pH in the range 6 to 7[200]. The runner bean is commonly cultivated in many parts of the world for its edible seeds and immature seedpods, there

are many named varieties[183]. Most varieties are climbing plants but some dwarf forms have been developed[200]. Plants are perennials but are often grown as annuals, especially in the temperate zone. Plants flower under long day conditions, which is ideal for temperate regions[200]. When grown for their edible pods, the immature pods should be harvested regularly in order to promote extra flower production and therefore higher yields[200]. The perennial roots will survive mild winters outdoors in many parts of the country, especially if given a protective mulch in late autumn, they will then give an earlier but lighter crop the following year. They can also be dug up in late autumn and stored like dahlias in a cool but frost free place over winter and replanted in the following spring. The plants might need some protection from slugs since these creatures adore the young shoots in the spring[K]. Runner beans grow well with carrots, cauliflowers, cucumbers, cabbage, leek and celeriac[18, 20]. They are inhibited by alliums and fennel growing nearby[18, 20]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[200]. Carbon Farming - Cultivation: regional crop. Management: standard. Phaseolus coccineus ssp.polyanthus (Cache Bean) is also worth considering as a carbon farming plant. It is similar to Phaseolus coccineus but more suited to tropical highlands and semi-arid conditions.

## 3 3 tlin

### 3.1 mran

#### 3.1.1 Portulaca oleracea

Green Purslane, Little hogweed

3 tlin 12 cyuc 4 kcak 2 tcan 3 dwat 0.3 m hkuc

htut cyutli tcup hwicli hrasjlut hpa7tli flatprikklwis hpa7tmwatli fyifxre7t hjonli

drutta Portulaca oleracea is a ANNUAL growing to 0.3 m (1ft) by 0.3 m (1ft in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 4 and is frost tender. It is in flower from June to September, and the seeds ripen from July to September. The species is hermaphrodite (has both male and female organs) and is pollinated by insects. The plant is self-fertile. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Leaves SeedEdible Uses: SaltLeaves and stems - raw or cooked[1, 4, 12, 27, 37]. The young leaves are a very acceptable addition to salads, their mucilaginous quality also making them a good substitute for okra as a thickener in soups[4, 183]. Older leaves are used as a potherb[4]. The leaves have a somewhat sour flavour[85]. A spicy and somewhat salty taste[9]. The leaves are a source of omega-3 fatty acids, though seed sources such as walnuts are magnitudes richer[222]. The leaves can be dried for later use[85]. They contain about 1.8% protein, 0.5% fat, 6.5% carbohydrate, 2.2% ash[179]. Another analysis gives the following figures per 100g ZMB. 245 - 296 calories, 17.6 - 34.5g protein, 2.4 - 5.3g fat, 35.5 - 63.2g carbohydrate, 8.5 - 14.6g fibre, 15.9 - 24.7g ash, 898 - 2078mg calcium, 320 - 774mg phosphorus, 11.2 - 46.7mg iron, 55mg sodium, 505 - 3120mg potassium, 10560 - 20000ug B-carotene equivalent, 0.23 - 0.48mg thiamine, 1.12 - 1.6mg riboflavin, 5.58 - 6.72mg niacin and 168 - 333mg ascorbic acid[218]. Seed - raw or cooked[62, 102, 159]. The seed can be ground into a powder and mixed with cereals for use in gruels, bread, pancakes etc[183, 193]. The seed is rather small and fiddly to utilize[85]. In arid areas of Australia the plants grow quite large and can produce 10, 000 seeds per plant, a person can harvest several pounds of seed in a day. The seedling plants are uprooted and placed in a pile on sheets or something similar, in a few days the seeds are shed and can be collected from the sheet[193]. In Britain, however, yields are likely to be very low, especially in cool or wet summers[K]. The seed contains (per 100g ZMB) 21g protein, 18.9g fat 3.4g ash[218]. Fatty acids of the seeds are 10.9% palmitic, 3.7% stearic, 1.3% behenic, 28.7% oleic, 38.9% linoleic and

nwatta Macadamia tetraphylla succeeds in cool tropical or subtropical climates - in Australia they fruit well even when growing at least as far south as Sydney[157, 335

]. In the tropics the plant fruits best at elevations from 1,000 - 1,500 metres. It grows best in areas where annual daytime temperatures are within the range 14 - 28°C, but can tolerate 8 - 38°C[418

]. When dormant, the plant can survive temperatures down to about -2°C, but young growth can be severely damaged at -1°C[418

]. The plant can survive slight frosts, though cold weather can result in the loss of the entire crop[200

]. It prefers a mean annual rainfall in the range 1,250 - 2,000mm, but tolerates 850 - 3,000mm[418

]. Plants grow best in rich moist but well-drained soils and a position in full sun[117

]. They require copious summer watering in their early stages[167

]. Prefers a pH in the range 5.5 - 7, tolerating 4.5 - 8[418

]. Trees require a sheltered position and are easily damaged by strong winds[117

, 200

]. Plants are slow growing in cultivation, seedlings take 6 - 7 years to produce their first fruit[117

, 167

]. The trees then produce commercial crops for about 40 - 50 years and can fruit for up to 100 years[200

]. There are some named varieties[167

, 183

]. Plants are self-fertile but yield better if cross-pollinated[117

]. Pruning is not normally necessary, but is tolerated if carried out in the autumn[188

].

#### 9.2.17 Macadamia integrifolia

Macadamia, Macadamia nut

9 tlin 12 cyuc 4 kcak 3 tcan 0 dwat 10 m hkuc

htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikklwis hpa7tmwatli xre7t hjonli

drutta Macadamia integrifolia is an evergreen Tree growing to 10 m (32ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 9 and is frost tender. It is in leaf all year. The species is hermaphrodite (has both male and female organs) and is pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Oil SeedEdible Uses: Milk OilSeed - raw or cooked. The fine, crunchy texture, rich cream colour and delicate flavour make the macadamia nut one of the finest dessert nuts[303 ]. The eating quality of the nut is enhanced by lightly roasting it in coconut oil and salting[303 ]. Sweet and delicious, the seeds can also be added to cakes, biscuits, ice cream etc[167, 183 ]. They can be ground into a flour and then added to cereals to enrich their protein value. The shell is very hard, making it difficult to extract the seed[260 ]. The seed is up to 3cm long and wide[286 ]. An edible oil can be obtained from the seed[183 ], though it is seldom extracted due to the high value of the seed[63 ] The seed contains the highest level of oil yet found in a nut - up to 75%[303 ]. The oil contains 80% monounsaturated fats and 8% omega-6 fatty acids[301 ]. It has a subtle, nutty flavour and is added to salads, used in cooking etc[301 ].

tcanta Cosmetic Fuel Oil Plant breeding TanninAgroforestry Uses: The decomposed husk is commonly used in potting soil[303, 418 ]. Macadamia will retard the growth of papaya trees planted near to it[303 ]. Other Uses: Macadamia shells may be used as fuel, generating sufficient energy to dry wet, in-shell nuts[303 ]. The oil from the seed is used in cosmetics[307 ]. The green seed hulls contain approximately 14% of tannins[303 ].

nrakta Australia - New South Wales, Queensland. ksacta Dry rainforests of the eastern coastal scrub[167

, 260

]. Found mainly on alluvial situations bordering rivers and creeks where the fertile volcanic soils are rich in humus[63

]. propta Seed - best sown as soon as it is ripe in a warm greenhouse[188]. The dehusked seed germinates quickly at 25°C[200]. The seed can also be sown in the spring in a warm greenhouse[188]. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for at least their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. If trying them outdoors, give the plants some protection from the cold for their first few winters. Cultivars may be grafted.

nwatta Agroforestry Services: Crop shade Global Crop Management: Standard Other Systems: Multi-strata Staple Crop: OilMacadamia integrifolia is a plant of the subtropics and tropics of eastern Australia. It has fairly stringent environmental needs if good crops of seeds are to be produced[303

]. In the tropics it fruits best at elevations from 1,000 - 1,600 metres, but succeeds down to sea level in the subtropics[418

]. It grows best in areas where annual daytime temperatures are within the range 10 - 26°C, but can tolerate 8 - 35°C[418

]. Mature plants are capable of withstanding mild frosts, but only for short periods[303

]. It prefers a mean annual rainfall in the range 1,000 - 3,000mm, but tolerates 700 - 3,500mm[418

]. Requires a sunny position[418

]. Plants grow best in rich, moist but well-drained soils and require copious summer watering in their early stages[167

, 303

]. Prefers a pH in the range 5 - 6, tolerating 4.5 - 7[418

]. Established plants are very drought resistant[200

]. Trees require a sheltered position and are easily damaged by strong winds[200

]. Floral initiation takes place when temperatures drop and trees become quiescent in autumn, the optimum temperature being 18°C[303

]. The initials remain dormant for 50 - 96 days; the racemes extend after a rise in temperature and some rain[303

]. Seedling growth is initially slow, but gathers momentum as saplings produce a series of extension growth flushes in a year[303

]. The juvenile phase lasts for 7 years or more, but grafted trees come into bearing after 3 years[303

]. Plants are slow growing in cultivation, especially when young, seedlings take 6 - 7 years to produce their first fruit[167

, 303

]. The trees then produce commercial crops for about 40 - 50 years and can fruit for up to 100 years[200

]. The trees can flower and produce fruit all year round[324

]. Yields of 45 kg nuts-in-shell from better trees or an average of 3.2 - 3.5 t/ha per year are obtained in Hawaii[303

]. Pruning is not normally necessary, but is tolerated if carried out in the autumn[188

]. There are some named varieties[167

, 183

].

#### 9.2.18 Passiflora edulis

Passion Flower, Purple granadilla

9 tlin 12 cyuc 4 kcak 1 tcan 1 dwat 9 m hkuc

htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikklwis hpa7tmwatli xre7t hjonli

drutta Passiflora edulis is an evergreen Climber growing to 9 m (29ft 6in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. It is in leaf all year; in flower from July to August. The species is hermaphrodite (has both male and female organs) and is pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Fruit OilEdible Uses: Drink Oil SweetenerFruit - raw or cooked. An agreeable cooling

mixed with palm oil, and massaged onto areas of rheumatism, and for troubles of the breasts and for jiggers[ 332 ]. In India the tuber is considered to be diuretic and to be a remedy for diarrhoea and haemorrhoids[ 332 ]. The fruits are used to treat boils and for fever[ 332 ]. Sap expressed from the vine stems is applied to treat purulent ophthalmia, and for snake-bite[ 332 ]. The leaves are used, often by steam-distillation, against pink-eye[ 332 ]. Various medically active substances have been detected in the plant. Dioscorine has been detected in the tuber, though certain Nigerian material has been reported free of the alkaloid[ 332 ]. Alkaloids have been reported from the leaves and stems and particularly in the fruits[ 332 ]. Diosgenin has been detected at 0.745% concentration[ 332 ]. Saponin is present and a number of other pharmacologically active substances[ 332 ].

nrakta E. Asia - Malaysia. ksacta Not known  
 propta Seed - rarely produced, they are not normally used to propagate this species. Cuttings of tubers. Small tubers can be cut into 2 - 4 sections, larger ones into 6 - 8 sections. Each section should have 2 - 3 dormant buds. The cut tuber is often left in the sun for several hours to promote wound healing and reduce the risk of fungal infection[ 300 ]. Aerial tubers can also be used, they usually produce vigorous plants[ 300 ]. The aerial bulbs are often divided into 2 or more equal sized pieces[ 300 ]. Plants often need to be grown for two seasons in order to produce full-size aerial bulbs[ 300 ].

nwatta Industrial Crop: Starch Management: Standard Minor Global Crop Staple Crop: Basic StarchA plant of the moist, lowland tropics. It grows best in areas where annual daytime temperatures are within the range 20 - 30°C, but can tolerate 12 - 38°C[ 418 ]. It can be killed by temperatures of 9°C or lower[ 418 ]. It prefers a mean annual rainfall in the range 1,200 - 2,600mm, but tolerates 900 - 4,000mm[ 418 ]. It prefers a well-defined dry season of 2 - 3 months[ 418 ]. This species is more tolerant than most other yams of temperatures below 25°C[ 300 ]. For best yields, this species requires a deep, well-drained, sandy loam that is not liable to water-logging[ 300 ]. Prefers a pH in the range 6 - 6.7, tolerating 5.3 - 8[ 418 ]. Daylengths of more than 12 hours are preferred during the early growing season since this encourages vegetative growth; daylengths of less than 12 hours towards the end of the growing season will encourage tuber formation and development[ 300 ]. The bulbils are produced in 5 - 6 months from planting, though some forms can produce a crop in as little as 3 months[ 300 ]. Average yields of the bulbs are in the range of 3 - 5 tonnes per hectare, though up to 15 tonnes have been obtained[ 300 ]. The bulbils of selected cultivars tend to be angular with a flattened shape and a skin-colour which evokes the name 'turkey liver yam'. They may attain as much as 2 kg in weight but an average weight is about 0.5 kg. Races with increased bulbil production tend to show a reduction of the tuber, and in those with the highest bulbil return the tuber is but a woody rootstock[ 332 ]. Bulbils are ready for harvesting when they fall off the plant at a slight touch[ 332 ]. When produced, yields of 2 - 8 tonnes per hectare of the roots have been obtained[ 300 ]. There are some named varieties[ 300 ]. Aerial yam is a species of many races[ 332 ]. The wild ones, which are toxic raw, have globose, dark brown to liver-coloured, non-angular bulbils which serve as a famine-food, as do the tubers[ 332 ]. Wild strains are often planted intermixed with or on the perimeter of plantings of improved races as a protection against thieving[ 332 ]. Cattle eating them accidentally may be fatally poisoned showing frothing at the mouth and bloating[ 332 ]. The species is in the process of ennoblement and selected cultivars show in varying degree bitterness and poisonousness. Of some races even after prolonged preparation the bulbils remain bitter. Superior races are said to be very palatable and sweet, and to be entirely free from toxic substances so that consumption, even raw, is safe[ 332 ]. The skin is grey, lighter coloured than the wild forms, and the flesh is pale yellow to near white[ 332 ]. A dioecious species, both male and female plants need to be grown if seed is required. Flowering time: Late Fall/Early Winter. Bloom color: Pale Green Green

## 9.2.15 Terminalia ferdinandiana

Billy Goat Plum  
 9 tin 12 cyuc 4 kcaak 0 tcan 2 dwat 10 m hkuc

htut cyutli tcup hwicli hrasljut hpa7tli flatprikliw hpa7tmwatli hjonli

drutta Terminalia ferdinandiana is a deciduous Tree growing to 10 m (32ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 9 and is not frost tender. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked[296 , 301 , 777 ]. Eaten fresh, it can have a drying effect in the mouth[777 ]. Used in making preserves, jams etc[301 ]. About 3cm long, it has a slightly bitter-tasting flesh[296 ]. The fruit looks and tastes like a gooseberry[301 ]. It is one of the world's richest natural sources of ascorbic acid with some forms containing up to 3,150mg of ascorbic acid per 100g of fruit[301 ]. When ripe, the fruit is soft and has a yellow-green colour - to harvest you merely shake the trunk of the tree and the ripe fruits fall to the ground[296 ].

dwatta The pounded fruit is used as an antiseptic and as a soothing balm for aching limbs[777 ].

nrakta Australia - Northern Australia, Queensland, Western Australia. ksacta Sandplains behind beaches, dry creek beds, flood plains, cliff tops, ridges, coastal vine thickets, mangrove edges in Western Australia[285 ].

propta Seed -  
 nwatta Succeeds in any moderately fertile, well-drained soil in a sunny position[200 ]. Found in the wild on red sands, sandy clay, black peat, sandstone, ironstone and granite soils[285 ]. The fruit of this species could contain the highest concentration of vitamin C to be found in any fruit in the world[307 ]. It is being researched for its commercial potential[307 ].

## 9.2.16 Macadamia tetraphylla

Queensland Nut, Macadamia nut  
 9 tin 12 cyuc 4 kcaak 3 tcan 0 dwat 10 m hkuc  
 htut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikliw hpa7tmwatli fyifxre7t hjonli

drutta Macadamia tetraphylla is an evergreen Tree growing to 10 m (32ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 9 and is frost tender. It is in leaf all year. The species is hermaphrodite (has both male and female organs) and is pollinated by Bees. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Oil SeedEdible Uses: Milk OilSeed - raw or cooked[2 , 46 , 105 ]. Pleasantly flavoured and nutritious[1 , 61 ], the seed is a little sweeter than the related Macadamia integrifolia and contains a little less oil[301 ]. They can be eaten as a dessert nut and can also be ground into a flour and then mixed with cereal flours to enrich the protein content. The shell is very hard, making it difficult to extract the seed[260 ]. The seed is up to 30mm long and 24mm wide[286 ]. The seed contains up to 72% of a high grade oil[156 , 183 ]. This oil is seldom extracted due to the high value of the seed[63 ].

tcanta Cosmetic Fuel Oil Plant breeding TanninAgroforestry Uses: The decomposed husk is commonly used in potting soil[303 ]. Other Uses: Macadamia shells may be used as fuel, generating sufficient energy to dry wet, in-shell nuts[303 ]. The oil from the seed is used in cosmetics[307 ]. The green seed hulls contain approximately 14% of tannins[303 ]. The tree is used as a rootstock for M. integrifolia[418 ].

nrakta Australia - New South Wales, Queensland. ksacta In or near rainforests[167

]. Found mainly on alluvial situations bordering rivers and creeks where the fertile volcanic soils are rich in humus[63

].  
 propta Seed - best sown as soon as it is ripe in a nursery bed[188

]. The dehusked seed germinates quickly at 25°C[200

]. Cultivars may be grafted. Side wedge grafting has been used exclusively in Hawaii[303

].

9.9% linolenic[218]. The ash of burnt plants is used as a salt substitute[183].

dwatta Antiscorbutic Depurative Diuretic Febrifuge Skin Tonic VermifugeThe plant is antibacterial, antiscorbutic, depurative, diuretic and febrifuge[4 , 7 , 147 , 152 , 238]. The leaves are a rich source of omega-3 fatty acids, which is thought to be important in preventing heart attacks and strengthening the immune system[238]. Seed sources such as walnuts, however, are much richer sources[222]. The fresh juice is used in the treatment of strangury, coughs, sore eyes etc[4 , 7 , 147 , 152]. The leaves are poulticed and applied to burns[222], both they and the plant juice are particularly effective in the treatment of skin diseases and insect stings[7 , 238]. A tea made from the leaves is used in the treatment of stomach aches and headaches[222]. The leaf juice is applied to earaches, it is also said to alleviate caterpillar stings[222]. The leaves can be harvested at any time before the plant flowers, they are used fresh or dried[238]. This remedy is not given to pregnant women or to patients with digestive problems[238]. The seeds are tonic and vermifuge[218 , 240]. They are prescribed for dyspepsia and opacities of the cornea[218].

nrakta S. Europe. A not infrequent casual in Britain. ksacta Fields, waste ground, roadside verges, cultivated ground and by the sea[7].

propta Seed - for an early crop, the seed is best sown under protection in early spring and can then be planted out in late spring[4]. Outdoor sowings in situ take place from late spring to late summer, successional sowings being made every two to three weeks if a constant supply of the leaves is required[4].

nwatta Requires a moist light rich well-drained soil in a sunny position[4 , 37 , 200]. Plants will not produce good quality leaves when growing in dry conditions[4]. A perennial plant in warmer climates than Britain, purslane is killed by frost but can be grown as a half-hardy annual in this country[1]. It can become an aggressive weed in areas where the climate suits it[274]. The flowers only open in full sunlight[244]. Purslane is occasionally cultivated for its edible leaves, there are some named varieties[183]. The plants take about six to eight weeks to produce a crop from seed and can then be harvested on a cut and come again principle, providing edible leaves for most of the summer[4].

## 4 4 tlin

### 4.0.1 Astrebla squarrosa

Bull Mitchell grass  
 4 tin 12 cyuc 4 kcaak 1 tcan 0 dwat 1.5 m hkuc  
 htut cyutli ghgkyuctcup hwicli hyishrasljutnyikfrip hpa7tli flatprikliw hpa7tmwatli hjonli

drutta Astrebla squarrosa is a PERENNIAL growing to 1.5 m (5ft) by 0.1 m (0ft 4in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: SeedEdible Uses: Carbon Farming Solutions - Staple Crop: balanced carb (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1]. Cultivated in the past but largely or completely abandoned.

tcanta Providing habitat for organisms such as mammals.

nrakta Australasia. ksacta Heavy, cracking clays on plains and river flats, sometimes with Lysiphylum or Excoecaria, or in Dicanthium-Eulalia grassland and cleared Brigalow areas; flowers after rain.

propta Wild. Seed.

nwatta Historic Crop Management: Standard Staple Crop: Balanced carbClimate: subtropical to tropical. Humidity: semi-arid. Grow on clay soils, mainly between an upper limit of 600 mm average annual rainfall, and a lower limit of 200 mm, and even below in depressions where the

water concentrates following rains e.g. in Sturt's Stony Desert. Mitchell grasses are deep rooted and become dormant during drought, allowing them to survive extended periods without rainfall. Carbon Farming Solutions - Cultivation: historic crop. Cultivated in the past but largely or completely abandoned. Management: standard (Describes the non-destructive management systems that are used in cultivation) [1-1].

## 5 5 tlin

### 5.0.1 Lomatium cous

Biscuitroot, Cous biscuitroot  
 5 tlin 12 cyuc 4 kcaak 1 tcan 0 dwat 0.1 m hkuc  
 htut cyutli kyuctcup hwicli hrasljutnyik hpa7tli flatprikliw hpa7tmwatli fyifxre7t hjonli

drutta Lomatium cous is a PERENNIAL growing to 0.1 m (0ft 4in) by 0.1 m (0ft 4in). See above for USDA hardiness. It is hardy to UK zone 6. The species is hermaphrodite (has both male and female organs) and is pollinated by Insects. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil.

kcakta Edible Parts: Root SeedEdible Uses: Root - raw or cooked[257]. It is usually peeled before being eaten[257]. The root can be dried and ground into a powder and then be mixed with cereal flours or added as a flavouring to soups etc[46 , 61 , 95 , 105]. When dug up in the spring it has a parsnip-like flavour[161]. Seed[106]. No more details are given, though it is most likely used as an aromatic flavouring in cooked foods[K].

nrakta Western N. America. ksacta Dry often open rocky slopes and flats, often with sagebrush, especially in foothills and lowland, occasionally above the treeline[60].

propta Seed - best sown as soon as it is ripe in a cold frame. Stored seed can be rather slow to germinate, when sown in the spring it usually takes at least 12 months to germinate. Giving it a period of cold stratification might reduce this time. The seedlings need to be pricked out into individual pots as soon as they are large enough to handle, and should be planted out into their permanent positions in the summer. Fresh seed can be sown immediately in situ. Division may be possible in spring or autumn.

nwatta We have almost no information on this species and do not know if it will be hardy in Britain, though judging by its native range it should succeed outdoors in much of the country. It can be assumed that plants will require a dry to moist but well-drained soil in a sunny position. Polymorphic[60]. This is a taxonomically very difficult genus, many of the species now included in it have at times been included in other genera[60]. For polyculture design as well as the above-ground architecture (form - tree, shrub etc. and size shown above) information on the habit and root pattern is also useful and given here if available. The plant growth habit is a clumper with limited spread [1-2]. The root pattern is a tap root similar to a carrot going directly down [1-2].

## 6 6 tlin

### 6.0.1 Malva verticillata

Chinese Mallow, Cluster mallow  
 6 tlin 12 cyuc 5 kcaak 2 tcan 2 dwat 1.7 m hkuc  
 hmimhtut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikliw hpa7tmwatli fyifxre7t hjonli

drutta Malva verticillata is a ANNUAL/BIENNIAL growing to 1.7 m (5ft 7in). See above for USDA hardiness. It is hardy to UK zone 6 and is not frost tender. It is in flower from July to September, and the seeds ripen from August to October. The species is hermaphrodite (has both male and female organs) and is pollinated by Insects. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid,

neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcasta When grown on nitrogen rich soils (and particularly when these are cultivated inorganically), the plant tends to concentrate high levels of nitrates in its leaves[76]. The leaves are perfectly wholesome at all other times.

ksakta Edible Parts: Leaves SeedEdible Uses: Leaves - raw or cooked[2, 51, 61, 100, 183]. The leaves of well-grown plants can be 15cm or more across. They have a mild and very pleasant flavour that makes an excellent addition to salads[K]. We use them as a tasty alternative to the lettuce[K]. Young seeds - raw or cooked. Used when green and immature[85]. A pleasant nutty taste but the seed is too small and fiddly for most people to want to harvest[K].

tcanta DyeCream, yellow and green dyes can be obtained from the plant and the seed heads[168 ]. An extract of the leaves, flowers and stems is used as an ingredient in commercial cosmetic preparations as a skin conditioner[1243 ]. An essential oil obtained from the seeds is used as an ingredient in commercial cosmetic preparations as an emollient and skin conditioner[1243 ]. The following were listed under Malva meluca and mohlieviensis (both now considered to be synonyms of this species) The seed contains up to 10 - 20% of a greenish oil with an iodine number 116.9[74 ]. It is used for making soap[74 ]. The fibre obtained from the stem is a useful substitute for jute in cordage production. The fibre is strong, but somewhat coarse and brittle. It is inferior in quality to kenaf and hemp. The fibre has a breaking strength of 14 kilos without a knot and 9 - 10 kilos with a knot[74 ].

dwatta Demulcent Digestive Diuretic Emollient Galactogogue LaxativeThe seed contains mucilage, polysaccharides and flavonoids[279]. It is demulcent, diuretic, emollient, galactogogue and laxative[147, 176, 218]. The seeds are used in Tibetan medicine, where they are considered to have a sweet and astringent taste plus a heating potency[241]. They are used in the treatment of renal disorders, the retention of fluids, frequent thirst and diarrhoea[241]. The root is used to cause vomiting in the treatment of whooping cough[240]. The leaves and stems are said to be digestive[240]. They are given to women in the advanced stages of pregnancy[240].

nrakta E. Asia - China. ksacta On plains and in arable fields[74, 266].

propta Seed - sow early spring in situ. Germination should take place within 2 weeks.

nwatta A very easily grown plant, succeeding in ordinary garden soil[1], though it prefers a reasonably well-drained and moderately fertile soil in a sunny position[200]. This species is cultivated as a salad crop in parts of Europe[17, 50, 51]. There is at least one named variety:- 'Crispa' has more tender leaves than the species with curled leaf edges that make it look more attractive in salads. This species was one of the earliest domesticated crops in China, it has been in cultivation for well over 2,500 years[183]. Plants seem to be immune to the predations of rabbits[233]. Plants are prone to infestation by rust fungus[200]. In garden design, as well as the above-ground architecture of a plant, root structure considerations help in choosing plants that work together for their optimal soil requirements including nutrients and water. The root pattern is clumping, giving the plant a clumping habit. The predictable growth behaviour makes it easier to maintain without having to apply containment methods[2-1].

## 6.0.2 Syzygium australe

Brush Cherry

6 tlin 12 cyuc 4 kcaak 3 tcan 0 dwat 3 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliws hpa7tmwatli xre7t hjonli

drutta Syzygium australe is an evergreen Shrub growing to 3 m (9ft 10in). See above for USDA hardiness. It is hardy to UK zone 7. The species is hermaphrodite (has both male and female organs). Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ksakta Fruit - raw or made into jellies[46, 397]. Crisp and juicy, it ranges in flavour from delicious to mediocre[440]. The reddish-pink to red, obovoid fruit is about 15 - 25 mm long and 15 mm in diameter, with a large seed[365].

tcanta Agroforestry Uses: The plant has a very dense habit of growth and responds well to trimming. It is often grown as a hedge, especially the cultivar 'Brilliant'[K]. The reddish or yellowish wood is light, elastic and seasons well[46]. It is used for making oars, boat building etc, and was traditionally used for making boomerangs and shields[46]. We do not have any more specific information for the wood of this species, but the various species of Syzygium tend to have somewhat similar timber. The general description of syzygium timber is as follows:- The heartwood is a golden brown, greyish brown or brown, with pink or purplish glints; it is not clearly demarcated from the 1 - 4cm wide band of sapwood. The texture is fine; the grain slightly interlocked, sometimes wavy or irregular; there are resin deposits. The wood is heavy; moderately hard; somewhat durable, being moderately resistant to fungi and termites, but susceptible to dry wood borers. It seasons slowly, with a high risk of checking and distortion; once dry it is moderately stable in service. It works well with ordinary tools, nailing and screwing are good so long as the wood is pre-bored; gluing is correct. The wood is used for musical instruments, tool handles, furniture components, shipbuilding, heavy carpentry, flooring, joinery etc[848].

nrakta Australia - New South Wales. ksacta Along the coast and adjacent plateaux[265].

propta Seed - best sown when fresh. Either the whole fruit can be sown, or the seed can be separated from the flesh[397]. Germination usually takes 1 - 2 months but, especially if not sown fresh, maybe slow and spasmodic[397, 694]. Cuttings of firm, current season's growth[397].

nwatta A tree of warm temperate and subtropical climates, just reaching into tropical areas[397]. It is tolerant of occasional, light frosts[694]. Succeeds in full sun and in partial shade[694]. Prefers rich soils and assured moisture[397]. Succeeds in most soils[694]. Several named forms have been developed for ornamental purposes, including some compact forms that grow no larger than 2 metres[397].

## 6.0.3 Amaranthus hybridus

Rough Pigweed, Slim amaranth

6 tlin 12 cyuc 4 kcaak 1 tcan 1 dwat 2 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliws hpa7tmwatli fyif hjonli

drutta Amaranthus hybridus is a ANNUAL growing to 2 m (6ft 7in). See above for USDA hardiness. It is hardy to UK zone 6 and is frost tender. It is in flower from July to September. The species is monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and is pollinated by Wind. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcasta No members of this genus are known to be poisonous, but when grown on nitrogen-rich soils they are known to concentrate nitrates in the leaves. This is especially noticeable on land where chemical fertilizers are used. Nitrates are implicated in stomach cancers, blue babies and some other health problems. It is inadvisable, therefore, to eat this plant if it is grown inorganically.

ksakta Edible Parts: Leaves SeedEdible Uses: Leaves and young seedlings - cooked as a spinach, added to soups etc or eaten raw[46, 61, 62, 159, 183]. The nutritious leaves have a mild flavour[K]. Seed - raw or cooked[22, 46, 61, 85]. Used as a cereal substitute, the seed is usually ground into a flour for use in porridges, bread etc. It is rather small, about 1mm in diameter[266], but is easy to harvest and very nutritious[K]. The seed can be cooked whole, and becomes very gelatinous like this, but it is rather difficult to crush all of the small seeds in the mouth and thus some of the seed will pass right through the digestive system without being assimilated[K].

tcanta DyeYellow and green dyes can be obtained from the whole plant[168].

dwatta AstringentA tea made from the leaves is astringent[105, 222]. It is used in the treatment of intestinal bleeding, diarrhoea, excessive menstruation etc[222, 257].

nrakta Tropics. Naturalized in Europe[50]. ksacta Of uncertain origin, it grows wild in cultivated fields and waste

18-24 in. (45-60 cm).

## 9.2.13 Byrsonima crassifolia

Golden Spoon, Nance, Nancy Tree

9 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 12 m hkuc htut cyutli hgatkuyctcup hwicli hrasjlutnyik hpa7tli flatprikliwssliphsom hpa7tmwatli hjonli

drutta Byrsonima crassifolia is an evergreen Tree growing to 12 m (39ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 9 and is frost tender. The flowers are pollinated by Bees, Birds. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcasta The leaves and stems, if put in water, can stupefy fish[ 303 ]. This possibly means they contain saponins[ K ]. Although poisonous, saponins are poorly absorbed by the human body and so most pass through without harm. Saponins are quite bitter and can be found in many common foods such as some beans. They can be removed by carefully leaching in running water. Thorough cooking, and perhaps changing the cooking water once, will also normally remove most of them. However, it is not advisable to eat large quantities of food that contain saponins. Saponins are much more toxic to some creatures, such as fish, and hunting tribes have traditionally put large quantities of them in streams, lakes etc in order to stupefy or kill the fish[ K ].

ksakta Edible Parts: Fruit OilEdible Uses: Drink Oil-Fruit - raw or cooked. Thin-skinned and peculiarly odorous, with a white, juicy, oily pulp that varies in flavour from insipid to sweet, acid or cheese-like[ 303 ]. A very popular fruit, it is usually eaten out of hand, and is also cooked as a dessert, used in jams, soups, sherbets etc[ 301 , 307 ]. A refreshing drink, known as 'chicha', is obtained from the fermented fruits - it is very much relished by most Panamanians[ 551 ]. The orange-yellow round fruit is up to 5cm in diameter with a single, fairly large stone, containing 1-3 white seeds[ 303 , 307 ]. An edible fat is extracted from the fruit with boiling water[ 301 , 303 ].

tcanta Charcoal Dye Fibre Fire retardant Furniture Ink Oil Soil reclamation Tannin WoodOther uses rating: Medium (3/5). Small flowering tree, backyard tree, Accent, Large planter, Small street tree, Xerophytic. Agroforestry Uses: The tree is well suited for the restoration of infertile and burned-over land[ 303 ]. It has a heavy leaf fall which helps to restore soil fertility[ 303 ]. Other Uses The bark contains 17-28 % tannin and 3 % oxalic acid. It is employed in tanning[ 303 , 307 ]. The fruit is high in tannin, especially when unripe and is sometimes used in dyeing. The fruit skin imparts a light-brown hue to cotton cloth[ 303 , 307 ]. An ink can be made from the bitter green fruit[ 307 ]. The bark yields a strong fibre[ 303 ]. The heartwood is a reddish or pinkish-brown; the thin band of sapwood is greyish. It is coarse-textured, close and cross-grained. The wood is heavy, hard, tough, strong, brittle, and only moderately durable. It takes a good polish. The wood is usually available only in small sizes; it is highly prized for boat ribs, and is used for tool handles, turnery, cabinetry, furniture and small-scale construction[ 303 , 551 ]. In Brazil, the wood is chosen for the hot fire over which people smoke the stimulant paste of guaran' (Paullinia cupana) because the burning wood has a pleasant odour. In some areas, the wood is used for making a good quality charcoal[ 46 , 303 ]. This plant is attractive to bees, butterflies and birds.

dwatta Antacid Antidiarrhoeal Antidote Antiinflammatory Astringent Dysentery Emmenagogue Febrifuge Hypotensive Mouthwash Poulitce Purgative Skin StingsThe bark (probably the inner bark[ K ]) is rich in tannins and has been used medicinally by many local peoples[ 303 ]. It is antidi, antiinflammatory, astringent, emmenagogue, febrifuge and purgative[ 303 , 348 ]. It has been used to treat gastrointestinal disorders, including indigestion, diarrhoea and dysentery; pulmonary complaints; snakebites; fevers; cases of leucorrhoea; and to promote menstruation[ 303 , 348 ]. The bark has been used externally as a wash or poultice to treat wounds, skin infections, ulcers etc[ 303 , 348 ]. As a

mouthwash it has been used to tighten the teeth where gums are diseased[ 303 ]. An infusion of the leaves is used to treat high blood pressure[ 348 ]. The leaves are used as a wash to clean and soothe ulcers[ 348 ]. The brown powder from the under surface of the leaf is applied onto the cut end of the umbilical cord to prevent infection[ 348 ]. The sap from the bark and leaves is inserted into the orifice of the penis as a treatment for gonorrhoea[ 348 ]. The leaves contain various flavonoids, saponins and terpenes[ 348 ].

nrakta Northern S. America - Brazil and Peru, north to Mexico. ksacta Open pine forests and grassy savannahs, sometimes in extensive stands[ 303 ]. Lowland moist or dry thickets and woodland[ 307 ].

propta Seed - best sown as soon as it is ripe in a partially shaded position in a nursery seedbed. A germination rate of less than 30% can be expected, with the seed sprouting within 25 - 35 days[ 625 ]. The seeds are collected from ripe fruit are the flesh removed by allowing them to partly decompose in a plastic bag. The pulp is removed under running water. Seeds need to be planted fresh. They are best in light shade.

nwatta Trees succeed in tropical and subtropical climates up to elevations of 1,000 metres[ 303 ]. They are tolerant of a wide range of environments, from humid tropical lowlands to semi-desert regions[ 303 ]. The tree is often found on rocky ground. It grows well on sandy and alkaline-sandy soils[ 303 ]. Although it succeeds in poor soils, better yields are achieved when a good supply of organic matter is added. Grows best in a fertile, well-drained soil[ 307 ]. Established plants are highly drought tolerant[ 303 , 307 ]. Plants are very tolerant of salt laden winds[ 307 ]. Very often, when the forest is cleared this tree is left and allowed to grow in a state of semi-wild cultivation[ 303 ]. A fire-resistant tree[ 303 ]. A very variable species with a wide distribution in tropical America[ 307 ]. It has sometimes been recognised as more than one species[ 307 ].

## 9.2.14 Dioscorea bulbifera

Aerial Yam, Air Potato

9 tlin 12 cyuc 4 kcaak 0 tcan 2 dwat 10 m hkuc hmimhtut cyutli hgattcup hwicli hrasjlutnyik hpa7tli frusflatprikliwssli hpa7tmwatli hjonli

drutta Dioscorea bulbifera is an evergreen Perennial Climber growing to 10 m (32ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9. The flowers are pollinated by Wind, Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought.

pcasta Edible species of Dioscorea have opposite leaves whilst poisonous species have alternate leaves[ 174 ]. The aerial bulbs of this species contain toxic substances, including the alkaloid dioscorine[ 300 ]. This can be destroyed by thorough cooking[ 301 ]. Asiatic forms of the plant usually contain less alkaloids than plants originating in Africa[ 300 ]. There are forms that are almost or entirely free of toxins[ 332 ].(Parts of plant are poisonous if ingested)

ksakta Edible Parts: Flowers RootEdible Uses: Aerial tubers - cooked[ 300 ]. An agreeable taste, they can be boiled, baked, fried etc[ 301 ]. They must be thoroughly cooked in order to destroy toxic alkaloids[ 300 ]. Wild forms of the plant are always toxic raw, though selected cultivars have been developed that are much lower, or even free from, the toxins[ 332 ]. The tubers are produced, and can be harvested, over a long period of time[ 301 ]. Root - cooked[ 300 ]. Roots are usually around 0.5kg, though they can be up to 1.5kg[ 300 ]. They are not always produced by the plants[ 300 ]. The inflorescences are apparently eaten[ 301 ].

dwatta Antidiarrhoeal Antifungal Antihaemorrhoidal Antiinflammatory Antirheumatic Diuretic Febrifuge Ophthalmic Parasiticide Poulitce SkinThe juice of the roots is taken to expel threadworm[ 272 ]. The juice is dripped into wounds to expel worms and germs[ 272 ]. Both the tuber and the bulbil of wild races have medicinal uses[ 332 ]. In particular they are used externally, usually as a poultice, to treat wounds, sores, boils and inflammations; in dressings for treating dermal parasitic and fungal infections; or crushed,

new growth[ K ]. The stem pith is boiled, mixed with rice and cooked. The palm heart is edible.

tcanta Basketry Broom Fencing Fibre Hair Houseplant Pipes Scourer String Stuffing Thatching Waterproofing WoodOther uses rating: High (4/5). Other Uses: A very strong, fine, soft and durable fibre is obtained from the leaf bases[ 454 ]. It is used to make a wide range of products, but especially brooms, brushes, ropes, baskets etc[ 266 , 287 , 297 , 454 ]. It is also used for stuffing cushions[ 454 ]. A woolly substance, or scurf, scraped from the leaf-stalks is used for caulking boats[ 454 ]. It is also extensively used in machine brushes for polishing linen and cotton yarns, for cleaning flax fibre after it is scutched, for brushing velvets, and other similar purposes[ 454 ]. The leaves are used for thatching[ 317 ]. The mature wood is strong, heavy and durable. The stem yields an inferior timber sometimes used for construction purposes, especially in traditional buildings, for purposes such as planking, flooring, rafters, roofing, partitioning and fencing, and also for making spears. The stem, cut lengthways in half with its centre scooped out, is used for gutters and drains, or to convey water over long distances. Polished stems are used as monoliths in modern houses[ 266 , 303 ]. Suitable for growing indoors.

dwatta Antirheumatic Mouthwash SkinA porridge prepared from the seed flour is prescribed by local physicians to treat gastric ulcers, migraine headaches, snake-bite poisoning and rheumatic swellings[ 303 ]. The root is used for treating tooth ailments[ 303 ]. The bark and seed are used to treat boils[ 303 ]. The tender flowers are used for promoting hair growth[ 303 ].

nrakta E. Asia - India, Sri Lanka. ksacta Limestone areas and valley forests at elevations of 370 - 1,500 metres in southern China[ 266 ]. An understory tree in moist lowland and submontane forests[ 303 ].

propta Seed - At room temperature the seeds remain viable for 30 - 90 days, depending on storage conditions. An experiment in Sri Lanka on the effect of seed storage and exposure to sunlight revealed a germination rate of 99% for seeds sown after 30-day storage in a dark room[ 303 ]. Seed germinate in 2-4 months. Seedlings can tolerate sun while quite small.

nwatta Industrial Crop: Fiber Management: Standard Regional Crop Staple Crop: SugarPlants are found in moist tropical climates where temperatures never fall below 10°C, the average annual rainfall is 1,500mm or more and the driest month has 25mm or more rain[ 297 ]. They can also succeed in warm temperate zones and in drier areas with an annual rainfall as low as 250mm and one month or more where rainfall is below 25mm[ 297 , 314 ]. Mature plants can be killed by temperatures of 5°C or lower[ 418 ]. Plants grow well in full sun, even when small[ 297 ]. Prefers a moist, shady situation[ 303 , 418 ]. Prefers a pH in the range 6 - 7.5, tolerating 5.5 - 8[ 418 ]. A slow-growing plant[ 303 ]. A monocarpic species, living for several years without flowering, but then dying once it has flowered[ 302 ]. It attains full size in about 10 - 15 years, and flowers when 15 - 30 years old[ 418 ]. It flowers from the top down, and once the last fruit on the bottom inflorescence matures, the plant dies.[ 314 ]. The daily yield per tree of sap for wine and sugar is 20 - 27 litres[ 303 ]. When flowering begins, the inflorescence is stimulated to produce juice; the inflorescence is then bound into a 'candle' form and tapped for its sweet juice by repeatedly slicing off the end of the candle. A tapping period may last for 10 - 15 years before the tree dies[ 303 ]. Harvest for sago and other purposes is mainly from wild and semi-wild populations. The trunk yields 100 - 150 kilos of starch. Usually harvests for timber occurs when the tapping period has ended[ 303 ]. Suitable for growing indoors as a house plant. Resistant to deer.

## 9.2.12 Sechium edule

Chayote, Mirliton, Cho Ko, Cho-Cho, Vegetable Pear  
9 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 12 m hkuc  
hminhtut cyutli tcup hwicli hrasjutnyik hpa7tli flatprikwis hpa7tmwatli fyif hjonli

drutta Sechium edule is a PERENNIAL CLIMBER growing to 12 m (39ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Insects, Parthenocarpic. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and

heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcaakta Edible Parts: Flowers Fruit Leaves Root Seed ShootsEdible Uses: Fruit - raw or cooked[296 , 301 ]. The fruits can vary in flavour, from bland or starchy to sweetish, depending on the cultivar[299 ]. They can be boiled or baked as a vegetable[298 ]. They can be mixed with lime juice and used as a substitute for apples in pies[301 ]. Fruits of bland cultivars are used industrially as food fillers for pastes and sauces[299 ]. Because of their low energy value, the fruits are gaining importance as a dietary food in hospitals and nursing homes, and are also considered good baby food[299 ]. The fruit is normally used when immature and before the seed has enlarged[299 , 300 ]. The obovoid fruit is up to 18cm long[200 ]. Seed - cooked[299 , 301 ]. Nut-like in flavour[299 ]. The mature, protruding seeds are considered by some to be the best part of this fruit[301 ]. When deep-fried they taste remarkably like french-fried potatoes[301 ]. The seeds are a good source of protein[299 ]. Tuber - raw or cooked[298 ]. They are boiled, baked, fried and candied in syrup[301 ]. The starch-rich tuber can weigh up to 5 kilos[298 ]. Young leaves and stem tips - cooked as a vegetable[298 , 299 ]. Eaten like asparagus[301 ]. A good source of iron, carotene, thiamine, riboflavin and niacin[298 ]. Flowers[331 ].

tcanta Basketry Fibre StringOther Uses: Fibres from the stem have been used to make baskets and hats and, as reported from Ghana, as binding material in the construction of mud houses[299 ].

dwatta Diuretic Hypotensive KidneyAn infusion of the shredded fruit is used to lower blood pressure[348 ]. The tubers are a potent diuretic and are also applied for pulmonary ailments and relief of intestinal inflammation[299 ]. The leaves are said to possess cardiovascular modifying as well as blood pressure lowering properties and to dissolve kidney stones[299 ].

nrakta C. America - Guatemala, southern Mexico. ksacta Moist, steep hillsides[418 ].

propta Seed - keep the seed inside the fruit when sowing[296 ]. A mature fruit, with the germinating seed inside, should be planted to two thirds of its length with its widest end down[300 ]. Stem cuttings 15 - 20cm long are sometimes used[300 ]. These should be planted in a shady position and kept moist until they have rooted[300 ].

nwatta Chayote is a plant of the tropics and subtropics, it can also be grown as an annual crop in areas of the temperate zone that can offer a growing season of at least 6 months[418 ]. It can be grown at elevations up to 2,000 metres in the tropics, yielding better crops above 500 metres. It grows best in areas where annual daytime temperatures are within the range 19 - 30°C, but can tolerate 12 - 40°C[418 ]. Higher yields are achieved when there is a reasonable drop in temperatures over night[300 ]. Temperatures below 13°C cause damage to small unripe fruits, and the plant is killed by frosts[299 ]. It prefers a mean annual rainfall in the range 800 - 2,000mm, but tolerates 600 - 2,600mm[418 ]. The plant generally grows well in full sun, but some cultivars produce higher yields when grown in light shade[300 ]. It grows best in a sheltered position in a well-drained, fertile, humus-rich soil[299 , 300 , 418 ]. Prefers a pH in the range 5.5 - 7, tolerating 4.3 - 8[418 ]. Chayote is a long-lived perennial plant, but in cultivation it is recommended to renew it at least every 3 years because of disease problems[299 ]. Plants can begin to produce a crop of immature fruits within 3 - 4 months from sowing the seed[296 , 300 ] and then continue producing for a considerable time[300 ]. Individual plants grown on their own usually set a good crop of fruit[299 ]. Mature fruits can be produced 120 - 180 days after sowing the seed[418 ]. The tubers do not develop until the second year, and do not develop well in climates without a dry season. In regions with a season of arrested growth, they can reach 10 kilos in weight and resemble yam tubers[299 ]. Yields of up to 60 tonnes per hectare of mature fruits can be obtained[300 ]. A plant can produce 80 - 100 fruits a year plus 20 - 25 kilos of roots[331 ]. Plants are very susceptible to pests and diseases in wet climates[296 ]. The seed germinates in the ripe fruit whilst still on the mother plant. The stem of the seedling grows out from the fruit apex and curves upwards. It produces roots which abort if they do not make contact with soil[299 ]. The are many named varieties[300 , 301 ]. Flowering Time: Late Fall/Early Winter. Bloom Color: White/Near White. Spacing:

places[43].

propta Seed - sow late spring in situ. An earlier sowing can be made in a greenhouse and the plants put out after the last expected frosts. Germination is usually rapid and good if the soil is warm[133]. A drop in temperature overnight aids germination[133]. Cuttings of growing plants root easily[206].

nwatta Prefers a well-drained fertile soil in a sunny position[200]. Requires a hot sheltered position if it is to do well[K]. Plants should not be given inorganic fertilizers, see notes above on toxicity. Cultivated as a food crop in India[46, 105], there are many named forms[183]. This species has the potential, through crossbreeding, of imparting early maturity to the white seeded grain amaranths[183]. Most if not all members of this genus photosynthesize by a more efficient method than most plants. Called the 'C4 carbon-fixation pathway', this process is particularly efficient at high temperatures, in bright sunlight and under dry conditions[196]. In garden design, as well as the above-ground architecture of a plant, root structure considerations help in choosing plants that work together for their optimal soil requirements including nutrients and water. The root pattern is clumping, giving the plant a clumping habit. The predictable growth behaviour makes it easier to maintain without having to apply containment methods[2-1].

## 6.0.4 Fagopyrum esculentum

Buckwheat

6 tin 12 cyuc 4 kcaak 4 tcan 3 dwat 1.5 m hkuc  
htut cyutli hgatkyuctcup hwicli hyishrasjutnyikfrip hpa7tli frusflatprikwis hpa7tmwatli hjonli

drutta Fagopyrum esculentum is a ANNUAL growing to 1.5 m (5ft) by 0.3 m (1ft in) at a fast rate. It is frost tender. It is in flower from July to September, and the seeds ripen from August to October. The species is monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and is pollinated by Bees, flies. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista Buckwheat seed is considered to be one of the most important food allergens. It also contains compounds that can cause irritating skin disorders ('fagopyrism') mainly in sheep and pigs and occasionally in humans, especially in cases where there is heavy consumption and also exposure to sunlight[299

]. Fagopyrism has also been observed in humans after the consumption of buckwheat honey. It may also affect cattle when fed pure buckwheat silage[299

]. The plant has caused photosensitivity in some people, only the dehusked grain is considered to be safe.

kcaakta Edible Parts: Leaves SeedEdible Uses: Rutin-Leaves - raw or cooked like spinach[4 , 183 , K ]. Not that wonderful raw, they improve somewhat with cooking[K ]. The leaves are rich in rutin[171 ] (see below for more details) and so are a very healthy addition to the diet[K ]. Seed - raw or cooked. A nutty flavour, though it has a somewhat gritty texture that is not universally liked[K ]. It can be cooked like rice[299 ]. The seed can be soaked overnight in warm water then sprouted for a few days and added to salads[183 ]. It can also be ground into a powder and used as a cereal[2 , 4 , 9 ], when it can be made into pancakes, noodles, bread etc or be used as a thickening agent in soups etc[46 , 183 ]. It is popular for use in mixtures with wheat, barley or rye flour to improve the taste and nutritional value of bread and other foodstuffs. Up to 30% of buckwheat flour may be mixed in the wheat dough for baking bread[299 ]. Due to the absence of gluten, buckwheat is suitable for the diet of people with coeliac disease[299 ]. Rich in vitamin B6[160 ]. Excellent beer can be brewed from the grain[244 ]. Fresh leaves and inflorescences are used for the industrial extraction of rutin, which is applied to strengthen the inner lining of blood vessels (however, it is rather the related species Fagopyrum tataricum (L.) Gaertn., which is commonly grown for rutin production). Rutin is also industrially used as a natural pigment, antioxidant, stabilizer, food preserving and absorber of UV light.

tcanta Dye Green manure Soil reclamationA very good green manure plant, it can be used to reclaim badly degraded soils and subsoils[1 , 18 , 20, 201]. A blue dye is obtained from the stems[57, 106]. A brown dye is obtained from the flowers[4]. Livestock forage and feed: Buckwheat has historically been used as feed for cattle, pigs and chickens (Myers and Meinke, 1994). Green manure and cover crop:Buckwheat grows in the shortest time period of all cover crops (Bjorkman and Shail, 2010) flowering within 3 to 6 weeks and completely maturing within 11 to 12 weeks (Bjorkman et al., 2008). Weed suppressor: because buckwheat grows quickly, it is an excellent suppressor of weeds, and it has been used for this purpose in North America for several centuries. Cover crop: Buckwheat can also be grown as a cover crop to prevent erosion, improve soil aggregate stability, scavenge nutrients such as phosphorus and calcium, and mineralize rock phosphate (Clark, 2007; Bjorkman and Shail, 2010). Pollinator and beneficial insect habitat: Buckwheat is an excellent plant for bee pasture and insectary gardens(Mader et al., 2011; Lee-Mader et al., 2014). About one acre of buckwheat can provide enough forage for a hive of honey bees, producing about 150 pounds of honey in one season (Oplinger et al., 1989; Myers and Meinke, 1994). The flowers also attract beneficial insects such as parasitic wasps, minute pirate bugs, insidious flower bugs, tachinid flies, ladybeetles and hoverflies, which may prey on insect pests of neighboring crops (Clark, 2007; Bjorkman and Shail, 2010). Wildlife habitat:Buckwheat is sometimes an ingredient in birdseed mixes and planted with other crops for wildlife food plots(Oplinger et al., 1989). USDA.gov.

dwatta Acrid Astrigent Eczema Galactogogue VasodilatatorBuckwheat is a bitter but pleasant tasting herb that is frequently used medicinally because the leaves are a good source of rutin[238]. Rutin is useful in the treatment of a wide range of circulatory problems, it dilates the blood vessels, reduces capillary permeability and lowers blood pressure[238, 254]. The leaves and shoots of flowering plants are acrid, astringent and vasodilator[4, 141, 165]. It is used internally in the treatment of high blood pressure, gout, varicose veins, chilblains, radiation damage etc[4, 141, 165]. It is best used in conjunction with vitamin C since this aids absorption[254]. Often combined with lime flowers (Tilia species), it is a specific treatment for haemorrhage into the retina[254]. The leaves and flowering stems are harvested as the plant begins to flower and are dried for later use[238]. They should be stored in the dark because the active ingredients rapidly degrade in the light[238]. Some caution should be exercised in the use of this herb because it has been known to cause light-sensitive dermatitis[238]. A poultice made from the seeds has been used for restoring the flow of milk in nursing mothers[4]. An infusion of the herb has been used in the treatment of erysipelas (an acute infectious skin disease)[4, 244]. A homeopathic remedy has been made from the leaves[9]. It is used in the treatment of eczema and liver disorders[9].

nrakta Probably originating in China, the plant is cultivated in many temperate areas where it sometimes escapes and is found wild. ksacta Waste ground as an escape from cultivation[17]. Its original habitat is obscure.

propta Seed - sow from the middle of spring to early summer in the site. The seed usually germinates in 5 days[115]. The earlier sowings are for a seed or leaf crop whilst the later sowings are used mainly for leaf crops or green manure.

nwatta Fagopyrum esculentum is a plant of the temperate and subtropical zones, though it can also be grown at higher elevations, generally above 1,500 metres, in the tropics[299

]. It grows best in areas where annual daytime temperatures are within the range 17 - 27°C, but can tolerate 7 - 40°C[418

]. It is very sensitive to frost[299

]. It prefers a mean annual rainfall in the range 700 - 1,000mm, but tolerates 400 - 1,300mm[418

]. A very easily grown plant, it prefers dry sandy soils but succeeds in most conditions, including poor[57

, 141

, 171

], heavy[18

] or acid soils[141

] and even sub-soils[160

]. It prefers a pH in the range 5 - 6.5, tolerating 4.4 - 7.5[418



]. It prefers a cool moist climate, but it also succeeds in dry and arid regions[171

]. Hot drying temperatures and drying weather at blooming time blast the flowers and prevent seed formation[418

]. The plant has a poorly developed root system that makes it rather sensitive to drought[299

]. Fagopyrum esculentum is cultivated in many parts of the world for its edible seed. It is a prolific producer of seeds, and these are often spread by animal activity. It easily escapes from cultivation and can become established as a weed of cultivated and waste ground, though it is easy to control and does not usually become a pest. Buckwheat is a fast-growing plant that can reach its full height within 4 - 6 weeks. Flower formation starts 20 days after emergence, the plant continuing to flower until complete senescence and death of the whole plant. After the onset of flowering, the leaves and stems continue to grow while the fruits develop; hence seed ripening is very uneven, making harvesting difficult. From the middle of the flowering period onwards, when the leaf area has reached its maximum, further growth of the vegetative parts is slow, and producing ripe seed becomes the main focus of the plant. The seed is ready for harvesting 70 - 130 days after emergence, depending on cultivar and ecological conditions[141

, 183

, 299

, 418

]. The seed is harvested when most of it (at least 75%) is mature, and most leaves have yellowed and dropped. The crop is harvested by mowing, after which the stems are bunched and put in heaps to dry. Farmers prefer to harvest early in the morning or late in the afternoon, or even at night, when the plants are slightly damp from dew, to reduce grain shattering[299

]. The average seed yield in the United States is 0.9 - 1 tonne per hectare; in Kenya, it is 1 tonne, and in Russia 1 - 1.3 tonnes; but up to 4 tonnes can be obtained[418

]. The seed ripens irregularly over a period of several weeks, so it is difficult to harvest[141

]. Plants have poor frost resistance, but they are disease and insect resistant[166

]. They inhibit the growth of winter wheat[18

, 20

, 201

]. There are some named varieties[183

]. The flowers have a pleasant sweet honey scent[245

] and are extremely attractive to bees and hoverflies[4

, 171

].

## 6.0.5 Hibiscus cannabinus

Kenaf, Brown Indianhemp

6 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 1.8 m hkuc

htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli fyfxre7t hjonli

drutta Hibiscus cannabinus is a ANNUAL/PERENNIAL growing to 1.8 m (6ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. It is in flower from August to September, and the seeds ripen from October to November. The species is hermaphrodite (has both male and female organs) and is pollinated by Insects. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcaakta Edible Parts: Flowers Leaves Oil Oil Root SeedEdible Uses: Condiment Oil OilYoung leaves - cooked[74, 105, 177]. Used as a potherb or added to soups[183]. The leaves have an acid flavour like sorrel[2]. Seed - roasted or ground into a flour and made into a kind of cake[105, 177, 183]. Root - it is edible but very fibrous[144]. Mucilaginous, without very much flavour[144]. An edible oil is obtained from the seed[61, 183]. The yield varies from 2 - 10 tonnes per hectare[74] (or is it per acre?)

tcanta Dye Fibre Friction sticks Oil Oil Paper Plant support Soap making Soil reclamation StringAgroforestry Uses: Kenaf plants accumulate minerals such as selenium and boron, and can be used as a bioremedial tool for removing

these metals from contaminated soil[299, 1519]. Yields a fibre from the stem[1, 123], a very good jute substitute though it is a bit coarser[61]. The fibre strands, which are 1.5 - 3 metres long, are used for making rope, cordage, canvas, sack- ing, carpet backing, nets, table cloths etc[74, 123, 269]. For the best quality fibre, the stems should be harvested shortly after the flowers open[171, 269]. The best fibre is at the base of the stems, so hand pulling is often recommended over machine harvesting[269]. Yields of about 1.25 tonnes of fibre per hectare are average, though 2.7 tonnes has been achieved in Cuba[74, 269]. The pulp from the stems has been used in making paper[269]. The seed contains between 18 and 35% of an edible semi-drying oil[61, 74]. It is rather similar to groundnut oil, obtained from *Arachis hypogaea*[240]. The oil is also used for burning, as a lubricant and in making soap, linoleum, paints and varnishes[46, 61, 74, 269]. The seed yield varies from 2 to 10 tonnes per acre[74] (or is it per hectare?). The stems have been used as plant supports for growing runner beans etc[269]. The soot from the stems has been used as a black pigment in dyes[269]. The stem has been used as a base for drilling fire[269].

dwatta Antibilious Aphrodisiac Dysentery Poulitce PurgativeThe juice of the flowers, mixed with sugar and black pepper, is used in the treatment of biliousness with acidity[240]. The seeds are aphrodisiac[240]. They are added to the diet in order to promote weight increase[240]. Externally, they are used as a poultice on pains and bruises[240]. The leaves are purgative[240]. An infusion of the leaves is used in the treatment of coughs[269]. In Ayurvedic medicine, the leaves are used in the treatment of dysentery and bilious, blood and throat disorders. The powdered leaves are applied to Guinea worms in Africa[269]. The peelings from the stems have been used in the treatment of anaemia, fatigue, lassitude, etc[269].

nrakta Original habitat is obscure, it probably arose in the tropics of Asia or America. ksacta Not known in the wild. propta Seed - sow early spring in a warm greenhouse. Germination is usually fairly rapid. Prick out the seedlings into individual pots when they are large enough to handle. If growing them as annuals, plant them out into their permanent positions in early summer and protect them with a frame or cloche until they are growing away well. If hoping to grow them as perennials, then it is better to grow them on in the greenhouse for their first year and to plant them out in early summer of the following year. Cuttings of half-ripe wood, July/August in a frame. Overwinter them in a warm greenhouse and plant out after the last expected frosts.

nwatta Prefers a well-drained humus rich fertile soil in full sun[200]. Tolerates most soils but prefers a light sandy soil[123]. Plants are adapted to a wide range of soils and climatic conditions[171]. Kenaf is reported to tolerate an annual precipitation in the range of 57 to 410cm, an annual temperature range of 11.1 to 27.5°C and a pH in the range of 4.3 to 8.2 (though it prefers neutral to slightly acid)[269]. The plant is frost sensitive and damaged by heavy rains with strong winds[269]. Kenaf is widely cultivated in tropical and sub-tropical areas of the world, where it is grown mainly as a fibre crop but also for its seeds and leaves[269]. It is not very hardy outdoors in Britain, it really requires a frost free climate[123]. It can, however, probably be grown as an annual. A fast-growing plant, it can be harvested in 3 - 4 months from seed[50, 61]. The plant requires temperatures in the range of 15 - 25°C[169]. It succeeds as a crop as far north in N. America as Indiana, Iowa, Kansas and Nebraska[160]. Plants are daylight sensitive, they remain vegetative and do not flower until the daylength is less than 12.5 hr/day. Two weeks of very cloudy days will induce flowering as daylength approaches 12.5 hr[269]. The plant has a deep-penetrating taproot with deep-seated laterals[269]. Plants, including any varieties, are partially self-fertile[269].

# 7 7 tlin

## 7.1 bwon

### 7.1.1 Lens culinaris

Lenfil

tfo2n 7 tlin 12 cyuc 5 kcaak 3 tcan 1 dwat 0.5 m hkuc

on the previous year's growth[ 377 ]. The fruit of this species has a thick exocarp, making it suitable for long-distant transport[ 317 ]. This gives it potential in breeding programmes with other members of the genus to develop fruits with thick skins suitable for shipping[ 46 ].

### 9.2.9 Melicococcus bijugatus

Mamoncillo, Spanish Lime, Guayo

9 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 18 m hkuc

hmimhtut cyutli hgatykuctcup hwicli hvihsrasjlutnyik hpa7tli prikklwissliphsom hpa7tmwatli hjonli

drutta Melicococcus bijugatus is an evergreen Tree growing to 18 m (59ft) by 18 m (59ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

kckakta Edible Parts: Fruit SeedEdible Uses: DrinkFruit - raw or cooked. The fruit is juicy, aromatic and somewhat sweet with a pleasant, acid flavour. A sweet and gelatinous pulp with a grape-like flavour[200 ]. Usually eaten out of hand, they can also be cooked in pies, jams and jellies etc[301]. They make a cooling drink[301 ]. The fruit is up to 3cm in diameter, containing a single, occasionally two, large seed[200]. The large, starchy seeds are roasted and used as a substitute for cassava[200, 301, 317, 335 ]. The elliptic seeds can be up to 28mm long[447 ].

tcanta Furniture WoodSeaside and Shade tree. Street tree. Specimen. Xerophytic. Other Uses The heartwood is light brown to pale yellow-gray; the sapwood light brown. The wood is of medium weight, fairly hard but does not resist decay. It is sometimes used for cabinet work, construction and interior works[307 , 447 ].

dwatta Antidiarrhoeal Antihydrotic DysenteryA decoction of the bark is widely used by local people to treat dysentery[200 ]. An infusion of the leaves is used to decrease or retard perspiration[348 ].

nrakta Northern and western S. America - Colombia and Venezuela. ksacta Dry coastal limestone woodland[307 ]. Along the sides of roads, secondary thickets and woodlands at elevations up to 600 metres in Jamaica[426 ].

propta Seed - seedlings often do not fruit as well as their parent[200 ]. Air layering. Greenwood cuttings. Grafting.

nwatta A plant of the moist, lowland tropics, where it is found at elevations up to 600 metres. It grows best in areas where annual daytime temperatures are within the range 22 - 30°C, but can tolerate 13 - 34°C[418 ]. When dormant, the plant can survive temperatures down to about -3°C, but young growth can be severely damaged at -1°C[418 ]. It prefers a mean annual rainfall in the range 800 - 1,600mm, but tolerates 500 - 2,700mm[418 ]. Prefers a fertile, well-drained soil in a sunny position[307 ], though it can also succeed in poor soils[335 ]. Prefers a pH in the range 5.5 - 7, tolerating 5 - 8.7[418 ]. Established plants are very drought tolerant[307 , 335 ]. Plants can withstand the strongest salt-laden winds[307 ]. Seedling plants take 7 - 10 years to begin fruiting[307 , 335 ]. Cuttings can fruit in 4 - 5 years[335 ]. The flowers are pleasantly scented and attract bees[447 ]. There are some named varieties[301 ]. Trees are intolerant of pruning[307 ]. Some members of this species are hermaphrodite, whilst others can be dioecious[307 ]. Most forms are dioecious, in which case it is necessary to grow both male and female forms if fruit and seed are required[335 ]. Flowering Time: Late Winter/Early Spring mid SSpring. Bloom Color: White/Near White. Spacing: 20-30 ft. (6-9 m).

### 9.2.10 Bambusa odashimae

Odashimae Bamboo

9 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 15 m hkuc

hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Bambusa odashimae is an evergreen Bamboo growing to 15 m (49ft) by 10 m (32ft) at a fast rate. See above

for USDA hardiness. It is hardy to UK zone 9. The flowers are pollinated by Wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant can tolerate strong winds but not maritime exposure.

kckakta Edible Parts: ShootsEdible Uses: Edible portion: Shoots. Young shoots, harvested as they emerge from the soil, cooked[ 266 ]. A delicious flavour[ 266 ]. The shoots are up to 13cm in diameter[ 266 ]. Considered similar to B. oldhamii, but highly prized for edible shoots due to its crisp flesh, similar to Asian pears.

nrakta E. Asia - southern China in Taiwan. ksacta Lowland hills areas[ 266 ].

propta Seed - surface sow in containers as soon as it is ripe, preferably at a temperature around 20c. Do not allow the compost to dry out. Germination usually takes place fairly quickly so long as the seed is of good quality, though it can take 3 - 6 months. Prick out the seedlings into containers when they are large enough to handle and grow on in a lightly shaded place until large enough to plant out. Plants only flower at intervals of many years and so seed is rarely available. Division as new growth commences[ 220 ]. Take divisions with at least three canes in the clump, trying to cause as little root disturbance to the main plant as possible. Grow them on in light shade in pots of a high fertility sandy medium. Mist the foliage regularly until plants are established. Plant them out into their permanent positions when a good root system has developed, which can take a year or more[ 200 ].

nwatta Bamboos have an interesting method of growth. Each plant produces a number of new stems annually - these stems grow to their maximum height in their first year of growth, subsequent growth in the stem being limited to the production of new side branches and leaves. In the case of some mature tropical species the new stem could be as much as 30 metres tall, with daily increases in height of 30cm or more during their peak growth time. This makes them some of the fastest-growing species in the world[ K ]. Bamboos in general are usually monocarpic, living for many years before flowering, then flowering and seeding profusely for a period of 1 - 3 years before usually dying.

### 9.2.11 Caryota urens

Jaggary Palm, Toddy Palm, Fishtail Wine Palm

9 tlin 12 cyuc 4 kcaak 4 tcan 2 dwat 12 m hkuc

pcimhmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli frusflat-prikklwisslip hpa7tmwatli dyat hjonli

drutta Caryota urens is an evergreen Tree growing to 12 m (39ft) by 6 m (19ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The fruit is capable of irritating the skin and causing a burning sensation[ 287 ].

kckakta Edible Parts: Flowers Leaves Sap StemEdible Uses: Drink SweetenerEdible portion: Sap, Starch, Cabbage, Sago, Palm heart. The sap extracted from the inflorescence of the plant is used to make sugar and alcoholic beverages[ 46 , 297 ]. A primary product of the plant in rural communities is the sugar substitute called kitul honey or jaggary obtained from the juice from the flowers (should this read sap? K ). This is concentrated in large, wide-mouthed vessels on an open fire to prepare a viscous, golden syrup with a delicious flavour. The sap can be further concentrated to give kitul jaggary (candy)[ 303 ]. Sap collected from the inflorescence is fermented with a crude, mixed inoculum of yeast to obtain toddy. This beverage can be distilled, as is coconut toddy, to prepare a more concentrated spirit[ 303 ]. A starch obtained from the stems is used to make sago[ 46 , 266 , 297 , 317 ]. Leaves - cooked[ 301 ]. The very young unfolding leaves and leaf bud are used as a vegetable[ 46 , 266 , 301 ]. Harvesting this terminal bud effectively kills the tree since it is unable to make side shoots and so cannot produce



pcimhmimhtut cyutli hqatkyuctcup hwicli hrasjlutnyik hpa7tli frusflatprikwlisslip hpa7tmwatli hjonli

drutta Manihot esculenta is a deciduous Shrub growing to 3 m (9ft) by 3 m (9ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

pcista The leaves contain the harmful glucoside linamarin, which can release the toxic hydrocyanic acid in the presence of the enzyme linase[298 , 300 ]. This can be destroyed by heat[298 ] (Parts of plant are poisonous if ingested)

kcakta Edible Parts: Leaves RootEdible Uses: Young leaves - cooked as a vegetable[296 ]. Boiled like spinach, or added to stews[301 ]. The leaves need to be boiled for about 15 minutes in order to destroy harmful glucosides[298 ]. Some sweet varieties contain little or no glucosides[300 ]. Root - cooked and used as a vegetable[296 ]. The tuberous root can be sliced and fried like chips, boiled and added to vegetable dishes, or made into a flour and used in breads and biscuits, or as a thickener in gravies, soups, desserts etc[296 ]. The root is higher in carbohydrate and rather deficient in protein than many other root crops[296 ]. Unfortunately, where cassava is used as the main staple in the diet, it can lead to malnutrition[200 ]. It is a fairly good source of vitamin C[296 ]. Starch from the tuber is used to make tapioca[46 , 296 ]. Some care should be exercised in using this plant for food since it is more or less poisonous when raw. Sweet varieties need to be simmered for 10 minutes before eating, whilst bitter varieties should be soaked for 24 hours prior to simmering for at least 10 minutes in fresh water[296 ].

tcanta Adhesive Mulch RepellentOther Uses Insect repellent - a mulch of the leaves and stems repels root knot nematodes[296 ]. A glue can be made from the starch[200 ]. It is used on postage stamps[200 ]. The starch in the root is used as a size for cotton fabrics[46 ].

dwatta Antibacterial Antidiarrhoeal Antifungal Antiviral Dysentery Febrifuge Haemostatic Laxative Ophthalmic Poultice Skin Vitamin CCassava is often used in traditional medicine and has a number of applications[311 ]. The plant is antifungal, antiviral, mutagenic and antibacterial[311 , 348 ]. The roots of bitter varieties can be used to treat scabies, diarrhoea and dysentery[254 ]. The juice of the grated tubers is used to treat constipation and indigestion[311 ]. A flour made from the roots can be used as a dusting powder on the skin in order to help dry weeping skin[254 ]. Soaked with Carapa oil, it is used as a poultice on shattered muscles[348 ]. It is mixed with rum and rubbed onto children's skin as a treatment for abscesses and skin eruptions[348 ]. It can be made into an ointment to treat fungal dermatitis[348 ]. The leaves are haemostatic[348 ]. They are made into a poultice to treat wounds[348 ]. The leaves are infused in bath water to treat influenza and fevers[311 ]. The leaves are heated and rubbed across sore eyes[311 ]. The stem is folded and rubbed across the eyes of people suffering from glaucoma[311 ]. The bark of the plant, together with that of Cordyline terminalis, is thought to prolong life[311 ]. Sugar cane and annatto are employed in an antidote to ingested water which has been poisoned by the soaking roots of this plant[348 ]

nrakta Tropics. ksacta Widely cultivated as a food crop, it is not known in a truly wild situation.

propta Seed - seedlings are very unlikely to be true to type and could possibly revert to bitter types. Cuttings - they root easily[296 ]. Take shoots about 30cm long and 15mm thick from a woody part of the stem and remove all leaves. It is possible to root the shoots by standing them in a container of water, planting them out when they have made good roots. Alternatively, plant the cuttings out directly in the soil making sure that they are kept moist[296 ].

nwatta Cassava grows best at elevations below 1,700 metres[300 ]. Plants do not grow well at temperatures lower than 16°C, the stems and leaves are very sensitive to even short periods of chilling[300 ]. Temperatures in excess of 29°C may have an adverse effect on growth and development[300 ]. Plants grow best in areas where rainfall is in the range of 500 - 2,500mm per annum[300 ]. A short-day plant, tuber production is reduced in daylengths greater than

12 hours[300 ]. Plants need some shelter from bright sunshine or their leaves can be burnt[200 ]. A quite tolerant plant, succeeding in drier and moister soils as well as in quite deep shade[296 ]. Cassava is not a particularly greedy plant, though yields are improved if they are well fed[296 ]. A sandy or sandy loam is generally preferred for growing the plant[300 ]. Requires a well-drained soil[300 ]. Some cultivars are extremely drought resistant[300 ]. Tolerates a pH in the range 5.5 - 8.0[300 ]. The plant grows, and can be harvested, all year round[296 ]. The roots take about six months to mature, so it is possible to grow two crops a year[296 ]. The roots are often badly damaged by termites[296 ]. There are many named varieties. There are two groups of cultivars, the sweet and the bitter[300 ]. Sweet forms contain much less hydrocyanic acid, and this is sweetened mainly to the outer phellogen layers of the root tuber[300 ]. In bitter varieties the hydrocyanic acid is widely distributed throughout the tuber[300 ]. Care must be taken to grow the cultivated 'sweet' varieties that have been developed as food crops - ornamental, usually variegated, forms are usually bitter tasting and poisonous[296 ]. The leaves are particularly susceptible to damage by insecticide sprays[296 ]. Cassava will usually grow into a tall spindly bush unless cut back - they are very tolerant of heavy harvesting and so in cultivation it is best to keep them at about 1 metre tall[296 ]. Flowering Time: Late Spring/Early Summer. Bloom Color: Pale Yellow Cream/Tan. Spacing: 36-48 in. (90-120 cm) 36-48 in. (90-120 cm)36-48 in. (90-120 cm).

## 9.2.8 Annona liebmanniana

Hardshell custard-apple, Posh-te

9 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 20 m hkc hmimhtut cyutli tucpjh7n hwicli hrasjlutnyik hpa7tli frusflatprikwlisslip hpa7tmwatli hjonli

drutta Annona liebmanniana is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil. The plant is not wind tolerant.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw. Delicious and aromatic, it is best eaten fresh from the plant[ 46 , 301 ]. A richer flavour than the soursop (A. muricata) with a suggestion of the flavour of the white sapote (Casimiroa edulis)[ 301 ]. A creamy banana-pineapple like flavour, it is said to be one of the most flavourful and refreshing fruits in the genus[ 377 ]. The fruit has an agreeable flavour, it is 8 - 10cm in diameter, but the seeds are very large, up to 2cm long[ 331 ].

nrakta Central America - south Mexico, Guatemala, Honduras. ksacta Moist or wet, mixed forest at elevations of 1,800 metres or less, chiefly near sea level[331].

propta Seed - usually breeds true to type[ 200 ]. Sow in individual pots, not deeper than 2cm, at 21c[ 200 ]. The seed of many species in this genus has a hard seedcoat and may benefit from scarification before sowing in order to speed up germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing[ K ]. Semi-ripe cuttings[ 200 ].

nwatta A plant of the moister, lowland tropics, usually growing near sea level but also found at elevations up to 1,800 metres[ 331 ]. It grows best in areas where annual daytime temperatures are within the range 23° - 26°C, but can tolerate 8° - 32°C[ 418 ]. It prefers a mean annual rainfall in the range 3,500 - 4,500mm, but tolerates 3,000 - 5,000mm[ 418 ]. Young trees seem to grow better in shade, but older trees grow well in sunny positions[ 418 ]. Prefers a moist, well-drained, sandy loam with a pH of around 6[ 200 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 4.5 - 7[ 418 ]. The tree may suffer from wind damage on exposed sites[ 418 ]. Trees can commence fruiting in just 4 years from seed, by which time they are 4 - 6 metres tall[ 377 , 418 ]. Trees flower

htut cyutli kyuctcup hwicli hyishrasjlutnyik hpa7tli flatprikwlis hpa7tmwatli fyifxre7t hjonli

drutta Lens culinaris is a ANNUAL growing to 0.5 m (1ft 8in). It is not frost tender. The species is hermaphrodite (has both male and female organs) and is pollinated by Cleistogamy (self-pollinating without flowers ever opening). The plant is self-fertile. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil.

kcakta Edible Parts: Seed SeedpodEdible Uses: Seed - cooked or sprouted and eaten raw[1]. A very nutritious food[171, 177], the seeds can be cooked on their own or added to soups, stews etc[183]. The seed can be soaked for 12 hours in warm water and then allowed to sprout for about 5 days[244]. They have a crunchy, fresh flavour[244]. Lentils are more digestible than many legumes[K]. The dried seed can also be ground into a powder and used with cereal flours in making bread etc[183], this greatly enhances the value of the protein in the bread. The seed stores better if it is left in its husk[200]. Young seedpods - used fresh or cooked like green beans[61, 177, 183].

tcanta Fuel Green manureAgroforestry Uses: The plant can be used as a green manure[418 ]. Lentil is mainly grown as a sole crop, but sometimes mixed with other crops, e.g. in India with barley, mustard or castor[299 ]. Other Uses: The seeds are a source of starch for the textile and printing industries[310 , 418 ]. The plant remains, after the seed has been harvested, can be used as a fuel[299 ].

dwatta Laxative PoulticeThe seeds are mucilaginous and laxative[240]. They are considered to be useful in the treatment of constipation and other intestinal affections[240]. Made into a paste, they are a useful cleansing application in foul and indolent ulcers[240].

nrakta Original habitat is obscure, possibly the Mediterranean. ksacta Not known in the wild.

propta Seed - sow early April in situ[1]. Some cultivars are probably suitable for sowing outdoors in the autumn, at least in the milder parts of the country[200].

nwatta An easily grown plant[K], it prefers a sandy soil in a warm sunny sheltered position[27, 37, 200]. Another report says that it does best on clay[37]. It produces most seed when grown on poorer soils[37]. Lentils are widely cultivated in warm temperate and tropical zones for their edible and very nutritious seed, there are many named varieties[183]. The plants are much hardier than is commonly supposed and many of these varieties can succeed in Britain, particularly in warm summers. There is at least one, called 'WH2040', that can withstand temperatures as low as -23°C in the seedling stage[200]. 'Chilean' is a low-growing plant that can be grown in the winter in areas where winter vegetables can be grown[183]. 'HarLen' tolerates temperatures down to -10°C and performs very well in gardens[183]. The plants take the same time as peas to mature, so lentils are a potential commercial crop for Britain[141]. Yields of up to 2 tonnes per hectare are possible[200]. The main problem with growing them as a commercial crop is that they are produced by using cheap labour in many countries which makes it very difficult for British farmers to compete on prices. However, this does not preclude their being grown in the garden and allotment. Lentils are also beneficial to grow as part of a rotation on the farm or garden. They have a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby and, if the roots are left in the ground when the seeds are harvested, this will provide a source of nitrogen for the next crop[200].

## 7.2 mran

### 7.2.1 Dioscorea japonica

Glutinous Yam, Japanese yam

7 tlin 12 cyuc 4 kcaak 0 tcan 2 dwat 3 m hkc htut cyutli tucp hwicli hrasjlutnyik hpa7tli flatprikwlis hpa7tmwatli nyanhjen hjonli

drutta Dioscorea japonica is a PERENNIAL CLIMBER growing to 3 m (9ft 10in). See above for USDA hardiness. It

is hardy to UK zone 8. It is in flower from September to October. The species is dioecious (individual flowers are either male or female, but only one sex is to be found on any one plant so both male and female plants must be grown if seed is required). The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcista Edible species of Dioscorea have opposite leaves whilst poisonous species have alternate leaves[174].

kcakta Edible Parts: Leaves RootEdible Uses: Tuber - cooked[174, 177, 179]. A very pleasant mild flavour with a floury texture, the roots can be eaten as a potato substitute[2]. The starch can be used as a binding agent for other foods[183]. Roots contain about 1.9% protein, 20% carbohydrate, 0.1% fat and 1% ash[179]. Leaf tips - cooked[183]. Tubercles - cooked[183].

dwatta Contraceptive Miscellany TonicThe tubers are prescribed in the treatment of diarrhoea, enteritis, enuresis and spermatorrhoea[218]. They are also dried and cut into shavings then used as a tonic[218]. The roots of most, if not all, members of this genus, contains diosgenin[222, 240]. This is widely used in modern medicine in order to manufacture progesterone and other steroid drugs. These are used as contraceptives and in the treatment of various disorders of the genitinary organs as well as in a host of other diseases such as asthma and arthritis[222].

nrakta E. Asia - China, C. and S. Japan. ksacta Wooded foothills[58]. Mixed forests and margins, scrub forests, herb communities, mountain slopes, valleys, along rivers and streams, roadsides; 100 - 1200 metres[266].

propta Seed - sow March to April in a sunny position in a warm greenhouse and only just cover. It germinates in 1 - 3 weeks at 20°C[175]. Prick out the seedlings as soon as they are large enough to handle and grow on in a greenhouse for their first year. Plant out in late spring as the plant comes into new growth. Basal stem cuttings in the summer[37]. Division in the dormant season, never when in growth[1]. The plant will often produce a number of shoots, the top 5 - 10 cm of the root below each shoot can be potted up to form a new plant whilst the lower part of the root can be eaten[K]. Tubercles (baby tubers) are formed in the leaf axils. These are harvested in late summer and early autumn when about the size of a pea and coming away easily from the plant. They should be potted up immediately in individual pots in a greenhouse or cold frame. Plant out in early summer when in active growth[K].

nwatta We have very little information on this species and do not know if it will be hardy in Britain, though judging by its native range it could succeed outdoors at least in the mildest areas of this country. The following notes are based on the general needs of the genus. Easily grown in a fertile well-drained soil in a sunny position or light shade[200]. Prefers a rich light soil[1]. Plants produce tubercles (small tubers that are formed in the leaf axils of the stems), and can be propagated by this means[K]. A climbing plant that supports itself by twining around the branches of other plants[219]. Dioecious. Male and female plants must be grown if seed is required. For polyculture design as well as the above-ground architecture (form - tree, shrub etc. and size shown above) information on the habit and root pattern is also useful and given here if available. Growth habit is a single or multiple shooting vine from a crown [1-2]. Herbaceous. The root pattern is tuberous with swollen potato-like roots [1-2].

### 7.2.2 Sorghum hybrids

Perennial Sorghum

7 tlin 12 cyuc 4 kcaak 3 tcan 1 dwat 3 m hkc htut cyutli hqatkyuctcup hwicli hrasjlutnyik hpa7tli flatprikwlis hpa7tmwatli hjonli

drutta Sorghum hybrids is a PERENNIAL growing to 3 m (9ft) by 1 m (3ft 3in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 7. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista The pollen can induce hay fever[269].

kcakta Edible Parts: Seed Edible Uses: Carbon Farming Solutions - Staple Crop: balanced carb, sugar (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1].

tcanta Possible but not reported. Sorghum halepense is a good biomass plant. The plant is a potential source of biomass with yields of up to 19 tonnes per hectare[269]. Sorghum bicolor has been used as Biomass, Brooms, and for Weaving. The flowering panicles are used as brushes brooms and whisks etc[1, 2, 4, 46, 57]. Stems are used for weaving fences, mats, wattle houses etc[178]. The plant is an excellent source of biomass[269].

dwatta Possible. For example Sorghum bicolor is Astringent, Demulcent, Diuretic, and Haemostatic. Sorghum halepense is Demulcent and Diuretic.

nrakta Origin: Hypothetical hybrid. Sorghum species range extend to Australia, Africa, Asia, Mesoamerica, and certain islands in the Indian and Pacific Oceans. ksacta Not known in the wild. Under development

propta Seed - sow April in a greenhouse and only just cover the seed. Germination should take place within 2 weeks. Prick out the seedlings into individual pots once they are large enough to handle and plant them out after the last expected frosts. Division in mid spring as the plant comes into new growth. Larger divisions can be planted out direct into their permanent positions. We have found it best to pot up the smaller divisions and grow them on in a lightly shaded position in a cold frame, planting them out once they are well established in the summer.

nwatta Management: Hay Management: Standard Staple Crop: Balanced carb Staple Crop: Sugar Under Development Climate: cold temperate to tropical, tropical highlands. Humidity: semi-arid to humid. Sorghum is well suited for dry conditions, areas with uneven rainfall distribution that may adversely affect the growing season of other crops, and high year to year variation in rainfall and water supplies. Carbon Farming Solutions - Cultivation: under development. Management: standard, hay (Describes the non-destructive management systems that are used in cultivation) [1-1]. Sorghum is already weakly perennial in the tropics. It "rattoons", or sprouts for several years. Perennial breeding at the Land Institution focused on crosses with Johnsongrass (Sorghum halepense), while other breeders focus on Ni gao liang (Sorghum propinquum). Perennial sorghum could be bread for grain and sweet syrup. Sorghum is particularly suited to dry regions and some promising hybrids have been trialed [1-1]. For polyculture design as well as the above-ground architecture (form - tree, shrub etc. and size shown above) information on the habit and root pattern is also useful and given here if available. The plant growth habit is a runner spreading indefinitely by rhizomes or stolons [1-2].

## 7.2.3 Oryza hybrids

Perennial Rice

7 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 2 m hkuc htut cyutli tcuphja7nhs6s hwicli hrasjltunyk hpa7tli flatprikwis hpa7tmwatli hjonli

drutta Oryza hybrids is a PERENNIAL growing to 2 m (6ft) by 0.3 m (1ft in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 8. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist or wet soil and can grow in water.

kcakta Edible Parts: Seed Edible Uses: Carbon Farming Solutions - Staple Crop: balanced carb (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1]. Under development as new cereal, annual O. sativa crossed with its perennial ancestors, O. longistaminata and O. rufipogon.

tcanta The straw, which may attain considerable length if the plant has grown in flood water, is valued for thatching[299, 332]. Because they are a source of resistance to or tolerance of biotic and abiotic stresses, the most important use of the various species of wild rice is probably in breeding programmes to improve the species of cultivated rice[1040].

dwatta Urinary Rice is a nutritive, soothing, tonic herb that is diuretic, reduces lactation, improves digestion and controls sweating[238]. The seeds are taken internally in the treatment of urinary dysfunction[238]. The seeds, or the germinated seeds, are taken to treat excessive lactation[238]. The germinated seeds are used to treat poor appetite, indigestion abdominal discomfort and bloating[238]. The grains are often cooked with herbs to make a medicinal gruel[238]. The rhizome is taken internally in the treatment of night sweats, especially in cases of tuberculosis and chronic pneumonia[238]. The rhizomes are harvested at the end of the growing season and dried for use in decoctions[238].

nrakta Origin: hypothetical hybrid. ksacta Various depending on the species.

propta Seed. The seed of wild rice less than 12 months old often exhibits strong dormancy, which implies (though this has not been established) that the seed retains its viability for a considerable period[1040]. Heat treatment is generally effective in breaking dormancy - alternating temperatures between 34°C for 16 hours then 11°C for 8 hours is usually effective, though the time taken varies between species[1040]. Surface sow the seed in light shade and do not allow to dry out. Seed should germinate within 7 days at 30°C[1040]. Prick out 2 - 3 seedlings into individual pots when large enough to handle and, after a few days, move to a sunny position. Grow on until large enough to plant out. Division.

nwatta Staple Crop: Balanced carb Under Development Climate: cold temperate to tropical, tropical highlands. Humidity: humid, aquatic. Succeeds in full sun and in moderate shade[1040]. Requires a wet soil or shallow water[1040].

## 7.2.4 Ipomoea aquatica

Kangkong, Swamp Morning Glory

7 tlin 12 cyuc 4 kcaak 0 tcan 2 dwat 0.5 m hkuc htut cyutli tcuphja7nhs6s hwicli hrasjltunykrip hpa7tli frusflatprikwis hpa7tmwatli fyif hjonli

drutta Ipomoea aquatica is an evergreen Annual/Perennial growing to 0.5 m (1ft 8in) by 0.3 m (1ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 8. The flowers are pollinated by Bees, Butterflies. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist or wet soil and can grow in water.

pcista Accumulation of heavy metals in the plant has been reported in Asia, mainly because the plants are often grown in polluted water[299].

kcakta Edible Parts: Leaves Root Shoots Edible Uses: Leaves and young shoots - raw or cooked[296, 298]. The tasty leaves are produced all year round[296]. The youngest shoot tips can be added to salads, older leaves are cooked and make a mild-flavoured spinach[298]. The leaves can be stir-fried, steamed, boiled for a few minutes or lightly fried in oil and eaten in various dishes. They are often mixed with hot peppers and garlic and prepared with a savoury dish[299]. Very nutritious, the leaves are a good source of protein as well as providing good quantities of vitamin A, iron, calcium and phosphorus[298]. Roots - occasionally cooked and eaten[29, 301].

dwatta Antidote Antihæmorrhoidal Antitussive Febrifuge Hypoglycaemic Laxative Laxative Poultrice Skin Tonic The young shoots are mildly laxative and are used by diabetic patients[272]. A decoction of the leaves is used to treat coughs[272]. The fried leaves are eaten to cool down a fever[310]. The crushed leaves are applied as a poultice on sores and boils[310, 348]. A paste made from the buds is used to treat ringworm[272, 299]. The roots are laxative, tonic and antidote[310]. They are used in the treatment of opium or arsenic poisoning, and also to counter the effects of drinking unhealthy water[310]. A decoction of the roots is used as a wash against hæmorrhoids[310, 348]. The plant has shown oral hypoglycaemic activity in tests with diabetic humans; it was shown that an aqueous leaf extract can be as effective as tolbutamide in reducing blood glucose levels[299].

nrakta Pantropical. ksacta Moist, marshy or inundated localities, shallow pools, ditches, rice fields, forming dense

dwatta Abortifacient Antidiarrhoeal Aphrodisiac Appetizer Astringent Cancer Digestive Dysentery Hypotensive Kidney Laxative Malaria Parasiticide Purgative Skin Vermifuge The skin of the unripe fruit, the leaves, sap and seeds of the papaya are all a source of the enzyme papain, a digestive stimulant that facilitates the digestion of protein[200, 238]. The unripe fruit is an especially good source[254]. Papain can be used internally, especially in the form of the extracted enzyme, to treat digestive disorders[238]. It is also applied externally to aid the healing of deep or slow-healing wounds[238]. An infusion of the young, latex-filled, green fruit is used as a children's vermifuge[348]. The juice of the fruit is used to treat diabetes and hypertension[348]. The immature fruit, sometimes combined with aspirin, is used as an abortifacient[348]. The fruit pulp is mixed with fat in a pomade to remedy abscesses[348]. The juice of the fruit is used to dissolve warts[348]. The leaves and the fruit, especially the unripe fruit, are taken internally in the treatment of a range of digestive disorders, diarrhoea, high blood pressure and painful womb[254, 348]. The green leaves are cooked as a treatment for tertiary malaria and for irregular bowel movement in children[348]. Externally, the leaves are applied to wounds as a dressing that helps to speed the healing process[254]. The leaves and seeds are used locally to rid the body of threadworms and roundworms[238]. The seeds are used as a gentle purgative to rid the body of worms[254]. Immature seeds are swallowed to treat diarrhoea[311]. The seed is eaten as a children's vermifuge, and also to increase visual acuity[348]. The latex from the trunk of the tree has a strong purgative action when taken internally and is sometimes used to rid the body of worms[254]. The latex is applied externally to wounds, boils, ulcers, warts and cancerous tumours in order to speed their healing[254]. It is also applied to the gums to treat toothache[348]. The ripe fruit is a mild laxative[254]. A decoction of the ripe fruit is used to treat persistent diarrhoea and dysentery in children[254]. An infusion of the flowers is drunk in order to induce menstruation, and also to treat laryngitis, bronchitis and venereal diseases[254, 348]. The flowers are used in combination with milk and butter as an appetite stimulant[348]. The bark is used to treat diarrhoea[348]. The inner bark is used to treat toothache[311]. The root is aphrodisiac, astringent and vermifuge[348]. The macerated root is used in the treatment of gonorrhoea[348]. An infusion of the root in alcohol is used to treat bladder and kidney problems[348]. A decoction is drunk to treat abdominal stricture, diarrhoea, malaria and intestinal worms[348]. Applied externally, an infusion of the root in alcohol is rubbed on the limbs to treat rickets[348]. A decoction of the root is used externally to treat abdominal stricture[348]. The latex contains the protein-degrading (proteolytic) and mucolytic enzymes papain and chymopapain[348]. The plant contains hydrocyanic acid, carpaine, terpene hydrocarbons, terpene alcohols, cyanogenic glycosides[348].

nrakta The original habitat is believed to be Central America and southern Mexico, but is not known for certain. ksacta Not known as a truly wild plant

propta Seed - best sown as soon as ripe in a position in indirect light. Germination takes 2 - 6 weeks at 24 - 30°C[200]. Move to a sunny position about 2 weeks after germination. Greenwood cuttings. Grafting.

nwatta Papaya succeeds in tropical and subtropical areas, where it can be found between 32°N and S. It produces best at elevations below 900 metres, though it can also succeed as high as 2,100 metres near the equator[335, 418]. It grows best in areas where annual daytime temperatures are within the range 21 - 30°C, but can tolerate 12 - 44°C[418]. It can be killed by temperatures of -1°C or lower[418]. It prefers a climate with well distributed rainfall and a mean annual rainfall in the range 1,500 - 2,500mm, but tolerates 1,000 - 3,000mm[200, 335, 418]. Low temperatures cause smaller fruit size and low quality. Prefers a sunny position in a deep, humus-rich soil[296]. Requires a well-drained, well-aerated soil, trees can die within a few days if the soil becomes waterlogged[200]. Grows best in a position sheltered from strong winds[200]. Plants produce masses of easily damaged feeding roots near the surface and so are best hand weeded when young and given a good organic mulch as they grow[200]. Prefers a pH in the range 5.5 - 7, tolerating 4.5 - 8[418]. A very productive plant, it can start to crop when only 6 months old and can produce fruit all year round[296]. Yields of between 22 - 56 tonnes/ha of fresh fruit are

obtained in Hawaii and yields up to 80 tonnes/ha have been reported. The yields are highest in the second and third year and they then decline rapidly[418]. The productive life of a tree is very short, yields have declined sharply by the time it is four years old[418]. There are many named varieties[46, 200, 296]. Individual plants can bear only male flowers, only female flowers or hermaphrodite flowers. One male plant will be enough to fertilize 6 or more females[296]. Hand pollinated fruits ripen after about 150 - 240 days[418].

## 9.2.6 Passiflora ligularis

Sweet Grenadilla, Passion Flower

9 tlin 12 cyuc 5 kcaak 0 tcan 0 dwat 5 m hkuc hmimhut cyutli tcup hwicli jltunyk hpa7tli flatprik hpa7tmwatli hjonli

drutta Passiflora ligularis is an evergreen Climber growing to 5 m (16ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista Parts of plant are poisonous if ingested kcakta Edible Parts: Fruit Edible Uses: Drink Sweetener Fruit - raw or made into drinks[301]. A pleasant, sweet flavour[46]. The orange-yellow fruit contains a soft, translucent, perfumed pulp of a very agreeable taste[301]. Claimed by many to be the best tasting of the passion fruits[200, 301]. The ovoid fruit is about 8cm x 5cm[200].

nrakta Western and Northern S. America - Peru and Bolivia north through Central America to Mexico. ksacta Found at elevations from 1,000 - 3,000 metres[262].

propta Seed - best sown as soon as it is ripe along with the pulp which will help break down the seed coat and speed up germination[262]. Fresh seed germinates in 10 - 20 days[262]. Stored seed should be soaked for 24 hours in warm water and germination time can be reduced if the seed is then mixed with the juice of a fresh passion fruit (of any species)[262]. Even so, it can take 12 months for stored seed to germinate[262]. Place the seed tray in a shady position, maintaining a temperature around 19 - 24°C[262]. Prick the seedlings out into individual containers as soon as they are large enough to handle and plant out when large enough[262]. Cuttings of young shoots, taken at the nodes. The cuttings root best in a neutral to slightly acid compost, but 100% sharp sand also produces good results[262]. Cuttings of fully mature wood taken at a node. They can take 3 months, but there is usually a high percentage[3]. Layering. Very easy[262]. Air layering.

nwatta It is said that this species is unsuitable for cultivation in the lowland tropics[262]. It is usually grown at elevations between 800 - 3,000 metres in the tropics and down to sea level in the subtropics[262, 418]. It grows best in areas where annual daytime temperatures are within the range 22 - 26°C, but can tolerate 16 - 31°C[418]. When dormant, the plant can survive temperatures down to about -1°C, but young growth can be severely damaged at 0°C[418]. It prefers a mean annual rainfall in the range 1,000 - 1,200mm, but tolerates 650 - 1,800mm[418]. Requires a humus-rich, moist but well-drained soil and a position in the dappled shade[262]. Passiflora species tend to flower and fruit more freely when grown in soils of only moderate fertility[200]. Prefers a circumneutral soil, disliking very acid or very alkaline conditions[262]. Prefers a pH in the range 6 - 7, tolerating 5.1 - 7.5[418]. Plants produce tendrils and climb by attaching these to other plants. Plants are very tolerant of pruning and can be cut back to ground level if required to rejuvenate the plant[202]. Plants in this genus are notably resistant to honey fungus[200]. Flowering Time: Mid Spring Late Spring/Early Summer Mid Summer Late Summer/Early Fall Mid Fall. Bloom Color: Pale Pink Pale Yellow White/Near White. Spacing: 36-48 in. (90-120 cm).

## 9.2.7 Manihot esculenta

Cassava, Tapioca Plant, Yuca

9 tlin 12 cyuc 5 kcaak 2 tcan 2 dwat 3 m hkuc

pollinated by Bees. The plant is self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought.

**kcakta Edible Parts:** Fruit; Leaves Oil Seed**Edible Uses:** Oil PectinFruit - raw or cooked. The flavour can range from sweet to acidic[296 ]. A soft fleshy pulp with a delicious aromatic flavour[296 , 303 ]. Very high in vitamin C, it is also a good source of vitamin A and pectin[296 , 303 ]. The fruit makes a very nice jam and can also be pureed then added to a range of desserts[296 ]. The yellow-skinned fruit can be ovoid or pear shaped, is 4 - 12cm in diameter and can weigh up to 500g[303 ]. An edible oil is obtained from the seeds[301 ]. In some Asian countries such as Indonesia, the leaves are used in cooking[303 ].

**tcanta Charcoal Dye Essential Fencing Fuel Insecticide Oil Parasiticide Pectin Pioneer Tannin Teeth Wood**Backyard tree. Courtyard. Specimen. Small shade tree. Large bright conservatory. Agroforestry Uses: A popular fruit crop with many other uses, the plant succeeds in full sun and quickly establishes itself in pastures etc; it is an excellent pioneer species for use in permaculture when establishing woodland gardens[K ]. The plant has been identified as useful for bio-indication and as a bio-accumulator in India. It is sensitive to sulphur dioxide[303 ]. Other Uses The leaves and bark may be used for dyeing and tanning[272 , 303 ]. The leaves are pounded with coconut milk and other substances to make a dye that turns silk black[307 ]. The leaves are the source of an essential oil that contains methylchavicol, persein and d-pinene[303 ]. The plant has insecticidal properties[303 ]. The heartwood is brown or reddish; the sapwood light brown. The wood is hard, moderately heavy, moderately strong, very elastic and moderately durable. It is used for tool handles, fence posts and in carpentry and turnery[303 , 419 ]. The wood makes excellent firewood and charcoal, at least in part because of its abundance, natural propagation, and classification as an undesirable weed[303 ].

**dwatta Antibacterial Antidiarrhoeal Antiinflammatory Antispasmodic Antitussive Astringent Dysentery Febrifuge Hypoglycaemic Mouthwash Parasiticide Skin Vitamin C Vulnerary**A decoction of the plant is antispasmodic, astringent, febrifuge and vulnerary[272 ]. Guava exhibits antibacterial action against intestinal pathogens such as *Staphylococcus*[303 ]. All parts of the young fruit are astringent[303 ]. The dried ripe fruits are recommended as a remedy for dysentery, while the leaves and fruits are used as a cure for diarrhoea[303 ]. The ripe, fresh fruit is eaten as a cure for constipation[311 ]. Water from soaking the fruit is good to treat diabetes[303 ]. The clear fruit juice has been recommended as a treatment for hepatitis, gonorrhoea, and diarrhoea[303 ]. The oil from the seed contains bisabolene and flavonoids that exhibit anti-inflammatory properties[303 ]. Compounds in the leaves have shown antidiabetic activity[311 ]. The leaves are used as a treatment for diarrhoea, coughs, stomach ache and dysentery [307 , 311 ]. The leaves are pounded, squeezed in salt water and the solution is used to treat toothaches[311 ]. A decoction of the leaves or bark is taken externally as a lotion for skin complaints, ringworm, wounds, and ulcers[303 ]. The bark, mixed with the roots of *Achyranthes aspera* and *Urena lobata*, is used to treat diarrhoea and dysentery[272 ].

**nrakta S.** America from Peru north to Mexico and the Caribbean. **ksacta** Common in disturbed places often forming thickets in pastures, plantations and other similar habitats in the Pacific Islands[311 ].

**propta Seed** - very easy, plants will often self-sow very freely[296 ]. Seedlings tend to be true to their parents and can fruit within 3 years of germinating[296 ]. Seed can be sown in beds, pots or directly in the field at a depth of 1 cm; germination occurs within 15 - 20 days[303 ]. They should be planted out when about 25 cm high[303 ]. Air-layering. Cuttings. Grafting.

**nwatta** The guava is a hardy tree that adapts to a wide range of growing conditions from the humid lowland tropics to the cooler elevations, fruiting at elevations up to 1,500 metres and surviving as high as 2,000 metres[200 , 303 ]. It can stand a wide range of temperatures; the highest yields are recorded at mean temperatures of 23 - 28°C, whilst in the subtropics quiescent trees can withstand light frost, and 3.5 - 6 months (depending on the cultivar) of mean tempera-

tures above 16°C are sufficient for flowering and fruiting[303 ]. When dormant, the plant can survive temperatures down to about -5°C, but young growth can be severely damaged at -1°C[418 ]. It can also tolerate low to moderate rainfall levels though, for good fruiting, it requires at least 1,000mm per annum with a clear dry period to allow its fruit to ripen[200 ]. It prefers a mean annual rainfall in the range 1,000 - 3,000mm, but can tolerate 400 - 5,000mm[418 ]. For maximum production in the tropics it requires rainfall distributed over the year[303 ]. If fruit ripens during a very wet period it loses flavour and may split[303 ]. Prefers a fertile, moisture-retentive soil and a sunny position[307 ]. Plants are tolerant of a range of soil conditions[200 ]. Moderately tolerant of saline soils[404 ]. Prefers a pH in the range 5.5 - 7.5, tolerating 4 - 8.5[418 ]. The plant is more drought-resistant than most tropical fruit crops[303 ]. The guava often escapes from cultivation and is considered a noxious weed in many tropical pasture lands - its proliferation may result in the abandonment of a pasture[303 ]. There are many named varieties, selected for their superior fruit forms[301 ]. Plants have some deep roots, but do not form a taproot[303 ]. The trees flower all year round[307 ]. Seedlings may flower within 2 years; clonally propagated trees often begin to bear during the first year after planting[303 ]. Trees reach full bearing after 5 - 8 years, depending on growing conditions and spacing[303 ]. The guava is not a long-lived tree (about 40 years), but the plants may bear heavily for 15 - 25 years[303 ]. Average yields are between 30 - 40 kg/plant in 5-year-old plants and will reach a maximum production of 50 - 70 kg at about 7 years if well managed[303 ]. Flowering Time: Late Spring/Early Summer. Bloom Color: White/Near White. Spacing: 20-30 ft. (6-9 m).

## 9.2.5 Carica papaya

Papaya, Mamo, Melon Tree  
9 tlin 12 cyuc 5 keak 3 tcan 3 dwat 8 m hkuc  
htut cyutli tcup hwicli hrasjlutnyik hpa7tli frusfatprikhwisslip hpa7tmwatli dyat hjonli

**drutta** *Carica papaya* is an evergreen Tree growing to 8 m (26ft) by 4 m (13ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees, Moths, Wind. The plant is not self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers moist soil. The plant is not wind tolerant.

**pcista** Older leaves contain the alkaloid carpain[ 298 ].

**kcakta Edible Parts:** Flowers Fruit Leaves Seed**Edible Uses:** Condiment Drink**Edible portion:** Fruit, Flowers, Leaves, Vegetable, Seeds - spice. Fruit - raw or cooked. The vitamin-rich fruit has a firm, creamy texture and a delightful flavour reminiscent of melon and apricot[ 200 ]. Delicious raw[ 301 , K ], it is a very versatile fruit and can also be preserved, dried, cooked in pies, made into jam, ice cream, jellies, sherbets etc[ 301 ]. The immature green fruit can be eaten as a vegetable, either boiled, baked, made into chutneys, jams or added to vegetable soups etc[ 296 , 301 ]. Seeds - used as a spice, especially in salad dressings[ 296 , 301 ]. A pungent, mustard and cress-like flavour[ 238 ]. Male flowers - cooked and used as a green vegetable[ 296 ]. A bitter flavour; it is probably best to change the water at least once during the cooking[ 296 ]. Very young leaves - cooked[ 298 , 418 ]. A strong bitter flavour[ 298 ]. Some caution is advised since older leaves contain alkaloids[ 298 ].

**tcanta** Fibre Insecticide Mulch Parasiticide Soap**Other uses rating:** Medium (3/5). Agroforestry Uses: Young leaves are used as mulch[ 418 ]. Other Uses The dried leaves can be beaten in water to form a soap substitute[ 298 ]. Papain, found in its greatest concentration in the latex in the skin of unripe fruits, has a multitude of uses. It is added to cosmetic skin creams, termite control, used in clarifying beer, degumming natural silk etc[ 200 , 418 ]. A fibre obtained from the plant can be up to 150cm long, but it is of questionable utility[ 454 ]. The whitish or pale yellow wood is very soft, very lightweight, and fleshy. There is a large white pith, and the centre of the trunk is hollow except at nodes. The wood is not used[ 447 ].

masses[310 ]. Also found along roadsides at elevations from sea-level up to 1,000 metres[310 ].

**propta** Seed - sow in situ in moist to wet soil[300 ]. Only the annual form is usually propagated this way[300 ]. Germination rates of local cultivars are often low (less than 60%) because of hard-seediness induced by long storage. Reliable seed companies supply improved cultivars with a high (in excess of 80%) germination percentage. The seeds do not germinate well at temperatures lower than 25°C[299 ]. Cuttings of young shoots at any time of the year. The shoots readily produce roots, even whilst still on the parent plant[300 ].

**nwatta** Swamp morning glory is a plant of the moist to wet, lowland tropics, where it is found at elevations up to 1,000 metres. It grows best in areas where annual daytime temperatures are within the range 15 - 35°C, but can tolerate 10 - 40°C[418 ]. It prefers a mean annual rainfall in the range 2,000 - 2,500mm, but tolerates 700 - 4,200mm[418 ]. Plants grow well in full sun[296 ]. A very easy plant to grow, it succeeds in bathtubs, ponds and still water[296 ]. Succeeds in a wide range of soils, including heavy clays[300 ]. Best leaf production comes from plants grown in soils rich in organic matter[298 ]. Prefers a pH in the range 5 - 7, tolerating 4.3 - 7.5[418 ]. The plant is widespread as a swamp weed in all tropical and many subtropical lowland areas. It is a declared aquatic or terrestrial noxious weed in the south-eastern United States[299 ]. A very fast-growing plant, it starts developing lateral branches from cotyledonary buds 2 - 3 weeks after sowing. Thereafter the main axis and both laterals each produce about one leaf every 2 - 3 days[298 , 299 ]. Cultivars selected for once-over harvest or uprooting have retarded branching or almost no branching. Their harvest takes place 21 - 30 days after sowing[296 , 299 ]. Cut and come again harvesting of vegetatively propagated plants or wild plants can start about one month after plant establishment[299 ]. Flowering commences after 2 - 5 months, but the plant continues to form new leaves and branches[299 ]. Swamp morning glory is a quantitative short-day plant, early flowering being induced by short days of less than 12 hours. Flowering is also stimulated by drought[299 ]. There are some named varieties[301 ]. Two main forms exist in cultivation: A short-lived perennial form grows in very wet soils and water (it has been named *Ipomoea aquatica aquatica* by some authorities). This form can produce yields of up to 90 tonnes per hectare in Thailand[300 ]. An annual creeping form tolerates drier conditions (this has been named *Ipomoea aquatica reptans*)[300 ]. Under dryland cultivation, yields per crop can range from 7 - 30 tonnes per hectare, averaging 20 tonnes. In theory one crop can be produced every month leading to a potential yield of around 240 tonnes per hectare in a year[299 ] produce.

# 8 8 tlin

## 8.1 bwon

### 8.1.1 Castanospermum australe

Moreton Bay Chestnut  
tfo2n 8 tlin 12 cyuc 4 keak 3 tcan 1 dwat 25 m hkuc  
htut cyutli tcup hwicli hrasjlutnyik hpa7tli frusfatprik hpa7tmwatli xr7 hjonli

**drutta** *Castanospermum australe* is an evergreen Tree growing to 25 m (82ft) by 20 m (65ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 9. It is in leaf all year, in flower from September to October. The species is hermaphrodite (has both male and female organs) and is pollinated by Birds. It can fix Nitrogen. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist soil.

**pcista** The immature seed is poisonous, though mature seeds are harmless[167, 240]. Another report says that the raw seed is poisonous and needs treatment to render it edible[193].

**kcakta Edible Parts:** Seed**Edible Uses:** Seed - cooked[ 1 , 46 , 61 , 105 ]. The fresh raw seed contains high levels of

saponins[ 238 ] and can be harmful[ 34 , 63 ]. The cooked seed tastes like a sweet chestnut[ 2 ]. It probably requires considerable leeching before it is safe to eat[ 144 ]. The Australian aborigines finely sliced the seeds and soaked them in running water for 10 days before roasting them and grinding them into a powder[ 193 ]. This powder could be stored for later use[ 193 ]. The seeds are about 3 - 4.5cm wide and are carried in pods 10 - 25cm long and containing 3 - 5 seeds[ 193 , 260 ].

**tcanta** Miscellany Wood**Other uses rating:** Medium (3/5). Flowering tree, Public open spaces, Street tree, Specimen. Agroforestry Uses: The extensive root system is used to protect riverbanks and catchment areas in Australia[ 303 ]. Other Uses The seeds have a high saponin content[ 238 ]. Although the report does not elaborate, the saponins could probably be used as a soap substitute[ K ]. The seeds contain toxic saponins which are reportedly toxic to a serious pest of stored grain[ 303 ]. The wood can be used as a fuel[ 303 ]. Wood - durable, resists decay, hard, heavy, polishes well, has a high resistance to the passage of electric current. The sapwood varies from white to yellow. The heartwood is dark-brown to almost black, slightly greasy and straight grained but sometimes interlocked[ 303 ]. Used in construction, cabinet making, carving etc[ 61 , 144 , 156 , 167 ]. One of the most valuable woods in Australia, the sliced veneers can be good substitute for teak[ 303 ]. The wood has a density of 700 kg/cu m[ 303 ].

**dwatta** Astringent Miscellany**The seed yields compounds called castanospermine that are under investigation as HIV inhibitors and might be useful in the treatment of AIDS[ 200 , 238 , 260 , 303 ]. The seedpods are astringent[ 240 ]. Used to treat post-prandial hyperglycaemia in diabetic patients[ 303 ].**

**nrakta** Australia - New South Wales, Queensland. **ksacta** Subtropical and tropical gallery-type rainforests and on the banks of creeks[ 144 , 303 ], usually in good rich moist soils[ 167 ].

**propta** Seed. Prick out the seedlings into individual deep pots as soon as they are large enough to handle and plant out when 15cm or more tall.

**nwatta** Industrial Crop: Starch Management: Standard Regional CropA tree of moist, lowland tropical and subtropical climates, it grows best at an elevation between 50 - 750 metres[ 303 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 32°C, but can tolerate 10 - 41°C[ 418 ]. It prefers a mean annual rainfall in the range 1,600 - 3,200mm, but tolerates 1,000 - 3,800mm[ 418 ]. Requires a very well-drained[ 260 ] but moist high-grade soil and a very sunny position when grown in areas cooler than its natural climate[ 167 , 200 ]. Prefers a pH in the range 5 - 6, tolerating 4.5 - 6.5[ 418 ]. The crushed leaves smell like cucumbers[ 193 ]. Flowers are produced on the old wood[ 260 ]. The flowers are rich in nectar and are pollinated by parrots in the wild[ 260 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[ 200 ].

### 8.1.2 Saccharum hybrids

Energy Cane  
tfo2n 8 tlin 12 cyuc 4 keak 4 tcan 2 dwat 6 m hkuc  
htut cyutli tucpja7n hwicli hrasjlutnyik hpa7tli frusfatprik-wishom hpa7tmwatli hjonli

**drutta** *Saccharum hybrids* is a PERENNIAL growing to 6 m (19ft) by 1.5 m (5ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and saline soils. It cannot grow in the shade. It prefers moist or wet soil.

**pcista** Sugarcane production has probably caused more biodiversity loss than any other crop [1-1].

**kcakta Edible Parts:** Sap Stem**Edible Uses:** Carbon Farming Solutions - Staple Crop: sugar (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world)[1-1].

**tcanta** Fodder**Carbon Farming Solutions - Industrial Crop:** biomass (Crops grown for non-food uses. Industrial

crops provide resources in three main categories: materials, chemicals, and energy. Traditional materials include lumber and thatch, paper and cardboard, and textiles [1-1]. "Noble" cane types are optimized for sugar production while Energy cane types have three times the fiber for use as biofuel. Many energy canes are the result of crosses with biomass grasses like Miscanthus, raising the interesting possibility of cold-tolerant sugarcane [1-1]. Fodder: bank. dwatta Possible. See individual species.

nrakta Not known as a wild plant. Hybrid of Asian species. ksacta Originated in cultivation.

propta Seed - Cuttings, consisting of 2 - 3 joints of the upper part of a stem that has been selected from a vigorous, healthy plant. They are placed in the ground with only 2 - 5cm of the cutting projecting above the surface. In about two weeks from planting the 'eyes' at each node will send forth shoots, and roots will grow from the nodes themselves. As the shoots develop, the parent stem decays and the young plants produce roots of their own[459 ].

nwatta Fodder: Bank Industrial Crop: Biomass Management: Hay New Crop Staple Crop: SugarClimate: subtropical to tropical. Humidity: humid. Carbon Farming Solutions - Cultivation: new crop. Management: hay (Describes the non-destructive management systems that are used in cultivation) [1-1]. Need not be grown in large monocultures as is common in homegardens around the world [1-1]. Global sugarcane biomass yields averaged 70.2t/ha in 2012 [1-1]. Sugarcane and energy cane breeding is active and ongoing including GMO types.

### 8.1.3 Saccharum officinarum

Sugarcane, Purple Sugar Cane

t2n 8 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 6 m hkuc htut cyutli tucphja7n hwicli hrasljutnyik hpa7tli frusflatprikli-wishsom hpa7tmwatli hjonli

drutta Saccharum officinarum is a PERENNIAL growing to 6 m (19ft) by 1.5 m (5ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and saline soils. It cannot grow in the shade. It prefers moist or wet soil.

pcista Leaves and sheaths of some varieties are covered with a large number of siliceous hairs. These hairs penetrate the skin of cane cutters and are most unpleasant; hence cane cutters prefer varieties with few hairs or burnt cane[418 ]. (Plant has spines or sharp edges; use extreme caution when handling )

kcakta Edible Parts: Sap StemEdible Uses: Drink SweetenerThe stems contain a very sweet sap[46 ]. They are crushed to extract this sap, which is then used in a variety of ways. It can be used as a sweet, refreshing drink, though it is more commonly concentrated to make syrups or dried to make sugar, molasses etc[46 ]. The core of fresh stems is chewed as a sweet refreshment[301 ].

tcanta Alcohol Biomass Fibre Fodder Fuel Insulation Paper Polish WaxAgroforestry Uses: Sugar cane is a very greedy crop that soon exhausts the soil. In some countries the plant is intercropped with indigo or other leguminous plants between the rows when the canes are first planted. These legumes are turned into the soil while they are still green and succulent. This process has a very beneficial effect[459 ]. Other Uses A wax obtained from the stems resembles carnauba wax[46 ]. It is used in the production of furniture, shoe, and leather polishes, electrical insulating material, and waxed paper[418 ]. The sweet sap from the stems can be manufactured into alcohol for used as a fuel in infernal combustion engines[46 ]. The stems are a source of fibre used for making paper[46 ]. Bagasse is the residue of the cane after the sugar is extracted. It is used as a fuel and for the manufacture of fibreboard, paper pulp, plastic, furfural, and cellulose[46 , 418 ]. Nitrogen fixation during decomposition of sugarcane (Saccharum officinarum) is an important contribution to nutrient supply in traditional dryland agricultural systems of Hawaii[1].

dwatta UrinaryThe leaf ash is used to treat sore eyes[311 ]. The stem juice is used to treat sore throats[311 ]. The sweet juice in the stem is used to treat snakebite and wounds from poison arrows[348 ]. Mixed with an infusion

of 'wallaba' (Eperua sp.) it is used to treat curare poisoning[348 ] A decoction of the young leaves is used to treat urinary conditions[348 ].

nrakta Originated in cultivation. ksacta Not known as a wild plant.

propta Seed - Cuttings, consisting of 2 - 3 joints of the upper part of a stem that has been selected from a vigorous, healthy plant. They are placed in the ground with only 2 - 5cm of the cutting projecting above the surface. In about two weeks from planting the 'eyes' at each node will send forth shoots, and roots will grow from the nodes themselves. As the shoots develop, the parent stem decays and the young plants produce roots of their own[459 ].

nwatta Agroforestry Services: Nitrogen Fodder: Bank Global Crop Industrial Crop: Biomass Industrial Crop: Wax Management: Hay Other Systems: Dyke-pond Other Systems: Homegarden Staple Crop: Sugar-Most commercial sugarcane is grown at latitudes between 35N and S in the tropics, usually at elevations from sea level to 1,600 metres[418 ]. The plant grows best in areas where the mean annual rainfall is in the range 1,500 - 2,000mm, tolerating 1,000 - 5,000mm[418 ]. It prefers a mean annual temperature within the range 24° - 37°c, though can tolerate 15 - 41°c[418 ]. There are large differences between different cultivars in their tolerance to cold and susceptibility to frost[418 ]. Generally long-term exposure to temperatures below 10c can be lethal, whilst even short periods at 0°c causes the leaves to become chlorotic, at about -3°c young plants turn brown and the terminal buds and leaves of mature cane die, when the temperature reaches -11.5c the whole plant dies[418 ]. Grows best in a sunny position. A very greedy plant, soon exhausting the soil of nutrients[459 ]. The plant is considered to be moderately tolerant to saline soil conditions and relatively tolerant of acid soils[418 ]. Grows best in a position sheltered from strong winds[418 ]. Prefers a pH in the range 5 - 8, but can tolerate 4.5 - 9[418 ]. Well-grown plants can become invasive[200 ]. When irrigated, yields of 100 - 150 tons of cane can be obtained from mature plants[418 ]. Young plants can yield 60 - 90 tons[418 ]. There are many named varieties[301 ]. The roots develop from the growth ring on the original planting piece and also from the new shoots that develop. The majority of the roots are thin and superficial with four fifths of the roots commonly found in the top 25 - 50cm of the soil. Thicker roots will penetrate to depths of 4 metres or more[418 ]. Flowering Time: Late Winter/Early Spring. Bloom Color: White/Near White.

## 8.2 mran

### 8.2.1 Phoenix dactylifera

Date Palm

8 tlin 12 cyuc 5 kcaak 3 tcan 2 dwat 25 m hkuc htut cyutli hgatkuyuctup hwicli hrasljutnyik hpa7tli prikl-wissliphsom hpa7tmwatli dyat hjonli

drutta Phoenix dactylifera is an evergreen Tree growing to 25 m (82ft) by 7 m (23ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 9. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista Plant has spines or sharp edges; use extreme caution when handling

kcakta Edible Parts: Flowers Fruit Pollen SapEdible Uses: Drink SweetenerFruit - raw or cooked[297 ]. The fruit is often dried and then eaten raw or used to add sweetness to a variety of foods such as cakes, fruit pies, confectionary etc[301 , K ]. The fruit is about 5cm long, 2.5cm in diameter, produced in clusters that can be as large as 1,500 fruits[335 ]. Male inflorescence - eaten as a delicacy[301 ]. Pollen is eaten[301 ]. Wherever fruiting is poor, the sap is tapped and becomes the main product from the tree[303 ]. It can be drunk fresh, fermented and drunk as toddy, or distilled and drunk as the spirit 'arrack'[303 ].

tcanta Basketry Fencing Fibre Fire retardant House-plant Insulation Roofing Soil reclamation String Thatching Weaving WoodAgroforestry Uses: Being a salt-tolerant species, the date has been used for decades for the revegetation of salt affected lands in the Mediterranean region[303

ing cashew nuts at home. 1. It is best to fill a lidded oven-safe pot with sand and bury the unopened nuts completely in the sand. Use an old pot as after processing the pot will not be suitable to use for any other purpose due to traces of the caustic latex that may remain behind. I have a lidded casserole dish dedicated solely for this purpose. 2. Preheat the oven to around 250 deg C and roast the nuts in their shell for 10 minutes. Make sure to have windows open and the kitchen well ventilated as the heat causes the shell to crack and the caustic latex to ooze out. While the sand will absorb the oil, it may also emit a caustic choking smoke, avoid inhaling this! Take extreme care opening the oven door. I would recommend taking the lidded pot outdoors before removing the lid. Better still, if you have an outdoor stove, use that from the start. 3. Wear disposable gloves when you open the pot and carefully remove the nuts from the sand as they may have some oil residue. Place the whole roasted nuts in a dish of water and detergent and thoroughly wash them. 4. It should now be safe to open the shell and remove the kernel. Finally, remove the thin brown paper cover from the kernel. 5. Note that if any of the latex has stuck to the roasted kernel during processing then that nut(kernel) is not edible and must be thrown out. 6. If like me you are a hobby gardener or a subsistence farmer, and not growing commercial quantities, the unopened nuts can be stored for a couple of years until enough nuts have been stored to warrant processing. My tree produced one cashew apple and nut in its first year and I certainly was not going to go through that process for one solitary nut!

tcanta Adhesive Charcoal Fuel Gum Hedge Ink Insecticide Oil Plant support Preservative Soil stabilization Tannin Varnish Waterproofing WoodOther uses rating: Medium (3/5). Backyard Tree, Courtyard, Large Planter; xerophytic. Agroforestry Uses: Because it grows well on poor sandy soils and near the coast, it has sometimes planted for erosion control[ 63 , 200 , 303 ]. It has been intercropped with cowpea, groundnuts and horsegram in India[ 303 ]. In Andhra Pradesh and Orissa in India, casuarina and coconut constitute a popular crop combination[ 303 ]. Plants are often used as a support for growing cultivated vanilla[ 200 ]. Other Uses The fruits contain 45 - 47% oil which has high heat resistance[ 46 ]. It is an excellent lubricant and is also used in varnishes, inks, termite proofing wood, insulating coatings etc[ 46 ]. The bark contains an acrid sap of thick brown resin, which becomes black on exposure to air. This is used as indelible ink in marking and printing linens and cottons[ 303 ]. The resin is also used as a varnish, a preservative for fishnets and a flux for solder metals[ 303 ]. The stem yields an amber-coloured gum, which is partly soluble in water; the main portion swelling into a jellylike mass[ 303 ]. This gum is used as an adhesive (for woodwork panels, plywood, bookbinding), partly because it has insecticidal properties[ 303 ]. It is also used in inks, dyes and varnishes[ 46 , 200 ]. The acrid sap of the bark contains 3-5% tannin and is employed in the tanning industry[ 303 ]. One of the components of the bark gum acts as a vesicant and has insect repellent properties[ 303 ]. The toxic, acrid oil in the shell has high polymerizing and friction-reducing properties and is used as a waterproofing agent and preservative[ 324 ]. It can be used for treating fishing nets, woodwork etc in order to repel termites[ 63 , 200 ]. The oil in the shell can also be added to paraffin to make it more effective in controlling mosquito larvae[ 63 ]. It has been used in the manufacture of plastics, and in the manufacture of certain sorts of paints such as are used for ship's keels, cement surfaces and where corrosive influences preclude the use of ordinary paint[ 63 ]. Distilled and polymerized, the oil is also used in insulating varnishes and in the manufacture of typewriter rolls, oil- and acid-proof cements and tiles, friction-modifying material for brake linings, as a component of space-rocket lubricants, inks, etc[ 324 ]. The reddish-brown wood is light in weight, fairly hard, but is subject to termite attack[ 303 , 324 , 404 ]. It is sometimes used for construction and general carpentry[ 324 ]. It is usually of unsuitable dimensions for construction[ 63 ]. Pulp from the wood is used to fabricate corrugated and hardboard boxes[ 303 ]. The wood makes a good charcoal and fuel[ 63 ]. The residue of the shell is often used as fuel in cashew nut shell liquid extraction plants[ 63 ].

dwatta Anti-diarrhoeal Antifungal Antiscurbic Astringent Astringent Cholera Contraceptive Diuretic Febrifuge Foot care Hypoglycaemic Leprosy Malaria Purgative Rubefacient Skin Vesicant VesicantThe leaves are febrifuge[ 238 ].

They are used in west Africa in the treatment of malaria[ 254 ]. In India and Africa the leaves are used to treat toothache and gum problems[ 254 ]. The leaves can be harvested at any time and dried for later use[ 238 ]. The bark is astringent, rubefacient and vesicant[ 303 ]. Research has shown that it is also hypoglycaemic, having the ability to reduce blood sugar levels[ 238 ]. The bark is used in Ayurvedic medicine to detoxify snake bites[ 254 ]. The bark is harvested as required and used fresh or dried[ 238 ]. Leaf and bark infusions are used in the treatment of toothache and sore gums, whilst the bark and leaf extracts and fruit juice are taken internally to treat diarrhoea[ 238 ]. The fruit is anti-scurbutic, astringent and diuretic[ 238 , 303 ]. Cashew syrup is a good remedy for coughs and colds. Cashew apple juice is said to be effective for the treatment of syphilis, and is also used in the treatment of cholera and kidney troubles[ 303 ]. The fresh, acrid juice inside the shell is vesicant[ 324 ]. It has been used for removing warts[ 63 , 238 ] as well as for treating ringworm, leprosy and corns[ 238 ], and is applied to the soles of the feet to cure cracks in the skin[ 303 ]. It is toxic to many disease-causing organisms, such as Staphylococcus bacteria[ 238 ]. The sap, or bark extract[ 238 ], is considered to be contraceptive[ 307 ]. The gum is bactericidal, fungicidal and kills worms and protozoa[ 254 ]. It is applied externally in the treatment of leprosy, and for corns and fungal conditions[ 254 ]. An infusion of the root is an excellent purgative[ 303 ].

nrakta S. America - Brazil. ksacta Arid thickets in stony, sandy soils at elevations around 600 metres[ 200 , 307 ]. Sand dunes near the sea[ 419 ].

propta Seed - traditionally sown in situ, germination usually taking place in 8 - 10 days[ 63 ]. 100% germination has been reported for seed that has been stored 4 months in open conditions, this drops to 50% after 10 months and zero after 14 months[ 303 ]. Plants produce a long tap root and do not always transplant very well[ 63 ]. Cuttings of ripe wood at the end of the growing season[ 238 ]. Layering.

nwatta Agroforestry Services: Living fence Global Crop Industrial Crop: Oil Management: Standard Other Systems: Homegarden Staple Crop: Protein-oilA plant for lowland tropical and subtropical areas, succeeding at elevations up to 1,000 metres[ 324 ]. Grows well in hot, semi-arid, frost-free climates, fruiting well with an annual precipitation of 500 - 900mm[ 200 ]. It occurs in warm and humid climates with an annual rainfall of 1,000 - 3,500 mm[ 303 , 324 ]. Prefers a pronounced dry season of 3 - 4 months[ 324 ]. Plants are not tolerant of frost, preferring a minimum temperature no lower than 18c[ 238 , 303 ]. Plants produce their best crops when grown not too far from the coast[ 63 ]. Cashews can also be grown satisfactorily in semi-arid areas but can show erratic production as a result of relative small variations in rainfall[ 324 ]. An easily grown plant requiring very little attention once established, it succeeds in soils that are too poor to support other crops[ 63 , 200 ]. Prefers a well-drained sandy soil and a position in full sun[ 238 ]. The species can bear heavy, waterlogged clay soils or saline soils but with an extreme poor growth[ 404 ]. Brackish soils near seashores and inundated or swampy soils are not suited[ 404 ]. Tolerates a pH in the range 4.5 - 6.5[ 200 ]. Established plants are drought resistant[ 200 , 324 ]. Tolerant of maritime exposure[ 63 ]. Early growth is usually rapid, with young trees sometimes flowering when only 18 months old[ 63 ]. Although slow-growing, it can commence bearing when only 4 - 5 years old[ 200 , 307 ]. Trees are fast growing[ 324 ]. Trees have a productive life span of 30 - 40 years, normally beginning to bear in their third or fourth year and, under favourable conditions, attaining maximum production in around 7 years[ 324 ]. There are many named forms[ 200 ]. The root system of a mature tree, when grown from seed, consists of a very prominent taproot and a well-developed and extensive network of lateral and sinker roots[ 303 ]. Spacing over 40 ft. (12m).

### 9.2.4 Psidium guajava

Guava, Tropical Guava, Goiaba, Araçá-goiaba 9 tlin 12 cyuc 5 kcaak 5 tcan 2 dwat 10 m hkuc htut cyutli hgattucp hwicli hrasljutnyikrip hpa7tli frusflat-priksom hpa7tmwatli fyif hjonli

drutta Psidium guajava is an evergreen Tree growing to 10 m (32ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are

taanta Fodder OilSummer shade tree. Backyard tree. Xerophytic. Other Uses: The pulp and the seeds contain fatty acids, such as oleic, lanolic, palmitic, stearic, linoleic, capric and miristic acid which constitutes 80% of the fruits fatty content. The non-drying oil extracted from the seed is used by the cosmetic industry in soaps and skin moisturizer products[303 ]. The fresh fruit pulp is massaged into the hair and scalp as a vitamin-rich hair tonic and restorer[307 ]. A reddish-brown dye obtained from the seed is used for marking clothes[307 , 447 ]. Watery extracts of the avocado leaves contain a yellowish-green essential oil[303 ]. The ground-up seed mixed with cheese is used as a rat and mouse poison[303 ]. The heartwood is light brown; the sapwood is whitish. The wood is moderately soft, heavy, brittle, but not durable. It is brittle, and susceptible to termite attack[303 ]. It has been used for house building (especially for house posts), light construction, furniture, cabinet making, agricultural implements, carving, sculptures, musical instruments, paddles, small articles like pen and brush holders, and novelties. It also yields a good-quality veneer and plywood[303 , 307 , 447 ]. More popular for its fruits the wood of avocado is seldom used[303 ].

dwatta DysenteryThe avocado has long been used medicinally, with most parts of the plant being employed[254 ]. There has been some research into the medicinal properties of the plant that support traditional uses. Research has shown that there is anti-cancerous activity in extracts of the leaves and fresh shoots[303 ]. Leaf extracts have shown antihypertensive activity[348 ] The leaf and seed contain cyanide[348 ]. The oil from the seeds contains steroids that are used for pharmaceuticals[348 ]. The seed extract has an erythroagglutinating property[348 ]. The fruit contains reductase and transferase enzymes[348 ]. The leaves are astringent, carminative, antitussive, emmenagogue and hypotensive[238 , 348 ]. An oral infusion of the leaves is used to treat dysentery[303 ]. It is also used for relieving coughs, lowering blood pressure, treating liver obstructions, promoting menstrual flow and for clearing high uric acid levels in the body which could lead to gout[254 , 348 ]. Combined with *Tripogandra serrulata*, they are used as a remedy for biliousness[348 ]. The bark is astringent, carminative, antitussive and emmenagogue[238 ]. It is used in the treatment of diarrhoea[348 ]. The fruit pulp is emollient, carminative and helps lower blood cholesterol levels[238 ]. The mashed fruit pulp is a nourishing food that is considered to have aphrodisiac properties[254 ]. From unripe fruit used to induce abortion. Used externally, the pulp is cooling and soothing to the skin - it is applied to suppurating wounds and to the scalp to promote hair growth[254 ]. The skin of the fruit has anthelmintic properties and is used traditionally for expelling worms[238 , 254 , 303 ]. The seed is ground and made into an ointment used to treat various skin afflictions, such as scabies, purulent wounds, lesions of the scalp and dandruff[303 ]. Oil extracted from the seeds has astringent properties[303 ].

nrakta Central America - Mexico. ksacta Humid lowland forests on limestone formations[307 ].

propta Seed - sown fresh it can germinate in about a month - this can be reduced to about 17 days if the seed coat is removed[200 ]. Seedling trees can flower within 5 - 7 years[200 ].

nwatta Fodder: Fruit Global Crop Industrial Crop: Medicinal Management: Standard Other Systems: Home-garden Other Systems: Multistrata Staple Crop: OilDifferent forms of the plant can succeed in a range of climates, ranging from subtropical with occasional frosts to lowland and highland tropics, where it can be grown at elevations as high as 2,800 metres. It grows best in areas where annual daytime temperatures are within the range 14 - 40°C, but can tolerate 10 - 45°C[418 ]. When dormant, the plant can survive temperatures down to about -4°C, but young growth can be severely damaged at -1°C[418 ]. It prefers a mean annual rainfall in the range 500 - 2,000mm, but tolerates 300 - 2,500mm[418 ]. Prefers a rich, neutral to alkaline soil and a position in full sun[307 ]. Succeeds on all kinds of soil[200 ]. Requires a well-drained soil, the plant is intolerant of water-logging[200 , 296 ]. West Indian rootstocks are fairly tolerant of saline conditions, though other forms are intolerant[200 ]. Prefers a pH in the range 5 - 5.8, tolerating 4.5 - 7[418 ]. Requires a position sheltered from strong winds[296 ]. Seedlings take 6-8 years to produce fruit, whilst grafts can start fruiting in their second year[296 ]. Yields of

15 tonnes per hectare have been recorded, but averages are about half that figure[200 ]. Mature fruit can be left hanging on the tree for weeks without damage[200 ]. The three main races of Avocado are as follows. There are many named varieties of each race:- Mexican. This is the hardiest form, succeeding in subtropical climates and not well adapted to lowland tropical conditions[303 ]. It can withstand short periods when temperatures drop as low as -6°C[303 ]. The optimum temperature for growth is between 14 - 25°C[303 ]. It has the highest oil content, over 20% and up to 30%[200 ]. Guatemalan. This form is semitropical. It can withstand short periods when temperatures drop as low as -4°C[303 ]. The optimum temperature for growth is between 15 - 28°C[303 ]. It has a medium oil content generally between 10 - 20%[200 ]. West Indian. This form is wholly tropical and grows well in a lowland tropical climate[303 ]. It can grow in a temperature range of 12 - 40°C, though the optimum is between 24 - 32°C[303 ]. It has the lowest oil content, generally below 10%, down to around 3%[200 ]. Although the flowers are hermaphrodite, the male organ produces pollen when the females are not receptive and so each tree is functionally self-sterile. Therefore at least two different trees are required for pollination[296 ]. Each avocado flower opens twice. The female part ripens first, then the flower closes to open many hours later in the male stage[200 ]. In the Mexican form, this gap is more than 24 hours, from morning to the next afternoon, whilst in the Guatemalan it is less than 24 hours[200 ]. Flowering Time: Mid Spring Late Spring/Early Summer. Bloom Color: Pale Green. Spacing: 20-30 ft. (6-9 m).

## 9.2.3 Anacardium occidentale

Cashew, Caju

9 tin 12 cyuc 5 kcaak 3 tcan 3 dwat 12 m hkuc htut cyutli hgattuc hwicli vyhysrjaslutnykrip hpa7tli flatprikliwis hpa7tmwatli fyf hjonli

drutta *Anacardium occidentale* is an evergreen Tree growing to 12 m (39ft) by 20 m (65ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Flies, Bees, Ants, Wind. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcista The shell of the nut contains an acrid juice that acts as a powerful vesicant[ 63 ]. The active ingredient is cardole and it is poisonous in the same way as poison ivy (*Toxicodendron spp.*)[ 63 , 200 ]. Very irritant to the skin, causing severe blistering[ 63 ]. It is destroyed by heat, so roasting the seed whilst in its shell renders it completely safe[ 63 , 200 ].(Handling plant may cause skin irritation or allergic reaction )

kcakta Edible Parts: Fruit Leaves Oil SeedEdible Uses: Gum OilEdible portion: Nut, Leaves, Fruit pulp, Flavoured, Vegetable, Seeds, Oil. Fruit - raw or cooked. Juicy and refreshing, though they are a bit acidic and often have an astringency that can leave your mouth feeling furry[ 63 , 296 ]. They are also somewhat fibrous[ 63 ]. They can also be dried or sliced with other fruits[ 296 ]. The fruit can also be lightly cooked to get rid of their astringency[ 296 ]. A refreshing juice can be extracted from the fruit[ 63 ]. Red fruits are considered to be superior to yellow fruits[ 307 ]. The apple is used to make spirits. The fruit is about 3cm long[ 307 ]. Seed - must be cooked before being removed from its shell[ 63 ]. Slightly sweet with a pleasant, bland flavour[ 63 ]. Eaten on their own, salted and used in a wide range of confections[ 63 ]. They can also be used as the basis of savoury protein-rich meat-alternative dishes[ K ]. Caution should be employed when harvesting the seed - see notes above on toxicity. An edible oil is obtained from the seed but, due to the high value of the seed, the oil is not usually extracted[ 324 ]. Young leaves and shoots - raw in salads or cooked[ 298 , 320 , 404 ]. Eaten in S.E. Asia, but too astringent for most tastes[ 298 ]. They are picked during the rainy season and eaten fresh with hot and spicy dishes. One of our users, Carol, from the tropics of northern Australia, kindly forwarded the following information. Safely process-

]. Whilst young, date trees occupy a lot of space, so a decision to introduce it into cultivated fields must be taken carefully. But once mature, the wide crown grows high above the field crops, and it little affects the yield of cultivated crops. In many places, numerous palms are found in arable fields of suitable regions[303 ]. Other Uses The leaves are widely used for a variety of purposes. They make an excellent thatch, being used to make roofs and walls of huts. A fibre obtained from the leaves, base of the leaves and bark can be used to make ropes, baskets, hats and mats[46 , 200 , 302 ]. A fibre obtained from the leaf petiole, combined with other suitable material, is used for making insulating boards[303 ]. Dried leaves, with their stiff, woody rachis, are used for fencing[303 ]. The wood in the outer portion of the stem is strong and resistant to termites[303 ]. It is much valued for use in construction[46 , 200 , 303 ]. The stems are used for fuel[303 ]. This plant is fire-retardant. Indoor Plant.

dwatta Demulcent Expectorant Febrifuge LaxativeDate fruits are demulcent, expectorant and laxative. They are used to treat respiratory diseases and fevers[303 ]. The tree yields a gum that is used in treating diarrhoea[303 ].

nrakta Original range is unknown. ksacta The tree has been cultivated for so long that it is not known in a truly wild situation.

propta Seed - pre-soak for 24 hours in warm water and sow in containers. Germination usually takes place in 2 - 3 months[297 ]. Seed viability can be maintained for 8 - 15 years at room temperature[303 ]. Division of suckers[297 ]. Pot up immediately into large containers and plant into permanent positions once the plant is established[297 ].

nwatta Agroforestry Services: Crop shade Global Crop Industrial Crop: Fiber Management: Standard Other Systems: Multistrata Staple Crop: SugarDate palm is a plant of drier areas in the tropics, where it is found at elevations up to 1,500 metres. Hot dry conditions are required for free fruiting, the fruit not forming very readily in cooler or moister climates[297 ]. It grows best in areas where annual daytime temperatures are within the range 26 - 45°C, but can tolerate 10 - 52°C[418 ]. When dormant, the plant can survive temperatures down to about -15°C, but the leaves and young growth can be severely damaged at -4°C[418 ]. It prefers a mean annual rainfall in the range 200 - 300mm, but tolerates 100 - 400mm[418 ]. The tree transpires large quantities of moisture and the amount of available rainfall is often little, or entirely absent in the production areas. The water requirement of the palm must be provided for by ground water (the roots of the tree can reach 2 - 6 metres deep) or by irrigation[418 ]. Plants are tolerant of a range of soil types[335 ], so long as they are well-drained[297 ]. Plants grow well in full sun, even when small[297 ]. Tolerant of salty soils, though fruit quality might be adversely affected[302 , 303 ]. Prefers a pH in the range 6.5 - 8, tolerating 6 - 8.5[418 ]. Seedlings begin to develop a stem when about 4 - 5 years old and will usually start flowering soon afterwards[303 ]. Plants propagated from suckers can commence fruiting within 2 - 4 years and normally reach full production at 5 - 8 years, although productivity may increase up to 9 - 15 years[418 ]. Pollination is critical for good fruiting; therefore, pollen is usually artificially introduced to the female flowers by cutting a male inflorescence and placing it strategically within a female inflorescence - this may be thinned a little to accommodate it. It is important that male trees are planted with females in ratios of about 1:50 in order to provide sufficient pollen[303 ]. An average well-managed palm can produce about 60 - 70 kilos of fresh dates per year[418 ]. Commercially, yields of dates are often restricted to about 50 kilos per tree in order to ensure high quality, though yields of 100 kilos have been recorded[200 ]. Yields decline after 40 - 50 years, but the tree will continue to produce until about the age of 75 years[418 ]. When fruit yields are poor, the tree is often tapped for its sap. The yield varies with management and site conditions, but it is in the range of 4 - 8 litres per day[303 ]. There are many named forms[200 ]. A dioecious species, at least one male plant for every 6 females is necessary to ensure fertilization[297 ]. Flowering Time: Early spring, Early winter, Late spring, Late winter, Mid spring, Mid winter (Late Winter/Early Spring Blooms repeatedly). Bloom Color: White (Pale Yellow). Spacing: 20-30 ft. (6-9 m).

## 8.2.2 Annona cherimola

Cherimoya, Custard Apple

8 tin 12 cyuc 5 kcaak 2 tcan 2 dwat 9 m hkuc htut cyutli hgattucyctuc hwicli vyhysrjaslutnykrip hpa7tli flatprikliwislip hpa7tmwatli hjonli

drutta *Annona cherimola* is a deciduous Tree growing to 9 m (29ft) by 9 m (29ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9 and is not frost tender. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista Blindness can result from the juice of the crushed seeds coming in contact with the eyes[ 303 ]. The seeds and twigs contain several alkaloids including ( + )-reticuline, (-)-anonaïne, liriodenine, and lanuginosine. Human ingestion of 0.15 g of the dark-yellow resin isolated from the seeds produces symptoms resembling the effects of atropine[ 303 ].(Seed is poisonous if ingested)

kcakta Edible Parts: FruitEdible Uses: Fruit - raw. A delicious flavour, tasting like a cross between a banana and a pineapple[ 301 ]. The white flesh of the ripe cherimoya is sweet, juicy and very fragrant. It is most commonly eaten out of-hand or scooped with a spoon from the cut open fruit[ 303 ]. It can also be used in making ice cream, custard, cakes etc[ 301 ]. The fruit is up to 20cm x 10cm and has a white pulp[ 200 ].

taanta InsecticideOther uses rating: Low (2/5). Other Uses: The seeds are crushed and used as insecticide[ 303 ]. Mixed with grease, powdered seeds are used to kill lice[ 303 ].

dwatta Rural people toast, peel and pulverize 1 or 2 seeds and take the powder with water or milk as a potent emetic and cathartic. Mixed with grease, the powder is applied on parasitic skin disorders[ 303 ]. A decoction of the skin of the fruit is taken to relieve pneumonia[ 303 ].

nrakta Western S. America - Peru, Bolivia, Ecuador. ksacta Not known

propta Seed - usually breeds true to type[ 200 ]. Sow in individual pots, not deeper than 2cm, at 21c[ 200 ]. Cherimoya seeds remain viable for 2 - 3 years if kept dry and protected from weevils and fungi. At 20C bottom heat, seeds germinate in about 21 days, but require about 40 days under normal ambient growing conditions[ 303 ]. The seed of many species in this genus has a hard seedcoat and may benefit from scarification before sowing in order to speed up germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing[ K ]. Semi-ripe cuttings[ 200 ]. Cuttings of mature wood have rooted in coral sand with bottom heat in 28 days[ 303 ].

nwatta The cherimoya does not grow very well in lowland tropical areas, preferring elevations above 700 metres and growing well as high as 2,400 metres[ 303 ]. It can also be grown in subtropical and warm temperate basically frost-free areas. Prefers a moist, sandy loam with a pH around 6[ 200 ]. It grows well on a wide range of soil types from light to heavy, but seems to do best on a medium soil of moderate fertility[ 303 ]. It prefers a pH in the range 6.5 - 7.6[ 303 ]. The tree requires protection from strong winds that interfere with pollination and fruit set[ 303 ]. This species has often escaped from cultivation and has become widely naturalized in subtropical to tropical climates[ 200 ]. The cherimoya begins to bear when 3 - 5 years old and production steadily increases from the 5th to the 10th year, when there should be a yield of 25 fruits/tree (5,000 per ha)[ 303 ]. In Colombia, the average yield is 25 fruits and in Italy, trees 30-35 years old produce 230-280 fruits annually[ 303 ]. A problem with the cherimoya is inadequate natural pollination because the male and female structures of each flower do not mature simultaneously. Few insects visit the flowers. Therefore, hand-pollination is highly desirable and must be done in a 6 - 8 hour period when the stigmas are white and sticky. It has been found in Chile that in the first flowers to open the pollen grains are loaded with starch, whereas flowers that

open later have more abundant pollen, no starch grains, and the pollen germinates readily. Partly-opened flowers are collected in the afternoons and kept in a paper bag overnight. The next morning the shed pollen is put, together with moist paper, in a vial and transferred by brush to the receptive stigmas. Usually only a few of the flowers on a tree are pollinated each time, the operation being repeated every 4-5 days in order to extend the season of ripening. The closely related *A. Senegalensis*, if available, is a good source of abundant pollen for pollinating the cherimoya, that of the sugar apple is not satisfactory. Fruits from hand-pollinated flowers are normally superior in form and size[ 303 ].

## 8.2.3 Zea hybrids

Perennial corn, Perennial Maize

8 tin 12 cyuc 5 kcaak 3 tcan 3 dwat 2 m hkuc  
htuc cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Zea hybrids is a PERENNIAL growing to 2 m (6ft) by 0.3 m (1ft in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 8. The flowers are pollinated by Wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcaakta Edible Parts: Oil Pollen Seed StemEdible Uses: OilCarbon Farming Solutions - Staple Crop: balanced carb (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1]. Maize/corn is one of the most important staple crops on the planet. The Land Institute has made substantial progress developing a perennial corn. Researchers believe it will be between 10 and 40 years before it is fully ready. Recently the US Department of Agriculture has shown interest [1-1].

tcanta OilPerennial hybrids will carry some of the qualities of the original species. Zea mays for example has agroforestry uses being grown as a sole crop or in intercropping with other food crops such as common bean, cowpea, pigeon pea, groundnut, yam, cassava, sweet potato, pumpkin, melon or watermelon[299 ]. Maize grows well with early potatoes, legumes, dill, cucurbits and sunflowers[18 , 20 , 201 ]. It dislikes growing with tomatoes[20 ]. Other Uses include a starch is obtained from the seed. It is used as a laundry starch and as a source material for many chemical products, including glues, cosmetics and the manufacture of glucose[13 , 61 , 299 ]. A semi-drying oil is obtained from the seed[57 ]. It has many industrial uses, in the manufacture of linoleum, paints, varnishes, soaps etc[21 , 61 , 299 ]. The corn spathe are used in the production of paper, straw hats and small articles such as little baskets[74 , 171 ]. They are often used to wrap foods, and may also be made into cloth or mats, and be used for mattress filling[299 ]. A fibre obtained from the stems and seed husks is used for making paper[189 ]. They are harvested in late summer after the seed has been harvested, they are cut into usable pieces and soaked in clear water for 24 hours. They are then cooked for 2 hours in soda ash and then beaten in a ball mill for 1½ hours in a ball mill. The fibres make a light greenish cream paper[189 ]. Be careful not to overcook the fibre otherwise it will produce a sticky pulp that is very hard to form into paper[189 ]. The dried cobs are used as a fuel and for thatching[171 , 299 ]. The pith of the stems is used as a packing material[171 ].

dwatta The annual Zea mays has a number of medical properties so in theory hybrids could too.

nrakta Hypothetical hybrid. ksacta Cold temperate to tropical, tropical highland climates. Humidity: semi-arid to humid.

propta Hypothetical crop

nwatta Management: Standard Staple Crop: Balanced carb Under DevelopmentClimate: cold temperate to tropical, tropical highlands. Humidity: semi-arid to humid. Carbon Farming Solutions - Cultivation: under development. Management: standard (Describes the non-destructive management systems that are used in cultivation) [1-1].

## 8.2.4 Punica granatum

Pomegranate, Dwarf Pomegranate

8 tin 12 cyuc 4 kcaak 3 tcan 4 dwat 5 m hkuc  
htuc cyutli kyucup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwatli xre7t hjonli

drutta Punica granatum is a deciduous Tree growing to 5 m (16ft) by 8 m (26ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 9 and is frost tender. It is in flower from June to September. The species is hermaphrodite (has both male and female organs). Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil.

pcista Take recommended doses. Overdose symptoms include: gastric irritation, vomiting, dizziness, chills, vision disorders, collapse and death [301].

kcaakta Edible Parts: Fruit Leaves SeedEdible Uses: CondimentFruit - raw[1, 2, 3, 4]. Juicy and refreshing with a sub-acid flavour[183], they are considered delicious by many people though others do not like the large number of seeds with relatively little fruit pulp[K]. The fruit juice can be used in soups, sauces, jellies, ice cream, cakes etc[183]. The fruit contains about 1.5% protein, 1.6% fat, 16.8% carbohydrate, 0.6% ash[149, 179]. Annual yields from wild trees in the Himalayas averaged 32kg per tree[194]. The fruit is about 12cm in diameter[200]. The fresh seed is soft and can be eaten raw[227]. When dried it is used as a seasoning in dal, fried samosa, stuffings and chutneys[183]. The boiled leaves are said to be eaten[183].

tcanta Dye Hedge Hedge Ink Tannin WoodLandscape Uses: Border, Container, Espalier, Foundation, Hedge, Massing, Superior hedge. Special Features: Not North American native, Attractive flowers or blooms. Agroforestry Uses: A deep rooting tree, it is important in soil erosion control, and is planted along rivers to stabilize banks[303 ]. A drought-tolerant tree, it is suitable for arid and semi-arid zone reforestation[303 ]. The leaf litter decomposes slowly and is suitable for mulching[303 ]. The plant is also used in water purification schemes[303 ]. Plants are grown as hedges in Mediterranean climates[200 ]. Their wind firm stature makes them a good wind break[303 ]. They are also sometimes used for fencing[303 ]. The plant is traditionally grown in living fences in the northwestern Himalayas, where it helps to exclude livestock and other animals; mark out land boundaries; whilst also providing a range of medicinal and other uses[1174 ]. Other Uses: A red dye is obtained from the flowers and also from the rind of unripened fruits[89, 100, 158, 168]. The dye can be red or black and it is also used as an ink[149]. It is coppery-brown in colour[168]. No mordant is required[168]. A fast yellow dye is obtained from the dried rind[194]. The dried peel of the fruit contains about 26% tannin[46, 223]. The bark can also be used as a source of tannin[146]. The root bark contains about 22% tannin, a jet-black ink can be made from it[194]. Plants are grown as hedges in Mediterranean climates[200]. Wood - very hard, compact, close-grained, durable, yellow. Used for making agricultural implements. A possible substitute for box, *Buxus spp*[146, 149, 158, 194].

dwatta Antibacterial Antidiarrhoeal Antiviral Astringent Cardiac Demulcent Dysentery Emmenagogue Refrigerant Stomachic VermifugeThe pomegranate has a long history of herbal use dating back more than 3,000 years[238 ]. All parts of the plant contain unusual alkaloids, known as 'pelletierines', which paralyse tapeworms so that they are easily expelled from the body by using a laxative[238 ]. The plant is also rich in tannin, which makes it an effective astringent. It is used externally in the treatment of vaginal discharges, mouth sores and throat infections[238 ]. The whole plant, but in particular the bark, is antibacterial, antiviral and astringent[21 , 46 , 57 , 89 , 176 , 194 ]. This remedy should be used with caution, overdoses can be toxic[21 , 218 ]. The flowers are used in the treatment of dysentery, stomach ache and cough[218 ]. Along with the leaves and seeds, they have been used to remove worms[4 ]. The juice of the flowers is used to treat nose bleeds[311 ]. The seeds are demulcent and stomachic[4 , 240 ]. A decoction of the seed is used to treat syphilis[311 ]. The fruit is a mild astringent and refrigerant in some fevers and especially in biliousness[4 ]. It is also cardiac and stomachic[240 ]. The juice of the fruit is used to treat jaundice and diarrhoea[311 ]. Combined with

of the plant is diuretic and laxative[ 200 ]. It is used in the treatment of sore throats[ 200 ]. An infusion of the seeds is diuretic[ 348 ]. A flour made from the seeds is resolutive[ 348 ]. Leaf contains cholesterol[ 348 ]. The root bark contains numerous flavones including cajanflavanone and cajanone, and triterpenes[ 348 ]. The root contains cajanone, an antimicrobial agent[ 348 ]. An enzyme called 'urease' can be extracted from the plant. It has medicinal applications[ 320 ].

nrakta E. Asia - India. ksacta Not known in a truly wild situation. It is , however, sometimes found in grassy habitats in savannahs, shrubland and waste land[ 404 ].

propta Seed - sow in situ during the wet season, placing the seed 2 - 3 cm deep in the soil[ 300 ]. Two seeds are often planted per station, thinning to the best plant[ 300 ]. The seeds germinate at temperatures of 19 - 43°C, but most rapidly at 20 - 30°C. Emergence is complete 2 - 3 weeks after sowing. Vegetative development starts slowly, but after 2 - 3 months growth accelerates[ 299 ].

nwatta Agroforestry Services: Alley crop Agroforestry Services: Crop shade Agroforestry Services: Nitrogen Agroforestry Services: Windbreak Fodder: Bank Fodder: Insect Global Crop as Annual Management: Coppice Management: Standard New Perennial Crop Other Systems: Homegarden Other Systems: Perennial fallow Staple Crop: ProteinGrows well in lowland tropical areas up to an elevation of 1,500 metres, though some forms can still do well up to 2,000 metres[ 300 ]. Plants generally prefer a rainfall in the region of 500 - 1,000mm per year, though there are some cultivars that are adapted to wet, humid tropics so long as the soil is well drained[ 300 ]. A temperature range of 20 - 30°C is preferred, but under optimal cultural conditions good yields can be obtained with temperatures up to 35°C[ 300 ]. Grows best in a sunny position[ 320 ]. Succeeds in a wide range of soils that are well-drained[ 300 ]. Plants produce deep tap roots, they can succeed in poor soils and are extremely drought resistant once established[ 298 , 300 ]. Dislikes very acid soils, growing best in a pH range of 5.5 - 6.5[ 300 ]. A short-lived, woody plant, dying after 1 - 5 years[ 404 ]. Harvesting of dwarf varieties can commence 5 months after sowing (8 - 12 months for taller varieties) and continue for several months[ 300 ]. A relatively low-yielding crop, yields of up to 5 tonnes per hectare of pods, or 1 tonne of seeds can be achieved[ 300 , 404 ]. In perennial crops, 2 - 10 tonnes per hectare a year of woody stalks can be harvested for fuel[ 404 ]. There are two main forms of this plant, and many named varieties of each[ 46 , 300 , 301 ]. Var. *Flavus* DC. Is a moderate height plant that is early maturing, it is often grown as an annual in India[ 300 ]. The green pods normally contain 3 seeds[ 300 ]. Var. *Bicolor* DC. Is a taller plant that is later to mature and is usually grown as a perennial[ 300 ]. The dark coloured pods contain 4 - 5 seeds[ 300 ]. Short-duration dwarf cultivars are usually daylength neutral, but the taller growing cultivars are usually short-day plants that will not readily flower if day length is 12 hours or more[ 300 ]. A good companion plant, it is often grown in association with other crops[ 300 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[ 200 ]. The crop is cultivated on marginal land by resource-poor farmers, who commonly grow traditional medium- and long-duration (5-11 months) landraces.

## 9.2 mran

### 9.2.1 Euterpe edulis

Jucara Palm, Assai Palm

9 tin 12 cyuc 5 kcaak 2 tcan 2 dwat 30 m hkuc  
hmimhtuc cyutli tcup hwicli hrasjlutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Euterpe edulis is an evergreen Tree growing to 30 m (98ft) by 5 m (16ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcaakta Edible Parts: Apical bud Fruit Leaves Oil SeedEdible Uses: OilLeaves - raw or cooked[ 297 ]. Crunchy, with a sweet flavour[ 297 ]. A tropical delicacy, they can also be eaten raw in salads[ 301 ]. A highly prized dish, often called 'Millionaires salad' due to its price[ 314 ]. The unexpanded leaves and bud from the crown of the plant are used[ 297 ]. Harvesting these leaves kills the plant because it is unable to make side-shoots[ 297 , 768 ]. Fruit - made into a juice[ 416 ]. The fruit has a thin, fleshy, fibrous pulp[ 416 ]. It is made into a high calorie juice[ 416 ]. The fruit is used for making a nutritious beverage or ice-cream[ 317 ]. The fruit is about 12mm in diameter[ 416 ]. The seeds are crushed in water to produce a drink called Assai.

tcanta OilOther Uses: The fruit has the potential to be used to make alcohol as a petrol substitute. The wood is light in weight, hard, long lasting in dry sites. Although of low quality, it is used locally in making rural buildings for purposes such as rafters and beams; for water troughs, posts and as a source of cellulose[ 419 ].

dwatta The juice squeezed from the young stem is applied to wounds to stop bleeding[ 739 ].

nrakta S. America - Argentina, Paraguay, southern and eastern Brazil. ksacta An understorey tree of swampy ground in high rainfall forests[ 200 ], at elevations from sea level to 1,200 metres[ 418 ].

propta Seed - it has a short viability of less than three months and so is best sown as soon as it is ripe in a partially shaded position in a nursery seedbed. Pre-soak them in cold water for 24 hours prior to sowing[ 419 ]. A germination rate of around 80% or more can be expected, with the seed sprouting within 30 - 70 days[ 419 ]. The seed germinates rapidly and grows quickly[ 297 ].

nwatta A plant of moist tropical and subtropical climates, where it is found at elevations from sea level to around 1,200 metres[ 418 ]. It grows in areas where the temperatures never fall below 10c, the average annual rainfall is 1,500mm or more and the driest month has 25mm or more rain[ 297 ]. Grows best in a warm, sheltered, and moist site that is well drained[ 314 ]. It likes filtered sunlight when young, but can take full sun as it matures[ 297 , 314 ]. Prefers a pH in the range 4.5 - 5, tolerating 4.1 - 5.6[ 418 ]. A fast-growing plant[ 200 ]. Utilizing the plant for its edible apical bud always leads to its eventual death since the palm is unable to form side branches and thus is unable to grow any more. This has led to plant populations coming under pressure in some areas[ 314 ]. Spacing: 6-8 ft. (1.8-2.4 m); 8-10 ft. (2.4-3 m); 10-12 ft. (3-3.6 m). They are grown commercially for palm hearts in Brazil.

## 9.2.2 Persea americana

Avocado, Alligator Pear

9 tin 12 cyuc 5 kcaak 3 tcan 3 dwat 15 m hkuc  
htuc cyutli hgattuc hwicli jlutnyik hpa7tli flatprikwiissliph-som hpa7tmwatli dyat hjonli

drutta Persea americana is an evergreen Tree growing to 15 m (49ft) by 25 m (82ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees, Insects. The plant is not self-fertile. It is noted for attracting wildlife. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcista The unripe fruit is poisonous[303 ]. The ground up seed is mixed with cheese and used as a poisonous bait to kill rats and mice[418 ]. (Parts of plant are poisonous if ingested)

kcaakta Edible Parts: Fruit Leaves OilEdible Uses: Oil-Fruit - raw[296 ]. The flesh has a buttery texture and a mild, oily flavour. It is commonly eaten raw and may also be used as a sandwich spread, in ice creams etc[301 ]. The pear-shaped fruit is up to 12cm long[200 ]. A non-drying oil obtained from the fruit has a mild, pleasant taste[46 , 301 ]. It is used as a salad dressing, especially with strong tasting leaves such as chicory, rocket and watercress[301 ]. A tea can be made from the leaves[301 ]. Toasted leaves are used as a flavouring in stews and bean dishes[301 ].



htut cyutli tcup hwicli hrasljutnyik hpa7tli priklwisslip hpa7tmwatli hjonli

drutta Pachyrhizus erosus is a CLIMBER PERENNIAL growing to 6 m (19ft) by 1.5 m (5ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in very alkaline soils. It cannot grow in the shade. It prefers moist soil.

pcista Seeds and leaves are poisonous[296 ]. The leaves, mature seedpods and the seeds contain a poisonous glycoside[300 , 418 ]. (Seed is poisonous if ingested Parts of plant are poisonous if ingested )

kcakta Edible Parts: Root SeedpodEdible Uses: Edible root - raw or cooked[296 ]. Crisp, sweet and juicy, it tastes somewhat like an apple when raw and a water chestnut when cooked[296 , 301 ]. The root stays crisp and does not discolour after being cut[296 ]. It also stays crisp after being cooked, which makes it a popular substitute for water chestnuts in Chinese cooking[301 ]. A starch extracted from the root is used in custards and puddings[301 ]. The root is harvested before it matures and becomes fibrous, when the plant has been growing for about 6 months and the tuber weighs about 2 kilos[200 ]. Mature tubers can reach 2 metres long and weigh up to 20 kilos[200 ]. Young seedpods - cooked and used as a vegetable[46 , 300 , 418 ]. They must be thoroughly cooked in order to destroy the poisonous principle rotenone[200 ].

tcanta Green manure InsecticideAgroforestry Uses: The plant can be used as a green manure[418 ]. Other Uses The plant contains rotenone, the active ingredient in the insecticide 'derris', and it has the potential to be used as an insecticide[200 ]. Derris is a relatively safe insecticide in that it does not affect warm-blooded animals and also breaks down into harmless substances with 24 hours of being used. It does, however, kill some beneficial insects and is also toxic to fish and amphibians[K ].

nrakta Central America - Mexico. ksacta Not known propta Pre-soak the seed for 12 hours in warm water and then sow in situ[300 ]. Division of the root tubers. Cuttings.

nwatta Plants are tolerant of a wide range of climatic conditions but grows best in lowland tropical areas at elevations up to 1,000 metres and a moderate rainfall[200 , 300 ]. The plant grows best in areas where the mean minimum temperature is about 20°C and the maximum is 30°C, though they can succeed where they are 15 - 36°C[418 ]. It prefers an annual rainfall in the range 1,300 - 1,700mm, but can tolerate 250 - 7,000mm[418 ]. Grows best in a sunny position[418 ]. Tolerates a wide range of soils[300 ]. Prefers a light, rich, well-drained, sandy soil[1 , 300 ]. Dislikes water-logged soils[300 ]. The plant prefers a pH in the range 6.5 - 8, but can tolerate 4.3 - 8[418 ]. Immature pods are ready for harvest about 200 - 240 days from sowing[418 ]. Tubers may be harvested after 150 - 270 days, before they become fibrous[418 ]. In warmer parts of Mexico with light, rich soil, mature tubers are commonly harvested after only 90 days[418 ]. Seed crops takes about 300 days to mature[418 ]. A short-day plant, it requires between 11 - 13 hours of daylight hours per day in order to initiate tuber production[K ], though vegetative growth is normal even in relatively long days of 14 - 15 hours[300 ]. When grown for its edible root the flowers and seedpods should be removed[1 , 459 ]. There are some named forms[301 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[200 ]. Flowering Time: Mid Fall. Bloom Color: Blue-Violet. Spacing: 6-9 in. (15-22 cm).

### 9.1.3 Cajanus cajan

Pigeon Pea, Puerto Rico Bean, Gandul, Dhal, Congo Pea tfo2n 9 tlin 12 cyuc 4 kcaak 4 tcan 2 dwat 4 m hkuc htut cyutli hgattcup hwicli hysrasljutnyik hpa7tli flatpriklwisslip hpa7tmwatli fyif hjonli

drutta Cajanus cajan is an evergreen Shrub growing to 4 m (13ft) by 4 m (13ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Insects. The plant is self-fertile. It can fix Nitrogen.

Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought.

kcakta Edible Parts: Leaves Seed SeedpodEdible Uses: Seed - cooked. Very young seeds can be cooked and eaten like peas, going well in rice dishes[ 46 , 301 ]. Mature seeds are dried and added to soups and stews[ 46 , 300 ]. Small but flavourful[ 298 ]. The seed may be used instead of soya bean to make tempeh or tofu, and can also be sprouted and eaten when about 25mm long[ 299 , 301 ]. The seed is usually round or oval and up to 8mm in diameter[ 300 ]. Seedpods - cooked[ 300 ]. The unripe pods are eaten in curries[ 301 ]. The pods are up to 10cm long and 14mm wide[ 200 ]. Leaves and young shoots - cooked and used as a vegetable[ 298 , 300 ]. A strong, spicy odour, with a new flavour that is not agreeable to everyone[ 298 ]. A good source of protein[ 298 ]. The leaves contain up to 9% protein[ 301 ]. The leaves quickly become fibrous[ 298 ]. Widely cultivated in all tropical and semitropical regions. An important legume crop of rainfed agriculture in the semi-arid tropics. The Indian subcontinent, eastern Africa and Central America are the world's three main pigeon pea-producing regions. Pigeon peas are cultivated in more than 25 countries, either as a sole crop or intermixed with cereals, such as sorghum (Sorghum bicolor), pearl millet (Pennisetum glaucum), or maize (Zea mays), or with other legumes, such as peanuts (Arachis hypogaea).

tcanta Basketry Broom Companion Deodorant Essential Fodder Fuel Green manure Hedge Plant support Roofing Shelterbelt Soil reclamation Soil stabilization Thatching WoodOther uses rating: Medium (3/5). Agroforestry Uses: A good green manure crop[ 46 , 200 ]. The plant has an extensive root system and is often grown to bind soil[ 200 , 320 ]. It is also grown to provide shelter from the wind[ 320 ]. It is also grown as a shade crop, cover crop, or as support for vanilla[ 299 ]. Due to its hardness, ability to grow on residual soil moisture, and slow early growth, this species is an ideal, non-competitive crop to plant with cereals[ 404 ]. For hedgerow intercropping, the hedges should be cut at height of 50 - 100cm when the grain crop is fully mature. The hedges can be cut 2 - 3 times a year in areas where the dry season lasts 4 - 6 months. At pod maturity, the branches are cut at about 50cm. Higher levels of pruning can result in higher and unacceptable levels of plant mortality[ 303 ]. The root system is reported to break plough pans, thus improving soil structure, encouraging infiltration, minimizing sedimentation and smothering weeds. Leaf fall at maturity adds to the organic matter in the soil and provides additional nitrogen. It seems to have special mechanisms to extract phosphorus from black Vertisol soils[ 303 ]. The plant improves the soil through its extensive root system, nitrogen fixation and the mulch provided by the fallen leaves. Other Uses The stems are of use in basketry and thatching[ 200 ]. The plants are often used as brooms[ 272 ]. An essential oil can be collected by the steam distillation of the leaves and other aerial organs. It contains a mixture of compounds including the terpenoid alpha - copaenol[ 404 ]. The macerated leaves are used as a deodorant[ 348 ]. The wood is used in light construction such as in roofing, wattling on carts, tubular wickerwork lining for wells and baskets[ 303 ]. The dried stalks and branches are used for fuel[ 320 ]. The sticks are an important household fuel in many areas. The heat value, with 1,450 kJ per 100g, is about half as high as the same weight of coal[ 303 ].

dwatta Anthelmintic Antidiarrhoeal Antitussive Deodorant Diuretic Expectorant Laxative Mouthwash Pectoral Sedative Skin VulneraryThe roots are anthelmintic, sedative, expectorant and vulnerary[ 272 ]. An infusion of the leaves is used as a treatment for pulmonary conditions such as coughs and bronchitis[ 348 ]. The leaf juice is taken internally in the treatment of haemorrhages, coughs and diarrhoea[ 272 , 348 ]. An infusion of the leaves, combined with Dactyloctenium aegyptium, is used to accelerate childbirth[ 348 ]. Young leaves are chewed to treat boils on the tongue[ 272 ]. A decoction is used for washing ulcers[ 348 ]. The boiled leaves are applied to sores and wounds to hasten cicatrization[ 348 ]. Young shoots and the green seedpods are used to make a good pectoral infusion[ 348 ]. An infusion of the flowers and leaves is diuretic and is used as a diabetes remedy[ 348 ]. An infusion of the flowers is pectoral[ 348 ]. A decoction

the juice of *Cynodon dactylon* leaves, it is used for treating runny noses and colds[311 ]. The dried rind of the fruit is used in the treatment of amoebic dysentery, diarrhoea etc[4 , 238 ]. It is a specific remedy for tapeworm infestation[254 ]. The rind of the fruit is ground in water and drunk every morning by diabetics[311 ]. The stem bark is emmenagogue[218 ]. Both the stem and the root barks are used to expel tapeworms[4 ]. Use this with caution, the root bark can cause serious poisoning[7 ]. The bark is harvested in the autumn and dried for later use[238 ]. The dried pericarp is decocted with other herbs and used in the treatment of colic, dysentery, leucorrhoea etc[218 ]. An ethyl alcohol extract of the fruit has shown interesting oestrogenic properties. In addition, it has been shown to reduce cell death from oxidation. The plant has potential as an active ingredient in preparations for the treatment of skin-ageing in post-menopausal women[1574 ].

nrakta S.E. Europe to E. Asia - Himalayas. ksacta Dry limestone soils to 2700 metres in the Himalayas[51].

propta Seed - sow spring in a greenhouse, preferably at a temperature of 22°C[200, 238]. Prick out the seedlings into individual pots when they are large enough to handle and grow them on in the greenhouse for at least their first 2 growing seasons. Plant out in late spring or early summer. Cuttings of half-ripe wood, 4 - 5cm with a heel, June/July in a frame[78, 113]. Good percentage[78]. Cuttings of mature wood, 20 - 25cm long, November in a warm greenhouse[113]. Layering. Division of suckers in the dormant season[200]. They can be planted out direct into their permanent positions, though we prefer to pot them up first and plant them out when they are growing away well in late spring or early summer.

nwatta An easily grown plant, it prefers a well-drained fertile soil[1, 182, 260] and succeeds in a hot dry position[166]. Requires a sheltered sunny position[219]. Not very hardy in Britain, the pomegranate tolerates temperatures down to about -11°C[3], but it is best grown on a south facing wall even in the south of the country because it requires higher summer temperatures than are normally experienced in this country in order to ripen its fruit and its wood[11, 166]. The wood is also liable to be cut back by winter frosts when it is grown away from the protection of a wall[11]. Trees do not grow so well in the damper western part of Britain[182]. Most plants of this species grown in Britain are of the dwarf cultivar 'Nana'. This is harder than the type but its fruit is not such good quality[11]. This subspecies fruited on an east-facing wall at Kew in the hot summer of 1989[K]. The pomegranate is often cultivated in warm temperate zones for its edible fruit, there are many named varieties[183]. In Britain fruits are only produced after very hot summers. Plants often sucker freely[7]. Flowers are produced on the tips of the current years growth[200]. Plants in this genus are notably resistant to honey fungus[200]. In garden design, as well as the above-ground architecture of a plant, root structure considerations help in choosing plants that work together for their optimal soil requirements including nutrients and water. The root pattern is flat with shallow roots spreading near the soil surface. The root pattern is suckering with new plants from runners away from the plant [2-1]. Heat zone: 12-7. Espalier: tree or other plant that is trained to grow flat against a support (such as a trellis or wall).

### 8.2.5 Dioscorea esculenta

Lesser Yam, Potato Yam, Chinese Yam, Wild Yam 8 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 3 m hkuc hmimhtut cyutli tcup hwicli hrasljut hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Dioscorea esculenta is an evergreen Perennial Climber growing to 3 m (9ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9. The flowers are pollinated by Wind, Insects. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista Edible species of Dioscorea have opposite leaves whilst poisonous species have alternate leaves[ 174 ].(Parts of plant are poisonous if ingested)

kcakta Edible Parts: RootEdible Uses: Root - cooked and used as a vegetable[ 300 ]. Sweet and pleasant, with a flavour

somewhat like sweet potato or chestnuts[ 301 ]. The tubers are oval, up to 20cm long and 6 - 8cm in diameter. Each plant can produce 5 - 20 tubers. The flesh is yellow or white and the average tuber weight may be 250 - 1,000g, though larger ones can weigh 3,000g[ 300 , 418 ].

nrakta E. Asia - India, Nepal, Bangladesh, Myanmar, Thailand, Vietnam, Malaysia, Indonesia, Philippines, New Guinea. ksacta Not known

propta Seed - not normally used to propagate this species. Cuttings of tubers. Pieces of tuber, each weighing around 50 - 80g with dormant buds, are planted in situ 4 - 8cm deep with the stem pointing downwards[ 300 ]. The cut tuber is often first left in the sun for several hours to promote wound healing and reduce the risk of fungal infection[ 300 ].

nwatta A plant of the drier to wet tropical lowlands, where it is found at elevations up to 900 metres. It grows best in areas where annual daytime temperatures are within the range 28 - 32°C, but can tolerate 17 - 45°C[ 418 ]. It can be killed by temperatures of 9°C or lower[ 418 ]. It prefers a mean annual rainfall in the range 800 - 2,000mm, but tolerates 600 - 8,000mm[ 418 ]. Plants like a well-defined dry season of 2 - 5 months[ 418 ]. This species will grow in drier climates than other yams, so long as the rainfall is evenly distributed throughout the year[ 300 ]. Succeeds in full sun and also in light shade[ 418 ]. For best yields, this species requires a deep, well-drained, sandy loam that is not liable to water-logging[ 300 ]. This species will succeed in poor gravelly soils, especially if enriched with organic matter[ 300 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 4.5 - 8.5[ 418 ]. Daylengths of more than 12 hours are preferred during the early growing season since this encourages vegetative growth; daylengths of less than 12 hours towards the end of the growing season will encourage tuber formation and development[ 300 ]. Crops take 7 - 10 months to mature, yields of 7 - 20 tonnes per hectare have been achieved[ 300 ]. There are some named varieties[ 300 , 301 ]. Two main forms of this plant are sometimes recognised: Var fasciculata (Roxb.)Prain. and Burk. Arose in cultivation and has no spines. Var spinosa (Roxb.)Prain. and Burk. Is believed by many botanists to be the wild form. It has thorny roots protecting the crown of the rootstock[ 266 , 300 ]. This is a variable characteristic, however[ 300 ]. The plant rarely produces flowers[ 418 ]. A dioecious species, both male and female plants need to be grown if seed is required.

### 8.2.6 Zingiber officinale

Ginger: Common,Cooking Stem, Canton 8 tlin 12 cyuc 4 kcaak 2 tcan 5 dwat 1.5 m hkuc hmimhtut cyutli tcup hwicli hrasljutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Zingiber officinale is a PERENNIAL growing to 1.5 m (5ft) by 1.5 m (5ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Flowers Leaves Oil Root ShootsEdible Uses: Condiment Drink Oil TeaThe rhizomes are widely used in many areas of the world as a flavouring, adding a hot, spicy flavour[301 ]. They are added to dishes such as cakes, curries, chutneys, stir-fry dishes, candies etc[301 ]. They are also commonly used in beverages, especially ginger beer[301 ]. The roots can be used fresh, where a small amount of the grated root is added to the dish, or the root can be dried and ground into a powder, when it will store well for later use. The dried root is about twice as pungent as the fresh root[238 ]. The very young rhizomes, known as stem ginger, are peeled and eaten raw in salads, pickled, or cooked in syrup and made into sweetmeats[301 ]. The young, slightly spicy leaves and young shoots can be eaten as a potherb, or pureed and used in sauces and dips[298 , 301 ]. The leaves can also be used to wrap food whilst it is cooked[301 ]. The young inflorescences can be eaten raw[301 ]. An essential oil obtained from the root is used in flavouring essences[418 ].

tcanta Cosmetic Essential OilOther Uses An essential oil obtained from the root is used in perfumery[418 ].

dwatta Antibilious Antirheumatic Antitussive Aromatic Diaphoretic Digestive Expectorant StimulantGinger root is



widely used in Eastern Herbal treatments - in Ayurveda it is known as the universal medicine and it is an ingredient of about half of all prescriptions in Ayurvedic and Chinese medicine[238 ]. The root is rich in volatile oils, gingerols and shogaols[238 ]. The shogaols are only produced when the root is dried, as a breakdown substance of the gingerols[238 ]. They are twice as pungent as the gingerols and so the dried root is normally used in different ways to the fresh root[238 ]. The root is a sweet, pungent, aromatic, warming herb that is expectorant; increases perspiration; improves digestion and liver function; controls nausea, vomiting and coughing; stimulates the circulation; relaxes spasms; and relieves pain[238 ]. The root is used internally in the treatment of all forms of nausea, including morning and motion sickness[238 ]. It is used to treat indigestion, colic, abdominal chills, colds, coughs, influenza and peripheral circulatory problems[238 ]. Externally, the root is used to treat spasmodic pain, rheumatism, lumbago, menstrual cramps and sprains[238 ].

nrakta Widely cultivated in Tropical areas, it probably originated in Tropical Asia. ksacta Not known in a truly wild situation.

propta Seed - Division as new growth begins[238 ].

nwatta A plant of the moist to wet tropics, where it is found at elevations up to 1,900 metres. It grows best in areas where annual daytime temperatures are within the range 19 - 29°C, but can tolerate 13 - 35°C[418 ]. Low temperatures will induce dormancy[418 ]. It prefers a mean annual rainfall in the range 1,400 - 3,000mm, but tolerates 700 - 4,000mm[418 ]. Prefers a well-drained, humus-rich, neutral to alkaline soil and a position in full sun or partial shade[238 ]. When grown on slopes the production may result in severe erosion unless adequate soil-conservation methods have been employed[418 ]. Prefers a pH in the range 6 - 7, tolerating 4.3 - 7.5[418 ]. Commercially, plants are given a ten month growing season from planting out a root, being harvested when the stalks begin to wither[238 , 418 ]. Ginger originated in South East Asia, but is nowhere known in a wild state. Yields of green ginger can be up to 38 tonnes/ha[418 ]. The expected yield of dried ginger may be 1.5 - 7.5 tonnes/ha[418 ]. The dried ginger constitutes about 25% of the raw rhizome's weight[418 ]. There are some named varieties[301 ]. Flowering Time: Late Winter/Early Spring(early summer, mid summer, late summer). Bloom Color: Chartreuse (Yellow-Green) Purple. Spacing: 12-15 in. (30-38 cm).

## 8.2.7 Tacca leontopetaloides

Polynesian Arrowroot, Pia  
8 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 1 m hkuc  
hmimhtut cyutli tcup hwicli hrasjnutnyk hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Tacca leontopetaloides is an evergreen Perennial growing to 1 m (3ft 3in) by 1 m (3ft 3in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The untreated root is considered to be toxic in some areas[398 , 451 ].

kcaakta Edible Parts: RootEdible Uses: The root is a rich source of starch. It can be eaten raw or roasted, or the starch can be extracted[301 ]. The tubers have eyes, a pale-yellow skin and dull-whitish flesh, and are usually bitter and almost inedible when raw[429 ]. The starch, called Tahiti (or Fiji) arrowroot, is easy to extract and is used in breads or soups, it can be mixed with papayas, bananas and pumpkins, flavoured with vanilla and lemon, and cooked into poi[301 , 429 ]. Good washing is essential because of the presence of the bitter substance (taccalin) which is said to be poisonous[451 ]. To obtain the starch, the tubers are peeled, grated, and the resultant pulp washed in water several times, finally in a sieve or cloth. The aqueous starch solution is collected and the starch grains allowed to settle out, collected and dried in the sun[429 ]. In cultivated plants the tuber can be 5 - 10cm long, with unconfirmed reports saying that it may reach the size of a coconut[451 ].

tcanta Adhesive Broom Fibre Miscellany WeavingOther Uses The leaf stalks and flower scapes make an excellent straw which can be used as a plaiting material for hats and bonnets[454 , 459 ]. The straw is split into narrow

strips then cured and dried. It is said to make an excellent, lightweight, glossy, white hat[459 ]. The leaf stalks are made into brooms[454 ]. The fresh starch extracted from the roots is used as a starch for clothes and as a glue[459 ]. Traditionally, it is employed for pasting together the thin layers of beaten bark of the paper mulberry (Broussonetia papyrifera) in making tapa cloth[459 ].

dwatta Antidiarrhoeal Dysentery Miscellany Skin StingsPolynesian arrowroot is often used in traditional medicine in the Pacific Islands[311 ]. The inside of the root is squeezed in water and applied as a rinse to injured eyes. The starch from the tubers of the plant was used as a remedy for diarrhoea and dysentery[311 ]. The root is also used as a thickener in medical preparations[311 ]. The starch from the root is rubbed onto sores and burns[311 ]. The crushed leaf stalks of the plant are rubbed onto bee and wasp stings[311 ]. The stem is roasted and the sap squeezed out and used in the form of ear drops as a remedy for earache[398 ].

nrakta Widely spread in tropical areas, either as a native plant or naturalized, from Africa, through Asia to Australia and the Pacific. ksacta Secondary forest and thickets, and many open situations, clearings, grassland, savannah, coconut groves, and beach vegetation (Barringtonia formation), not shunning seasonally dry areas, such as teak and eucalypt woodland[451 ].

propta Seed - Division of the small, tuberous rhizomes which form at the base of the plant and often remain in the soil when the larger ones are harvested[429 ]

nwatta A plant of low elevations in the moist tropics, where it is most commonly found near the sea and below elevations of 200 metres[429 ]. Grows best in a fertile, humus-rich soil in the shade of trees[200 ]. Plants can set seed three years from being a seedling[451 ]. The tuber is replaced during the year by a new main tuber which arises from a downward-growing runner-like thick rhizome at a lower level and remains dormant after the yearly death of the aerial parts of the original plant[451 ]. Tubers are harvested when the aerial parts have died off[451 ]. It usually takes about 8 months from planting the crop to harvest, but sometimes it can be as much as 10 - 12 months[429 ]. Most plants produce many starchy tubers, similar in appearance to potatoes, usually 10 - 15 cm in diameter, but they can reach 30 cm on rich soils[429 ]. They normally weigh from 70 to 340g but can reach 1 kg[429 ]. Two distinct forms have been reported from the Pacific Islands, one producing a single large tuber, the other with a number of smaller (potato-sized) tubers[429 ]. Flowering Time: Mid Spring Late Summer/Early Fall Blooms repeatedly. Bloom Color: Dark Purple/Black.

## 8.2.8 Cuminum cyminum

Cumin - Jeera  
8 tlin 12 cyuc 4 kcaak 2 tcan 3 dwat 0.3 m hkuc  
htut cyutli hgatkuyctcup hwicli hrasjnutnyk hpa7tli frusflat-prikwissiip hpa7tmwatli fyfekre7t hjonli

drutta Cuminum cyminum is an ANNUAL growing to 0.3 m (1ft) by 0.2 m (0ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9 and is frost tender. It is in leaf from May to October, in flower from June to July, and the seeds ripen from August to September. The species is hermaphrodite (has both male and female organs) and is pollinated by Insects. The plant is self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista May cause hypoglycaemia. Caution need for diabetics. Avoid if taking barbiturates [301]

kcaakta Edible Parts: SeedEdible Uses: CondimentSeed-cooked as a flavouring. Cumin seed was once widely used as a food flavouring in Europe, the Romans ground it into a powder and used it like pepper[ 268 ]. It is little used at present in Western cooking, though it is very commonly employed in India[ 268 ]. A hot and aromatic flavour, it is an important ingredient in curries, is used as a seasoning in soups and stews, and is also often used as a flavouring in biscuits, cakes and bread where it also helps in improving the digestion[ 1 , 4 , 14 , 21 , 27 , 46 , 132 , 171 , 244 , 418 ]. The seed is harvested when fully ripe and is then dried and stored in airtight jars[

244 ]. An essential oil from the seed is used as a food flavouring[ 46 , 61 , 171 ]. According to the USDA, one tablespoon of cumin spice contains: 22 kcal (92 kJ) of food energy, 1.34 g (0.047 oz) of fat, 2.63 g (0.093 oz) of carbohydrates, 0.6 g (0.021 oz) of fibre and 1.07 g (0.038 oz) of protein.

tcanta Essential InsecticideThe seed contains about 2.5% essential oil [240 ]. It is used in perfumery and for flavouring beverages[ 46 , 61 , 177 , 272 ].

dwatta Antibacterial Antidiarrhoeal Antirheumatic Antispasmodic Aphrodisiac Carminative Galactogogue Poulitice Stimulant StomachicCumin is an aromatic, astringent herb that benefits the digestive system and acts as a stimulant to the sexual organs[ 238 ]. It has been used in the treatment of minor digestive complaints, chest conditions and coughs, as a pain killer and to treat rotten teeth[ 238 , 254 ]. Cumin is seldom used in Western herbal medicine, having been superseded by caraway which has similar properties but a more pleasant flavour[ 4 ]. It is still widely used in India, however[ 4 ] where it is said to promote the assimilation of other herbs and to improve liver function[ 238 ]. The seed is antispasmodic, carminative, galactagogue, stimulant and stomachic[ 4 , 46 , 240 , 254 ]. A general tonic to the whole digestive system, it is used in the treatment of flatulence and bloating, reducing intestinal gas and relaxing the gut as a whole[ 254 ]. In India it is also used in the treatment of insomnia, colds and fevers and to improve milk production in nursing mothers[ 254 ]. Ground into a powder and mixed into a paste with onion juice, it has been applied to scorpion stings[ 254 ]. The herb has been used externally as a poultice to relieve stitch and pains in the side[ 244 ]. The essential oil obtained from the seed is antibacterial and larvicidal[ 238 ].

nrakta Europe to N. Africa and S.W.Asia? Original habitat is obscure. ksacta Not known in a truly wild condition.

propta Seed - sow early spring in individual pots in a greenhouse. Grow the plants on fast, and plant them out after the last expected frosts[ 200 ]. Give the plants some temporary protection such as a cloche for their first few weeks in the open ground to make sure that they keep on growing in the cooler weather of early summer[ K ].

nwatta An annual plant, it is cultivated from low elevations in the warm temperate to higher elevations in tropical zones. It does not do well in lowland areas of the tropics, but is successful at higher elevations, being grown up to 2,200 metres. It grows best in areas where annual daytime temperatures are within the range 17 - 26°C, but can tolerate 9 - 30°C[ 418 ]. The plant is intolerant of frost. It prefers a mean annual rainfall in the range 1,200 - 1,800mm, but tolerates 800 - 2,700mm[ 418 ]. Tolerant of most well-drained soils[ 268 ], though it prefers a warm fertile well-drained sandy loam in a sheltered sunny position[ 14 , 200 ]. Prefers a pH in the range 5 - 6.5, tolerating 4.5 - 8.3[ 418 ]. The plant can be harvested for its seed about 60 - 110 days after sowing[ 418 ]. Seed yields can be 500 - 1,200 kilos per hectare[ 418 ]. When bruised, the plant has a pungent aroma[ 245 ].

# 9 9 tlin

## 9.1 bwon

### 9.1.1 Inga edulis

Ice Cream Bean, Monkey Tamarind  
tfo2n 9 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 18 m hkuc  
hmimhtut cyutli hgatkuyctcuphja7m hwicli hrasjnutnyk hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Inga edulis is an evergreen Tree growing to 18 m (59ft) by 18 m (59ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry moist or wet soil and can tolerate drought.

kcaakta Edible Parts: SeedpodEdible Uses: The pulp surrounding the seeds in the seedpod is white, translucent and jelly-like with a sweet, perfumed flavour[301 ]. Much esteemed in Ecuador, some forms have a slight cinnamon flavour[301 ]. The seedpod is up to 100cm long[335 ]. The seedpod can vary considerably in size and in the quantity of

pulp it contains[408 ]. The best forms are found in S. America[408 ].

tcanta Containers Fencing Fuel Hedge Soil conditioner Soil stabilization WoodAgroforestry Uses: Commonly planted as a shade tree in coffee and cacao plantations, since it is fast-growing, fixes atmospheric nitrogen, has a well spreading crown and produces large quantities of leaves which cover the ground and add considerable quantities of organic matter to the soil[46 , 408 ]. In trial experiments on cultivated slopes, a mulch from this tree reduced soil erosion to levels almost equal to those in secondary forests[303 ]. The leaf litter is high in nitrogen, lignins and polyphenols. It is slow to decompose, but provides a long-term build up of organic nitrogen and effective weed control. Weed biomass decreased considerably in all agroforestry trials with this species, much more than with other leguminous species. Existing trials are too new to ascertain whether the species can maintain or improve soil fertility on acid sites in the long term, but results so far are promising[303 ]. Other Uses: The heartwood is light brown with dark stripes; the sapwood is pale yellow or almost white. The texture is coarse; the grain straight to interlocked; lustre is medium; there is no distinctive taste or aroma. The wood is not very heavy; hard to moderately hard. It is said to be very durable, even in water[453 , 549 ], though another report says it has low durability and is susceptible to blue stain[363 ]. It is easy to cut, saws slightly woolly and is liable to split in drying. It is used for making packing cases, and especially for making piles[453 , 549 ]. The wood is used for fuel[549 ]. A popular source of firewood, the wood has a high calorific value and burns with little smoke[303 ].

dwatta Antitussive SkinA decoction of the crushed leaves is taken to relieve coughing[348 ]. A decoction of the leaves is applied to sores of the lips (perhaps herpes)[348 ].

nrakta Northern and western S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, the Guyanas. ksacta Forests on the riverine flood plains[416 ]. Moist, wet, or sometimes rather dry forest, or in open places at elevations below 1,500 metres[331 ]. Thickets and wooded swamps at elevations of 110 - 540 metres in Peru[453 ].

propta Seed - best sown as soon as it is ripe[420 ]. Sow in a lightly shaded position in a nursery seedbed. A high rate of germination can be expected, with the seeds sprouting within a few days. Transplant the seedlings to individual containers when they have 4 - 6 leaves and they should be ready for planting out 4 - 5 months later[420 ]. Greenwood cuttings.

nwatta Agroforestry Services: Alley crop Agroforestry Services: Crop shade Agroforestry Services: Living fence Agroforestry Services: Nitrogen Management: Coppice Management: Standard Regional CropA plant of the hot, humid, lowland tropics, where it can also be found at elevations up to 2,200 metres[335 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 23 - 30°C, but can tolerate 18 - 35°C[418 ]. Mature plants can be killed by temperatures of -2°C or lower, whilst new growth is damaged at 0°C[418 ]. It prefers a mean annual rainfall in the range 1,200 - 2,500mm, but tolerates 640 - 4,000mm[418 ]. Prefers a sunny position, but also succeeds in dappled shade[418 ]. Tolerant of a range of soil conditions, including limestone[200 ]. It can succeed on floodplains that are waterlogged for 2 - 3 months each year, and is also remarkably resistant to drought, occurring in regions with a 6-month dry season[303 ]. Prefers a pH in the range 5 - 6.5, tolerating 4.5 - 8[418 ]. The tree can grow rapidly, even on the poorest nutrient-depleted soils[303 ]. Seedling trees can commence fruiting when only two years old[335 ]. Trees can flower and fruit all year round[335 ]. The tree responds well to coppicing[303 ]. A highly variable species, forms with the best quality seedpods are seldom found in Central America, where it is quite likely that all the trees are relics of former cultivation[408 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[755 ]. Flowering Time: Blooms repeatedly. Bloom Color: White/Near White.

## 9.1.2 Pachyrhizus erosus

Yam Bean, Jicama, Mexican Yam  
tfo2n 9 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 6 m hkuc

= 192 mg/kg-1 (dry). Manganese = 5 kg/kg-1 (dry). Copper = 1 mg/kg-1 (dry).

tcanta Adhesive Charcoal Containers Dye Fencing Fuel Furniture Gum Teeth Varnish WoodAgroforestry Uses: Said to be a suitable species for reforestation[ 332 ]. Natural regeneration is good[ 332 ]. Other Uses: The bark contains a dark-coloured gum which is used to mend broken pottery[ 332 ]. The bark is used for dyeing mats red[ 398 ]. The fruit-pulp is applied to pottery to glaze and varnish it[ 332 ]. The wood is used as chew-sticks[ 332 ]. The heartwood is black, very hard, but appears only in older trees over a certain girth; it is clearly demarcated from the 5 - 12cm wide band of creamy to reddish yellow sapwood that produces bands of black[ 848 ]. The freshly cut wood is light pinkish-brown, slightly darker to the centre[ 332 ]. Blackening of the heart-wood develops only after felling and appears to depend on edaphic characters, trees from savannah situations blackening while those from more thickly forested areas do not[ 332 ]. Blackening is possibly a pathological process and burying is said to accelerate it[ 332 ]. The texture is fine; the grain straight or slightly interlocked. The wood is heavy, very hard, strong; very durable, being resistant to fungi, dry wood borers and termites. It seasons slowly, with a high risk of checking or distortion; once dry it is poorly stable in service. The wood is difficult to saw and work, with serious dulling effect on saws and cutting edges - stellite tipped and tungsten carbide tools are recommended; the surfaces take an excellent polish, but picking up of interlocked or curly grain may occur in planing and a reduced cutting angle is recommended; it has a tendency to split upon nailing, and pre-boring is advised; it has good slicing properties, but powerful machines are needed; the gluing properties are satisfactory. The heartwood is valued for black-wood cabinetry, furniture manufacture and high-class carpentry. It is also used for heavy flooring, interior trim, ship building, vehicle bodies, musical instruments (especially the black keys of pianos, but also guitar fingerboards), precision equipment, turnery, carvings, knife-handles and brush backs[ 46 , 299 , 308 , 332 , 774 , 848 ]. The sapwood, and sometimes also the heartwood, is used for poles, posts, vehicle bodies, agricultural implements, toys, novelties, sporting goods, combs, ladders, boxes, crates, crossbows, veneer and plywood[ 299 ]. The wood makes good fuel wood and charcoal[ 303 ].

dwatta Antiarthritic Antibiotic Anti diarrhoeal Antifungal Astringent Dysentery Febrifuge Haemostatic Laxative Leprosy Mouthwash Odontalgic Skin Stimulant Stomachic VermifugeThe plant is widely used in traditional medicine in parts of Africa, and a number of medically active constituents have been isolated. The principle constituent appears to be plumbagin, which has been shown to have antibiotic, anti-haemorrhagic and fungistatic properties. It is found in the root-bark to a concentration of 0.9% and but a trace in the leaves[ 332 ]. Tannin, saponin and a substance probably identical to scopalamine are also present[ 332 ]. There is a high fluoride content[ 332 ]. The leaves are astringent, febrifuge, haemostatic, mildly laxative, stimulant and vermifuge[ 332 , 774 ]. Such reliance is placed on this drug-plant that it is usually prescribed alone[ 332 ]. An infusion is used in the treatment of a range of conditions - it is very effective in the treatment of fevers and infectious fevers; and is also used for dysentery; pneumonia; syphilis; leprosy and yaws[ 332 , 774 ]. A decoction of leafy twigs is taken in draught as a poison-antidote[ 332 ]. The leaves and fruit are used internally for treating menorrhoea and dysenteriform diarrhoea[ 332 ]. Externally, they are used in the treatment of headaches, arthritis and dermal troubles[ 332 ]. The leaves and fruit are chewed or applied as an infusion for treating gingivitis, toothache, as a dressing for cuts and wounds, and to prevent infection[ 332 ]. The sap is instilled into the ear for treating otitis[ 332 ]. An infusion of the bark is used to treat stomach aches[ 398 ]. Applied externally, it is used as a wash on sores, ulcers, etc[ 332 ]. Shavings of the wood, combined with the pods of *Acacia nilotica* and roots of *Borassus* spp. are pounded in water and boiled for about two hours, after which the liquid is used in Nigeria to rinse the mouth for treating toothache[ 332 ]. Sap from freshly felled trees, as also water from holes in the tree, or an infusion of the black heart-wood, are similarly used[ 332 ]

nrakta Tropical Africa - Senegal to Eritrea and Yemen, south to Namibia, Transvaal and Mozambique. ksacta Riparian forest, more rarely on termite mounds or rocky outcrops or in dry semi-evergreen forest at elevations of 60 - 1,370 me-

tres[ 308 ]. Drier northern borders of the humid rain-forest zone especially in wet situations[ 332 ].

propta Seed - pre-soak overnight by immersing the seed in hot water which is allowed to cool in order to break dormancy[ 303 ]. They should be sown in flat seed trays filled with river sand. Under ideal conditions seeds germinate within 50 days[ 303 ]. Seedlings are then planted out when they reach the 3-leaf stage because if left longer, the taproot may be damaged when transplanting[ 303 ]. They are rather slow growing initially but the growth rate speeds up considerably after a year[ 303 ]. Young trees do not transplant easily[ 332 ] Seed storage behaviour is orthodox. Viability can be maintained for one season in open storage, but can be maintained for several years in hermetic storage at 3°C with 5-6% mc[ 303 ]. Root suckers.

nwatta A plant of the dry to moist tropics, where it is found at elevations up to 1,300 metres. It grows best in areas where annual daytime temperatures are within the range 16 - 27c, but can tolerate 12 - 34c[ 418 ]. It prefers a mean annual rainfall in the range 500 - 1,300mm, but tolerates 400 - 1,500mm[ 418 ]. Prefers a sunny position[ 418 ]. Prefers heavy soils[ 303 ]. Prefers rocky soils along seasonal water courses and swamps[ 303 ]. It grows well in moist, red loams, volcanic and loamy sands[ 303 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 5 - 7[ 418 ]. Trees can be coppiced[ 303 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required.

## 10.2.38 Irvingia gabonensis

Dika Nut

10 tlin 12 cyuc 4 kcaak 3 tcan 3 dwat 30 m hku hminhtut cyuti tcup hwicli hrasjlutnyik hpa7tli frusfaprikli-wis hpa7tmwathi hjonli

drutta Irvingia gabonensis is an evergreen Tree growing to 30 m (98ft) by 30 m (98ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: Chocolate Condiment Drink OilEdible portion: Seeds, Fruit, Kernels, Leaves, Bark - drink. Seed - cooked. In season, the fallen fruits are collected in the forest and stacked till the pulp has rotted away[332 ]. The nuts are opened and the cotyledons removed and dried[332 ]. These cotyledons are a common item of market produce and are used in soups and as a food flavouring[301, 332 ]. They are said to have a pleasant taste with a lingering slight bitterness[63, 332 ]. The seeds are 25 - 38 mm long, 17 - 27 mm wide, 8 - 12 mm thick; the endosperm is almost non-existent[405 ]. The principal domestic use of the seed is for the preparation of odika, or dika bread, also known as Gabon chocolate[301, 332 ]. For this the cotyledons are ground and heated in a pot that is lined with banana leaves in order to melt the fat, and then left to cool. The resultant grey-brown greasy mass is dika bread. It has a slightly bitter and astringent taste with a more or less aromatic odour. Pepper and other spices may be added, and it may perhaps be subjected to wood smoke. The end product may be made up into cylindrical packets wrapped in a basket-like or leaf-wrapping. It can be kept for a long time without going off and it is used as a food-seasoner[332 ]. An alternative method of preparation, more akin to the making of vegetable butters, is to take the fresh or stored cotyledons and pound them into a paste[332 ]. A third preparation, known in Gabon as ov'ke, is to soak the kernels for 15 - 20 days till soft and then to knead them by hand into a cheese-like paste[332 ]. A fourth practice is known in Sierra Leone, in which the cotyledons are dried and ground to a brown 'flour' in which form it can be stored for use as an additive to food as and when required[332 ]. The kernel is an important source of vegetable oil[301, 332 ]. There is a wide variation in quantity and composition of the oil; even so the seeds are considered a suitable source of industrial and edible oils[332 ]. Total fat content has been recorded as 54 - 68%[332 ]. The crude dika paste yields on heating or boiling 70 - 80% of a pale yellow or nearly white solid fat, dika butter, which has qualities comparable with cacao-butter, and is, in fact, a possible adulterant or substitute for the latter in

liquid extract from the leaves and flowers is used as a body wash for convalescents[ 299 ]. The leaves are used in the treatment of infected sores, wounds and skin eruptions[ 299 ]. The whole plant is used as an antidote for snakebites[ 299 ]. The roots are used in the treatment of colic, gonorrhoea and eczema[ 299 ].

nrakta Pantropics. ksacta Open moist places to elevations of 1600 metres in Nepal[272].

propta Seed - sow in situ. Germination should take place within 5 - 7 days.

nwatta Landscape Uses: Border, Container, Massing, Seashore. A plant of the tropics, able to be grown also in the subtropics and warm temperate zones. It can be grown at elevations up to 1,600 metres. It grows best in areas where annual daytime temperatures are within the range 25 - 30°C, but can tolerate 20 - 40°C[ 418 ]. It can be killed by temperatures of 5°C or lower[ 418 ]. It prefers a mean annual rainfall in the range 1,500 - 2,500mm, but tolerates 1,000 - 3,000mm[ 418 ]. For best leaf production, the plant requires a fertile, moisture-retentive but well-drained soil in a sunny sheltered position[ 200, 300 ], though it is tolerant of a range of soil types[ 300 ]. Prefers a pH in the range 6 - 6.5, tolerating 5.5 - 7.5[ 418 ]. Originally from tropical Africa, the plant has spread wherever humans have gone in the tropics and subtropics, both as a weed and as an escape from cultivation[ 305 ]. Early vegetative growth is slow, but flowering may occur already 6 - 7 weeks after sowing. Improved cultivars have a more rapid early vegetative development but flower later, 12 - 14 weeks after sowing[ 299 ]. The green form can be harvested for leaves and green shoots 30 - 40 days from sowing, and for seeds after 80 - 90 days[ 418 ]. The red form is somewhat slower, but produces seeds 100 - 120 days from sowing[ 418 ]. Leaf yields from the green form may be 10 - 15 kg per 10 square metres. The red form yields about 25 kg per 10 square metres[ 418 ]. The early flowering of local cultivars or wild types makes them less attractive to consumers and more amenable to once-over harvesting by uprooting, whereas the improved cultivars can be harvested by uprooting as well as by repeated cutting. Flowering is delayed by repeated cutting of the tender vegetative parts[ 299 ]. Plants have a tolerance to both dry and humid growing conditions and have few pest or disease problems[ 298 ]. Plants will often self-sow[ 298 ]. There are many named varieties, selected for their ornamental value[ 200 ]. Special Features: Attracts butterflies, Suitable for cut flowers, Suitable for dried flowers.

# 10 10 tlin

## 10.1 bwon

### 10.1.1 Tamarindus indica

Tamarind

tfo2n 10 tlin 12 cyuc 4 kcaak 3 tcan 3 dwat 20 m hku htut cyuti hgatkyuctup hwicli hrasjlutnyik hpa7tli frusfaprikli-wishsom hpa7tmwathi hjonli

drutta Tamarindus indica is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by insects. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and saline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate maritime exposure.

kcakta Edible Parts: Flowers Leaves Seed SeedpodEdible Uses: Seedpod - raw or cooked. An acid flavour[398 ]. Harvested when fully grown but still green and tender, they are used as a seasoning and also to make juices and paste[296 ]. The immature pods are used in a variety of ways, being eaten fresh mixed with spices, pickled like green mango, or added whole to soups, stews and sauces[301 ]. The pods are 5 - 15cm long[302 ]. When fully mature, the pods contain a sticky paste which can be eaten raw , used to make drinks, jellies, syrups etc. and, mixed with salt, is a favourite flavouring in the curries of India[296 , 301, 303 ]. This paste is usually quite sour due to its content of tartaric,

acetic and citric acids[307 ], though sweet forms can also be found[298 ]. The sweet-fruited forms are considered a delicacy and are eaten raw[301 ]. Mixed with water, the pulp makes a pleasant lemonade-like drink[298 ]. Mature seeds - dried then toasted or boiled and the shell is removed[298 ]. The seed can be ground into a flour[298 ]. The roasted seed is also used as a coffee substitute[301 ]. Young leaves - raw or cooked. An agreeably sour flavour; they go well cooked with other blander leaves[298 ]. Young leaves can be added to salads[298 , 301 ]. Seedlings, when about 30cm tall, are used as a vegetable[301 ]. Flowers - raw in salads or cooked[298 , 301 ].

tcanta FodderSeaside. Large shade tree. Street tree. Public open space. Bonsai. Xerophytic. Agroforestry Uses: Tamarind is not very compatible with other plants because of its dense shade, broad spreading crown and allelopathic effects. It has been tested as an agroforestry species in India but although the reduction in crop yield is less than that with species such as teak, the spreading crown makes it little compatible with other species[303 , 325 ]. The dense shade makes it more suitable for firebreaks as no grass will grow under the trees[303, 325]. The deep roots make it very resistant to storms and suitable for windbreaks[325 ]. Other Uses The pulp of the fruit, sometimes mixed with sea-salt, is used to polish silver, copper and brass[303 ]. It is normally used when the pulp is over-ripe[307 ]. The seed contains pectin that can be used for sizing textiles[303 ]. Ground, boiled, and mixed with gum, the seeds produce a strong wood cement[303 ]. An amber coloured seed oil - which resembles linseed oil - is suitable for making paints and varnishes and for burning in lamps[303 ]. Both leaves and bark are rich in tannin. The bark tannins can be used in ink or for fixing dyes[303 ]. The leaves yield a red dye, which is used to give a yellow tint to cloth previously dyed with indigo[303 ]. Sapwood is light yellow, heartwood is dark purplish brown; very hard, durable and strong (specific gravity 0.8-0.9g/cubic m), and takes a fine polish. It is used for general carpentry, sugar mills, wheels, hubs, wooden utensils, agricultural tools, mortars, boat planks, toys, panels and furniture. In North America, tamarind wood has been traded under the name of 'Madeira mahogany'[303 ]. Provides a good firewood with the calorific value of 4 850 kcal/kg, it also produces an excellent charcoal[303 , 498 ].

dwatta Dysentery Malaria UrinaryThe bark is astringent and tonic and its ash may be given internally as a digestive. Incorporated into lotions or poultices, the bark may be used to relieve sores, ulcers, boils and rashes. It may also be administered as a decoction against asthma and amenorrhoea and as a febrifuge[303 ]. Leaf extracts exhibit anti-oxidant activity in the liver, and are a common ingredient in cardiac and blood sugar reducing medicines[303 ]. Young leaves may be used in fomentation for rheumatism, applied to sores and wounds, or administered as a poultice for inflammation of joints to reduce swelling and relieve pain[303 ]. A sweetened decoction of the leaves is good against throat infection, cough, fever, and even intestinal worms[303 ]. The filtered hot juice of young leaves, and a poultice of the flowers, is used for conjunctivitis[303 ]. The leaves are warmed and tied to affected areas in order to relieve swellings and pains, particularly sprains[348 ]. They are also used for bathing sores or to bathe persons suffering from measles or allergies[348 ]. The leaves and flowers are used to make a sweetened tea that is drunk by children as a remedy for measles[348 ]. They were also used in a preparation which was drunk in early Guyana as a malaria remedy[348 ]. A decoction of the flower buds is used as a remedy for children's bedwetting and urinary complaints[348 ]. The fruit is aperient and laxative[348 ]. A syrup made from the ripe fruit is drunk in order to keep the digestive organs in good condition, and also as a remedy for coughs and chest colds[348 ]. The flesh of the fruit is eaten to cure fevers and control gastric acid[348 ]. The fruit pulp may be used as a massage to treat rheumatism, as an acid refrigerant, a mild laxative and also to treat scurvy[303 ]. Powdered seeds may be given to cure dysentery and diarrhoea[303 ]. The plant contains pyrazines and thiazoles[348 ]. The seed contains polyoses[348 ]. The bark yields proanthocyanidin and hordenine[348 ].

nrakta Probably originating in tropical Africa, it is now widespread through the tropics and subtropics. ksacta Low-altitude woodland, savannah and bush, often associated with termite mounds. Prefers semi-arid areas and wooded grassland, and can also be found growing along stream and river-

banks[303 ].

propta Seed - when dried, it retains viability for several years at ambient temperatures[325 ]. Pre-soak the seed for 24 hours in warm water and sow in a nursery seedbed or containers at 21°C[200 ]. About 90% germination is achieved in 40 - 50 days[303 ]. Germination is best when seeds are covered by 1.5 cm loose, sandy loam or by a mixture of loam and sand[303 ]. The seedlings quickly develop a taproot and so should not be allowed to grow in a nursery seedbed for more than 4 months before being transplanted into containers[325 ]. Seedlings should attain at least 80 cm before being transplanted to their final location at the beginning of the rainy season[303 ]. They can be planted out when 30cm tall[325 ]. Cuttings of Greenwood Air layering Grafting.

nwatta Agroforestry Services: Crop shade Agroforestry Services: Living trellis Agroforestry Services: Wind-break Fodder: Bank Management: Standard Minor Global CropTamarind grows best in drier areas of the tropics, though it can also do well in much wetter, monsoon areas so long as there is a distinct dry season. It is found at elevations up to 1,500 metres[298 , 325 , 418 , 774 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 35°C, but can tolerate 12 - 45°C[418 ]. When dormant, the plant can survive temperatures down to about -3°C, but young growth can be severely damaged at -1°C[418 ]. The plant is very sensitive to frost[325 ]. It prefers a mean annual rainfall in the range 800 - 3,000mm, but tolerates 300 - 4,500mm[418 ]. In India, it is not grown commercially in areas receiving more than 1,900mm of rain a year and in the wet tropics, with over 4,000 mm of rain, flowering and fruit setting is significantly reduced[325 ]. Regardless of total annual rainfall, a long, well-marked dry season is necessary for fruiting[303 ]. Plants succeed in a range of soils, though they prefer a well-drained, fertile soil in a sunny position[302 , 307 ]. Often found near the coast and in sandy soils, which suggests it is tolerant of saline conditions[298 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 4.5 - 8.5[418 ]. Plants have an extensive root system, which makes them very tolerant of windy conditions (including salt-laden winds) and drought[200 , 303 , 307 ]. Growth is generally slow; seedling height increasing by about 60cm annually[303 ]. Trees commence bearing fruit at 7 - 10 years of age, with maximum yields being obtained from about 15 years onwards[303 ]. Trees can continue yielding for 200 years[325 , 774 ]. Yields of 200 kilos per tree have been recorded[200 ]. There are many named forms[298 ]. The trees respond to coppicing and pollarding[303 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[200 ]. Flowering Time: Mid Winter. Bloom Color: Rose/Mauve Pale Yellow. Spacing: 4-6 ft. (1.2-1.8 m).

## 10.1.2 Pueraria montana

Kudzu Vine  
tfo2n 10 tlin 12 cyuc 4 kcaak 3 tcan 5 dwat m hkuc  
htut cyutli tcup hwicli jlutnyik hpa7tli frusflatprikliw  
hpa7tmwatli dyat hjonli

drutta Pueraria montana is a deciduous Perennial Climber growing to 10 m (32ft) by 0.3 m (1ft in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Insects. The plant is not self-fertile. It can fix Nitrogen. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist soil.

pcista Although no specific mention has been found for this species, the leaves of the closely related Pueraria hirsuta (which might be no more than a synonym for this species) have barbed hairs and these can cause severe irritation[151 ].

kckahta Edible Parts: Flowers Leaves Root Shoots StemEdible Uses: Root - cooked[105 , 171 ]. Rich in starch[109 ]. The root can be up to 1.8 metres long[174 ] and has been known to weigh 35 kilos or more[269 ]. The root contains about 10% of a fine quality starch - this can be extracted and used as a crispy coating in deep fried foods, or as a thickening agent in soups etc[174 , 183 , 303 ]. It can

also be made into noodles, or like agar or gelatine is used as a gelling agent for salads[183 ]. The roots are a staple food in Japan, the peeled root contains about 2.1% protein, 0.1% fat, 27.1% carbohydrate, 1.4% ash[179 ]. The starch of the roots contains (per 100 g) 340 calories, 16.5 percent moisture, 0.2 g protein, 0.1 g fat, 83.1 g total carbohydrate, 0.1 g ash, 35 mg Ca, 18 mg P, 2.0 mg Fe, and 2 mg Na[269 ]. A nutritional analysis for the whole root is available. Flowers - cooked or made into pickles[183 ]. Stems and young leaves - raw or cooked[105 ]. A very nutritious food, the fresh young shoots taste like a cross between a bean and a pea[183 ]. The cooked leaves contain (per 100 g) 36 calories, 89.0 percent moisture, 0.4 g protein, 0.1 g fat, 9.7 g total carbohydrate, 7.7 g fibre, 0.8 fat, 34 mg Ca, 20 mg P, 4.9 mg Fe, 0.03 mg thiamine, 0.91 mg riboflavin, 0.8 mg niacin[269 ].

tcanta Fibre Paper Soil reclamation Soil stabilization StringAgroforestry Uses: The plant can be used as a ground cover in a sunny position[188 ]. It can also be used to make a quick, temporary screen[1 ]. Plants are very fast-growing and have an extensive root system which can be 1.8 metres deep. They are used for erosion control and for rebuilding depleted soils[171 , 174 ]. A member of the Fabaceae, the plant also adds nitrogen to the soil through the actions of root bacteria. Other Uses A tough, strong fibre from the stems is used to make ropes, cables, coarse cordage and textiles[61 , 109 , 151 , 169 , 189 ]. The fibre is 2 - 3mm long and can be used to make paper. Straight first year stems, 2 - 2.7 metres long, are harvested in mid summer, the leaves are removed and the stems steamed until the fibres can be stripped. The fibres are then cooked for 2 hours with lye, tough vines might require 4 hours cooking, and the fibre put in a ball mill for 3 hours. The resulting paper is greenish/cream in colour[189 ].

dwatta Antidiarrhoeal Antidote Antiemetic Antipyretic Antispasmodic Demulcent Diaphoretic Digestive Dysentery Febrifuge Galactagogue Hypoglycaemic Hypotensive Poul-tice Skin StypticThe kudzu vine, known as Ge Gen in China, is commonly used in Chinese herbalism, where it is considered to be one of the 50 fundamental herbs[218 ]. Recent research has shown that compounds called 'daidzin' and 'daidzein', which are contained in the roots and the flowers, are a safe and effective method for treating alcohol abuse[238 ]. They work by suppressing the appetite for alcohol, whereas existing treatments interfere with the way the alcohol is metabolised and can cause a build-up of toxins[238 ]. The plant is often used in combination with Chrysanthemum x morifolium in treating alcohol abuse[254 ]. The flowers and the roots are antidote, antiemetic, antipyretic, antispasmodic, demulcent, diaphoretic, digestive, febrifuge, hypoglycaemic and hypotensive[174 , 176 , 218 , 222 , 238 ]. A concoction of the flowers and tubers is used to treat alcoholism, fever, colds, diarrhoea, dysentery, acute intestinal obstruction etc[174 , 176 , 218 , 222 ]. It is useful in the treatment of angina pectoris and migraine[218 ]. The root is frequently used as a remedy for measles, often in combination with Cimicifuga foetida[254 ]. The root contains puerarin. This increases the blood flow to the coronary artery and protects against acute myocardial ischaemia caused by the injection of pituitrin[176 ]. The root can be harvested from the autumn to the spring and is used fresh or dried[238 ]. The flowers are harvested just before they are fully open and are dried for later use[238 ]. The stems are galactagogue and are also applied as a poultice to incipient boils, swellings, sore mouths etc[218 , 222 ]. The seed is used in the treatment of hangover and dysentery[218 , 222 ]. The leaves are styptic[218 ].

nrakta E. Asia - China, Japan, Korea, Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, th the Solomon Islands and Vanuatu. ksacta Thickets and thin woods all over Japan[58 ].

propta Pre-soak the seed for 12 hours in warm water and sow in a warm greenhouse in early spring. Germination should take place within 2 weeks. Prick out the seedlings into individual pots when they are large enough to handle and plant them out after the last expected frosts[200 ]. Cover the young plants with a frame or cloche until they are growing away well. Division of young shoots from the crown. The young shoots are removed in the spring with some of the underground part of the stem, preferably with some roots already formed. They are potted up and will usually develop new roots from the nodes. They are planted out in the summer if growth is sufficient, otherwise they are grown on in

in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought.

pcista The seeds are toxic[ 307 ]. The stems contain an irritant sap[ 348 ]

kckahta Edible Parts: Fruit Leaves ShootsEdible Uses: Fruit - raw or cooked. Juicy and refreshingly acid[ 301 ]. The fruit has a pineapple like aroma, but its subacid to acid flavour is unique and the pulp is very juicy and rich in vitamin A and C[ 317 ]. The fruits are consumed fresh for dessert when fully ripe or mixed with ice cream or milk to make a delicious drink[ 303 ]. Immature fruits, harvested when the seeds are still soft, are cooked as a vegetable in soups etc[ 301 , 303 , 306 ]. The most desirable characteristics of the fruit are its extremely pleasing fragrance and flavour[ 303 ]. The ovoid fruit is up to 20 x 10cm[ 200 ] and can weigh 1 kilo[ 306 ]. Young shoots - cooked[ 301 ]. Eaten as a vegetable[ 317 ]. A tea, called corosol tea, is made from the leaves[ 301 ].

tcanta Fuel Insecticide Insecticide Parasiticide WoodOther uses rating: Low (2/5). Seaside, Backyard Tree, Screening, Large Container, Courtyard, Conservatory, Xerophytic. Agroforestry Uses: Sour sop is suitable for intercropping between larger fruit trees like mango or avocado. When these achieve crown closure the sour sops can be removed[ 404 ]. Other Uses A powder of the dried leaves and sap from fresh ones are useful in destroying vermin[ 303 ]. A powder or oil from the seeds has been used to kill lice and bedbugs[ 303 ]. All tree parts have insecticidal properties and can also be used, with fruit as bait, to kill fish[ 303 ]. The heartwood is brown; the sapwood is whitish. The wood is soft, light (specific gravity of 0.4), not durable[ 303 ]. It is rarely used as a construction timber but has been used for ox yokes[ 303 , 404 ]. The wood makes a suitable fuel[ 404 ].

dwatta Antianxiety Antibacterial Antidiarrhoeal Antifungal Antirheumatic Antisporic Antispasmodic Cardiac Cardiotonic Carminative Cytotoxic Dysentery Febrifuge Hypotensive Malaria Narcotic Parasiticide Sedative Skin Uterine tonic Vasodilator VermifugeSour sop is often used in traditional medicine. Research has shown that it is anti-malarial, uterine stimulant, antitricutacean, antiparasitic, cytotoxic (acetogenins), cardiac depressant, antimicrobial, antibacterial, antifungal, hypertensive, spasmogenic, vasodilator, insecticide, smooth muscle relaxant[ 311 ]. The plant contains isoquinoline alkaloids including reticuline[ 348 ]. The seed contains galactomannan, sitosterol, stigmasterol and cholesterol[ 348 ]. The leaves are antispasmodic, calumative, narcotic[ 348 ]. The crushed leaves are used as a remedy for distension and dyspepsia, scabies and skin diseases, rheumatism, coughs and colds[ 303 ]. A decoction, often combined with Ludwigia erecta, is used to treat hypertension and heart conditions such as palpitations[ 348 ]. A decoction of the leaves, combined with the leaves of avocado (Persea americana) is drunk as an antihypertensive[ 348 ]. The leaves may also be used to make a decoction, which is taken orally with salt for digestive tract ailments and to relieve fatigue[ 303 ]. The pungent leaves are well-known for their sleep-inducing properties - they can be taken in an infusion, or simply placed under the pillow[ 307 ]. Applied externally, the crushed leaves are used to mature boils and abscesses[ 303 ]. A massage of the leaves is good for remedying nervous shock[ 303 ]. The fruit is antiscorbic, febrifuge, mildly antidyenteric and a good vermifuge[ 348 ]. It is used to treat bedwetting in children[ 348 ]. A decoction is used to remedy excess foot and hand perspiration[ 348 ]. The fruit is used to make a tonic that is used for treating fever, headache, hypertension, and heart problems[ 348 ]. A crushed leaf and seed decoction is taken orally for intestinal malaise[ 303 ]. The leaves and bark are cardiotonic and sedative[ 348 ]. A decoction is used for treating anxiety attacks[ 303 ]. The green bark is rubbed on wounds to stop bleeding[ 303 ]. Flower or flower bud tea is mixed with honey for colds, chest pain and nerve disorders[ 303 ]. The bark and young fruits, which contain tannin, are used to treat diarrhoea and dysentery[ 303 ]. The green bark is rubbed on wounds to stop bleeding[ 404 ]. The seed is an ingredient in a remedy for treating convulsions[ 348 ].

nrakta S. America - northern S. America, southern Central America, Caribbean. ksacta Found on coastal limestone and lowland woodland[ 307 ].

propta Seed - usually breeds true to type[ 200 ]. Sow in individual pots, not deeper than 2cm, at 21c[ 200 ]. Seeds may be sown directly into the field or in a nursery bed[ 303 ].

The seed of many species in this genus has a hard seedcoat and may benefit from scarification before sowing in order to speed up germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing[ K ]. Semi-ripe cuttings[ 200 ].

nwatta Grows best in the moist, humid tropical and subtropical lowlands at elevations up to about 1,000 metres[ 303 , 306 ]. It prefers a mean annual temperature in the range 25 - 30c with a mean annual rainfall over 1,000mm[ 303 ]. Grows best in a sunny position[ 307 ]. Prefers a moist but well-drained, sandy loam with a pH in the range 5.5 - 6.5[ 200 , 303 , 404 ]. Prefers a deep rich loam[ 303 , 306 ]. Succeeds in light-textured, alkaline soils[ 307 , 404 ]. Established plants are very drought tolerant[ 307 ]. The leaves have an aroma similar to blackcurrants. Flowers are protandrous, and the pollen is shed as the outer petals open towards the evening. The inner petals open much later and only very slightly, admitting small insects attracted by the fragrance of the flowers. Presumably these insects effect cross-pollination, though rather inadequately, for few flowers set fruit and many fruits are misshapen since numerous ovules are not fertilized. Hand pollination is effective in improving fruit yield and quality[ 303 ]. Sporadic flowering and fruiting can occur all year round in favourable conditions[ 303 ]. Fruiting starts in the 2nd year, and 5-year-old trees produce 10 - 50 fruits, depending on pollination efficiency and nutrient status[ 303 ]. It bears fruit almost continually throughout the year, but there is normally one season when more fruit are getting ripe. Fruit can weigh up to 4-5 kg each. A tree can produce 12-24 fruit in a year. The fruit contain 11-14% sugars. There are many named varieties[ 301 ]. The area around the base of the tree should be kept free from weeds or covered with mulch to avoid dehydration of the shallow roots during the dry season[ 303 ]. Annona muricata can tolerate dry soil conditions, but the trees shed too many leaves if they experience prolonged drought[ 303 ]. Problems include: seed borers, scale, mealy bugs.

## 10.2.37 Diospyros mespiliformis

West African Ebony, Monkey guava, jackalberry  
10 tlin 12 cyuc 4 kcaak 4 tcan 3 dwat m hkuc  
htut cyutli tcup hwicli hrasjlutnyikrip hpa7tli flatprikliw  
hpa7tmwatli dyat hjonli

drutta Diospyros mespiliformis is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. The plant is not self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcista Sawdust of this species, as also of most Diospyros spp., causes dermatitis after continuous contact[ 332 ].

kckahta Edible Parts: Fruit LeavesEdible Uses: Drink GumFruit - raw, cooked, dried or made into beverages by fermentation[ 308 , 332 , 335 ]. A sweet flavour[ 332 , 335 ], similar to the persimmon (D. kaki)[ 332 ]. A kind of soft toffee can be made from the fruits, which along with some other similar edible fruits, such as figs and dates, are known as lubiya[ 332 ]. The globose, yellow fruit is up to 25mm in diameter[ 308 ]. The leaves are sometimes eaten[ 317 , 332 ]. Chemical composition (Sudan sample, after Abdelmuti): Protein (crude) = 3.0% (dry). Fat = 0.9% (dry). Fibre (crude) = 16.5% (dry). Ash = 4.5% (dry). Carbohydrate (soluble): Starch = 6.1% (dry). Sucrose = 0% (dry). D-Glucose = 7.61% (dry). F-Fructose = 9.9% (dry). Amino acids (g (16g N)-1): Aspartic acid = 5.7g. Threonine = 3.0g. Serine = 3.3g. Glutamic acid = 6.6g. Proline = 7.6g. Glycine = 4.0g. Alanine = 3.3g. Valine = 4.3g. Cysteine = 1.0g. Methionine = 1.0g. Isoleucine = 3.7g. Leucine = 5.0g. Tyrosine = 2.0g. Phenylalanine = 3.3g. Lysine = 4.0g. Histidine = 2.3g. Arginine = 4.0g. Minerals: Sulphur = 0.05% (dry). Phosphorus = 0.11% (dry). Magnesium = 0.08% (dry). Calcium = 0.37% (dry). Na = 0.01% (dry). K = 1.51% (dry). Zinc = 5 mg/kg-1 (dry). Iron

is heated and applied to the chest as a poultice to stop severe coughing[ 360 ]. The tree bark is commonly used for postpartum baths[ 360 ]. The essential oil is an ingredient of a commercial preparation called 'Lysout', a natural anti-lice foaming gel that also contains Echinacea purpurea[ 360 ].

nrakta Southeast Asia - Philippines. ksacta Lowland rainforest[ 307 ]. Primary forests at low and medium elevations[ 338 ].

propta Seed - we have no specific information for this species but seeds of this genus generally have a hard seed coat and germinate erratically. Filing away some of the seed coat to allow moisture to enter more readily, without damaging the seed, will encourage a faster and more even germination[ 658 ].

nwatta Management: Standard Regional Crop Staple Crop: OilA single tree yields 4 - 5 kilos of resin[ 402 ]. Wild forms usually have three, sometimes two kernels present in the nut, each in its own compartment[ 63 ]. In the case of cultivated trees, however, only one kernel is sometimes found in each nut[ 63 ]. When this is so, the kernel is proportionately larger and the nut easier to crack[ 63 ]. Trees are dioecious, both male and female forms need to be grown if fruit and seeds are required.

## 10.2.34 *Treculia africana*

African Breadfruit or Breadnut

10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 30 m hkuc hmimhtut cyutli tcup hwicli jlutnyikfrip hpa7tli flatprikwisi hpa7tmwatli hjonli

drutta *Treculia africana* is an evergreen Tree growing to 30 m (98ft) by 30 m (98ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. Suitable for: medium (loamy) and heavy (clay) soils and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The sap of the male tree is caustic and toxic, though the sap from female trees is used medicinally[307 ].

kcakta Edible Parts: Oil SeedEdible Uses: Milk OilSeed - cooked[301 ]. A flavour similar to peanuts[335 ]. Eaten as dessert nuts after roasting or boiling, they are also ground into a meal, used in soups and to produce a variety of baked foods such as bread and paste[63, 303 ]. The seeds are extracted after macerating the fruit in water[303 ]. The grains have an excellent polyvalent dietetic value - the biological value of its proteins exceeds even that of soybeans[303 ]. Numerous seeds about 8mm long are embedded in a massive fruit that can weigh up to 14 kilos[63 ]. A non-alcoholic beverage, almond milk, can be prepared from the powdered seeds, which is recommended as a breakfast drink in Nigeria[303 ]. An edible oil can be extracted from the seed[301, 303 ].

tcanta Charcoal Fencing Fuel Furniture Mulch Oil Paper Soil conditioner Teeth WoodShade tree. Fruiting tree. Humid shade garden. Botanical collection. Agroforestry Uses: The tree has been used in soil conservation programmes[303 ]. The leaf fall is a good source of mulch[303 ]. It has also been recommended as a promising species for use in home gardens, and for intercropping systems in agroforestry[303 ]. Other Uses The heartwood is yellow with very narrow pale sapwood; very dense, fairly elastic and flexible, rather heavy, with fine, even structure. It is suitable for furniture, carving, turnery and inlay wood[303 ]. It is suitable for pulp and papermaking[303 ]. The wood is used for fuel and making charcoal[398 ].

dwatta Anthelmintic Antitussive Febrifuge Laxative Leprosy OdontalgicIn Ghana, a root decoction is used as an anthelmintic and febrifuge[303 ]. The caustic sap of male African breadfruit is applied on carious teeth[303 ]. A decoction of the bark is used in the treatment of cough and whooping cough[303 ]. The ground bark, mixed with oil and other plant parts, is used in the treatment of swellings[303 ]. It is also used in the treatment of leprosy and as a laxative[303 ].

nrakta Tropical Africa - Senegal to southern Sudan, Uganda and Kenya, south to northern Angola, Zambia, Malksacta Usually found near streams or in swampy areas in forests at an altitude up to 1,500 metres[303 ]. Riverine, mixed evergreen and swamp forests, woodlands, sea level to 1,300 metres[308 ].

propta Propagation is by seedlings, which are sown in pots, and direct spot sowing at site. Pre-treatment of seeds is not necessary. It is also propagated through budding, cuttings and shield grafting. Using adult scions, budded trees have produced fruits with viable seeds within 2-4 years. With juvenile cuttings, one can obtain 69% rooting. Where climatic conditions are favourable, fruit collection is possible throughout the year

nwatta Agroforestry Services: Living fence Managemen Standard New Crop Staple Crop: ProteinTolerant of a wide range of climatic conditions, it will thrive in most tropical and subtropical regions at elevations up to 1,500 metres[303 ]. It is found in areas where the mean annual rainfall is within the range 1,250 - 3,000mm, and the mean annual temperature ranges from 22 - 35°C[303 ]. Prefers a rich, deep, moisture-retentive soil and a position in partial shade or full sun[303 ]. It is not a very light demanding plant, and will grow in a wide variety of soils[303 ]. Plants start to fruit when about 4 years old[303 ]. Under favourable climatic conditions and in a good soil, 120 - 200 kilos of dried grains can be harvested in a year from each tree; this would translate to between 5 - 10 tonnes per hectare[303 ]. A fairly fast-growing tree. There is a striking variation in the number of fruit heads produced by trees belonging to T. africana var. africana (with large fruit heads) and T. africana var. inversa (with small fruit heads). The former is clearly superior in the weight of seeds produced while the latter produces more fruit and also produces twice as many branches[303 ]. Bloom Color: Cream/Tan. Spacing: 8-10 ft. (2.4-3 m).

## 10.2.35 *Vitex madiensis*

Ekarukei, Murukukwe

10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta *Vitex madiensis* is a TREE growing to 4 m (13ft) by 4 m (13ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Fruit OilEdible Uses: OilFruit - raw or cooked[323 ]. Sweet and mealy[398 ]. The thin pulp clings to the stone, which contains 3 to 4 seeds[323 ]. The purple-black fruit is about the size of an olive[323 ]. The oblong-rounded fruit is about 25mm long and 10 - 20mm wide[398 ].

tcanta Charcoal Cosmetic Fuel OilOther Uses The leaves yield an essential oil of such sweet and penetrating fragrance that it has been recommended for commercial development[323 ]. The branches are used as chew sticks for maintaining the health of teeth and gums[774 ]. The wood is used for fuel and to make charcoal[398 ].

dwatta Odontalgic SkinThe leaves and roots have medicinal uses[323 ]. Bark extracts are used in the treatment of skin diseases and toothache[774 ].

nrakta Tropical Africa - Senegal to Somalia, south to Angola, Zambia, Zimbabwe and Mozambique. ksacta Combretum, Terminalia and Brachystegia woodland and flood pans with Brachystegia; grassland, wooded grassland or dense woodlands; at elevations from 1,000 - 1,800 metres[398 ].

propta Seed - nwatta Not known

## 10.2.36 *Annona muricata*

Sour Sop

10 tlin 12 cyuc 4 kcaak 2 tcan 3 dwat m hkuc hmimhtut cyutli hgattcup hwicli hyishrasjlutnyik hpa7tli frusflatprikwissi hpa7tmwatli hjonli

drutta *Annona muricata* is an evergreen Tree growing to 7 m (23ft) by 7 m (23ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Flies, Beetles, Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow

pots for a year and planted out late the following spring.

nwatta Kudzu vine can be grown in a wide range of climates from milder areas in the temperate zone to the subtropics and higher elevations in the tropics. It grows best in areas where annual daytime temperatures are within the range 18 - 28°C, but can tolerate 9 - 32°C[418 ]. When dormant, the plant can survive temperatures down to about -6°C, but young growth can be severely damaged at -1°C[418 ]. Plants are hardy to about -15°C, they can resprout from the base if they are cut down by frosts[200 ]. It prefers a mean annual rainfall in the range 1,200 - 1,400mm, but tolerates 950 - 2,200mm[418 ]. Succeeds in most well-drained soils in a sunny position[200 ], though it does not make good growth on very light poor sand or on poorly drained heavy clay[269 ]. Grows best on well-drained loam soil of good fertility[269 ]. Plants cannot stand waterlogging on any soil[269 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 5 - 7.[269, 418 ]. A deep-rooted plant, once established it is very drought resistant[171, 269 ]. When grown in warm climates, the root can be invasive and plants have become weeds[182, 219 ]. Introduced into the southern N. American states in 1876 as a soil stabilizer, the plant has spread very widely (it can grow up to 30cm in a day), and has swamped out native vegetation, including large trees. It is considered to be one of the most obnoxious weeds in that region[274 ]. The tubers can be harvested about 1 year after planting, if grown from cuttings. If left longer in the soil they can become very large, with weights of up to 180 kilos[303 ]. *Pueraria montana* has three varieties. The form *Pueraria montana lobata* (Willd.) Sanjappa and Pradeep (formerly known as *Pueraria lobata*) is the form most commonly mentioned for its medicinal and other uses. The other varieties should be very similar in their applications[K ]. The flowers have a sweet vanilla scent[245 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[200 ].

## 10.1.3 *Archidendron jiringa*

Jengkol, Jiringa

tfo2n 10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 20 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyikfrip hpa7tli frusflatprikwissi hpa7tmwatli hjonli

drutta *Archidendron jiringa* is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Moths, insects. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista Djenkolic acid, an amino acid derivative, has been found in the seed. Ingestion of the seed can cause the formation of sharp needle-like crystals of djenkolic acid in the kidney or urinary tract. In severe cases, crystals of djenkolic acid have been found in urine. Indeed, people who are suffering from djenkolism show similar symptoms to those suffering from kidney or urinary stones, a condition for which it has been frequently mistaken[ 306 ].

kcakta Edible Parts: Flowers Fruit Leaves Seed Seedpod ShootsEdible Uses: Edible portion: Pods - flavouring, Shoots, Seeds, Spice, Leaves. Seed - raw or cooked[ 301 ]. The seed has a powerful odour that many people find objectionable[ 63 ]. Young seeds are often eaten raw[ 303 ]. Generally the young seeds are believed to have a better flavour than older ones, though some people prefer to eat germinating mature seeds[ 306 ]. The seedpod is 20 - 25cm long and 3 - 4cm wide, twisted in a wide spiral[ 418 ]. Mature seeds contain djenkolic acid and need careful preparation to neutralize it. Traditionally, they are boiled in three changes of water[ 451 ]. Sometimes the seeds are boiled in a mixture of water, wood ash, bamboo leaves and pieces of steel or nails, discarding the cook water a number of times[ 306 ]. The resulting beans are said to be highly nutritious[ 306 ]. Other ways in which the seeds are prepared are:- 1). Boiled thoroughly till the offensive smell has disappeared, then consumed with salt and grated coconut[ 303 ]. 2). Steeped for a couple of hours

in salt water, before being fried in oil. This also removes most of the bad smell[ 303 ]. 3). Made into a local delicacy, called emping. After cooking, the cotyledons are flattened by hammering them one by one into the shape of small cakes which are sun-dried, and fried in coconut oil and sprinkled with salt before consumption[ 301, 303 ]. 4). Buried for 14 days until they germinate, then dug up and washed clean, whilst at the same time the sprouts are cut off and thrown away[ 303 ]. The latter way of preparation is said to minimize the danger of intoxication by jengkollic acid, crystals of which can cause kidney failure. It is recommended to drink much water when eating the seeds[ 303 ]. A starch is also extracted from the seed[ 301 ]. Young leaves - cooked[ 46, 301 ]. The very young wine-red shoots are consumed raw as a vegetable[ 303 ]. Flowers[ 301 ]. Eaten as a vegetable[ 46 ]. Fruit[ 301 ].

tcanta Dye Fuel Furniture Hair Insecticide Soap making WoodOther uses rating: Low (2/5). Other Uses The pods have been used as a source of purple dye for silk[ 303, 451 ]. The bark and leaves are used for dyeing matting black[ 303, 451 ]. To obtain this colour the mat is boiled with extract from the bark and then immersed in mud[ 303 ]. A reddish dye is obtained from the seeds[ 317 ]. The pods are used as a shampoo[ 303 ]. The pulverised seeds are used, they are rich in saponins[ 317 ]. The bark, leaves and seeds have insecticidal properties[ 317 ]. The heartwood is white, the sapwood white or pinkish-white. The wood has a strong smell of garlic when fresh, it is soft, easy to saw and to work with[ 303, 451 ]. It is considered to be only suitable for cabinet work, interior joinery[ 303, 418 ]. The wood is used for fuel[ 303, 418 ].

dwatta Diuretic Hypoglycaemic SkinThe seed is said to be good for relieving the symptoms of diabetes[ 63, 306 ]. The old leaves, burnt to ashes, are used against itching[ 303, 418 ]. The ashes of young leaves are used as wound powder for cuts (e.g. Circumcision)[ 303 ]. They are also applied traditionally as a diuretic, but are poisonous when eaten in large amounts[ 303 ].

nrakta E. Asia - Bangladesh. Myanmar, Thailand, Malaysia, Indonesia. ksacta Forests of humid and mountainous areas, as well as along river banks[ 306 ]. A sub-canopy tree in primary and secondary rain forest and in evergreen forest[ 303, 451, 653 ].

propta Seed - The trees are grown from seed planted in the location where they are to grow. A spacing of 10-15 m is suitable.

nwatta A plant of the humid tropics, where it is found at elevations up to 1,600 metres. It grows best in areas where annual daytime temperatures are within the range 20 - 30c, but can tolerate 12 - 40c[ 418 ]. It prefers a mean annual rainfall in the range 2,000 - 3,000mm, but tolerates 1,000 - 4,000mm[ 418 ]. Grows well in full sun and in light shade[ 418 ]. Prefers a well-drained soil[ 303 ]. It is found growing on sandy soils, lateritic soils and reddish sandy clay on flat land and low undulating hills[ 303 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 4.5 - 7[ 418 ]. Although most species in the family Fabaceae have a symbiotic relationship with bacteria on their roots that can fix atmospheric nitrogen, there is a report that this species does not have this relationship.

## 10.1.4 *Inocarpus fagifer*

Tahiti Chestnut, Polynesian Chestnut

tfo2n 10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 20 m hkuc pcmimimhtut cyutli hgattcuphia7n hwicli hyishrasjlutnyik hpa7tli frusflatprikwissi hpa7tmwatli hjonli

drutta *Inocarpus fagifer* is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bats. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid, very alkaline and saline soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist or wet soil and can tolerate drought.

kcakta Edible Parts: SeedEdible Uses: Seed - raw or cooked[301 ]. Boiled before they are quite ripe, they resemble chestnuts in flavour and are very nutritious[63, 301 ]. They can be boiled or baked[301 ]. The grated seeds are used for making flat cakes, breads and puddings[301 ]. Although

quite palatable, the seeds are reputed to be somewhat indigestible even when cooked[301 ]. The kernels (seeds) are large, each weighing 5 - 50 g, and measuring 20 - 70mm in length by 16 - 40mm in width[312 ]. The kernel is edible when cooked but is highly perishable and has a short shelf life. It rapidly changes colour from white to reddish brown after being extracted from the shell[312 ].

tcanta Fuel Shelterbelt Soil stabilization WoodAgroforestry Uses: The tree has a good network of lateral roots including three or four structured buttresses at the base of the trunk; it is used to stabilize soils, especially near the coast and along the banks of rivers[312 ]. A good medium-height tree for windbreaks because it tolerates strong winds and resists breakage[312 ]. The tree can be used to provide shade for plantation crops[312 ]. It has a dense canopy, which makes it unsuitable for close planting between light-demanding agricultural crops such as sweetpotato (Ipomoea batatas), taro (Colocasia esculenta), sugarcane (Saccharum officinarum), and corn (Zea mays). However, it is suitable as a boundary tree to provide shade and shelter for more shade-tolerant crops. Some types are compatible with other trees such as vi (Spondias cythera), canarium nut (Canarium spp.), and breadfruit (Artocarpus altilis). It also grows together well with cutnut (Barringtoniasp.),sago palm (Metroxylon salomonense), betel nut palm (Areca catechu),and coconut (Cocos nucifera)[312 ]. Other Uses: The wood is fairly durable, but may be more susceptible to termites as sawn timber[312 ]. It is used for crafts, tool handles, canoes, and light construction[312 ]. Fallen branches are used for fuel[312 ].

dwatta Antidiarrhoeal Mouthwash Skin StomachicThe tahiti chestnut is often used in traditional medicine, where it has a range of applications[311 ]. The bark is used to treat sickness relapses[311 ]. An infusion of the bark is used to treat burns; diarrhoea and teething problems in infants[311 ]. A decoction of the bark is used in treating scabies[311 ]. Extracts from heated bark scrapings are used in a treatment for pneumonia[311 ]. The dried inner bark mixed with coconut oil is applied to bone fractures[311 ]. The root is used to treat stomach-ache[311 ]. Liquid from the stems is used to treat pain in the bones[311 ]. Weakness after childbirth and fish poisoning are treated with the fluid from the leaves[311 ]. The plant is also said to stop internal bleeding[311 ].

nrakta E. Asia - Malaysia to Australia and the southwest Pacific. ksacta Common in coastal forests, margins of swampy places, along rivers, and even in dry forests[311 ]. Lowland secondary forest, stream banks, swamps and marshes, mangrove areas, and coconut plantations at elevations from sea level to 500 metres[312 ].

propta Seed - it does not tolerate desiccation and has a very short viability of a few weeks. The seeds are large and can be sown directly into their permanent positions or into deep, individual containers. Young plants require shade from strong sun. Germination can take place within 7 days, with almost 100% of the seeds sprouting. Nursery sown seeds can be transplanted to their permanent positions about 2 months after germinating, when about 20 - 30cm tall[312 ]. Single-node cuttings, taken from stems of the current year's growth, can root within 14 days, with almost 100% success rate[312 ].

nwatta Agroforestry Services: Crop shade Agroforestry Services: Nitrogen Management: Standard Other Systems: Multistrata Regional Crop Staple Crop: Balanced carbA plant of hot, humid, tropical lowlands at elevations below 500 metres[335 ]. It is found in areas where the mean annual rainfall ranges from 1,500 - 4,300mm and there is only a small or no dry season[312 ]. The mean annual temperature is around 27°C, with the hottest month ranging from 29.4 - 34.5°C and the coolest month 20 - 23°C[312 ]. Plants are fairly shade tolerant, although heavy shade can reduce yields of seeds[312 ]. The plant succeeds in a wide range of soils that include highly calcareous and saline soils and poorly drained seasonal to permanently waterlogged valleys, swamps, and marshes. It occurs in soils with medium to very low fertility rating. It can grow in mildly acidic to very alkaline coastal soils with a pH up to 14[312 ]. It has medium to high tolerance of steady and strong winds and is windfirm due to a strong lateral root system including buttresses[312 ]. The plant has a moderate to fast rate of growth, with annual increases in height when young of up to 2 metres per year[312 ]. Trees can commence flowering when around 3 - 5 years old[312 ]. Yields of up to 75 kilos of fruits per tree per

annum can be obtained from trees 25 or more years old[312 ]. Trees can live for 80 - 90 years[312 ]. The tree responds well to coppicing[312 ]. Although many species within the family Fabaceae have a symbiotic relationship with soil bacteria, this species is said to be devoid of such a relationship and therefore does not fix atmospheric nitrogen[755 ].

### 10.1.5 Inga jinicuil

Ice Cream Bean, Jinicuil

tfo2n 10 tlin 12 cyuc 4 kcaak 1 tcan 0 dwat 20 m hkuc htut cyutli hgattcup hwicli hrasjlutnyik hpa7tli flatprklwsh-som hpa7tmwatli hjonli

drutta Inga jinicuil is an evergreen Tree growing to 20 m (65ft) by 25 m (82ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. It can fix Nitrogen. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in saline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant is not wind tolerant.

kcakta Edible Parts: Fruit Seed SeedpodEdible Uses: Inside the seedpod lies a slightly sweet, creamy, white, high protein pulp surrounding the brown seeds[307 ]. This pulp has a flavour likened to vanilla ice cream and is considered a delicacy by many, especially children[307 , 317 ]. The seedpod is about 20cm long and 5cm wide[307 ]. Seed-cooked[317 ]. Traditionally eaten with Phaseolus beans and Chenopodium leaves[317 ].

nrakta Central America - Mexico to Costa Rica. ksacta Moist lowland slopes[307 ].

propta Seed - Greenwood cuttings.

nwatta A plant for the lowland moist tropics[307 ]. Prefers a position in full sun in a fertile, well-drained soil[307 ]. Requires a position sheltered from strong winds[307 ]. Plants flower irregularly throughout the year[307 ]. The flowers are easily damaged by high winds or heavy rain[307 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[755 ].

### 10.1.6 Pithecellobium dulce

Manila Tamarind, Madras Thorn

tfo2n 10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 15 m hkuc htut cyutli hgatyuctup hwicli hyshrasjlutnyik hpa7tli flatprklwshlphsom hpa7tmwatli hjonli

drutta Pithecellobium dulce is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerates strong winds but not maritime exposure.

pcista The bark contains irritating substances, which can cause eye infections[306 ]. (Danger: Handling plant may cause skin irritation or allergic reaction Plant has spines or sharp edges; use extreme caution when handling)

kcakta Edible Parts: Fruit Oil Seed SeedpodEdible Uses: Drink Gum OilThe pods contain a sweet, pulpy flesh that surrounds the seed[301 ]. This flesh can be eaten raw, boiled or made into a refreshing beverage that is suggestive of lemon-ade[301 , 303 , 331 ]. The pods are 10cm long by 1.5cm wide[200 ]. When mature, the pods split open at the lower suture exposing the edible pulp. For this reason the fruit does not keep long and has to be consumed within a few days[306 ]. Seeds - raw or eaten in curries[301 , 303 ]. An oil is obtained from the seed[301 , 303 ].

tcanta Biomass Dye Fencing Fodder Fuel Gum Hedge Oil Shelterbelt Soap making Soil reclamation Tannin WoodAgroforestry Uses: Since it can fix atmospheric nitrogen, and grow on waste and denuded lands, it is used to afforest and conserve poor soils[303 ]. With regular trimming, the tree

conspicuous flowers have a sweet, delicate fragrance[200 ]. Various species of biting and stinging ants have been found inhabiting hollow twigs on this tree[407 ]. Flowering Time: Late Winter/Early Spring Mid Spring Late Spring/Early Summer Mid Summer Late Summer/Early Fall. Bloom Color: Cream/Tan Inconspicuous/none (white). Spacing: 15-20 ft. (4.7-6 m).

### 10.2.32 Couma macrocarpa

Barca, Milk Tree, Couba, Sorva, Sorva

10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprklwsh hpa7tmwatli hjonli

drutta Couma macrocarpa is an evergreen Tree growing to 25 m (82ft) by 25 m (82ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista Handling plant may cause skin irritation or allergic reaction

kcakta Edible Parts: Fruit Leaves SapEdible Uses: Drink Gum Milk TeaWhen the bark is cut or broken, there issues from it a rich creamy latex that is sweet and palatable[ 331 , 625 ]. It is not very sticky and may be drunk like cow's milk[ 331 ]. A latex obtained from the trunk can be used to make chewing gum[ 46 ]. Fruit - raw[ 625 ]. The succulent pulp is sweet and extremely glutinous[ 625 ]. It contains latex[ 625 ]. The globose, yellow-green fruit is about 6cm in diameter, containing a few seeds[ 625 ]. An infusion of the leaves is used as a beverage[ 331 ].

tcanta Containers Furniture Gum Insulation Latex Teeth Waterproofing WoodOther Uses: A latex exudes from the cut or broken bark. When boiled in water it gives a product similar to gutta-percha that can be used for caulking canoes[ 331 ]. Gutta-percha is a natural latex obtained from the sap of the tree. Allowing this fluid to evaporate and coagulate in the sun produces a hard and durable latex that can be made flexible again with hot water, but which does not become brittle. Prior to the advent of synthetic materials, gutta-percha had a wide range of uses - most particularly as an insulating material for electricity wiring and for underwater telegraph wires, a purpose for which it is very well suited since it is bio-inert and so is not attacked by marine plants or animals. Gutta-percha can be moulded into any shape and has been used to make items such as ornate furniture, pistol grips, acid-resistant receptacles and 'mourning' jewellery, where its dark colour was an advantage. It has been widely used as the core of golf balls and is still used in modern dentistry where its bio-inertness makes it ideal as a temporary filling for teeth and as a filling material inside tooth fillings[ 46 , 418 ]. The heartwood is cream-coloured or pale brown, often with a pinkish tinge; there is no sharp demarcation from the sapwood. The texture is medium; the grain fairly straight to inter-locked; lustre rather low to medium; odour and taste not distinctive. The wood is light in weight; moderately hard; natural durability is low and the wood is prone to attacks by blue-stain fungi. It is easy to both air dry and kiln dry, with little or no degradation due to warping or checking. The wood is easy to work with all tools, however, there is some difficulty to generate smooth surfaces on quarter-sawn stock due to the interlocked grain; it is easy to nail and screw, and generally finishes well. The wood is used for interior millwork, general construction, furniture components, veneer for plywood, particleboard and fiberboard, boxes and crates[ 316 , 331 , 625 ].

dwatta DysenteryA latex in the stems can be used in the treatment of amoebiasis, including amoebic dysentery[ 739 ].

nrakta S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana; C. America - Panama to Guatemala. ksacta Low wet mixed forest, or often seen in cleared pastures, at or a little above sea level[ 331 ]. A climax tree of the rainforest, found mainly on well-drained sites in upland areas of the Amazon[ 625 ].

propta Seed - short viability, it should be sown as soon as it is ripe in a shady position in a nursery seedbed or in individual containers[ 625 ]. A germination rate in excess of

70% can be expected, with the seeds sprouting within 25 - 35 days[ 625 ].

nwatta Experimental Crop Industrial Crop: Hydrocarbon Management: CoppiceA tree of the lowland humid tropics. Prefers a shady position. A popular fruit.

### 10.2.33 Canarium luzonicum

Manila Elemi

10 tlin 12 cyuc 4 kcaak 4 tcan 3 dwat 30 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprklwsh hpa7tmwatli dyat hjonli

drutta Canarium luzonicum is an evergreen Tree growing to 30 m (98ft) by 20 m (65ft). See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Fruit Oil Seed ShootsEdible Uses: OilSeed - raw or cooked. The sweet nuts have a delicious flavour when roasted and are served like almonds[ 301 ]. They can also be used in confections, ice cream, nut milks etc, and as an adulterant to chocolate[ 301 ]. The coat surrounding the kernel should be removed since it can cause diarrhoea[ 63 ]. The shell is very thick and difficult to crack, though some thinner shelled forms have been found[ 63 ]. A sweet oil obtained from the seed is used for cooking purposes[ 301 ]. The fruit pulp is boiled and eaten[ 301 ]. Rather tasteless[ 63 ]. An oil can be extracted from the fruit pulp[ 301 ]. It has a tangy, resin-like flavour[ 301 ]. Young shoots - raw[ 301 ]. Eaten in salads[ 301 ].

tcanta Essential Furniture Ink Oil Parasiticide Resin Tannin Varnish Waterproofing WoodOther uses rating: High (4/5). Other Uses: An oily resin called Manila elemi is obtained from incisions in the bark[ 46 , 317 ]. Manila elemi is a soft and fragrant oleoresin, oily, pale yellow to greenish, of honey consistency, balsamic in odour and bitter tasting[ 360 ]. It is used in varnishes and inks; for caulking boats; torches; perfumery and for various medicinal applications[ 46 , 317 ]. It can be used for the same purposes as turpentine[ 46 ]. A tannin of reasonable quality is obtained from the bark[ 402 ]. The wood is not very hard. It is used for light construction[ 402 , 451 ]. This species is one of the sources of kedondong timber, which is obtained from several species in the family Burseraceae[ 884 ]. However, the tree is more highly valued for its resin and edible seed and so is little harvested for its wood. We do not have a specific description of the wood for this species, but the general description of kedondong wood is as follows:- The heartwood is generally a light brown; it is not sharply demarcated from the 3 - 5cm wide band of lighter-coloured sapwood. The texture is moderately fine and even; the grain is interlocked to wavy; the surface is lustrous. The wood is light in weight; moderately hard; not very durable, being susceptible to fungi, dry wood borers and termites. It seasons somewhat slowly with only a slight risk of checking and distortion; once dry it is moderately stable to stable in service. The wood has a fairly high blunting effect, stellite-tipped and tungsten carbide tools are recommended; it is moderately easy to slightly difficult to plane; finishes smooth to rough; can be easy to very difficult to bore; slightly difficult to difficult to turn; nailing and screwing properties are good; gluing is correct. The wood is suitable for internal use as a general utility timber for planking, cladding, plywood, flooring, furniture, packing cases, pallets and general carpentry work[ 316 , 848 ].

dwatta Antibacterial Antifungal Antirheumatic Antirheumatic Antiseptic Antispasmodic Antitussive Fibrifuge Parasiticide Poultice Rubefacient SkinManila elemi (the oleoresin obtained from the tree), and the essential oil distilled from the resin, have a long history of medicinal use. They are considered to be antibacterial, antifungal, antirheumatic, antiseptic, antispasmodic and rubefacient[ 360 ]. A study on the composition of Manila elemi oil from the distillation of elemi resin yielded 39 compounds, with limonene, the most abundant at 56%[ 360 ]. A corn-sized drop of the resin is taken with water in the treatment of fevers and chills[ 360 ]. The oleoresin is applied externally to arthritic and rheumatic joints, boils, abscesses, furuncles, burns and sores[ 360 ]. It

Prick the seedlings out into individual containers as soon as they are large enough to handle and plant out when large enough[262 ]. Cuttings of young shoots, taken at the nodes. Layering. Very easy[262 ]. Air layering.

nwatta Prefers a cooler, less humid atmosphere than most other members of the genus, growing well at moderate elevations, generally above 1,000 metres in the tropics, and at lower elevations in the subtropics and warm temperate zones[262 ]. It grows best in areas where annual daytime temperatures are within the range 15 - 18°C, but can tolerate 8 - 30°C[418 ]. When dormant, the plant can survive temperatures down to about -5°C, but young growth can be severely damaged at -2°C[418 ]. It prefers a mean annual rainfall in the range 1,300 - 1,700mm, but tolerates 700 - 2,300mm[418 ]. Requires a humus-rich, moist but well-drained soil and a position in dappled shade where it can grow up towards the sun[262 ]. Passiflora species tend to flower and fruit more freely when grown in soils of only moderate fertility[200 ]. Prefers a circumneutral soil, disliking very acid or very alkaline conditions[262 ]. Prefers a pH in the range 6 - 7, tolerating 4.3 - 8[418 ]. Plants have escaped from cultivation in several areas of the world[262 ], and the plant has been declared a noxious weed in America. Many of these reports refer to the related, but more vigorous Passiflora tarminiana[968 ]. The plant starts fruiting after about 2 years from seed[418 ]. Well managed plants can produce 300 - 400 fruits per year, equivalent to 30 - 47 tonnes per hectare[418 ]. Plants are very tolerant of pruning and can be cut back to ground level if required to rejuvenate the plant[202 ]. Plants in this genus are notably resistant to honey fungus[200 ].

### 10.2.31 Terminalia catappa

Indian Almond, Tropical Almond Tree  
10 thin 12 cyuc 4 kcaak 3 tcan 2 dwat 30m hkuc  
htuc cyutli hgattcup hwicli hrsajlut hpa7tli frusflatprik-wissliphsom hpa7tmwattli hjonli  
drutta Terminalia catappa is a deciduous Tree growing to 30 m (98ft) by 35 m (114ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Insects. It is noted for attracting wildlife. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid, very alkaline and saline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant can tolerate maritime exposure.

pcasta Various species of biting and stinging ants have been found inhabiting hollow twigs on this tree[407 ].

kcakta Edible Parts: Fruit Oil SeedEdible Uses: Gum OilSeed - raw or cooked[46 , 303 ]. The almond-flavoured seeds can be eaten out of hand or roasted[301 ]. They can be chopped and added to cookies, bread mixes, dessert fillings, sweets, soups and stews[301 ]. The seed contains about 50% oil[63 ]. The seed is 3 - 4 cm long, 3 - 5 mm thick and enclosed in a thick shell that is difficult to crack[63 , 324 ]. The seeds are a rich source of zinc[658 ]. The seeds yield 38 - 54% of a colourless, bland tasting yellow semi-drying oil that is used in cooking[46 , 301 ]. Rather similar to almond oil, but less prone to become rancid[63 , 301 , 345 , 451 ]. The fruits have a tender skin and a thin layer of subacid juicy flesh[301 ]. It is often fibrous and not very tasty in spite of the pleasant smell[303 ]. The sweetish, fibrous flesh is palatable when very young, and is usually liked by children[307 ].

tcanta Containers Dye Fodder Furniture Gum Ink Mulch Oil Soil conditioner Soil stabilization Tannin WoodSeaside tree. Public open space. Xerophytic. Agroforestry Uses: The tree's vast root system binds together both sands and poor soils. It has a heavy leaf fall and so is a good provider of mulch for the protection of the soil[303 ]. It is a promising species for the reforestation of sandy areas[303 ]. Planting the tree can help eradicate Imperata cylindrica and other unwanted aggressive grasses[303 ]. Other Uses The trunk is a source of gum[303 ]. The oil from the seed is used for making soap, but its industrial use is limited by the difficulty in extracting the kernel[324 ]. Bark, leaves, roots and fruit are all important sources of tannin with the astringent bark containing 9 - 23% tannin[46 , 303 ]. The outer shell is also rich in tannin. It is used in leather preparation and as a base for inks; sometimes the roots and fruits are used for

the same purposes[303 ]. A black dye that is used to make ink is extracted from the bark and fruit[146 , 307 ]. A yellow-green dye is obtained from the leaves[307 ]. The trunk is a source of yellow and black dye[303 ]. Wood chips soaked in water give a yellow colour[721 ]. A black dye is obtained from the fruit[46 ]. The heartwood varies from light to dark brown to reddish brown, and often with irregular darker and lighter belts; it is not clearly demarcated from the lighter coloured sapwood. The texture is fine to coarse, the grain crossed and often curly and twisted. The wood is moderately hard; moderately heavy; strong and pliable; somewhat durable, but very susceptible to termite damage. It seasons well and works easily. A good quality timber, it is used for cabinet work, furniture and for the construction of buildings, boats, bridges, floors, panelling, boxes, crates, planks, carts, wheelbarrows, barrels and water troughs[146 , 303 , 307 , 451 , 459 , 721 ].

dwatta Antidiarrhoeal Antidiarrhoeal Antirheumatic Antitussive Astringent Diaphoretic Dysentery Emetic Febrifuge Galactagogue Laxative Leprosy Skin Tonic VermifugeVarious parts of the tree, such as the leaves and fruit, contain tannins and are astringent[303 , 459 ]. The leaves, crushed with Dacrydium elatum and rhizomes of Cyperus rotundus, are combined to treat dysentery[303 ]. The red leaves act as a vermifuge, while the sap of young leaves, cooked with oil from the kernel, is used to treat leprosy[303 ]. The juice of the leaves is ingested for coughs[311 ]. An infusion of the leaves is used to treat jaundice[311 ]. The leaves are used to treat indigestion[311 ]. The young leaves are used to cure headaches and colic[303 ]. Externally, the leaves may be rubbed on breasts to cure pain or, when heated, may be applied to numb parts of the body[303 ]. They may be used as a dressing for swollen rheumatic joints[303 ]. The leaves, applied to the head and sides, are refreshing and sudorific[582 ]. Leaves, bark and fruit are used to treat yaws[303 ]. The bark and root bark are useful for bilious fever, diarrhoea, thrush, and as a remedy for sores and abscesses[303 , 311 ]. The fluid from the bark is used to treat diabetes and as a tonic[311 ]. An infusion of the bark is used to treat stomach ache and also as an emetic for infants[311 ]. Externally, the bark is used to treat sores, pimples and fungal skin diseases[311 ]. The kernel of the fruit mixed with beeswax stops putrid exudation and bloody faeces. It is recommended as a mild laxative and a galactagogue for women, but too frequent use causes diarrhoea[303 ].

nrakta Africa - Maagascar; E. Asia - China, India, Myanmar, Cambodia, Vietnam, Malaysia, Indonesia, Philippines, New Guinea to Australia and the Pacific. ksacta A mid-canopy tree in areas just inland from ocean beaches, near river mouths, and on coastal plains. These areas are typically flat, but they may have dunes or rocky bluffs[303 , 653 ]. Sandy or rocky beaches[451 ].

propta Seed - pre-soak for 24 hours in cold water[303 ]. About 70% of ripe seed germinate in about 20 days[303 ]. Seeds remain viable for a long time and germinate readily, even after floating in water for long distances[303 ].

nwatta Fodder: Insect Management: Standard Minor Global Crop Staple Crop: Protein-oilPlants grow best in the lowland tropics at elevations below 800 metres[303 ]. It grows best in areas where the mean maximum and minimum annual temperatures are within the range 21 - 32°C, though it can tolerate 10 - 36°C[418 ]. It prefers a mean annual rainfall in the range 1,500 - 3,400mm, though can tolerate from 700 - 4,200mm[418 ]. Succeeds in any moderately fertile, well-drained soil in a sunny position[200 ]. Prefers sands and loamy sands, though it also does well on silts, loam, and even clays if the drainage is good[303 ]. Tolerates saline soils[324 ]. Prefers soil that are neutral to moderately alkaline and rich in bases, however it will also grow in strongly acid soils[303 ]. A particularly useful plant for coastal gardens, being tolerant of salt spray[200 , 303 ]. Established plants are drought tolerant[303 ]. Prefers a pH in the range 5 - 7, but tolerates 4.3 - 8[418 ]. Plants are fast growing, often in excess of 1 metre a year when young[303 ]. Trees can yield two crops a year in some areas, and in places have been known to exhibit more or less continuous fruiting[324 ]. A tree may yield around 5 kg of kernels per year[324 ]. There has been some selection in cultivating forms with larger seeds[451 ]. The tree sheds its leaves all at once, quite suddenly, usually twice a year (January or February and July or August). Unlike most tropical trees, the leaves turn first yellow, then vivid red before falling, giving a well-marked 'autumn colour'[451 ]. The in-

makes a dense, almost impenetrable thorny hedge that keeps out livestock and forms useful shelter belts; for hedges, seeds may be sown in 2 rows of 15 x 30 cm[303 ]. When trimmed hard it makes an attractive if rather fierce hedge[200 ]. When grown in hedges it is commonly mixed with other species such as Ziziphus mauritiana and Azadirachta indica[404 ]. Other Uses A yellow dye is obtained from the bark[302 , 303 ]. The bark contains about 25% tannin[272 , 303 ]. The seeds and leaves are also sources of tannin[302 , 303 , 306 ]. The wounded bark exudes a mucilaginous reddish-brown gum somewhat like gum arabic[303 ]. The seeds contain about 20% of a greenish oil which, after refining and bleaching, can be used in the making of soap and can substitute kapok and ground nut seed oils[303 , 306 ]. The heartwood is yellowish or reddish-brown; the sapwood yellowish. The wood is strong and durable yet soft and flexible. It is moderately hard and usually straight grained. It weighs about 590 kg/m<sup>3</sup>, is easy to saw and finishes to a smooth surface. Not of a very high quality, though it can be used in construction and for posts. The short spines and irregular, crooked growth make it less attractive for wood uses[303 , 404 ]. Fast-growing and coppices vigorously but due to its smokiness and low calorific value (5 177-5 600 kcal/kg), this species is not of very high quality for fuel[303 ]. In parts of India, it is planted and harvested to be bricked kilns[303 ].

dwatta Abortifacient Antidiarrhoeal Antiinflammatory Dysentery FebrifugeThe leaves can be used as a plaster to allay pain even from venereal sores, and can relieve convulsions. A paste made from the leaves is applied externally to treat muscular swellings caused by some inflammations[272 ]. The leaves together with salt can cure indigestion and, in larger doses, can also induce abortion[272 , 306 ]. The bark of the root is a good remedy for diarrhoea and dysentery[272 , 306 ]. The bark is used medicinally as a febrifuge[303 ]. The fruit pulp is taken orally to stop blood flow in case of haemoptysis[303 ]. The seed juice is inhaled into the nostrils against chest congestion and pulverised seeds are ingested for internal ulcers[303 ].

nrakta S. America - Brazil, Peru, Ecuador, Colombia, Venezuela; C. America - Panama to Mexico; Caribbean. ksacta Dry, brushy or thinly forested plains or hillsides, often in coastal thickets, at elevations from sea level to 500 metres[331 ].

propta Seed - takes about 2 weeks to germinate[303 ]. No pre-treatment is required - soaking actually reduces germination and heating kills the seeds[303 ]. Best sown into nursery beds and planted out when about 12 months old[303 ]. Plants often self-seed, especially around the margins of cultivated fields where plentiful seeding can be found under mature trees[303 ]. Cuttings. Air layering. Grafting.

nwatta Agroforestry Services: Alley crop Agroforestry Services: Crop shade Agroforestry Services: Living fence Agroforestry Services: Nitrogen Agroforestry Services: Windbreak Fodder: Bank Fodder: Insect Fodder: Pod Industrial Crop: Biomass Industrial Crop: Tannin Management: Coppice Management: Standard Minor Global CropThe tree grows well at low and medium altitudes in both wet and dry areas of the tropics[306 ]. It can tolerate an annual rainfall as low as 140mm and as high as 2,200mm[303 ]. It will grow in areas where the average temperature ranges from 18 - 27.9°C[303 ]. An easily grown plant that can succeed in most soils, it prefers a well-drained soil in a sunny position[302 ]. Can also succeed in heavy clay soils[306 ]. The tree can grow on poor soils, on wastelands and even with its roots in brackish water[303 ]. Established plants are drought tolerant[302 , 331 ]. Tolerates a pH as high as 8.3[303 ]. Plants have escaped from cultivation and become naturalized as a weed in dry places in some areas of the tropics[302 ]. Commences flowering when only 1 - 2 metres tall[331 ]. Trees can reach a height of 12 - 15 metres in about 40 years. In favourable soil conditions, they may reach a height of 10 metres in only 5 - 6 years[303 ]. The trees coppice vigorously and produce root suckers upon injury to the roots[303 ]. Once planted in the field, the tree does not need any treatment other than occasional pruning[303 ]. There are some named varieties[301 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[755 ]. Flowering Time: Late Winter/Early Spring. Bloom Color: White/Near White Cream/Tan. Spacing: 20-30 ft. (6-9 m).

### 10.1.7 Vitex doniana

Black Plum  
tfozn 10 thin 12 cyuc 4 kcaak 4 tcan 3 dwat 15 m hkuc  
hmimhtuc cyutli tcup hwicli hyhsrhtajlutnyik hpa7tli frusflat-prik hpa7tmwattli hjonli

drutta Vitex doniana is a deciduous Tree growing to 15 m (49ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Sunbirds. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcasta The sawdust from the wood has been known to cause dermatitis[299 ].

kcakta Edible Parts: Fruit Leaves Seed ShootsEdible Uses: Coffee Condiment Drink Sweetener TeaFruit - raw, cooked, candied etc[299 , 335 ]. A sweet flavour with a mealy texture, it tastes a bit like prunes[303 , 323 , 335 ]. It contains vitamins A and B and can be made into a jam[303 ]. The jam is of good quality, somewhat like plum jam but better for spreading[299 ]. A syrup made from the fruit pulp can be used instead of other syrups as a nutritive sweetener[299 ]. The black fruit is about 2cm long[335 ]. The fruit can be made into a wine[303 ]. Wine obtained from controlled fermentation had 10.5% alcohol content, and wine obtained from spontaneous fermentation 5%[299 ]. Young twigs and leaves are an esteemed vegetable[299 , 317 ]. The leaves are often used as a herb for cooking[303 ]. The pounded leaves can be added to warm filtered grain beer and then drunk[303 ]. It is said to make them stronger[299 ]. Seeds[299 ]. The seeds are roasted and used to make a coffee-like drink[323 ]. The leaves can be used as a tea substitute[301 ].

tcanta Charcoal Dye Friction sticks Fuel Furniture Ink Mulch Pioneer Resin Soil conditioner Teeth WoodAgroforestry Uses: The heavy rounded crown provides good shade[303 ]. The tree has nitrogen-fixing roots and this, combined with the leaf fall, contributes to the improvement of soil fertility[299 , 303 ]. The leaves can be used for mulch[303 ]. The tree has some potential for use as a pioneer species - in Central Africa it is often the first species to establish when gallery forests evolve in low-lying areas in the savannah[299 ]. Other Uses An ink is produced from the dried fruits, young leaves and bark[317 ]. The blackish extract obtained by boiling the leaves, bark, roots and/or fruits is used as ink and as a dye for clothes[299 , 303 ]. The twigs are used as chewing sticks for teeth cleaning[299 ]. An aqueous extract of the chewing sticks has been shown to exhibit strong activity against a wide spectrum of bacteria including medically and dentally relevant bacteria, although the extracts of chewing sticks from Garcinia kola and Anogeissus leiocarpa had broader and generally stronger effects. This supports the traditional use of these chewing sticks with reported anticaries effect[299 ]. The dried seeds yield about 30% oil[299 ]. The oil has high iodine and low saponification values and can be used for skin cream, resin and paint production[299 ]. The wood is said to be used as friction sticks to start a fire[323 ]. The heartwood is creamy white to pale brown, yellowish brown or greyish brown; it is indistinctly demarcated from the 25 - 60mm wide sapwood[299 ]. The grain is straight to wavy or interlocked; texture moderately fine to moderately coarse. The wood resembles teak; it is medium-weight and soft; usually not durable, although good durability has also been reported, especially resistance against termites[299 , 303 ]. It is easy to saw and work with hand and machine tools; it often planes to a silky or furry surface due to the presence of interlocked grain; it nails well with little splitting, but it does not always hold nails well. Veneer of good quality can be produced, but the logs are often too irregular to be suitable for rotary peeling. The wood is often too soft for turnery[299 ]. It is suitable for light building material, furniture, carvings and boats[303 ]. The wood makes a good fuel and is also used to make charcoal[303 , 323 ].

dwatta Anodyne Antidiarrhoeal Dysentery Febrifuge Galactagogue Hypotensive Leprosy Odontalgic Ophthalmic Skin TonicThe plant is often used in traditional medicine. Modern research has shown that the plant has a range of actions upon the body. Consumption of large amounts of the fruits has been shown to cause a transient reduction in reproductive functioning in female olive baboons. The pres-



ence of progestogen-like compounds in the fruit has been suggested as the probable cause[299]. An aqueous extract of the stem bark has been shown to produce a dose-dependant hypotensive effect and to also be hepato-protective[299]. Stem bark extracts can inhibit the growth of clinical isolates of *Salmonella typhi*, *Shigella dysenteriae* and *Escherichia coli*, suggesting that they may be valuable in the treatment of dysentery and other gastroenteric infections[299]. The fruit is used to improve fertility and to treat anaemia, jaundice, leprosy and dysentery[303]. Both the dried and the fresh fruits are eaten as a treatment against diarrhoea[299]. The root is anodyne[299]. A decoction is used to treat gonorrhoea, ankylostomiasis, rickets, gastro-intestinal disorders and jaundice[299, 303]. A decoction of the root is drunk by women to treat backaches[303]. The leaves are anodyne, febrifuge, galactagogue and tonic[299]. A decoction is taken internally as a tonic and to treat fevers and respiratory diseases[299]. It is applied externally to increase milk flow and as a treatment for headache, stiffness, measles, rash, fever, chickenpox and hemiplegia[299]. The young tender leaves are pounded and the juice squeezed into the eyes to treat conjunctivitis and other eye troubles[299, 303]. A paste made from the pounded leaves and bark is applied to wounds and burns[299]. The powdered bark is added to water and then taken to treat colic[299]. A bark extract is used to treat stomach complaints, kidney troubles, leprosy, liver diseases, and to control bleeding after childbirth[299].

nrakta Tropical Africa - Senegal to the Sudan, south to Angola, Zambia and Mozambique. ksacta Dense forest, wooded savannah, coastal savannah, galleried soudanian and riverine thickets[332]. A deciduous forest tree of coastal woodland, riverine and lowland forests and deciduous woodland, extending as high as upland grassland[303].

propta Seed - The seed has a hard coat, which slows down germination. Any pre-treatment would be to soften or abrade this seed coat and allow the ingress of water[303]. This can either be done by soaking the seed in hot water that is allowed to cool - if the seed has not shown signs of swelling within 12 - 24 hours then remove from the water and abrade the seedcoat, being careful not to damage the seed below[K]. It is thought forest fires help in inducing germination because they help break the hard seedcoat[303]. The treated seed is said to germinate easily - it can be raised in a nursery and transplanted, or can be sown in situ[323]. Root suckers[323]. Cuttings[323].

nwatta Black plum is a plant of hot, tropical climates where it is found at elevations from near sea level to 1,850 metres[303]. It grows best in areas where annual daytime temperatures are within the range 14 - 28°C, but can tolerate 10 - 36°C[418]. It prefers a mean annual rainfall in the range 750 - 2,000mm, but tolerates 600 - 2,500mm[418]. Grows best in a sunny position[418]. Occurs on a variety of well-drained soils of varying origins, usually alluvial soils[303]. Prefers a pH in the range 5.5 - 7, tolerating 5 - 7.5[418]. The growth rate is moderate. In plantations in northern Cote d'Ivoire, seedlings were on average 70 - 90cm tall after 3 years, the tallest ones reaching 170cm[299]. On good soils in southern Burkina Faso early growth is a bit faster[299]. Trees respond well to coppicing and also produce root suckers[303, 323]. The fruit falls from the trees when it is ripe. It is not damaged by this fall so people generally harvest from under the tree rather than picking it from the tree[323]. The flowers are extremely attractive to bees[323]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[200].

## 10.1.8 Inga densiflora

Densely flowered Inga  
tfo2n 10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 15 m hkuc  
htuc cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliwis  
hpa7tmwathi hjonli

drutta Inga densiflora is a TREE growing to 15 m (49ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

ksakta Edible Parts: FruitEdible Uses: Fruit - raw[317]. Highly valued, the white pulp surrounding the seeds has a sweet flavour[317].

nrakta S. America - Peru, Ecuador, Colombia, Venezuela, Guyana, French Guiana; C. America - Panama, Costa Rica, Nicaragua, Guatemala, Mexico. ksacta Not known propta Seed

nwatta A tropical plant. Although many species within the family Fabaceae have a symbiotic relationship with soil bacteria, this species is said to be devoid of such a relationship and therefore does not fix atmospheric nitrogen[755].

## 10.1.9 Parkia biglobosa

African Locust Bean  
tfo2n 10 tlin 12 cyuc 4 kcaak 4 tcan 2 dwat 15 m hkuc  
htuc cyutli hgactup hwicli hrasjlutnyik hpa7tli fruslatprik  
hpa7tmwathi hjonli

drutta Parkia biglobosa is a deciduous Tree growing to 15 m (49ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bats, Bees, Insects. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought.

pcista The bark and pods contain substances toxic to fish - the alkaloid parkine that occurs in the pods and bark may be responsible[303].

ksakta Edible Parts: Flowers Leaves Seed SeedpodEdible Uses: DrinkThe pods contain a sweet, yellow, farinaceous pulp surrounding the seeds[46, 301]. This pulp can be eaten fresh or made into sweetmeats and drinks[299, 301, 303]. It contains up to 29% crude protein and up to 60% saccharose, is rich in vitamin C and high in oil content[303, 317]. The pulp also yields a flour that is much used in parts of Africa[301, 317]. The pink brown to dark brown pods are about 45cm long and 2cm wide[418]. Seeds are fermented to make dawadawa, a black, strong-smelling, tasty food high in protein. Dried fermented seeds keep for more than a year in traditional earthenware pots without refrigeration, and small amounts are crumbled during cooking into traditional soups and stews that are usually eaten with sorghum- or millet-based dumplings and porridges. Because of the savoury taste and the high protein and fat values of the seed, it is sometimes described as a meat or cheese substitute, but it is not usually eaten in large amounts. Dawadawa is rich in protein, lipids and vitamin B2. Parinari curatellifolia is deficient in the amino acids methionine, cystine and tryptophan, but fermented beans are rich in lysine. The fat in the beans is nutritionally useful (approximately 60% is unsaturated)[299, 303]. The seeds contain antinutritional factors and have to be processed before use as food. Boiled and fermented seeds contain 35% proteins, 29% lipids, 16% carbohydrates and have good organoleptic properties and a positive effect on intestinal flora[299]. A coffee substitute is prepared from the parched seeds[299, 301, 303]. The seeds are roasted and ground into a powder for use as a coffee substitute[317]. Young pods are sometimes roasted on embers and eaten[303]. Leaves are edible but not commonly eaten[303]. They are sometimes eaten as a vegetable, usually after boiling and then mixed with other foods such as cereal flour[299]. Young flower buds are added to mixed salads[299].

tcanta Containers Dye Fibre Fodder Fuel Furniture Insecticide Mordant Musical Potash Shelterbelt Soap making Soil conditioner Tannin Teeth WoodAgroforestry Uses: A useful windbreak and shade tree[303]. Soils under the tree are improved by its leaf fall[299, 303]. It is common practice to grow several crops such as maize, cassava, yams, sorghum and millet under the canopy[303]. Other Uses Pods and roots contain fibres and are used as sponges and as strings for musical instruments[299, 303]. Twigs are used to clean the teeth. The bark stains the mouth red and also contains saponins that clean the teeth[303]. A mucilage obtained from part of the fruit is made into a fluid and used for hardening earth floors and to give a black glaze in pottery[303]. The fruit pods are used to produce an insecticide powder, which is added to water and sprayed on crops[325]. The husks of pods, mixed with indigo, improve the lustre of dye products[303]. The boiled pods are used to dye pottery black[299]. The ash is applied as a mordant[299]. The

resin was formerly collected for use as canoe caul and was burnt to give light[ 312]. The resin is aromatic and has been used as incense[ 312]. The soot from burning resin was formerly used as a ceremonial black face paint[ 312]. An oil extracted from the kernel has various local uses. It may be substituted for coconut oil and has potential in skin-care products[ 312]. The oil-rich seeds can be strung together, then lit and used as torches[ 350]. The pink-brown wood is soft and fine textured. It has a medium density and is non-durable when exposed to weather[ 312, 598]. It is suitable for light construction (in low-decay situations), moldings, veneer, and numerous interior purposes[ 312]. Traditionally, the wood is used to make canoes, bowls and other wood articles[ 312]. The wood is sometimes used as a fuel[ 312, 598].

dwatta SkinA preparation made from the bark is used for the treatment of chest pains[ 312, 350].

nrakta Eastern Indonesia, Papua, New Guinea, Solomon Islands, and Vanuatu. ksacta A canopy or subcanopy tree in low elevation rainforests[ 324, 388]. Usually found near the coast and up to elevations of 450 metres[ 658].

propta Seed -pre-soak in fresh water for 24 hours prior to sowing[ 312]. Discard any nuts that float or that do not sink completely to the bottom[ 312]. Seed should be sown 1 cm deep on their sides directly into large pots or polybags, or 3 - 4 can be sown together direct into the position where the tree is to grow[ 312]. Nursery grown plants are usually ready to plant out when they are about 3 months old, by which time they should be up to 30cm tall[ 312]. The seed has a short viability and should be sown as soon as possible after collection. If seeds need to be stored for a few weeks, then the outer flesh should be removed and the nut-in-shell stored in a shaded, cool (e.g., 15 - 25°C) dry place, secure from rodents and other pests[ 312].

nwatta Management: Standard Regional Crop Staple Crop: OilA plant of the lowland, subhumid to humid tropics, found at elevations from sea level to about 600 metres[ 312]. It experiences very warm temperatures throughout the year with a mean annual temperature of 25 - 28°C; and an annual rainfall in the range of 1,800 - 4,000 mm[ 312]. Plants are usually found in areas where the dry season is less than 2 months, but they can tolerate up to 4 months dry season[ 312]. Prefers a medium to heavy-textured soil of moderate to high fertility[ 312]. Intolerant of shallow, infertile, or saline soils[ 312]. Fruits best in a position with little or no shade, though young trees grow best in semi-shade[ 312]. Plants succeed with free to slightly impeded drainage and a neutral pH[ 312]. Prefers a pH in the range 6.1 - 7.4[ 312]. Plants are fairly tolerant of strong winds, quickly recovering if any damage is caused[ 312]. The tree has a minor potential to become invasive[ 312]. Plants grow fairly slowly during their first year, usually reaching 0.6 - 2 metres in height[ 312]. After that, the growth rate increases with annual height increases of 2.5 - 3 metres common for the next 5 - 6 years[ 312]. Trees produce a deep taproot[ 312]. Plants can commence fruiting when about 7 years old[ 312]. Annual yields have been estimated at up to 4 - 7 tonnes of kernels per hectare[ 312]. Selection of plants over the centuries has led to a number of distinct forms with thinner shells and larger seeds[ 312]. Plants are most commonly dioecious, meaning that both male and female forms need to be grown if seed is required. However, some trees also bear hermaphrodite flowers plus either male or female flowers[ 312].

## 10.2.29 Garcinia madruno

Madruno, Charichuela, Madrono  
10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat m hkuc  
hmimhtut cyutli tcup hwicli hrasjlut hpa7tli priklwis  
hpa7tmwathi hjonli

drutta Garcinia madruno is an evergreen Tree growing to 10 m (32ft) by 8 m (26ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ksakta Edible Parts: FruitEdible Uses: DrinkFruit - raw or cooked. The fruit has a translucent whitish pulp that is juicy, slightly aromatic and pleasantly subacid[46, 301]. Usually eaten raw, it is also used for making jams, preserves

and drinks[301]. The yellow, oval to elliptical fruits are 6 - 7.5cm long[46].

tcanta Fuel Furniture Resin WoodOther Uses: A greenish resin, called 'Maria Balsam', is obtained from the tree[46]. The pinkish wood is coarse-textured, irregular-grained, hard and heavy. It is not commonly used, mainly being employed locally in construction and as a fuel[336, 625]. We do not have any more information on the wood of this species, but a general description of the wood for trees in the Americas which were formerly considered to be in the genus *Rheedia* is as follows:- The heartwood is dark yellow-brown, grayish- or pinkish-brown, merging gradually into the sapwood; surfaces are sometimes specked with resinous exudations. The texture is medium to coarse; the grain straight to irregular and roey; luster medium to rather low; it is free from discernible odour or taste. Species in Surinam are rated durable to attack by decay fungi and fairly resistant to dry wood termites. Species in Colombia are resistant to a brown-rot fungus but not the white-rot in a laboratory assay. Under field conditions the wood was susceptible to decay and attack by insects. It dries rapidly, but is reported to be moderately difficult to air season, tending to warp and check. Reports on workability vary with species from moderate to high resistance to cutting to machining fairly well; reports on ease of finishing are also variable. The wood is used for purposes such as furniture, flooring (quarter sawn), heavy construction, and general carpentry[316].

dwatta The yellow latex of the tree is used to treat ulcers and other sores[336, 469].

nrakta S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, the Guyanas; C. America - Panama to Nicaragua. ksacta Dry forests with generally sandy soils[416]. Humid, secondary forests, principally in areas not subject to inundation, on sandy, well-drained soils[625]. Found at elevations below 1,200 metres[336].

propta Seed - best sown as soon as it is ripe in a semi-shaded position in a nursery seedbed. Germination rates in excess of 70% are usually achieved, with the seed sprouting within 60 - 70 days[625].

nwatta A plant of the hot, humid tropical lowlands[335]. Succeeds in full sun or light shade[625]. Plants are tolerant of occasional inundation[625]. Newly planted young trees establish well and grow away fairly quickly[625]. A dioecious species, both male and female forms need to be grown if fruit and seed are required. Spacing: 15-20 ft. (4.7-6 m).

## 10.2.30 Passiflora tripartita mollissima

Banana Passionfruit  
10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat m hkuc  
hmimhtut cyutli tcup hwicli jlutnyik hpa7tli flatprikliwis  
hpa7tmwathi hjonli

drutta Passiflora tripartita mollissima is an evergreen Climber growing to 5 m (16ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ksakta Edible Parts: FruitEdible Uses: Drink SweetenerFruit - eaten raw or used in ice creams, fruit salads, pies, jellies, to make drinks etc[301]. The yellow, oblong, aromatic fruits are highly prized for their juice[301]. The fruit is about 70mm long and 35mm wide[200]. The fruits of this species are a pale yellow colour, the pulp is more aromatic and tart and has a somewhat superior flavour to the flesh of the deep yellow to orange fruits of *Passiflora tarminiana*[968].

nrakta Western S. America - Andes. ksacta Found at elevations between 2,000 - 3,200 metres[262].

propta Seed - best sown as soon as it is ripe along with the pulp which will help break down the seed coat and speed up germination[262]. Stored seed should be soaked for 24 hours in warm water and germination time can be reduced if the seed is then mixed with the juice of a fresh passion fruit (of any species)[262]. Even so, it can take 12 months for stored seed to germinate[262]. Place the seed tray in a shady position, maintaining a temperature around 19 - 24°C[262].



Grow young plants on in a sheltered position with some shelter from the sun[63 ].

**nwatta** Management: Standard Regional Crop Staple Crop: OilA plant of the humid, lowland, tropical forests, where it is found at elevations up to 1,000 metres[335 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 21 - 28c, but can tolerate 10 - 35c[418 ]. It prefers a mean annual rainfall in the range 1,600 - 2,000mm, but tolerates 1,200 - 2,400mm[418 ]. Grows best in a sunny position[418 ]. Prefers well-drained, light loams of good depth and fertile sandy soils[63 , 418 ]. Dislikes poor soils[63 ]. Plants are very susceptible to drought[200 ]. Prefers a pH in the range 6 - 6.5, tolerating 5.5 - 7[418 ]. Fruits take about 4 months to ripen from flowering[63 ]. Plants can take up to 20 years to produce their first crop from seed, though this can be greatly reduced by applying shade and wind protection when the plants are young[200 ].

## 10.2.27 Shorea robusta

Sal Tree

10 tin 12 cyuc 4 kcaak 4 tcan 3 dwat 40 m hkuc htuc cyutli tucp hwicli hrasjlutnyik hpa7tli frusflatprik hpa7tmwatli dyat hjonli

drutta Shorea robusta is an evergreen Tree growing to 40 m (131ft) by 30 m (98ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist soil.

**kcka**ta Edible Parts: Fruit Oil SeedEdible Uses: OilSeed - roasted[272 ]. The seeds are boiled into a porridge with the flowers of *Bassia latifolia* and the fruits of *Dolichos biflorus*[303 ]. They can be ground into a coarse flour that is used to make bread, and the plant is used as a famine food[303 ]. A de-fatted kernel powder, popularly known as sal seed cake, contains about 50% starch, in addition to proteins, tannins and minerals. The physico-chemical property of the starch can be exploited for preparing canned food products[303 ]. The chemical composition of the seeds consists of 10.8% water, 8% protein, 62.7% carbohydrate, 14.8% oil, 1.4% fibre and 2.3% ash. The seeds are a source of 'sal butter', an oil that is used in cooking like ghee and as a substitute for cocoa butter in making chocolate[301 ]. Fruit - occasionally eaten[301 ].

**tcanta** OilOther Uses: When tapped, the tree exudes large quantities of a whitish, aromatic, transparent resin known as 'lal dhuna'. It is used to caulk boats and ships and as incense. In some places in the Upper Tista forests of the Darjeeling District, large pieces, often 450 - 600 cubic centimetres in size, are found in the ground at the foot of the trees[146 ]. The leaves are widely used for making plates, cups and for wrapping[272 ]. An oil obtained from the seed is used for illumination[272 ]. The bark is a source of tannins[272 ]. The heartwood is a dark, reddish brown; the thin band of sapwood whitish. The grain is strongly spiralled and rather coarsely structured. The wood is hard, heavy, very durable and highly resistant to termite attack. Seasoning can present problems. The wood is easy to saw, but because of its high resin content, it is difficult to plane and turn; it has a tendency to split when nails are driven into it. This important Indian hardwood is especially well suited for constructing structures subject to heavy stress in houses etc, it is also used in hydraulic engineering, ships and railway cars, poles, railway ties and posts, simple interior finishing such as window frames and floors, and many other applications[303 ]. For making household or agricultural implements, the coppice shoots are used[146 , 303 ]. The wood is an important local source of fuel[272 ].

**dwatta** DysenteryThe resin is valued for its use in the treatment of dysentery, gonorrhoea, boils and toothaches[272 ]. The leaf juice is used in the treatment of dysentery[272 ]. The leaves are warmed and used as a poultice on areas of the body that are swollen[272 ]. They have a quick effect[272 ]. They are also applied to the stomach of children with dysentery[272 ]. The oil from the seed is used to treat skin diseases[272 ].

**nrakta** E. Asia - Indian subcontinent to south-western China[266 ]. **ksacta** A rare plant in China, it is gregarious in

savannah woodlands at elevations below 800 metres in south-eastern Xizang[266 ]. Often the main tree in forests of Nepal at elevations up to 1,400 metres[266 ].

**propta** We have no specific information for this species - the information below is a general guide for the genus. Seed - best sown as soon as possible. It does not require pretreatment, but it is recommended to soak the seed for 12 hours prior to sowing[325 ]. The seeds are sown in seedbeds, where they are covered with a mixture of sand and soil (1:1) or with a thin layer of sawdust[325 ]. Germination of fresh seeds is usually good and rapid. About two weeks after germination, when the seedlings are 5 - 6cm tall, they are potted up into individual containers about 15 x 23cm with good drainage holes at their base[325 ]. It is normally recommended to use a mixture of forest soil and sand (at a ratio of 3:1) as the potting medium in order to introduce the appropriate mycorrhiza to the roots. The seedlings are placed in 50 - 60% sunlight and watered twice daily[325 ]. Seedlings can be planted out when 30 - 40cm tall - harden the seedlings off in full sunlight for one month prior to planting[325 ].

**nwatta** A plant of the tropics, where it is found at elevations up to 2,000 metres. It grows best in areas where annual daytime temperatures are within the range 28 - 34°C, but can tolerate 7 - 47°C[418 ]. The plant can survive temperatures down to about -1°C[418 ]. It prefers a mean annual rainfall in the range 1,500 - 3,500mm, but tolerates 1,000 - 7,300mm[418 ]. There is usually a dry season of 4 - 8 months[303 ]. Prefers a position in full sun, but tolerates light shade[418 ]. Succeeds in most well-drained, fertile soils, though it prefers a moist sandy loam with good subsoil drainage[303 , 418 ]. Prefers a pH in the range 5 - 6.7, tolerating 4.5 - 7.5[418 ]. Young trees grow quickly, developing a long taproot at a very young age and attaining top heights of up to 6 metres after 6 years[303 ]. Fruit and seed bearing begins around the age of 15 years, the tree then bears fruit regularly every 2 years or so, and a good seed-bearing year can be expected every 3 - 5 years[303 ]. The tree responds well to coppicing[303 ]. Rotations of 30 - 40 years are used when coppice regeneration is practised, and 80 - 160 years for high forest regeneration[303 ]. The tree is very tolerant of forest fires, usually surviving them if not too small[303 ].

## 10.2.28 Canarium indicum

Canarium Nut, Ngali, Galip nut, kenari nut 10 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 35 m hkuc hmihtuc cyutli hgattucp hwicli jltunyk hpa7tli flatprik-wisslip hpa7tmwatli dyat hjonli

drutta Canarium indicum is an evergreen Tree growing to 35 m (114ft) by 20 m (65ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought.

**kcka**ta Edible Parts: Fruit Oil SeedEdible Uses: OilEdible portion: Nut, Seeds - oil. Seed - raw or cooked[ 312 , 658 ]. The oily seed is consumed either fresh, roasted or smoked. It can be eaten as a snack food or incorporated into various cooked dishes[ 312 , 658 ]. Nuts which are removed from the shell and roasted can be stored in sealed containers for many months. The nuts are often coarsely ground and added to other foods[ 658 ]. The seed coat should not be eaten because it carries some substance that can produce diarrhoeal [658 ]. The seed can vary widely in size and weight, measuring 28 - 62 mm long by 20 - 35 mm wide and weighing 8 - 20 g each fresh weight[ 312 ]. An edible oil can be obtained from the seed[ 658 ]. It is eaten mixed with other foods[ 658 ]. The fruit of some cultivars is edible[ 312 ]. The fruit is an ovoid drupe, 3 - 6cm long and 2 - 3cm wide[ 310 ].

**tcanta** Containers Fuel Incense Lighting Oil Paint Shelterbelt Waterproofing WoodOther uses rating: Medium (3/5). Agroforestry Uses: Plants are very wind resistant and make an excellent addition to the top storey of a shelterbelt[ 303 , 312 ]. Canarium nut is amongst the oldest and most important tree crops in Melanesia, where it is an integral part of one of the world's first known permanent agroforestry systems[ 350 ]. Other Uses: A resin oozes from wounds on the trunk caused by a variety of natural factors such as pests/diseases, damage during cyclones, etc[ 312 ]. This

seeds and bark are a source of tannins[303 , 317 ]. The wood ashes are used as a source of potash in making soap and indigo dye[317 ]. Wood is whitish, moderately heavy, 580-640 kg/cubic m when air seasoned, relatively hard and solid; it smells unpleasant when newly felled, but seasoning does not take long and only occasionally causes shape distortion; easily worked by hand or power tools; nails, glues, varnishes and paints well; mainly useful as a light structural timber, for example, for vehicle bodies, agricultural implements, boxes, crates and barrels, furniture, mortars and pestles, bowls, planks and carvings[299 , 303 ]. The branches are sometimes lopped for firewood[299 , 303 ].

**dwatta** Analgesic Anticoagulant Anti diarrhoeal Antidote Antihaemorrhoidal Antiinflammatory Antiseptic Diuretic Febrifuge Hypotensive Leprosy Malaria Mouthwash Ophthalmic Purgative Skin Vitamin CThe bark is used as a mouthwash, vapour inhalant for toothache, or for ear complaints. It is macerated in baths for leprosy and used for bronchitis, pneumonia, skin infections, sores, ulcers, bilharzia, washes for fever, malaria, diarrhoea, violent colic and vomiting, sterility, venereal diseases, guinea worm, oedema and rickets, and as a poison antidote[303 ]. Leaves are used in lotions for sore eyes, burns, haemorrhoids and toothache[303 ]. Seed is taken for tension, and pulp for fevers, as a diuretic and as a mild purgative[303 ]. Roots are used in a lotion for sore eyes[303 ]. An alcoholic extract of crude seeds showed anti-hypertensive activity and contractile effect on smooth muscles of the intestine, and increased the tonus and mobility of the uterus[299 ]. Ichthyotoxic and molluscicidal activities have been recorded for the seeds due to the presence of saponins[299 ]. The bark, leaves and pod husks are rich in tannins, which in general have anti-diarrhoeal activities[299 ]. Analgesic and anti-inflammatory activities have been demonstrated for the bark extracts[299 ]. The aglycone flavonoids in the leaves have spasmodic activity on smooth muscles, and also vasodilatory and antiseptic effects[299 ]. Coumarin derivatives in leaf extracts have anticoagulant activity[299 ].

**nrakta** Western central and northeastern tropical Africa. **ksacta** Particularly found on areas such as farm woodland which are subject to semi-permanent cultivation, also open woodlands on savannahs, rocky slopes, stony ridges etc[303 ].

**propta** Seed - it has a hard seedcoat and benefits from scarification before sowing in order to speed up and improve germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing. The plant forms two different types of seed in each pod, reddish-dark ones and black ones[303 ]. The reddish dark have thinner seed coats and germinate more easily and quickly, even without scarification[303 ]. Young plants quickly form a deep taproot so it is best to sow the seed in individual, deep containers. Usually about 75% of all the seeds will germinate[303 ]. Seedlings can be ready to plant in their permanent positions when they are 10 - 14 weeks old[774 ]. Cuttings of mature wood[303 ]. Grafting.

**nwatta** Agroforestry Services: Nitrogen Fodder: Pod Management: Standard Other Systems: Parkland Regional Crop Staple Crop: Protein-oilAdapted to a wide ecological range, African locust bean is found naturally in the drier lowland tropics at elevations below 600 metres[325 ]. It grows best in areas where annual daytime temperatures are within the range 28 - 40°C, but can tolerate 8 - 44°C[418 ]. It prefers a mean annual rainfall in the range mm, but tolerates mm[418 ]. It prefers a strongly seasonal climate with a dry season of 4 - 8 months[303 , 325 ]. Grows best in a sunny position[418 ]. Prefers well-drained, deep, sandy to loamy cultivated soils, but it is also found on shallow, skeletal soils and thick laterites[303 , 418 ]. Prefers a pH in the range 4.5 - 5.5, tolerating 4 - 6[418 ]. The plant has a deep taproot system and an ability to restrict transpiration, this gives it the capacity to withstand drought conditions once it is established[303 ]. Young trees have a slow rate of growth[774 ]. Growth is comparatively fast: seedlings may reach a height of 1 metre within the first year, and young trees of superior provenances can reach 7 metres tall in 6-year-old plantations[299 ]. Trees start flowering at

5 - 7 years while still comparatively small. They reach their maximum height after 30 - 50 years, and can reach an age of 100 years[299 ]. Trees in some areas have two flowering periods each year[299 ]. The tree produces root suckers[774 ]. There are conflicting reports on whether or not this tree has a symbiotic relationship with certain soil bacteria, so it is unclear as to whether this tree fixes atmospheric nitrogen[755 ].

## 10.1.10 Inga cinnamomea

Inga Assu, Inga Acu tfo2n 10 tin 12 cyuc 4 kcaak 3 tcan 0 dwat 12 m hkuc htuc cyutli tucp hwicli hrasjlutnyik hpa7tli flatprikwis hpa7tmwatli hjonli

drutta Inga cinnamomea is an evergreen Tree growing to 12 m (39ft) by 12 m (39ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

**kcka**ta Edible Parts: FruitEdible Uses: Fruit - raw[416 ]. The seeds are covered in a dense, white aril that has a sweet flavour[416 ]. The fruit is a legume up to 30cm long and 8cm wide, containing 8 - 15 large seeds[416 ].

**tcanta** Containers Fuel Pioneer WoodAgroforestry Uses: The tree is often used to provide shade in plantations, often by being left as the native forest is cleared[317 , 416 ]. A natural pioneer species within its native range, it is fast-growing and a popular food crop so should make an excellent pioneer for re-establishing woodland[K ]. Other Uses: The wood is coarse-textured, irregular to spiral-grained, light in weight, hard to cut, with a low resistance to rot[625 ]. It is used for scaffolding, temporary constructions, interior ornamental screens, boxes etc[625 ]. The wood is used for fuel[625 ].

**nrakta** S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, French Guiana, Surinam. **ksacta** Forests in riverine flood plains in both primary and secondary formations[ 416 , 625 ].

**propta** Seed - it needs to be sown as soon as possible once it is ripe. Sow in a partially shaded position in a nursery seedbed. Germination rates are usually almost 100%, with the seed sprouting within 10 - 20 days[625 ].

**nwatta** Grows best in a sunny position[625 ]. Plants can withstand periodic inundation of the soil[625 ]. A fast-growing tree[625 ]. The branches are generally infested with boring ants[625 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[755 ].

## 10.1.11 Inga insignis

Guaba de zorro tfo2n 10 tin 12 cyuc 4 kcaak 0 tcan 0 dwat 8 m hkuc hmihtuc cyutli hgattucp hwicli hysihrasjlutnyik hpa7tli flatprikwis hpa7tmwatli hjonli

drutta Inga insignis is a TREE growing to 8 m (26ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. It can fix Nitrogen. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

**kcka**ta Edible Parts: FruitEdible Uses: Fruit - raw[317 ]. The sweet-tasting white pulp surrounding the seeds is eaten[305 ]. The seedpod is 14 - 18cm long and up to 2.5cm wide[305 ].

**nrakta** S. America - Peru, Ecuador, Colombia. **ksacta** Not known

**propta** Seed

**nwatta** A tropical plant. It can grow on poor soils. It can tolerate long dry seasons. In Ecuador it grows between 1,450-2,850 m above sea level. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of



loam[38] but tolerates poor soils[196]. If the soil is too rich it encourages leaf production at the expense of fruiting[196]. Plants tolerate a pH in the range 4.5 to 8.2[196]. The Cape Gooseberry is an evergreen shrub in its native environment. It is not very cold-hardy in Britain, however, though it can succeed outdoors as a herbaceous perennial in the mildest areas of the country or when grown in favoured positions such as the foot of a sunny wall. Some cultivars will tolerate temperatures down to about -10° when grown in this way[K]. It would be wise to apply a good protective mulch to the roots in late autumn after the top growth has been cut back by frosts. In most areas of Britain, however, it needs to be grown as an annual in much the same way as tomatoes. The plant is usually naturally bushy, but it can be useful to pinch out the growing tip whilst the shoots are less than 30cm tall in order to encourage side shoots[K]. This species is often cultivated for its edible fruit in warm temperate and tropical zones, there are some named varieties[3, 183]. 'Eduilis' is the most common cultivar in Britain, it has considerably larger fruits than the species but these do not have quite such a good flavour[K]. Yields of 20 tonnes per hectare are common in S. America, 33 tonnes has been achieved[196].

## 10.2.23 *Chenopodium quinoa*

Quinoa, Goosefoot, Pigweed, Inca Wheat

10 tlin 12 cyuc 5 kcaak 2 tcan 0 dwat 1.5 m hkuc  
htut cyutli hgtaccup hwicli hyishrasjtutnyik hpa7tli frusflat-  
prikliwssilphsom hpa7tmwatli fyifxre7t hjonli

drutta *Chenopodium quinoa* is a ANNUAL growing to 1.5 m (5ft) by 0.3 m (1ft in) at a fast rate. See above for USDA hardness. It is hardy to UK zone 10 and is not frost tender. It is in flower from July to August, and the seeds ripen from August to September. The species is hermaphrodite (has both male and female organs) and is pollinated by Wind. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid, very alkaline and saline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcista The leaves and seeds of all members of this genus are more or less edible. However, many of the species in this genus contain saponins, though usually in quantities too small to do any harm. Although toxic, saponins are poorly absorbed by the body and most pass straight through without any problem. They are also broken down to a large extent in the cooking process. Saponins are found in many foods, such as some beans. Saponins are much more toxic to some creatures, such as fish, and hunting tribes have traditionally put large quantities of them in streams, lakes etc in order to stupefy or kill the fish[K]. The plants also contain some oxalic acid, which in large quantities can lock up some of the nutrients in the food. However, even considering this, they are very nutritious vegetables in reasonable quantities. Cooking the plants will reduce their content of oxalic acid. People with a tendency to rheumatism, arthritis, gout, kidney stones or hyperacidity should take especial caution if including this plant in their diet since it can aggravate their condition[238].

kcaakta Edible Parts: Leaves SeedEdible Uses: Edible portion: Leaves, Seeds, Vegetable. Seed - cooked[ 1, 2, 4, 27, 57, 97 ]. A pleasant mild flavour, the seed can absorb the flavour of other foods that are cooked with it and so it can be used in a wide variety of ways[ K ]. The protein is good quality because of its amino acid balance. It has 2-6% more protein and better amino acid balance than wheat. It should be thoroughly soaked and rinsed to remove a coating of saponins on the seed surface. The seed can be used in all the ways that rice is used, as a savoury or sweet dish. It can also be ground into a powder and used as a porridge[ 37, 183 ]. The seed can also be sprouted and used in salads[ 183 ] though many people find the sprouted seed unpleasant[ K ]. The seed contains a very high quality protein that is rich in the amino acids lysine, methionine and cystine, it has the same biological value as milk[ 196 ]. The seed contains about 38% carbohydrate, 19% protein, 5% fat, 5% sugar[ 171 ]. Leaves - raw or cooked[ 2, 4, 37, 57 ]. The young leaves are cooked like spinach[ 183 ]. It is best not to eat large quantities of the raw leaves, see the notes above on toxicity.

tcanta Dye Repellent SoapOther uses rating: Low (2/5). Other Uses: Gold/green dyes can be obtained from the whole plant[ 168 ]. Saponins on the seed can be used as a bird and insect deterrent by spraying them on growing plants[ 141 ]. The saponins are obtained by saving the soak-water used when preparing the seed for eating. The spray remains effective for a few weeks or until washed off by rain[ K ]. nrrakta S. America - Western Andes. ksacta The original habitat is obscure, the plant probably arose through cultivation[139].

propta Seed - sow April in situ. The seed can either be sown broadcast or in rows about 25cm apart, thinning the plants to about every 10cm. Germination is rapid, even in fairly dry conditions. Be careful not to weed out the seedlings because they look very similar to some common garden weeds[ K ].

nwatta a cultivated food crop. A plant of higher elevations in the tropics, it has also been successfully grown in the temperate and subtropical zones. Plants tolerate light frosts at any stage in their development except when flowering[ 57, 196 ]. An easily grown plant, it requires a rich moist well-drained soil and a warm position if it is to do really well, but it also succeeds in less than optimum conditions[ 27, 37 ]. Tolerates a pH range from 6 to 8.5 and moderate soil salinity[ 196 ]. Plants are quite wind resistant[ K ]. Plants are drought tolerant once they are established[ 196 ]. The plant is day-length sensitive and many varieties fail to flower properly away from equatorial regions, however those varieties coming from the south of its range in Chile are more likely to do well in Britain[ 196 ]. Different cultivars take from 90 - 220 days from seed sowing to harvest[ 196 ]. Yields as high as 5 tonnes per hectare have been recorded in the Andes, which compares favourably with wheat in that area[ 196 ]. Young plants look remarkably like the common garden weed fat hen (*Chenopodium album*). Be careful not to weed the seedlings out in error[ K ]. The seed is not attacked by birds because it has a coating of bitter tasting saponins[ 141, K ]. These saponins are very easily removed by soaking the seed overnight and then thoroughly rinsing it until there is no sign of any soapiness in the water. The seed itself is very easy to harvest by hand on a small scale and is usually ripe in August. Cut down the plants when the first ripe seeds are falling easily from the flower head, lay out the stems on a sheet in a warm dry position for a few days and then simply beat the stems against a wall or some other surface, the seed will fall out easily if it is fully ripe and then merely requires winnowing to get rid of the chaff.

## 10.2.24 *Oryza sativa*

Rice, Common Rice

10 tlin 12 cyuc 5 kcaak 2 tcan 2 dwat 1.8 m hkuc  
htut cyutli tcuphja7nhs6s hwicli hrasjtutnyik hpa7tli flatprikli-  
wis hpa7tmwatli hjonli

drutta *Oryza sativa* is a ANNUAL growing to 1.8 m (6ft) by 0.3 m (1ft in) at a fast rate. See above for USDA hardness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist or seed soil and can grow in water.

kcaakta Edible Parts: Oil SeedEdible Uses: OilSeed - cooked. It is usually either boiled or steamed and can be eaten in a wide variety of both savoury and sweet dishes[238 ]. It is an essential accompaniment for curries and Far Eastern dishes, it is used in European dishes such as paella and risotto, whilst it is also used in sweet dishes such as rice pudding[238 ]. The grain can also be popped like popcorn to make a breakfast cereal[238 ]. An oil is obtained from the seed[418 ]. It is used in cooking and as a salad oil[418 ].

tcanta OilOther Uses Although grown mainly for food, rice starch it is also used in cosmetics, laundering starch, and textiles[418 ]. An oil is obtained from the seed[418 ]. It is used for soap manufacture and it is made into a plastic packaging material[418 ]. Rice straw is used for weaving into hats, shoes etc[46, 272 ]. Rice straw is also used for making and repairing thatched houses in Bangladesh, Nepal and India. It is used for construction of grain storage structures, ropes, packaging material and bags in India[418 ]. It is also used as a fuel in Vietnam[418 ]. In China, India, Indonesia and Pakistan rice straw is used in the production of pa-

then mixed with water to form a viscous substance known as guar gum[ 254 ]. This comprises about 86% water-soluble mucilage consisting of mainly galactomannin[ 254 ]. Guar gum is gently laxative, helps to lower blood cholesterol levels and acts as a digestive tonic[ 254 ]. The gum is taken internally as an effective but very gentle bulk laxative[ 254 ]. It also delays the emptying of the stomach and thereby slows the absorption of carbohydrates, thus helping to stabilize blood sugar levels[ 254 ]. This can be of great importance to people with blood sugar level problems, such as diabetics and pre-diabetics[ 254 ].

nrrakta E. Asia - India. ksacta Not known in a wild state. propta Seed - sow 2 - 3cm deep in situ[ 300 ]. Scarification can promote rapid germination, inoculating the seed with *Rhizobium* may be necessary[ 300 ]. Often they are grown in mixed cropping situations. It requires 15-24 kg of seed to sow a hectare. They are often put 20-30 cm apart in rows 65 cm apart. Seed germinate within one week.

nwatta Suitable for growing in the warm temperate zone as an annual, it is more commonly grown in lowland tropical and subtropical areas up to an elevation of 1,000 metres[ 300 ]. Tolerating high temperatures, it requires a high level of solar radiation to do well[ 300 ]. Grows best when the soil temperature is in the range of 25 - 30°c, but able to tolerate temperatures to 45°c[ 300, 418 ]. Prefers an annual rainfall in the range of 500 - 800mm, but can tolerate up to 2,700mm[ 300, 418 ]. Dry weather is essential once fertilization has taken place - the developing pods can be damaged by high humidity or rainfall[ 300 ]. Prefers a sunny position[ 418 ]. Grows best in alluvial and sandy loam soils[ 300 ]. Established plants are very drought resistant[ 300 ]. Some forms are tolerant of poor soils, alkaline or saline conditions[ 300 ]. Prefers a pH in the range 7.5 - 8, tolerating 5.5 - 8.5[ 300, 418 ]. Young pods can be harvested 2 - 3 months after sowing the seed[ 300 ]. Yields of 6 - 8 tonnes per hectare of the pods have been obtained[ 300 ]. Approximately 800kg of dried seed per hectare is considered average[ 300 ]. There are some named varieties[ 300, 301 ]. Many cultivars are daylength sensitive, though many new cultivars are daylength neutral[ 300 ]. The plant has a vigorous taproot[ 200 ]. This species has a symbiotic relationship with certain soil bacteria, these bacteria form nodules on the roots and fix atmospheric nitrogen. Some of this nitrogen is utilized by the growing plant but some can also be used by other plants growing nearby[ 200 ].

## 10.2 mran

### 10.2.1 *Bertholletia excelsa*

Brazil Nut

10 tlin 12 cyuc 5 kcaak 3 tcan 2 dwat 40 m hkuc  
htut cyutli tcup hwicli hyishrasjtutnyikfrrip hpa7tli frusflat-  
prikliwssil hpa7tmwatli fyif hjonli

drutta *Bertholletia excelsa* is an evergreen Tree growing to 40 m (131ft) by 25 m (82ft) at a medium rate. See above for USDA hardness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees. The plant is self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers moist soil.

pcista Nuts from trees growing on barium-rich soils can accumulate up to 0.29% barium and should be avoided due to danger of barium toxicity[ 324 ].

kcaakta Edible Parts: Oil SeedEdible Uses: OilEdible portion: Nut, Oil, Flavouring. Seed - raw or cooked. A mild flavour, the nuts are a common item of food, eaten raw and also roasted, salted or used in ice cream etc[ 301 ]. The nuts are very nutritious, containing roughly 66% fat or oil, 17% protein and 7% carbohydrate[ 63 ]. The ripe fruit is a wooden capsule weighing up to 750g and containing 12 - 24 angular brown seed, each about 5cm long and 2.5cm wide[ 63, 418 ]. An oil is obtained from the seed[ 301 ]. The fresh-pressed oil is pale yellow, almost odourless, with a pleasant nutty flavour[ 63 ]. It is not unlike almond oil in composition[ 63 ]. It can be used like olive oil[ 63 ]. Nuts have a high level

of selenium. They are also high in sulphur containing amino acids.

tcanta Containers Fibre Filter Fuel Furniture Lighting Oil Waterproofing WoodOther uses rating: Medium (3/5). Large Nut Tree, Public Open Spaces, Botanic Collections. Other Uses The hard woody 'fruit' that contains the seeds is used as cups or other receptacles[ 63 ]. It is also made into bracelets or carved to make other ornaments[ 63, 303 ]. Empty fruit capsules are used to carry small, smoky fires in order to discourage black flies (*Stimulium* spp.) from attacking people working in the field during the rainy season[ 303 ]. Open capsules are sometimes used to collect latex from rubber trees[ 303 ]. The oil obtained from the seed has been used as an illuminant[ 63 ]. The oil has also sometimes been used in perfumery, paint and soap making, and as a lubricant for watches and clocks[ 63, 418 ]. The woody 'fruits' make an excellent fuel[ 63, 303 ]. The nut, which has an elevated oil content of 63-69%, burns with a candle-like flame when lit[ 303 ]. The bark has been used in remote regions for fibre production[ 303 ]. It is used for caulking ships[ 46, 454 ]. The heartwood is light brown to reddish; it is not clearly demarcated from the 3 - 5cm wide band of sapwood. The texture is medium, the grain straight or interlocked; lustre is medium. The wood is moderately heavy, hard and moderately durable being moderately resistant to fungi and termites but susceptible to dry wood borers. Seasoning is fairly fast with only a slight risk of checking or distortion; once dry it is moderately stable in service. It works well with normal tools; nailing and screwing are good; gluing is correct for internal purposes only. The durable wood is sought by boat builders, and is also used for purposes such as interior joinery, cabinet making, high class furniture, construction, flooring, heavy carpentry and sliced veneer[ 63, 303, 363, 419, 848 ]. The felling of the trees is discouraged because they are more valuable as a nut crop, however the wood is well suited to all manner of structural work[ 63 ]. The charcoal from Brazil nut shells is good at purifying water.

dwatta *Skin*The bark of the tree is used as a treatment for liver problems[ 303 ]. The sweet oil from the seeds is applied to burns[ 348 ]. A tea made from the fruit is used as a treatment for gastralgia[ 739 ]. Nuts have a high level of selenium. They are also high in sulphur containing amino acids.

nrrakta North and western S. America - Brazil, Venezuela, the Guyanas. ksacta Deep, rich, alluvial soils, on slightly raised ground that is not subject to regular or extensive flooding[ 200 ].

propta Seed - fresh seed germinates rapidly, often within 2 - 3 weeks, so long as a portion of the hard shell is cracked or carefully removed first in order to allow the entry of moisture[ 63 ]. Otherwise seed can take 2 years to germinate[ 63 ]. Seedlings probably need good light to grow away well[ 303 ]. Seedling trees have borne a first crop at an age of 14 - 20 years[ 63 ]. If the conditions are right, some of the seeds buried by rodents may germinate. Trees appear to depend on natural or artificial disturbance to reproduce. For example, they will be found in clearings in the forest created by humans, forest gaps created by tree fall, or sprouting from damaged mother roots. Trees take about 10 years to start reproducing; grafted material may begin to bear nuts within 4 years. Other than using a single clone, several selections are cloned and grafted onto stock to encourage cross-fertilization, which increases yield[ 303 ].

nwatta Management: Standard Minor Global Crop Mostly Wild-collected Other Systems: Multi-strata Staple Crop: Protein-oilA plant of the lowland, tropical rain forests, where it is found at elevations up to 200 metres[ 303, 418 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 36°c, but can tolerate 12 - 40°c[ 418 ]. It prefers a mean annual rainfall in the range 2,400 - 2,800mm, but tolerates 1,400 - 3,500mm[ 418 ]. In eastern Amazonia, in the lower limits of its climatic range, there can be 2 - 7 months where the monthly rainfall is less than 100 mm[ 324 ]. A pronounced dry season is necessary for good fruit set[ 303 ]. Requires a deep, well-drained but moisture retentive fertile, medium to heavy soil[ 307, 418 ]. Mature trees grow best in a sunny position[ 307 ], but young trees require shade for their first 5 - 7 years[ 418 ]. Well adapted to heavy clay and low-fertility Oxisols but is not tolerant to waterlogging[ 303 ]. Prefers a pH in the range 5.5 - 7, tolerating 4.5 - 8[ 418 ]. Trees commence flowering when about 5 - 6 years old[ 418 ]. Fruiting starts at 12 - 16





ulcers[ 348 ]. The coconut is said to have vermicide properties[ 311 ]. Haemorrhaging is stopped with the use of the dry, spongy kernel[ 311 ]. In the Solomon Islands, diarrhoea and dysentery are treated with parts of this plant[ 311 ].

**nrakta Pantropical.** ksacta Commonly found along tropical seashores, sometimes extending inland on alluvial plains with a high water table, but avoiding waterlogged soils[ 297 ].

**propta Seed - Fresh seed germinates readily at 27 - 30°c[ 200 ].** The seed has no dormancy, and growth of the embryo and seedling is continuous. Germination may begin while the fruits are still attached to the palm[ 303 ]. For seed propagation, nuts are collected from selected mother palms or special seed gardens[ 303 ]. Tissue culture is a popular method of vegetative propagation for producing a large number of progeny[ 303 ].

**nwwata Agroforestry Services:** Crop shade Global Crop Industrial Crop: Fiber Management: Standard Other Systems: Homegarden Other Systems: Multistrata Staple Crop: Oil Staple Crop: SugarCoconuts grow well in lowland tropical regions as far as 26° north and south of the Equator and up to a maximum elevation of around 1,000 metres[ 297 ], though most commercial cultivation takes place within 20° of the Equator and below 300 metres[ 200 ]. They grow best in areas with a high rainfall[ 297 ]. Plants succeed in moist tropical climates where temperatures never fall below 10c, the average annual rainfall is 1,500mm or more and the driest month has 25mm or more rain[ 297 ]. The coconut palm thrives in a wide range of soils, from coarse sand to clay, so long as the soils have adequate drainage and aeration[ 303 ]. Requires a well-drained soil with a high water table[ 297 ]. Plants grow well in full sun, even when small[ 297 ]. Plants can tolerate at least some maritime exposure with salt spray and somewhat saline soil conditions[ 297 ]. Coconut palms are halophytic and tolerate salt in the soil well[ 303 ]. Plants are intolerant of drought[ 200 ]. Coconut can grow in soils with a wide range of pH but grows best at pH 5.5 - 7[ 303 ]. Coconut palm is one of the most widely grown tree crops in the tropical countries[ 303 ]. Its growth characteristics are ideal for small production and also for combining with other crops. The crown morphology and the relatively wide spacing facilitate the planting of a wide spectrum of field crops in coconut plantations[ 303 ]. It has therefore been intercropped with cereals (cassava, sweet potatoes, yams) or fruits (bananas, passion fruit, pineapples and ground nuts) in many countries[ 303 ]. Very occasionally a small pearl-like concretion, or 'coconut pearl', is found in the cavity of the nut. Generally about the size of a canary's egg or even that of a cherry, they are white or bluish white in colour with a pearl-like lustre and harder in texture than a pearl[ 63 ]. Made almost entirely of a form of lime or calcium carbonate, they are greatly prized and often used in jewellery[ 63 ]. The tall varieties reproduce by cross-pollination[ 303 ]. Male flowers open first, producing pollen for about 2 weeks. Female flowers are not usually receptive until about 3 weeks after the opening of the inflorescence, making cross-pollination the usual pattern[ 303 ]. Reproduction in dwarf varieties is generally through self-pollination[ 303 ]. Female flowers are receptive about a week after the male flowers open, both ending at about the same time[ 303 ]. Tall palms tend to be slow maturing, flowering 6 - 10 years after planting and with a life-span of 80 - 100 years[ 324 ]. Dwarf palms begin bearing in their third year and have a productive life of 30 - 35-(40) years[ 324 ]. The trees flower and fruit all year round. A new inflorescence is produced every month, whilst the fruit takes a year to mature[ 324 ].

## 10.2.5 Mangifera indica

Mango, Bowen Mango

10 thin 12 cyuc 5 kcak 3 tcan 3 dwat 25 m hkuc htut cyutli hgattcup hwicli hrasjutnyik hpa7tli frusflat-prikhsom hpa7tmwatli fyif hjonli

**drutta Mangifera indica** is an evergreen Tree growing to 25 m (82ft) by 25 m (82ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees, Bats, Flies, Ants. The plant is self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils.

It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

**pcasta** In sensitive individuals, ingestion of the fruit or skin contact with the juice may cause a rash like that of poison ivy[303 ]. (Parts of plant are poisonous if ingested)

**kcakta Edible Parts:** Flowers Fruit Leaves Seed**Edible Uses:** Condiment Drink TeaFruit - raw or cooked. One of the most popular fruits in the world, it is commonly eaten raw, is juiced and can also be prepared in a variety of ways such as in chutneys, jams, pickles etc[200 , 301 ]. The dried, unripe fruit is ground into a powder and used as a flavouring in Indian cuisine[301 ]. They are an ingredient of the spice mixture chat masala[301 ]. A variable fruit, ranging in colour from green through orange and yellow to red, it can be anything from 50g to 1.5kg in weight[296 ]. The fruit is usually 8 - 12cm long, but can be up to 30cm[303 ]. The fruit contains about 15% sugars, 0.5% protein and significant amounts of vitamins A, B and C[200 ]. The seeds are used in the preparation of dodol, or pudding[301 ]. A starch and an edible fat can be obtained from them[301 ]. The kernels are important as a famine food in India, but the astringency has to be removed by boiling, roasting and soaking them for a long time[303 ]. Flowers[301 ]. Young leaves[301 ]. Cooked as a vegetable[303 ].

**tcanta Charcoal Containers Dye Fuel Furniture Repellent Teeth WoodBackyard tree.** Large shade tree. Street tree. Large flowering tree, Public open space. Specimen. Other Uses The bark and the leaves are the source of a yellowish-brown dye used for silk[303 , 307 ]. The flowers are used to repel mosquitoes[307 ]. The slender branches are used as toothbrushes to treat toothache[272 ]. Heartwood is pale yellowish-brown to reddish-brown, darkening on exposure, not clearly demarcated from the pale yellowish-brown sapwood. Grain somewhat wavy, texture moderately coarse; freshly cut wood is scentless. The wood is used for many purposes, including indoor construction, meat-chopping blocks, furniture, carpentry, flooring, boxes, crates and boat building (canoes and dugouts)[303 ]. The wood is a source of 'machang' timber[895 ]. We do not have a specific description for the wood of this species, but a general description of machang timber is as follows:- The heartwood is light brown or light grey brown, occasionally with chocolate or black streaky corewood; it is not clearly differentiated from the wide band of sapwood. The texture is moderately coarse to coarse and even; the grain interlocked and wavy. The wood is moderately heavy to heavy; moderately hard; not durable under exposed conditions, being susceptible to fungi, dry wood borers and termites. The wood seasons somewhat rapidly with only a slight risk of checking or distortion; once dry it is moderately stable in service. It can be worked with ordinary tools, there is a slight difficulty resawing when green, but is easy when dry; planing is easy but the surface produced is moderately smooth with grain pick-up on the radial side; nailing and screwing is excellent; gluing is correct. The wood is suitable for light construction, turnery, flooring, interior panelling, boxes, crates, pallets and plywood manufacture[895 ]. Corewood can be used for decorative veneer production[848 , 895 ]. With a calorific value of 4200 kcal/kg, the wood makes excellent charcoal and firewood[303 ].

**dwatta Anthelmintic Antiasthmatic Antidiarrhoeal Antihæmorrhoidal Antirheumatic Antiscorbic Antitussive Aphrodisiac Astringent Diuretic Dysentery Hypotensive Mouthwash Odontalgic Skin Stimulant Stings Styptic Vitamin C**The leaves are astringent and odontalgic[348 ]. An infusion is drunk to reduce blood pressure and as a treatment for conditions such as angina, asthma, coughs and diabetes[272 , 307 , 348 ]. Externally, the leaves are used in a convalescent bath[348 ]. A mouthwash made from the leaves is effective in hardening the gums and helping to treat dental problems[272 , 307 , 348 ]. The leaves are used to treat skin irritations[272 , 307 ]. The charred and pulverized leaves are used to make a plaster for removing warts and also act as a styptic[303 ]. The seed is astringent, antidiarrhoeal; anthelmintic when roasted[348 ]. It is used to treat stubborn colds and coughs, obstinate diarrhoea and bleeding piles[303 ]. The pulverised seed is made into a sweetened tea and drunk, or taken as powders, for treating dysentery[348 ]. The seeds are ground up and used to treat scorpion stings[307 ]. The bark is astringent, homeostatic and antirheumatic[303 ]. Used in the treatment of haemorrhage, diarrhoea and throat problems[307 , 348 ]. When incised, the bark yields an ole-

## 10.2.17 Salacca zalacca

Salak Palm, Snake Palm

10 thin 12 cyuc 5 kcak 3 tcan 0 dwat 4 m hkuc hmimhtut cyutli tcup hwicli hrasjut hpa7tli frusflatprik hpa7tmwatli hjonli

**drutta Salacca zalacca** is an evergreen Shrub growing to 4 m (13ft) by 4 m (13ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

**pcasta Plant** has spines or sharp edges; use extreme caution when handling

**kcakta Edible Parts:** Fruit Seed**Edible Uses:** Fruit - raw[297 ]. An acid flavour[297 ]. Slightly crisp, with a delicious blend of acids and sugars and an apple-like flavour[200 , 301 ]. The flesh is exceptionally firm and crisp for a tropical fruit[303 ]. It is quite sweet when fully ripe, but the unripe fruit is sour and astringent due to the presence of a little tannic acid[303 ]. Considered to be one of the finest of palm fruits for eating raw[301 ]. In Indonesia the fruits are also candied ('manisan salak'), pickled ('asinan salak') and fresh unripe ones may be used in 'rujak', a spicy salad of unripe fruit[303 ]. The reddish-brown, ovoid fruit is 6 - 8cm in diameter[200 ]. The seed is edible[301 ]. The seed kernels of the young fruits of the Javanese 'Pondoh' form are edible[303 ].

**tcanta Fencing Hedge ThatchingAgroforestry Uses:** A closely-planted row of palms forms an impregnable hedge and the very spiny leaves are also cut to construct fences[303 ]. Other Uses The bark of the petioles may be used for matting[303 ]. The leaflets are used for thatching[303 ].

**nrakta E. Asia - Malaysia.** ksacta Rich soils in moist, shaded forests, often forming impenetrable thickets when growing in swampy areas and along the sides of streams[297 ].

**propta Seed - pre-soak** for 24 hours in warm water and sow in containers[297 ]. The seed needs to be fresh, it takes 2 - 3 months to germinate[297 ]. The seeds are sown directly in the field (2-5 seeds together in 5 cm deep holes) or in nursery beds. The seedlings are planted out in the field during the rainy season when they are a few months old[303 ]. Germination becomes visible when the cylindrical embryo-containing plug is extruded through the germpore at the kernel's apex. A radicle soon emerges from the tip of the plug and the shoot, a main root and several secondary roots emerge from the sides of this plug. About 60-90 days after sowing the first complete leaf, bifid and some 20-30 cm long, is fully expanded, the seedling still being firmly attached to the kernel[303 ]. Division of suckers[335 ].

**nwwata** A plant of the humid, lowland tropics, where it is found at elevations up to 500 metres. It grows best in areas where annual daytime temperatures are within the range 22 - 30°c, but can tolerate 12 - 36°c[418 ]. It prefers a mean annual rainfall in the range 1,700 - 3,100mm, but tolerates 1,400 - 3,500mm[418 ]. Requires a deep, rich, moist soil and some shade[303 ]. Prefers a light-textured soil[418 ]. Young palms require heavy shade which may be reduced after about one year[303 ]. Because of its superficial root system, the palm requires a high water table, rain or irrigation during most of the year, but it does not stand flooding[303 ]. Prefers a pH in the range 5 - 6, tolerating 4.5 - 6.5[418 ]. The palm starts flowering three to four years after sowing[303 ]. It can be productive for 50 years or more[303 ]. The scarce data available suggest that annual yields vary from 5 - 15 t/ha[303 ]. There are some named varieties[301 ]. A dioecious plant, requiring both male and female forms to be grown near each other if fruit and seed are required[200 ]. One male plant is usually adequate to fertilise nine females[200 ]. There is at least one monoecious variety[303 ]. 'Bali' produces inflorescences with both hermaphrodite and staminate flowers; the latter produce functional pollen[303 ]. Spacing: 10-12 ft. (3-3.6 m) 12-15 ft. (3.6-4.7 m) 15-20 ft. (4.7-6 m) 20-30 ft. (6-9 m).

## 10.2.18 Ipomoea batatas

Sweet Potato, Black Sweet Potato, Sweet Potato Vine  
10 thin 12 cyuc 5 kcak 3 tcan 0 dwat 3 m hkuc

htut cyutli tcup hwicli hrasjut hpa7tli flatprik hpa7tmwatli xre7t hjonli

**drutta Ipomoea batatas** is a PERENNIAL CLIMBER growing to 3 m (9ft 10in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9 and is frost tender. The species is hermaphrodite (has both male and female organs). Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It cannot grow in the shade. It prefers moist soil.

**kcakta Edible Parts:** Leaves Root Shoots**Edible Uses:** Root - cooked[200]. Sweet and fleshy, it is a delicious staple food and is also very nutritious providing a rich source of vitamins and minerals[200, K]. There are cultivars with soft, moist flesh and also forms with a more dry flesh[200]. There are also less sweet cultivars, bred for industrial production of starch[200]. In order for the roots to store through the winter, they need to be cured in the sunshine at temperatures around 25°c for about a week before being stored at around 14°c[264]. Young shoot tips[264].

**tcanta Biomass FuelLandscape Uses:** Alpine garden, Arbor, Container, Groundcover, Specimen. The root is a source of starch[200]. Sweet potato tubers are being examined as a valuable raw material for producing alcohol bio-fuel[418].

**nrakta Pantropical.** ksacta Derived in cultivation, probably from Ipomoea trifida, this species is not known in a truly wild situation.

**propta Pre-soak** the seed for 12 hours in warm water, or scarify the seed, and sow in individual pots in a greenhouse in early spring. The seed usually germinates in 1 - 3 weeks at 22°c. Plants are extremely resentful of root disturbance, even when they are quite small, and should be potted up almost as soon as they germinate. Grow them on in the greenhouse for at least their first winter then plant them out into their permanent positions in late spring or early summer, after the last expected frosts. Seedlings can be very variable and are likely to be less productive than vegetatively produced plants[200]. Stem cuttings obtained from terminal shoots[200]. Remove the lower leaves and insert the cuttings to half their depth in individual pots.

**nwwata** An easily grown plant. Sweet potato is a plant of the tropics, but can also be grown in the subtropics and, if there is a sufficient growing season of 110 - 170 days, as an annual crop in warmer parts of the temperate zone. It is grown in the tropics at elevations up to 2,800 metres. It grows best in areas where annual daytime temperatures are within the range 18 - 28°c, but can tolerate 10 - 38°c[418 ].

**].** When dormant, the roots can survive temperatures down to about 1°c, but young growth can be killed by temperatures of 5°c[418]

**].** It prefers a mean annual rainfall in the range 750 - 2,000mm, but tolerates 350 - 5,000mm[418]

**].** An easily grown plant, it prefers a well-drained, sandy loam soil and requires a sunny position[200 , 264

**].** Ample potash in the soil is essential for a good crop[264

**].** Prefers a pH in the range 5 - 7, tolerating 4 - 8.7[418

**].** A low humidity as the plants reach maturity is beneficial[200

**].** Plants grow very vigorously in the tropics. They have escaped from cultivation in some areas and become invasive[296

, 305

**].** Unlike many root crops, the sweet potato begins to store starch at an early age, making early harvests possible[298

**].** It is one of the most efficient plants to capture the energy of the sun as calories[298

**].** The plant can mature a crop within 2 months in tropical areas, though at least three months are required in subtropical regions[264

**].** Optimum yields vary from 17.5 - 27.5 tonnes per hectare depending on the cultivar and growing conditions, while average yields are 5 tonnes per hectare in Africa, 10 tonnes in South America and 16 tonnes in Asia. The world highest production yield at 80 tonnes has been obtained in Israel[418

**].** A short-day plant, it requires less than 11 hours of sunlight per day to initiate flowering[200

**].** However, day length variation appears to have little effect upon tuber production[200



value, it is sometimes used for fuel or to make charcoal[419 ]. The cocoa bean testa is used for fuel[303 ]. It has a calorific value of 16 000-19 000 BTU/kg, a little higher than that for wood[303 ].

dwatta Analgesic Antibacterial Antidiarrhoeal Antirheumatic Bitter Diuretic Emollient Hypotensive Leprosy Skin Stimulant TonicAlthough used mainly as a food, cacao does also have some therapeutic value[254 ]. The seed contains a range of medically active constituents including xanthines, a fixed oil and endorphins[254 ]. It is a bitter, stimulant, diuretic herb that stimulates the nervous system, lowers blood pressure and dilates the coronary arteries[238 , 254 ]. Cacao powder and butter are nutritive, the latter also soothes and softens damaged skin[238 ]. The seed is used in central America and the Caribbean as a heart and kidney tonic[254 ]. An infusion of the baked seed-membranes is drunk as a remedy for anaemia[348 ]. Combined with the stems of Chromolaena odorata and the wood of Cecropia obtusa, the seed is applied externally as an emollient in a remedy to extract splinters or prickles embedded in the skin[348 ]. Cacao powder is taken internally in the treatment of angina and high blood pressure[238 ]. The rural people in Amazonas State, Brazil, rub cocoa butter on bruises[303 ]. It is often used to treat chapped skin and burns[238 ]. Research has shown that it can help to counter the bacteria responsible for boils and septicaemia[254 ]. The leaf contains genistic acid. This has been shown to be antirheumatic and analgesic[348 ]. An infusion of the leaf buds is used with incense to treat diarrhoea[348 ]. An infusion of the dry pods is used to decrease leprosy spots[348 ].

nrakta S. America - Brazil, Peru, Colombia, the Guyanas; C. America - Belize, Guatemala, southern Mexico. ksacta An understory plant of evergreen rainforest in the wet humid tropics, growing in places that are not usually seasonally inundated[303 , 636 ].

propta Seed - loses its viability within 5 - 7 days from being separated from the pulp[200 , 303 ]. Sow the seed as soon as it is ripe, in individual containers in a shaded position, covering them with about 5mm of potting compost[419 ]. The seeds readily germinate when sown fresh, and do not pass through a dormancy period. They usually germinate within 7 - 10 days[303 ]. Seedlings grow away slowly[419 ]. Air layering. Leaf-bud cutting. Grafting.

nwatta Global Crop Management: Standard Other Systems: MultistrataA tree of the lowland tropics, usually found below 300 metres but occasionally found as high as 900 metres[303 ]. It succeeds where the mean annual temperature is in the range 18 - 28.5°C with a maximum temperature of 30 - 33.5°C and a minimum 13 - 18°C[303 ]. The absolute minimum is 10°C, below which trees are likely to suffer severe damage[303 ]. Rainfall should be plentiful and well distributed throughout the year[303 ]. An annual rainfall level of between 1,500 - 2,000mm is suitable, though it is reported to tolerate an annual precipitation of 480 - 4,300mm[303 ]. Requires a fertile, moisture-retentive but well-drained soil in sun or part shade in a position sheltered from the wind[200 ]. Prefers an acid soil[307 ]. Prefers a pH in the range 5 - 6.5, tolerating 4 - 8[418 ]. An understory tree of the forest, it grows best in dappled shade[307 ], but can even produce well in quite dense shade[200 ]. There are three main types of cacao: Criollo Cacaos originated in Central America. It is red skinned and the highest grade, but is low-yielding[307 ]. Trinitario Cacaos arose in Trinidad. It is high grade[307 ]. Forastero Cacaos comes from the Amazon Basin[307 ]. The insignificant flowers have a faint, sweet fragrance[200 ]. In favourable conditions both flowers and fruit will be borne throughout the year[200 ]. Freshly planted young trees are slow to establish and grow away, rarely growing more than 1.5 metres tall after 2 years[419 ]. Weeding and temporary shade are essential within the first 3 - 4 years of establishment before the canopy closes. Plantain appears to meet most of cocoa's requirements in this respect, whereas bananas compete heavily for moisture during the dry season[303 ]. There are some named varieties[301 ]. Flowering Time: Blooms all year. Bloom Color: White/Near White Cream/Tan. Spacing: 12-15 ft. (3.6-4.7 m).

## 10.2.16 Annona squamosa

Sugar Apple, Sweetsop, Custard Apple  
10 tlin 12 cyuc 5 kcaak 2 tcan 2 dwat 6 m hkuc

htut cyutli hgatkuyctcup hwicli hyishrasjlut hpa7tli prikl-wissliphsom hpa7tmwatli hjonli

drutta Annona squamosa is a deciduous Tree growing to 6 m (19ft) by 6 m (19ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcista The seeds, leaves and roots are poisonous. Both an alkaloid, and hydrocyanic acid have been shown to occur in these parts of the plant.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw. The sweet and creamy fruits are highly regarded as a dessert fruit[ 301 ]. They can also be used to make sherbet, ice cream, jellies etc[ 301 ]. The fruit is up to 10cm in diameter[ 200 ].

tcanta Fuel Insecticide StringOther uses rating: Low (2/5). Other Uses Green fruits, seeds and leaves have effective vermicide and insecticidal properties[ 303 ]. The seeds contain the insecticide acetogin[ 307 ]. The fibrous bark has sometimes been used locally for cordage[ 454 ]. The light yellow sapwood and brownish heartwood are soft, light in weight and weak[ 303 ]. The tree is a good source of firewood[ 303 ].

dwatta Antidiarrhoeal Antirheumatic Astringent Cancer Dysentery Purgative Sedative VermifugeLeaves, shoots, bark and roots have been reported to have medicinal properties[ 303 ]. They are all strongly astringent and are used to treat diarrhoea and dysentery[ 254 ]. The green fruits, seeds and leaves have effective vermicide properties[ 303 ]. The young shoots, combined with peppermint, are used in the West Indies to relieve colds and chills[ 254 ]. In Cuba, the leaves are taken to lower uric acid levels in the blood[ 254 ]. The unripe fruit is astringent[ 303 ]. The root is a drastic purgative[ 303 ]. The bark and leaves, combined with those of Annona muricata, are used in a sedative infusion[ 348 ]. An infusion of the leaves and fruit is used to aid digestion and treat rheumatism[ 348 ]. An oil distilled from the leaves is applied to the head for treating sleeplessness[ 348 ]. The powdered seeds are an excellent vermifuge[ 348 ]. Extracts of the plant have shown anticancer activity[ 348 ].

nrakta Caribbean. ksacta Not known in a truly wild situation

propta Seed - usually breeds true to type[ 200 ]. Sow in individual pots, not deeper than 2cm, at 21c[ 200 ]. They germinate within 2 - 4 weeks, and the seedlings are ready for planting out after 6 months[ 303 ]. The seed of many species in this genus has a hard seedcoat and may benefit from scarification before sowing in order to speed up germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing[ K ]. Semi-ripe cuttings[ 200 ]. Budding is done at the beginning of the growing season when the sap flows freely. Clef-grafting is the method more commonly used. Air-layering

nwatta Trees succeed in subtropical to tropical areas at elevations up to 2,000 metres, with a mean annual temperature up to 41c and a mean annual rainfall above 700mm[ 303 ]. They are said to do well in hot and relatively dry climates such as those of the low-lying interior plains of many tropical countries[ 303 ]. Plants can tolerate occasional light frosts[ 335 ]. Prefers a moist but well-drained, sandy loam with a pH around 6[ 200 ]. Also succeeds on rocky, alkaline soils with a pH up to 8[ 200 ]. The tree has a reputation, particularly in India, of being a hardy, drought-resistant crop. This is only partly correct. Although the rest period and leaf fall enable the tree to bridge a severe dry season, it requires adequate moisture during the growing season[ 303 ]. Trees start to bear fruit when 2 - 4 years old[ 303 ]. A mature tree, 5 metres high, produces several dozen fruits in a season[ 303 ]. There are some named varieties[ 301 ]. Fruit are often 200-300g each. The pulp is 20% sugar. The fruit is borne on old and new wood. As the fruit is more commonly on new wood, pruning is an advantage. A spacing of 6 m apart is suitable for sweetsop trees.

oresin which is stimulant, sudorific and antisyphilitic[348 ]. The stem is astringent. It is used to treat diarrhoea and to remedy stomach-ache[348 ]. The roots are diuretic[272 ]. The flowers are aphrodisiac[307 ]. The fruit is antiscorbatic and antisynergetic[348 ].

nrakta E. Asia - Indian subcontinent, Myanmar. ksacta A mid-canopy tree in humid tropical forests, usually growing in the more open, secondary formations, at elevations usually below 500 metres, but occasionally ascending to 1,700 metres[307 , 653 ].

propta Seed - best sown as soon as ripe[200 ]. Wash the seed, dry in shade and sow about 5cm deep with the convex side up[200 ]. Germination takes about 18 days if the seed is peeled first, or 30 days if it is not[200 ]. Give the seedlings some shade as they grow[303 ]. Plants that are raised in nursery beds can be transplanted without much difficulty before the taproot has developed to any great extent[303 ]. However, seedlings raised in baskets or containers are preferable[303 ]. Grafting onto a polyembryonic stock[200 ].

nwatta The optimal climate for growing mango ranges from the monsoon tropics to the frost-free subtropics, with a marked dry, or cool, season of at least three months to promote flowering[200 , 303 ]. It succeeds at any elevation up to about 1,200 metres, but for commercial purposes 600 metres is the maximum elevation[303 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 24 - 30°C, but can tolerate 8 - 48°C[418 ]. When dormant, the plant can survive short-lived temperatures down to about -1°C, but young growth can be severely damaged at 0°C[418 ]. It prefers a mean annual rainfall in the range 600 - 1,500mm, but tolerates 300 - 2,600mm[418 ]. The dry season of equatorial regions is too unreliable for commercial cultivation[200 ]. Whilst trees generally grow best in moderately dry climates, some cultivars can thrive and produce even under rainforest conditions[298 ]. Prefers a sunny position[307 ]. Plants are not too fussy over soil, not needing very fertile conditions[200 ]. However, they crop better in a rich, well-drained soil[307 ], whilst very poor soil, or shallow land, is unsuitable[200 ]. A pH in the range 6 - 7 is ideal[200 ]. Prefers a pH in the range 5.5 - 7.5, tolerating 4.3 - 8.5[418 ]. Grows best in areas sheltered from strong, drying winds[418 ]. Established plants are drought tolerant, and can also withstand occasional inundation of the soil[418 ]. Trees produce a taproot up to 5 metres deep[200 ]. Plants take 5 - 8 years from seed before they begin to fruit[296 ]. Grafted plants commence bearing in 3 - 5 years[335 ]. Individual trees often flower irregularly and may only produce one good crop every 3 - 4 year; some trees do not flower for periods of 10 - 20 years, sometimes even longer[303 , 418 ]. Yields increase up to the 20th year, decline after the 40th year and the tree may live for 100 years or more[418 ]. Flowering starts at the beginning of the rainy season and fruits ripen at the end of the rainy season[303 ]. Most varieties are self-fertile, but produce larger crops when cross-pollinated[335 ]. Yields of about 500 fruits per tree are average in 'on' years[200 ]. A plantation of full-grown trees may produce 10 - 30 tonnes per hectare of fruit each year. Average yields are, however, often quite low with 6 tonnes being achieved in the Philippines, 3.5 tonnes in Peninsular Malaysia and 2.3 tonnes in Thailand[418 ]. A very variable plant, there are many named varieties[200 , 296 ]. Some forms of the mango produce polyembryonic seeds (more than one seedling is produced from each seed) - these forms produce a tree genetically identical to the parent[296 ]. Flowering Time: Late Spring/Early Summer Mid Summer. Blooming Color: Red Pale Yellow White/Near White. Spacing: 30-40 ft. (9-12 m).

## 10.2.6 Manilkara zapota

Sapodilla, Nispero

10 tlin 12 cyuc 5 kcaak 4 tcan 2 dwat 25 m hkuc  
htut cyutli hgatkuyctcup hwicli hyishrasjlutnyik hpa7tli frusflatpriksom hpa7tmwatli hjonli

drutta Manilkara zapota is an evergreen Tree growing to 25 m (82ft) by 25 m (82ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Insects. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It cannot

grow in the shade. It prefers dry or moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcista Older leaves contain a poisonous alkaloid[298]. Seeds contain hydrocyanic acid and should be removed before eating the fruit[303].

kcakta Edible Parts: Fruit Leaves Sap ShootsEdible Uses: GumThe fruit can be eaten raw, or used in making sherbets, custard, ice cream, pies, jams, jellies etc[301 ]. Slightly larger than a plum, when fully ripe, the flesh is soft, very sweet, slightly acid and totally delicious, with the flavour of pears, cinnamon and brown sugar combined[200 , 301 ]. The fruit contains tannin, which is astringent[200 ]. In order to be at its best, the fruit needs to be eaten when it is absolutely ripe and has lost that astringency, and so it is difficult to grow commercially[200 ]. The globose fruit is about 10cm in diameter[307 ]. The stems are a source of a milky latex called balata or chicle[200 , 301 ]. This inelastic polymer can be coagulated when it becomes hard and brittle until chewed[200 ]. It has long been used as the base for chewing gum[200 , 301 ]. The very young leaves and shoots can be eaten raw or cooked[298 , 301 ]. Some caution is advised since older leaves contain poisonous alkaloids[298 ].

tcanta Furniture Gum Latex Tannin Teeth WoodSeaside backyard tree. Shade tree. Coastal street tree. Public open space. Xerophytic. Other Uses Wild and cultivated trees in America are tapped for their milky latex, which coagulates into chicle, the principal constituent of chewing gum before the advent of synthetic alternatives[303 ]. The gum is also used in transmission belts, dental surgery, and as a substitute for gutta-percha, a coagulum of the latex of Palaquium spp[303 ]. Chicle gum is obtained from oblique cuts or slashes made in the trunk of the tree during the rainy months. From these cuts there issues a milky latex which must be coagulated by heat, and formed into solid blocks for export[331 ]. Tannin from the bark is used to tan ship sails and fishing tackle[303 ]. The heartwood is dark reddish or reddish brown, the sapwood pinkish[331 ]. It is without distinctive odour or taste, of rather low lustre, rather fine-textured and with fairly straight grain[331 ]. The wood is noted for its strength and durability, it is also very hard, tough, dense, and resistant to insects[303 , 331 ]. It is not easy to work and has a tendency to splinter, but can be finished smoothly[331 ]. It is suitable for heavy construction, railway ties, furniture, joinery and tool handles[303 ].

dwatta Antidiarrhoeal Antipyretic Astringent Diuretic Febrifuge Odontalgic Tonic Urinary Leaf decoction is taken for fever, haemorrhage, wounds and ulcers[303 ]. For neuralgia, leaf with tallow is applied as a compress on the temples[303 ]. The flowers are used as one of the ingredients of a powder that is rubbed on the body of a woman after childbirth[303 ]. The bark is astringent, febrifuge and tonic[348 , 739 ]. Tannin from the bark is used to cure diarrhoea and fever[303 ]. The fruit is eaten as a remedy for indigestion and diarrhoea[348 ]. Seeds are antipyretic, and when ground with water they act as a diuretic[303 , 348 ]. They are used to expel urinary and gall bladder stones[739 ]. The pulverized roots are used to treat thrush in babies[739 ]. The plant is a source of sapotin, a glucoside used in medicine as a febrifuge[303 ].

nrakta C. America - Panama to Mexico. ksacta Lowland and coastal forests[200 , 307 ].

propta Seeds germinate after about 30 days without any treatment and with up to 80% success rate[303 ]. Cuttings Air-layering of 2-year-old branches, 45 - 60cm long, 1 cm in diameter and suitably leafy[303 ]. Grafting.

nwatta Sapodilla can grow well in a wide range of climatic conditions from the wet tropics to dry cool subtropical areas; but they prefer a moist hot climate similar to that found at medium to low elevations, usually below 600 metres, in tropical areas, such as in coastal regions[303 ]. Commercial crops can be obtained at elevations up to 900 metres in the tropics, with the tree producing at least some fruit up to 2,500 metres[418 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 34°C, but can tolerate 11 - 42°C[418 ]. When dormant, the plant can survive very short-lived temperatures down to about -4°C, but young growth can be severely damaged at -1°C[418 ]. It prefers a mean annual rainfall in the range 1,000 - 1,500mm, but tolerates 400 - 2,000mm[418 ]. Fruiting is not adversely affected by heavy rainfall[303 ]. Grows best in full sun[303 ]. An undemanding plant, it is one of the few fruit trees to thrive



in the poor, wind-swept low-lying coral islands of the West Indies, though it grows better given fertile conditions[307 ]. Grows well in calcareous soils[335 ]. Dislikes heavy clay soils[335 ]. Prefers a well-drained soil[200 ]. Prefers a pH in the range 6 - 7, tolerating 5.5 - 8.5[418 ]. Established plants are drought resistant, they also resist strong winds and moderate levels of salt in the soil[200 , 307 , 418 ]. The tree has a main fruiting period, but some flowers and fruits are produced throughout the year[303 , 335 ]. Fruits take about 4 months to mature[303 ]. Seedlings may take 5 - 8 years to bear fruit, while grafted varieties take only 2 - 3 years from planting out[303 ]. Trees reach their maximum cropping at around the age of 30 years[418 ]. A good tree may yield up to 2,500 - 3,000 fruits per year, or about 250 - 300 kilos[418 ]. Annual yields per ha of 20 - 30 tonnes have been reported in Florida, 20 - 25 tonnes in the Philippines and 20 - 80 tonnes in India[418 ]. There are some named varieties[416 ]. Flowering Time: Late Winter/Early Spring. Bloom Color: Pale Green Inconspicuous/none.

## 10.2.7 Nephelium lappaceum

Rambutan, Hairy Lychee  
10 thin 12 cyuc 5 kcak 3 tcan 2 dwat 20 m hkuc  
hmhimhtut cyuti tcp hwicli jlutnyik hpa7tli frusflatprik hpa7tmwatli fyif hjonli

drutta Nephelium lappaceum is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Insects. The plant is self-fertile. It is noted for attracting wildlife. Suitable for: medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The fruit wall contains a toxic saponin; cases of poisoning are known[303 ].

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilFruit - raw or cooked[46 ]. The sweet, juicy, light-coloured flesh is delicious eaten raw[296 , 301 ]. It can also be stewed, canned in syrup, used in jams, jellies etc[301 ]. The bright red, ovoid fruit is 5 - 6cm long and is produced in clusters of 10 - 12 fruits[335 ]. Seed - occasionally roasted and eaten[46 , 301 , 303 ]. A bitter flavour, it is said to have narcotic properties[303 ]. An oil or tallow similar to cacao butter, with a high level of arachidic acid, can be rendered from the seeds[301 , 303 ]

tcanta Dye Houseplant Lighting Oil Soap TanninSmall shade tree. Humid shade garden. Backyard tree. Large planter. Conservatory. Agroforestry Uses: Legumes with low growth habits, such as Canavalia, Crotalaria and Vigna, can be beneficially intercropped with rambutan[404 ]. Other Uses The young shoots are used to produce a green colour on silk that is first dyed yellow with turmeric[303 ]. The fruit walls are used, together with tannin-rich parts of other plants, to dye silk black after a preliminary red staining[303 ]. The leaves are used, together with mud, as an impermanent black dye. A red dye used in batik can be obtained from the leaves and fruit[307 ]. The seeds contain an oil that has been used for illumination and a fat that has been used to make soap[303 ]. The seed kernel can be used for the production of rambutan tallow, a solid fat similar to cacao butter, which is used for soap and candles[303 ]. The reddish coloured wood is liable to splitting during seasoning. It is moderately hard to very hard, strong and tough. It is easy to work and can be finished well. It is durable under cover and generally resistant to insect attacks, but susceptible to fungal attacks. Usually too small to be valued as timber.

dwatta Anthelmintic Antidiarrhoeal Astringent Febrifuge Poultice StomachicThe green fruit is said to be astringent, stomachic, and anthelmintic[303 , 404 ]. It is used in the treatment of various diseases, especially fevers and diarrhoea[404 ]. The leaves are used in poultices for headaches. The shell of the fruit contains tannins and is used as an astringent[307 ]. In Java, the toxic saponin found in the fruit wall is dried and used as medicine[303 ]. In Malaysia, the roots are used in a decoction for treating fever[303 ]. The bark is used as an astringent for tongue diseases[303 ].

nrakta E. Asia - China, Thailand, Cambodia, Laos, Vietnam, Malaysia, Indonesia, Philippines. ksacta Found in the

lower or middle storey in different types of primary and secondary forest ranging from dryland to swamp[303 ]. Lowland humid forests[307 ].

propta Seed - it has a very short viability and so need to be sown as soon as it is extracted from the fruit[303 ]. Wash the seed first to remove traces of the fruit[303 ]. When ripe, the seed germinates very quickly and grows rapidly[296 ]. Seedlings quickly produce a large root system and so need to be planted out into their permanent positions when still young[296 ]. The seed has a very short viability and needs to be sown as soon as possible after the fruit is harvested[296 ]. Layering. Grafting.

nwatta Rambutan grows best in the lowland humid tropics at an elevation below 600 metres, though it can also be grown non-commercially up to 1,950 metres[303 ]. It grows best in areas where annual daytime temperatures are within the range 21 - 35°C, but can tolerate 10 - 42°C[418 ]. When dormant, a mature plant can survive temperatures down to about -1°C, but young growth does not tolerate any frost and will be severely damaged at 4°C[418 ]. Temperatures down to about 5 - 6°C will cause defoliation[418 ]. It prefers a mean annual rainfall in the range 2,000 - 3,000mm, but tolerates 1,400 - 4,000mm[418 ]. It prefers climates with all-year rain, but can tolerate up to 2 - 3 dry months[418 ]. Prefers a sunny position, though young trees appreciate the shelter and dappled shade of trees growing overhead[307 , 418 ]. Prefers a clay loam soil, though it can be grown in a wide range of soil types, even ones with poor drainage, so long as they are not water-logged[303 ]. Requires a moist fertile acid soil rich in organic matter[296 , 307 ]. Requires shelter from drying winds[303 ]. Prefers a pH in the range 5 - 6.5, tolerating 4.5 - 7.5[303 , 418 ]. Seedling trees take 6 - 8 years to produce their first crop, whilst grafted trees can fruit in their second year[296 ]. Fruit yields increase for the next 8 - 10 years; the tree has an economic life of about 15 - 20 or even 30 years, whilst it might live for up to 60 years[418 ]. Trees usually fruit twice a year, yielding 1,000 - 1,500 fruits per tree per year at age 5 - 7 years and 5,000 - 6,000 fruits per tree for older trees[418 ]. Very good trees may yield up to 170 kilos per tree and yields per hectare may be from 2 - 20 tonnes[418 ]. There are many named varieties[301 ]. Trees are usually dioecious[307 ], but most commercial cultivars behave hermaphroditically and are self-fertile[303 ]. Spacing: 30-40 ft. (9-12 m).

## 10.2.8 Terminalia kaernbachii

Okari Nut

10 thin 12 cyuc 5 kcak 2 tcan 0 dwat 20 m hkuc  
htut cyuti tcp hwicli hrasjlutnyik hpa7tli flatprikliw hpa7tmwatli hjonli

drutta Terminalia kaernbachii is a deciduous Tree growing to 20 m (65ft) by 20 m (65ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Oil SeedEdible Uses: OilSeed - raw or cooked[46 , 301 ]. The seed has an excellent, mild, almond-like flavour; it can be eaten raw, roasted or baked[301 ]. The flavour is improved by roasting it lightly with salt[301 ]. The palatable kernels are the largest known in this plant family, they can be up to 7 - 8cm long, 3 - 4cm wide, and can weigh from 1.5 - 10g each[303 , 324 , 658 ]. The seed contains up to 50% of a sweet, colourless, non-drying oil[324 , 658 ]. It is the source of a vegetable butter[301 ]. Fruit[451 ]. The red, fleshy, ellipsoid fruit can be 60 - 175mm long, 40 - 80mm wide and 35 - 60mm thick[451 ].

tcanta Furniture Oil WoodOther Uses: The wood is moderately hard, inclined to be brittle[451 ]. It is sometimes used for timber in furniture construction, but is seldom logged as it is excluded from timber purchases because of the value of its seed[303 , 701 ].

nrakta E. Asia - Malaysia, Indonesia, New Guinea to the Solomon Islands. ksacta Scattered, but sometimes common, in lowland rainforest and riverine forest, at elevations up to 1,000 metres[303 ].

propta Seed - germinates freely when fresh, but quickly loses its viability[303 , 658 ].

2,800mm[418 ]. A position in full sun is best for fruit production, but young plants grow better if they are given some shade[418 ]. Plants are tolerant of a range of soil types, including heavy clays, so long as they are well drained, but grow best on deep, rich, acid soils that are rich in organic matter[200 , 404 ]. They have succeeded on limestone soils when iron chelates have been added[200 ]. Tolerant of wet soils, providing the water is not stagnant[200 ]. Plants require a position that is sheltered from the wind, especially when they are young[200 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 5 - 8.5[418 ]. Most varieties need between 50 - 150 hours of standard chilling at 10 - 10°C[303 ]. The trees have a positive requirement for winter chilling to between 7 - 12°C, and a dormancy period to induce flowering[200 ]. Various cultivars have been developed with differing degrees of winter chilling requirements[200 ]. Plants are slow to mature, but are long-lived[200 ]. Seedling trees take 8 - 12 years before they commence fruiting[335 ]. Grafted trees can commence fruiting when 2 - 5 years old, though full cropping does not take place until the trees are 20 - 40 years old and they can continue cropping for 100 years or more[307 ]. Fruit yields for 10-year-old trees range from 10 - 80 kg/tree, or 0.7 - 11.2 tonnes/ha[418 ]. Average yields are often only about 2 tonnes/ha[418 ]. There are many named varieties[200 , 301 ]. Flowering Time: Mid Spring. Bloom Color: Inconspicuous/none (fruit). Spacing: 15-20 ft. (4.7-6 m).

## 10.2.14 Musa x paradisiaca

Banana

10 thin 12 cyuc 5 kcak 2 tcan 2 dwat 8 m hkuc  
htut cyuti tcp hwicli hrasjlutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Musa x paradisiaca is an evergreen Perennial growing to 8 m (26ft) by 4 m (13ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Birds, Bats. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist soil. The plant is not wind tolerant.

kcakta Edible Parts: Flowers Fruit Shoots StemEdible Uses: Drink SaltFruit - raw or cooked. Dessert forms are sweet and succulent when fully ripe and are widely eaten out of hand, though they are very versatile and are used in a wide variety of other ways. For example, they are commonly used with other juicier fruits to make smoothies, they can be baked, cooked in cakes, dried for later use etc. Plantains are richer in starch and contain less sugars. Whilst these are more commonly cooked as a vegetable, when fully ripe they make a very acceptable raw fruit[K ]. Male inflorescences are eaten in curries or cooked with coconut milk[301 ]. The inner stem can be boiled and eaten, or can be dried and made into a flour and starch[301 ]. Blanched shoots that sprout from the base can be roasted and eaten[301 ]. The leaves are commonly used for wrapping foods that are to be cooked - especially glutinous rice dishes. They impart a distinctive flavour and a greenish colour[301 ]. Nectar of the flowers is consumed[301 ]. The ashes of the plant can be used as a salt substitute[301 ].

tcanta Containers Fibre Hair StringOther Uses The large leaves are used as plates for eating food[272 ]. The leaf sheath is used as a temporary binding[272 ]. The juice of the roots is used as a hair tonic[348 ].

dwatta Antidiarrhoeal Antitussive Astringent Dysentery Epilepsy Haemostatic Skin VesicantThe unripe fruits and their sap are astringent and haemostatic[254 , 348 ]. They are eaten, often roasted, as a treatment for diarrhoea[254 , 348 ]. The fruit is used to treat epilepsy[348 ]. The peeled and sliced fruit is placed on the forehead to relieve the heat of a headache[348 ]. The peel of the fruit is considered an abortive[348 ]. The leaves, dried and made into a syrup, are used to treat coughs and chest conditions such as bronchitis[254 ]. An infusion of the banana leaf, combined with sugarcane roots, is used to hasten childbirth[348 ]. The leaves are applied as a vesicant on blistering[348 ]. It is tied onto the forehead to relieve a headache[348 ]. The pulp of the trunk is made into an infusion to soothe dysentery[348 ]. A liquid collected at a cut stem is an antiseptic that is applied to furuncles and wounds[348 ]. The root is strongly astringent

and has been used to arrest the coughing up of blood[254 ]. Applied externally, the juice of the root is used to treat carbuncles and swellings[348 ]. The flowers are astringent[272 ]. The fruit contains two vasoconstrictors: norepinephrine (a chemical used to raise blood pressure) and dopamine. Norepinephrine is good for a weak heart[348 ]. The fruit is also rich in vitamin A[348 ]. Sap of the fruit contains serothine, which has an action on the long muscles[348 ].

nrakta Only known as a cultivated plant, it is a hybrid of *M. Acuminata* × *M. Balbisiana*. ksacta Not known

propta Seed - sow the large seed in individual pots in the spring in a warm greenhouse at about 20°C[200 ]. Grow the seedlings on in a rich soil, giving occasional liquid feeds. Keep the plants in the greenhouse for at least three years before trying them outdoors. Division of suckers in late spring. Dig up the suckers with care, trying to cause the least disturbance to the main plant. Pot them up and grow them on in a lightly shaded position in a greenhouse until they are well established.

nwatta The optimal temperature for fruit production is about 27°C, and night time temperatures should not fall much below 18°C when the fruit is ripening or flavour can be impaired[200 ]. Requires a sunny sheltered position in a well-drained fertile soil with a pH between 6 and 7.5[200 ]. There are very many named varieties, but two main types can be distinguished:- Dessert bananas which become very sweet when fully ripe. Plantains, which contain more carbohydrate and are more commonly cooked.

## 10.2.15 Theobroma cacao

Cacao, Cocoa Tree

10 thin 12 cyuc 5 kcak 3 tcan 3 dwat 8 m hkuc  
pcimhimhtut cyuti tcp hwicli jlutnyik hpa7tli frusflatprik hpa7tmwatli dyat hjonli

drutta Theobroma cacao is an evergreen Tree growing to 8 m (26ft) by 8 m (26ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Thrips, Midges, Ants, Aphids. The plant is not self-fertile. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist soil. The plant is not wind tolerant.

pcista Chocolate can cause allergies and migraine in some people[238 ].

kcakta Edible Parts: Oil SeedEdible Uses: Chocolate Colouring Drink OilThe dried, fermented and roasted seeds of this plant, called cacao beans, are the source of cocoa, chocolate and cocoa butter[301 ]. These are widely used in the confectionery industry to make chocolate confections, cakes, ice cream, drinks etc[301 ]. The somewhat bitter flavour is usually moderated by adding sugar or other sweeteners[238 ]. The seed contains up to 50% fat[303 ]. The ripe seeds are cured by pressing, fermenting and then drying them[307 ]. The cured seeds are then roasted and ground into a powder to make cocoa[307 ]. A butter-like fat (called cocoa butter) is extracted from the seeds[307 ]. The fruit contains about 20 - 40 seeds surrounded by a thin, succulent pulp with a slightly sweet flavour[416 ]. This pulp is sucked as a sweet snack[301 , 307 ]. It can be made into juices and jellies[416 ]. The seed contains a pigment that is said to be useful as a food colouring[301 ].

tcanta Charcoal Cosmetic Fibre Fuel Oil Paper Soap making String WoodHumid shade garden. Botanic collection. Large conservatory. Agroforestry Uses: The tree is often interplanted with bananas, coconuts and rubber[200 ]. Other Uses The cacao tree provides a wide range of commodities for local peoples including fibre for cloth, thread and paper; wood for construction, making implements etc; coverings for their houses and many other items[254 ]. The ash from pod husks contains potassium oxide, which can be extracted in the form of potassium hydroxide, a useful alkali in the saponification process[303 ]. The burnt husks can be pounded and made into a paste that has a soapy residue and can be used for washing clothes[307 ]. Cocoa-bean fat from unfermented cocoa beans can be extracted and used in soap making[303 ]. Cacao butter, obtained from the seeds, is used in skin creams, cosmetics and as a suppository base[238 ]. The wood is light, soft and of low durability[419 ]. Of little

latex serves as a substitute for rubber[ 303 ]. The bark yields a dark, water-soluble resinous gum that contains 3.3% tannin[ 303 ]. When boiled with alum, the sawdust or chips of the heartwood produce a rich yellow dye used for silk and the cotton robes of Buddhist priests[ 303 , 525 ]. Wood is yellow at first, becoming red. It is classified as medium hardwood. It is resistant to termite attack and fungal and bacterial decay and is easy to season[ 303 ]. It takes polish beautifully. Though not as strong as teak, it is considered superior to that wood for furniture, construction, turnery and inlay work, masts, oars, implements and musical instruments. The wood is widely used in India and Sri Lanka and is even exported to Europe[ 303 ]. Roots are highly prized for carvings and picture framing[ 303 ]. The wood is used for fuel[ 418 ].

dwatta Abortifacient Antiasthmatic Antidiarrhoeal Aphrodisiac Febrifuge Mouthwash Sedative Skin Stomachic Tonic Vermifuge The ashes of leeches, with or without oil, are used to treat ulcers, diarrhoea, boils, stomach-ache and wounds[ 303 ]. The pulp and seeds of the fruit are regarded as a cooling tonic[ 303 ]. The seeds are said to be an aphrodisiac[ 303 ]. The sap is an anti-syphilitic and a vermifuge[ 303 ]. The wood is claimed to have sedative properties, and its pith is said to be able to induce abortion[ 303 ]. A root decoction is used to alleviate fever, treat diarrhoea, skin diseases and asthma[ 303 ]. The bacteriolytic activity of the latex is equal to that of papaya latex[ 303 ]. Dried latex yields artonenone, a compound with marked antineoplastic action; it can also be mixed with vinegar to promote healing of abscesses, snakebite and glandular swellings[ 303 ].

nrakta E. Asia - Indian subcontinent. ksacta Rainforests[ 303 ]. Evergreen forests at elevations of 450 - 1,200 metres[ 525 ].

propta Seed - under suitable conditions, germination begins within 10 days, and 80-100% germination is achieved within 35-40 days after sowing[ 303 ]. The seed quickly loses viability and so should be sown as soon as possible[ 296 ]. Seedlings produce a long taproot and can be difficult to transplant, so it is best to pot them up into deep pots as soon as they are large enough to handle and to plant them out into their permanent positions as soon as possible. The seed germinates best at a temperature of 24 - 27°C[ 200 ]. Root cuttings. Air layering. Stem cuttings are also possible. Air layering is best done in the rainy season. Rooting hormones can be used to help roots develop. The shoots used for air layering should be 2-3 years old and brown in colour. To produce air layers, a small branch 3-4 cm across, is cut below a node and only part way around the stem. A ring 5-7 cm wide is cut and a layer of sand wrapped around the stem and covered with plastic. Using 1% IBA growth substances helps shoots to strike and form roots. Roots form in about 22 days and the stem can be cut off and planted after about 2-3 months.

nwatta Fodder: Fruit Management: Standard Minor Global Crop Other Systems: Homegarden Other Systems: Multistrata Staple Crop: Balanced carb Staple Crop: Basic StarchA plant of the humid lowland tropics, growing best at an elevation below 1,000 metres, with a mean annual temperature in the range 24 - 28°C, a mean max temperature of 32 - 35°C, a mean minimum temperature of 16 - 20°C, and a mean annual rainfall in the range 900 - 4,000mm evenly distributed through the year[ 303 ]. Prefers a climate without a dry season, but can tolerate a short dry season[ 525 ]. Jackfruits can grow at higher elevations than the breadfruit and also in cooler and drier climates[ 200 , 303 ]. They can even succeed in warm temperate areas, but they remain small and any fruit is of poor quality[ 200 ]. Trees can bear fruit at latitudes up to 30' from the equator, with good crops up to 25' distant[ 303 ]. Succeeds in a variety of soils[ 296 ]. Prefers a deep, well-drained alluvial soil[ 200 ]. Prefers a pH in the range 5.5 - 7.5, tolerating 4.3 - 8[ 418 ]. Young plants need some shade, but need increasing light levels as they mature[ 200 ]. Mature plants are relatively drought resistant[ 296 ]. Plants have poor drought tolerance[ 418 ]. Slightly more tolerant of cold than breadfruit. There are two main groups of cultivars, one group has soft rinds whilst the other has hard[ 46 ]. Jackfruits produce one of the largest fruits in the world[ 200 ]. The trees have a deep taproot[ 303 ]. Plants can produce their first crop within 3 years of the seed germinating, but 8 years is a more common time[ 296 , 418 ]. Flower and fruit loads are initially low and improve with increasing size and age; trees 2 years old produce about 25 flowers and 3 fruits; trees 5 years old bear as many as 840 flowers, and trees 6 years old 1,500 flowers[ 303 ]. However, only 15-

18 fruits develop due to the low production of female spikes (about 0.6-5% of the total number of inflorescences[ 303 ]. Young trees bear more male than female flowers at a ratio of 4:1; production of female flower increases with age. A male-to-female ratio of 2:1 produces 250 fruits per tree, and as the trees age, fruit productivity declines[ 303 ]. In suitable environments trees bear fruits and flowers throughout the year, but in areas with distinct dry and wet seasons, flowering occurs in the wet season[ 303 ]. In young trees, fruits are usually borne on branches and in older trees, on trunks and roots[ 303 ]. Jackfruit exhibits fairly rapid growth, attaining a height of 3 metres and a canopy diameter of 2 metres at 2 years of age. In 5 years, the tree height reaches 7 metres and the canopy diameter 4 metres; trees 20 years old are about 18 metres, as tree growth slows down with age[ 303 ].

## 10.2.13 Litchi chinensis

Lychee, Litchi

10 tlin 12 cyuc 5 kcaak 2 tcan 2 dwat 12 m hkuc hmimhtut cyutli tcup hwicli jlutnyikfrip hpa7tli fruslatprik hpa7tmwatli hjonli

drutta Litchi chinensis is an evergreen Tree growing to 12 m (39ft) by 12 m (39ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees, Flies, Ants, Wasps. It is noted for attracting wildlife. Suitable for: medium (loamy) and heavy (clay) soils and can grow in heavy clay soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked. The white, translucent fleshy arils are sweet, juicy and subacid, with a delicious flavour that is somewhat reminiscent of Muscat grapes[301 , 303 ]. Much eaten raw, they can also be dried, spiced, pickled, canned in syrup, used in jams, sauces, ice creams, fruit salads etc[301 ]. The dried fruits, called lychee nuts, have a distinctive smoky flavour and are widely eaten in China[301 ]. Rich in vitamin C[200 ]. The pink to strawberry red fruit is 25mm or more in diameter and is covered by a rough leathery rind or pericarp[303 ]. The fruits are borne in loose clusters of 3 - 20[418 ]. The smooth fruits of lowland-grown 'water lychee' are commonly preferred to the rather prickly fruits of 'mountain lychee' grown in the hills[317 ].

tcanta Houseplant Tannin WoodShade tree. Street tree. Backyard tree. Screening. Specimen. Bonsai. Large conservatory plant. Agroforestry Uses: The tree is sometimes grown to provide shade[317 ]. Other Uses The bark contains tannin[303 ]. The wood is very durable and is said to be nearly indestructible, although it is brittle and has few uses[303 , 418 ].

dwatta Antidiarrhoeal Mouthwash Vitamin CThe fruit, its peel and the seed are used in traditional medicine; decoctions of the root, bark and flowers are used as a gargle to alleviate throat ailments[303 , 317 ]. The fruit peel is used in the treatment of diarrhoea[307 ]. Seeds are used as an anodyne in neuralgic disorders and orchitis[303 ].

nrakta E. Asia - southern China, Cambodia, Vietnam, Philippines. ksacta The tree has been in cultivation for so long that wild forms are no longer believed to exist[200 ].

propta Seed - it has a very short viability and needs to be sown as soon as it is removed from the fruit[200 ]. Sow the seed 1cm deep in containers. The seeds germinate without pre-treatment when sown fresh[303 ]. Young seedlings grow vigorously until they reach 24 - 30cm[303 ]. The quality of seed-grown plants will be quite variable[200 ]. Trees can take 15 years to produce their first crop from seed[200 ]. Air layering. Rates of success are usually not less than 95%[303 ]. Greenwood cuttings Grafting

nwatta The litchi is adapted to the tropics and warm subtropics, producing best in regions with winters that are short, dry and cool but not frost free, and summers that are long and hot with high rainfall[303 ]. In the tropics it may thrive better at some elevation because of its requirement for winter chilling[303 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 35°C, but can tolerate 15 - 40°C[418 ]. When dormant, the plant can survive temperatures down to about -5°C, but young growth can be severely damaged at -1°C[418 ]. It prefers a mean annual rainfall in the range 1,000 - 1,700mm, but tolerates 700 -

nwatta Management: Standard Regional Crop Staple Crop: Protein-oilA plant of the tropical lowlands, where it is found at elevations up to 1,000 metres[335 ]. Plants can be found at elevations up to 1,300 metres, but do not fruit well at these higher elevations[658 ]. Succeeds in only moderately fertile, well-drained soil in a sunny position[200 ]. A fast-growing tree when young, able to increase height by up to 2 metres a year[658 ]. Trees take many years to come into full bearing from seed, even when 20 years old they usually only produce small crops[658 ]. Seeds are harvested after they fall to the ground[658 ]. The plant often crops poorly when close to the sea, but can produce good crops when growing inland.

## 10.2.9 Artocarpus altilis

Breadfruit

10 tlin 12 cyuc 5 kcaak 4 tcan 4 dwat 18 m hkuc htut cyutli tcup hwicli hyishrasjlutnyikfrip hpa7tli priklwish-som hpa7tmwatli dyat hjonli

drutta Artocarpus altilis is an evergreen Tree growing to 18 m (59ft) by 18 m (59ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees. The plant is not self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in saline soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: Flowers Fruit Leaves SeedEdible Uses: GumEdible portion: Fruit, Seeds, Leaves, Flowers, Vegetable. Breadfruit is a versatile food that can be cooked and eaten at all stages of its development[ 303 ]. The fruit can be eaten raw or cooked. The unripe fruit, as small as 2 - 6cm in diameter, is eaten as a starchy vegetable with a flavour similar to that of artichoke hearts[ 303 ]. It can be prepared in various ways including boiling, baking, added to soups, pickling etc[ 301 , 303 ]. Ripe fruits are somewhat sweet and are occasionally eaten raw, but are more often cooked as a starchy vegetable or fermented into a cheese-like food[ 301 ]. The mature fruit can be dried and ground into a flour[ 301 ]. The mature fruit is about 20cm long[ 307 ]. Compared with other staple starch crops, breadfruit is a better source of protein than is cassava; it is comparable to sweet potato and banana[ 303 ]. It is a relatively good source of iron, calcium, potassium and riboflavin[ 303 ]. Seed - cooked. Firm and close-textured, they are very nutritious, with a flavour somewhat reminiscent of chestnuts[ 301 , 303 ]. They can be cooked with the raw breadfruit or removed and boiled or roasted[ 301 , 303 ]. They are usually peeled before being eaten[ 301 ]. Both fresh and cooked seeds contain about 8% protein[ 303 ]. The seeds are low in fat compared with tree nuts such as almond, brazil nut and macadamia nut, which contain 50 - 70% fat[ 303 ]. The seeds are a good source of minerals and contain more niacin than cashews, almonds, macadamia nuts, brazil nuts, pecans, black walnuts or chestnuts[ 303 ]. Male inflorescence - cooked and used as a vegetable or used in the preparation of a sweetmeat[ 301 ].

tcanta Adhesive Bedding Containers Dye Fibre Fodder Fuel Gum Insecticide Shelterbelt String Waterproofing Weaving WoodOther uses rating: High (4/5). Seaside; shade tree, backyard tree, specimen. Agroforestry Uses: The breadfruit is an important component of traditional agroforestry systems in the Pacific Islands[ 303 ]. The trees are integrated into mixed cropping systems with yams and other root crops, Piper methysticum, bananas and some cash crops, especially black pepper and coffee[ 303 ]. The tree is sometimes used as a wind-break or shade tree for coffee plantations[ 320 ]. Other Uses The male flower spikes are blended with fibre of paper mulberry (Broussonetia papyrifera) to make elegant loincloths[ 303 ]. The inner layer of bark, or bast, was used to make bark cloth (tapa)[ 303 , 454 ]. Traditionally it had ceremonial and ritual uses, was also used for beddings and items of clothing such as cloaks, loincloths and robes[ 303 ]. Breadfruit bast makes good cordage with a diverse range of uses such as harnesses for water buffalo and nets for catching sharks[ 303 ]. The sticky, milky sap is a gum that is used to caulk canoes to make them watertight and can be used as an adhesive to seal and prepare wooden surfaces for paint-

ing[ 303 , 307 ]. A sticky latex is present in all parts of the tree and has many uses. It is used as a chewing gum in the Caribbean and elsewhere. Can be used as an adhesive for bark cloth and for caulking canoes[ 303 , 339 ]. The latex can be mixed with coconut oil for trapping houseflies[ 303 ]. The inflorescence has been used to make a yellow tan to brown dye[ 303 ]. The fat extracted from the seed is a light yellow liquid, viscous at room temperature, with a characteristic odour similar to that of peanuts. It has a chemical number and physical properties similar to those of olive oil[ 303 ]. The dried, hard flowers can be burned as a mosquito repellent[ 303 , 339 ]. The leaves are widely used as plates and also to wrap food for cooking and serving[ 303 , 339 ]. The dried stipules or senescent leaves are slightly rough, and in Hawaii they were used to polish and smooth bowls and nuts strung for decorative purposes[ 303 ]. The heartwood is golden speckled with orange, differentiated from the yellow or brownish-yellow sapwood. The golden yellow colour darkens with age. The wood is very light, durable, soft, but quite resistant in spite of its low specific gravity[ 303 ]. Traditionally it was widely used for the construction of houses and canoes because of its resistance to termites and marine worms. The wood is also used to make bows, carvings, furniture and even surfboards[ 303 ]. The trees are an important source of firewood in some areas[ 303 ].

dwatta Anticonvulsant Antifungal Antispasmodic Astringent Cancer Digestive Dysentery Purgative SkinBreadfruit has a very wide range of applications in traditional medicine with all parts of the plant being utilised in the treatment of a range of conditions[ 311 ]. Research has shown the presence of a number of active compounds in the plant: The fruit contains artocarpine and the enzyme papayotina[ 348 ]. The leaf contains the phenols quercetin and camphor, plus gamma-aminobutyric acid, which lowers the blood pressure[ 348 ]. The stem-bark and fruit contain cyclopropane sterols[ 348 ]. The toasted flowers are rubbed on the gums around aching teeth to ease pain[ 303 ]. An extract from the flowers is effective in treating ear oedema[ 303 ]. Latex is massaged into the skin to treat broken bones, bruises, sprains, abscesses etc, and is banded on the spine to relieve sciatica[ 303 , 348 ]. It is commonly used to treat puncture wounds in the eyes[ 311 ], skin ailments and fungal diseases such as thrush[ 303 , 311 ]. The latter is also treated with crushed leaves[ 303 ]. Diluted latex is taken internally to treat diarrhoea, stomach-ache and dysentery[ 303 ]. Latex and juice from the crushed leaves are both traditionally used to treat ear infections[ 303 ]. A filtrate of new, unfolded leaves is employed as a remedy for fish poisoning and as a muscle relaxant in cases of convulsive spasms[ 311 ]. The yellowing leaf is brewed into a tea and taken to reduce high blood pressure[ 303 , 348 ]. The tea is also thought to control diabetes[ 303 ]. Hypertension and diabetes medications are prepared from a mixture of the boiled leaves of this species combined with Persea americana, Carica papaya and Annona muricata[ 348 ]. The leaves are used in Taiwan to treat liver diseases and fevers[ 303 ]. The root is an astringent and is used as a purgative[ 303 ]. Pressed fluid of the root is used in the treatment of respiratory ailments which include difficult, painful breathing[ 311 ]. When macerated it is used as a poultice for skin ailments[ 303 ]. The bark is used to treat headache. Bark extracts exhibited strong cytotoxic activities against leukaemia cells in tissue culture, and extracts from roots and stem barks showed some antimicrobial activity against Gram-positive bacteria and may have potential in treating tumours[ 303 ]. Liquid squeezed from the bark or leaves is given to remedy chest pains and vomiting resulting from heart trouble[ 311 ]. Pressed liquid from the stem bark is employed in the treatment of pain in the bones and maternal postpartum infections[ 311 ]. The bark is also used to treat stomach aches and digestive tract problems[ 311 ]. Fluid pressed from young fruit is given to treat an illness which causes pain in the lungs and vomiting of blood[ 311 ].

nrakta E. Asia - Malaysia, Indonesia, Philippines, New Guinea, western Pacific.. ksacta Lowland humid tropics

propta Seed - best extracted from ripe fruits and sown immediately as they lose viability within a few weeks[ 200 , 303 ]. They are planted about 5 cm apart and 1 cm deep[ 303 ]. The seed germinates best at a temperature of 24 - 27°C[ 200 ]. Some 85% germinate about 2 weeks after sowing[ 303 ]. The germination bed should be kept moist. Seedlings can be transplanted into individual containers as soon as they

sprout[ 303 ]. They grow quickly and are ready for planting in the field when they are about 1 year old[ 303 ]. Root cuttings. These are best collected during the dormant season immediately preceding the renewal of growth, or at the beginning of that period, when carbohydrate stores in roots are highest[ 303 ]. The dormant period (2-3 months) begins immediately after the crop ripens[ 303 ]. Cuttings of roots 1.5 cm to 4 cm across and 25 cm long are suitable. Cuttings can be rooted during the wet season, in sand. They should be placed horizontally. They need to be kept moist and shaded. Using intermittent mist improves root formation and cutting establishment. Rooting hormones also assists. This process takes 10 weeks or more and then rooted cuttings should be hardened off in a sunny position for up to 3 more months before planting out into the field. Young plants do best with adequate sun and not shade. Root suckers produced naturally, or by damaging the roots, are a common method of production of new material. Marcottage or budding can also be used for propagation. Air layering.

nwatta Agroforestry Services: Crop shade Agroforestry Services: Windbreak Fodder: Fruit Industrial Crop: Fiber Industrial Crop: Hydrocarbon Management: Standard Minor Global Crop Other Systems: Homegarden Other Systems: Multistrata Staple Crop: Basic StarchA plant of the humid tropics, growing best in lowland areas below 650 metres, though also succeeding at elevations up to 1,550 metres[ 303 ]. It prefers a mean annual temperature in the range of 21 - 32°C, tolerating it as low as 12°C and as high as 40°C[ 200 , 303 ]. Plants can be injured if temperatures drop below 5°C[ 335 ]. Rainfall should be in the range 1,500 - 2,500mm, exceptionally to 3,000mm[ 303 ]. It prefers rainfall of fairly equal distribution but is quite tolerant of short dry periods[ 303 ]. Prefers a deep, fertile, well-drained soil[ 200 , 307 ]. Tolerant of a variety of soils so long as they are well drained[ 335 ]. Young plants need some shade, but require increasing light levels as they mature[ 200 ]. Trees usually produce two crops per year[ 335 ]. Plants begin to crop when about 3 - 6 years old, eventually producing up to 700 fruits per tree annually[ 200 ]. There are two main forms of the breadfruit, one with seeds and another that is seedless[ 307 ]. The seedless form is the most common[ 307 ]. There are some named varieties of each form[ 200 , 301 ]. Complete fertilizer in spring, deep organic mulch.

## 10.2.10 Annona mucosa

Wild Sweetsop

10 tin 12 cyuc 5 kca2 2 tcan 1 dwat 5 m hkuc  
htut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Annona mucosa is an evergreen Tree growing to 12 m (39ft) by 12 m (39ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked. Of excellent quality[ 46 ]. The yellow fruits have a juicy, melting flesh of a very pleasant flavour, reminiscent of lemon meringue pie[ 301 ]. Delicious[ 317 ]. Usually eaten raw, they can also be used in ice cream, pies, cakes etc[ 301 ]. The fruit can be up to 15cm wide[ 307 ].

tcanta Beads Containers Insecticide WoodOther uses rating: Low (2/5). Other Uses The seeds are very hard. They are used as beads in necklaces and bracelets[ 317 , 420 ]. The seeds are used as an insecticide[ 317 ]. The yellowish wood is medium-textured, straight grained, heavy in one report[ 307 ], but light in another[ 420 ], hard and strong[ 307 , 420 ]. It has poor mechanical properties and is not durable[ 420 ]. It is used for small constructions, making boxes and linings[ 317 , 420 ].

dwatta AntirheumaticThe leaves are utilized in folk medicine as a treatment against rheumatism[ 317 ].

nrakta S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana; C. America - Panama to Mexico; Caribbean. ksacta Lowland humid limestone forest from sea level to around 600 metres[ 307 ]. Found mainly in the more open areas of secondary growth[ 420 ].

propta The seed of many species in this genus has a hard seedcoat and may benefit from scarification before sowing in order to speed up germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing[ K ]. Sow the seed in a partially shaded position in a nursery seedbed. A germination rate in excess of 50% can be expected from treated seeds[ 420 ]. When the seedlings are 6 - 8cm tall, pot them up into individual containers[ 420 ]. Layering. Grafting.

nwatta A plant of the hot, humid, tropical lowlands[ 335 ]. Plants are very susceptible to frost damage[ 335 ]. Prefers a fertile, well-drained soil and a position in full sun[ 307 ]. A fast-growing tree[ 307 ]. Plants can commence bearing fruit when about 4 years old[ 416 ]. Plants are becoming threatened in the wild due to deforestation[ 307 ].

## 10.2.11 Elaeis guineensis

African Oil Palm

10 tin 12 cyuc 5 kca2 5 tcan 2 dwat 15 m hkuc  
htut cyutli tcuphja7n hwicli hrasljutnyik hpa7tli frusflatprikliwis hpa7tmwatli dyat hjonli

drutta Elaeis guineensis is an evergreen Tree growing to 15 m (49ft) by 5 m (16ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist or wet soil.

kcakta Edible Parts: Apical bud Oil Sap SeedEdible Uses: Drink OilEdible portion: Seeds, Cabbage, Fruit, Palm heart, Sap, Vegetable, Seeds - oil. Oil - two types of oil are obtained from the plant. Palm oil is obtained from the fruit whilst palm kernel oil is obtained from the seed[ 297 ]. They are obtained in a volume ratio of approximately 9 : 1[ 299 ]. Palm oil has a wide range of uses, including making margarine, vegetable ghee, bakery fats, ice cream and as a cooking oil[ 297 ]. Palm oil is popular in West Africa and Malaysia for cooking and is now imported by India to meet local shortages in edible oil, being cheaper than many other vegetable oils[ 303 ]. In West Africa, the unrefined red palm oil is an essential part of the diet and is often added directly to bring richness to soups and sauces[ 303 ]. Addition of oil to cereal preparations greatly increases their calorific density, which is particularly advantageous for young children[ 303 ]. Palm oil is also used as frying oil in the preparation of snacks such as bean cakes and fried plantain[ 303 ]. Its 10% linoleic acid content makes it an excellent source of carotene. This is important in reducing incidence of vitamin A deficiency and the occurrence of nutritional blindness[ 303 ]. Palm kernel oil is similar in composition and properties to coconut oil. It also has a wide range of uses, including making margarine, ice cream, confectioneries and as a cooking oil, where it is sometimes combined with coconut oil[ 297 , 299 ]. The boiled and pounded nuts yield palm nut butter, a thick red liquid popular in Ghana and Liberia for making palm butter soup and other dishes[ 299 , 301 ]. The plant also provides heart-of-palm, where the soft portion of the apical bud is eaten as a vegetable[ 299 , 303 ]. Since the tree is single-stemmed, and palm trees are generally unable to produce side branches, harvesting this bud leads to the death of the tree[ K ]. Palm wine is commonly produced in West Africa by tapping the unopened male inflorescences, or the stem just below the apex of felled oil palms, and fermenting the sap[ 299 ].

tcanta Basketry Beads Broom Cosmetic Fencing Fertilizer Fibre Fuel Hair Oil Paper Preservative Resin Soap String ThatchingAgroforestry Uses: Oil palm is a good crop for rehabilitating degraded areas. In Sumatra it has successfully been established on abandoned farmlands taken over by imperata cylindrical[ 303 ]. Other Uses: Two types of oil are obtained from the plant: Palm oil is obtained from the fruit[ 46 , 297 ]. About 10% of all palm oil, the inferior grades in particular and also refining residues, is used to manufacture soaps, detergents, candles, resins, lubricating greases, cosmetics, glycerol and fatty acids. Palm oil is employed in the

steel industry (for sheet-steel manufacturing and tin plating, where it protects the iron before the tin is applied) and epoxidized palm oil is a plasticizer and stabilizer in PVC plastics[ 46 , 299 ]. Palm kernel oil, obtained from the seed, is a non-drying oil. It is used as an alternative to coconut oil in making high quality soaps, as a lubricant etc[ 46 , 297 , 299 ]. It is a source of short-chain and medium-chain fatty acids. These acids are chemical intermediates in the production of fatty alcohols, esters, amines, amides and more sophisticated chemicals, which are components of many products such as surface-active agents, plastics, lubricants and cosmetics[ 299 ]. Both oils also have a wide range of other uses, including making detergents, shampoos, cosmetics, lubricating oil additives and fluxes[ 297 ]. It is technically possible to produce from palm oil either carbohydrates for conversion to alcohol or a methanolizable oil as a diesel substitute[ 303 ]. In Togo, the pressed fruits are dried and fashioned into cakes for cooking fuel[ 303 ]. The empty bunches, fibre and also the effluent (0.5 t sludge for each t of milled fruit bunches) from the oil mills can be converted into products such as organic fertilizers[ 299 ]. Palm fronds are useful for thatch[ 303 , 320 ]. The entire palm fronds of this species are less suitable for thatching than those of the coconut palm, because of irregular leaflet insertion. However, the leaflets are often woven into baskets and mats; the leaflet midribs are made into brooms and the rachises used for fencing[ 299 ]. Young leaflets produce a fine strong fibre, used for making fishing lines, snares and strainers[ 299 ]. The seed shells are polished and carved into ornamental rings and beads[ 299 ]. Palm trunks, available at replanting, provide excellent material for paper and board production, but this has not yet attracted much commercial interest[ 299 ]. The seed shells are much appreciated by local blacksmiths as a high calorific fuel for furnaces[ 299 ].

dwatta Analgesic Antiemetic Detergent Diuretic Emollient Laxative SkinTraditional medicinal uses in Africa are numerous[ 299 ]. Preparations made from the palm heart are used to treat gonorrhoea, menorrhagia, and perinatal abdominal pain, and are considered laxative, anti-emetic and diuretic[ 299 ]. The leaf sap is used in preparations used to treat skin affections[ 299 ]. The roots as analgesic[ 299 ]. The oil from the pulp is emollient and is used as an excipient for herbal ointments[ 299 , 739 ]. It is used to treat suppurations, whitlows and swellings of the legs caused by erysipelas and infestations by Filaria[ 739 ].

nrakta Tropical west and central Africa - Sierra Leone to Uganda and Kenya, south to Angola and Mozambique. ksacta More or less open forest in moist, sandy soils that are often poorly drained[ 297 ]. Often found along the edges of rivers[ 303 ].

propta Seed - pre-soak 24 hours in warm water and sow in containers. Germination takes place in 2 - 5 months[ 297 ]. Commercially, the seeds are placed in intact 500-gauge polythene bags arranged on wooden boxes in a germinator at 39-40 deg. C for 75-80 days. They are then soaked in cold water for 3 days, changing water every 24 hours. The seeds are drained and dried under shade and kept at room temperature. They are examined every 2 weeks for germination and drying. Drying seeds are sprayed with water; germinated seeds are picked for potting. This treatment gives an 80% germination rate[ 303 ].

nwatta Global Crop Industrial Crop: Fiber Management: Standard Other Systems: Multistrata Other Systems: Parkland Staple Crop: OilA major cash crop but also significant as a food by farmers in many areas. Plants succeed in moist to very wet tropical climates up to elevations of 1,300m. Commercial cultivation is below 700m and preferably lower than 300 m[ 303 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 35°C, but can tolerate 12 - 38°C[ 418 ]. The plant is quite tolerant, though, and succeeds in southern China where there are light frosts and mean daily temperatures can drop below 10°C for weeks on end[ 303 ]. It prefers a mean annual rainfall in the range 1,500 - 3,000mm, but tolerates 1,000 - 8,000mm[ 418 ]. Optimally, there should be at least 150 mm of rain each month of the year, ideally falling mostly at night[ 303 ]. Plants grow well in full sun, even when small[ 297 ]. Grows and thrives on wide range of tropical soils, provided they have adequate water supply[ 303 ]. Requires a humus-rich soil[ 297 ]. Waterlogged, highly lateritic, extremely sandy, stony or peaty soils should be avoided[ 303 ]. Tolerant of temporary flooding, provided the water is not stagnant[ 303 ]. Prefers a pH

range 4.5 - 6, tolerating 3.2 - 8[ 418 ]. The root system is adventitious, forming a dense mat with a radius of 3 - 5m in the upper 40 - 60cm of the soil. Some primary roots are directly below the base of the trunk descending for anchorage for more than 1.5m; the roots produce pneumatodes under very moist conditions[ 299 ]. It is a succession species favoured by slash and burn, and its gene pool has expanded as farmers clear land and create more open habitat for the germination of its seeds[ 303 ]. Plants can commence bearing 3 years after the seed has germinated[ 297 ]. The plant produces both male and female flowers, but not usually at the same time. An individual inflorescence will be all male or all female flowers; after a series of inflorescences of one sex the plant will then produce a series of inflorescences of the opposite sex[ 768 ]. Plants flower all year[ 335 ]. The fruit is produced in clusters approx 100 fruits[ 335 ]. The inflorescence is produced from about every second leaf axil. There are up to 1,500 deep violet fruits (ripening to orange-red) in each roundish dense cluster, weighing 30 kg or more[ 320 ]. Yields of 5 tonnes of oil per hectare have been obtained from mature plants[ 297 ]. Spacing: 15-20 ft. (4.7-6 m) 20-30ft. (6-9m) .

## 10.2.12 Artocarpus heterophyllus

Jackfruit

10 tin 12 cyuc 5 kca3 3 tcan 2 dwat 15 m hkuc  
hmimhtut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikliwisslip hpa7tmwatli hjonli

drutta Artocarpus heterophyllus is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Insects, wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Flowers Fruit Leaves Seed ShootsEdible Uses: Gelatine GumEdible portion: Fruit, Seeds, Leaves, Flowers. Fruit - raw or cooked in a variety of ways[ 301 ]. The pulp of young fruit is rich in carbohydrates and is usually cooked as a vegetable[ K ]. The fruit becomes sweeter as it ripens, as some of the carbohydrates are converted into sugars. It is often eaten raw at this stage, but is also still cooked as a vegetable[ K ]. The rind of the fruit yields a fair jelly[ 301 ]. The fruit case is enormous, it can be 30 - 50cm long, weigh up to 20kg and contain up to 500 individual golden-coloured fruits[ 46 , 296 ]. They have rather a strong smell which some people do not like, though they can be dried when the smell is less[ 296 ]. Seed - cooked. Lovely when boiled or roasted, with a flavour and texture similar to chestnuts[ 63 , 296 , 301 ]. They can be ground into a powder and used in making biscuits[ 301 ]. The seeds have a high starch content and about 5% protein[ 63 ]. When boiling the seeds, the water is sometimes changed 2 or three times in order to remove an objectionable odour[ 63 ]. Very young fruits and leaf shoots - cooked in soups and stews[ 301 ]. Young male flowers are eaten mixed with chillies, sugar, salt etc[ 301 ]. There can be 100-500 seed in a fruit. Unlike breadfruit, there are no seedless Jackfruit. When ripe the unopened fruit has a strong smell.

tcanta Adhesive Dye Fodder Fuel Gum Houseplant Latex Resin Soil stabilization String Tannin Vernish Weaving WoodOther uses rating: Medium (3/5). Suitable for growing indoors. Agroforestry Uses: The tree has a wide-ranging root system and can be planted to control floods and soil erosion in farms[ 303 ]. It is suitable for use in reforestation projects[ 418 ]. The tree is often used in mixed plantings. It can be used as a shade tree for coffee, planted with coconut groves, has been used as an intercrop in durian orchards, and with mango and citrus[ 303 , 418 ]. Young jackfruit orchards may be intercropped with annual cash crops such as banana, sweet corn and groundnut[ 303 ]. Other Uses The inner part of the bark or bast is occasionally made into cordage or cloth[ 303 ]. The latex obtained from the trunk and branches yields 71.8% resin, consisting of 63.3% flavaniles (yellow) and 8.5% albanes (white). These resins may be valuable in varnishes[ 303 ]. The latex is commonly used as adhesive for mending broken chinaware or earthenware, caulking boats, mending holes of buckets and trapping birds. In India and Brazil, the

propta Seed - difficult to germinate in nursery conditions, though the plants self-sow successfully in the wild[401 ]. Cuttings.

nwatta Management: Coppice New Crop Wild Staple CropA tropical plant. It grows in rainforest from sea level to 1,200 m altitude. It suits humid locations. It does best with a rainfall of 3,000 mm per year. It needs shade. Plants do not grow well in full sun. A plant of humid, lowland tropical rainforests, being found at elevations from sea level to 1,200 metres[299]. It grows best in areas where the annual rainfall is around 3,000 mm[299]. Succeeds in dappled shade in the woodland. Plants growing in full sun produce thinner leaves which are not so well liked by consumers[299]. Cultivated plants need to be given some support, such as a tree, to grow into[299]. The plant forms two distinct types of stem. Growing up from the base, the stems produce only small, scale-like leaves, and they grow rapidly towards the light. Higher up, side shoots are formed with fully-developed leaves[299]. The plant continues to grow during the dry season and new shoots may develop where the stem has been cut or where side shoots have been removed[299]. New shoots are also formed from rhizomes that spread along the forest floor[299]. Current methods of harvest from wild stands are very destructive[299]. Controlled harvesting, in which only side shoots or parts of stems are collected, allows new shoots to develop where a stem has been cut or where side shoots have been removed[299]. Preliminary observations indicate that 3 - 4 harvests per year are possible, still allowing for substantial regrowth. More frequent harvesting will result in thin leaves that are considered inferior[299]. The first harvest may take place 6 - 9 months after planting. The total lifespan of the plant is estimated at over 10 years[299]. Preliminary observation indicates that in cultivation during the first harvest year the fresh leaf yield may reach 20 t/ha. This may double in subsequent years[299]. Under wild conditions, the plant grows and forms underground tubers or roots that store plant food reserves. These can remain alive for many years when the vegetation and the plant growth above ground are cleared and the soil surface is laid bare[401]. A dioecious species, both male and female forms need to be grown if fruit and seed are required.

## 10.2.103 Paullinia cupana

Guarana

10 tlin 12 cyuc 4 kcaak 0 tcan 2 dwat 10 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Paullinia cupana is an evergreen Climber growing to 10 m (32ft) by 1 m (3ft 3in) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista Parts of plant are poisonous if ingested
kcakta Edible Parts: SeedEdible Uses: Chocolate Coffee DrinkThe roasted and pounded seed is made into a paste which is then used to make a stimulating beverage that is rich in caffeine[301 ]. The sweetened paste, called Brazilian chocolate, is used in soft drinks, candy etc[301 ]. The seeds contain 2.7 - 7% caffeine as well as the stimulants theophylline and theobromine[254 , 303 ]. The seeds contain up to 7% of a caffeine-like compound known as guaranine, which is not addictive and takes longer to be metabolized, giving it a gentler, more sustained stimulating effect[238 ]. The seeds are also roasted, pounded, and used as a flavouring in bread[418 ].

dwatta Antidepressant Antidiarrhoeal Antipyretic Astringent Bitter Diuretic Febrifuge Stimulant TonicGuarana seed contains xanthine derivatives, including up to 7% caffeine plus theobromine and theophylline; tannins and saponins[254 ]. It is an astringent, bitter, diuretic herb with a strong, stimulant effect[238 , 254 ]. The seed is said to be antipyretic, antineuralgic and antidiarrhoeal, and is also reputed to be a powerful stimulant, an analgesic comparable to aspirin and an anti-influenza agent[303 ]. The Rainforest tribes have used guarana mainly as a stimulant, astringent and in treating chronic diarrhoea[303 ]. The powdered seed is taken internally to relieve fatigue, aid concen-

tration and lift the spirits[238 ]. One report says that overuse can cause sleeplessness, although less so than caffeine-based drinks[238 ], whilst others say that the stimulating effect is due to caffeine[254 , 303 ]. A useful short-term remedy for boosting energy levels, though it tends to inhibit the body's natural restorative processes if used in the longer term[254 ]. The seed is also taken internally in the treatment of chronic diarrhoea; headaches and migraine; and in the treatment of mild depression[254 ]

nrakta Northern and western S. America - Brazil. ksacta Tropical rainforest at elevations up to 800 metres[254 , 303 , 418 ].

propta Seed - must be sown as soon as it is ripe since it loses viability within 72 hours[303 ]. Germination can take more than 100 days[303 ].

nwatta Guarana is a plant of the humid lowland tropics, where it is found at elevations up to 800 metres. It grows best in areas where annual daytime temperatures are within the range 24 - 32°C, but can tolerate 18 - 38°C[418 ]. When dormant, the plant can survive temperatures down to about 10°c[418 ]. It prefers a mean annual rainfall in the range 2,000 - 2,500mm, but tolerates 1,100 - 3,000mm[418 ]. It does not like a dry season[303 ]. Prefers a position in full sun, also succeeding in light shade[303 , 418 ]. The plant requires a soil that is deep, medium or heavy in texture, well drained and with high organic matter content[303 ]. Traditionally, plants are grown on very acid soils of low fertility with high concentrations of aluminium[303 ]. It grows naturally on gley soils with a pH in the range 3.5 - 4.5[303 ]. Prefers a pH in the range 4 - 5.5, tolerating 3.5 - 6.5[418 ]. Bloom Color: White/Near White.

### 10.2.104 Lacunaria jenmanii

Moela de mutum

10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 10 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Lacunaria jenmanii is an evergreen Tree growing to 10 m (32ft) by 8 m (26ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw[625 ]. The thick-skinned fruit has a succulent, sweet pulp with a delicious flavour[625 ]. The subglobose fruit is about 7cm in diameter[625 ].

tcanta Fuel WoodOther Uses The wood is coarse-textured, irregular-grained, heavy, slightly susceptible to wood eating organisms, easy to cut. It is only used for small items such as tool handles[625 ]. The wood is used for fuel[625 ].

nrakta S. America - Brazil, Peru, Ecuador, Colombia, Venezuela, the Guyanas. ksacta Humid upland rainforests in primary and secondary formations[625 ].

propta Seed - it has a short viability and should be sown as fresh as possible in a partially shaded position in a nursery seedbed. Germination rates are generally low, with the seed sprouting in 40 - 60 days[625 ].

nwatta Succeeds in sunny positions and in shade[625 ]. A slow-growing tree[625 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required[625 ].

### 10.2.105 Myrciaria vexator

Blue Grape, False Jaboticaba

10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 10 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Myrciaria vexator is an evergreen Tree growing to 10 m (32ft) by 8 m (26ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

chocolate manufacture[63 , 301 , 332 ]. Freed from its slight odour it can also be regarded as suitable for margarine manufacture[332 ]. The yellow, fibrous fruit looks somewhat like a small mango and has a similar flavour[63 ]. The fruit pulp is palatable and can be used for a fruit drink and for jam production[303 ]. The fruit is variable, with special forms[332 ]. The pulp of some trees is edible with a turpentine flavour, and of others inedible, bitter and acrid[332 ]. The edible ones are a good source of vitamins[332 ]. The ellipsoidal to cylindrical fruit is 40 - 65mm long, 42 - 64mm wide, 34 - 60mm thick, smooth, green at maturity; mesocarp bright orange, soft and juicy with few weak fibres[405 ].

tcanta Dye Oil Paper Tannin Teeth Wax WoodAgroforestry Uses: The tree is commonly preserved on farms when woodland is cleared in order to provide shade for crops, especially cocoa and coffee[299 ]. Other Uses: A wax has been extracted from the plant which has been found useful as an adjunct in making medicinal tablets[332 ]. Both the bark and the roots contain tannins[303 ]. The fruit pulp is used to prepare a black dye for cloth[299 , 332 ] The fat extracted from the seed is suitable for soap-making and other industrial uses[332 ]. The sap-wood is light brown, the heartwood a slightly darker or greenish-brown[332 ]. The wood is tough, very heavy, very hard, durable, immune to termite attack but rather difficult to split[46 , 332 ]. It has a fine moderately close grain and a good polished finish can be achieved[332 ]. It is not easy to cut, which limits its usefulness for native people who often only have simple implements[332 ]. Its weight is said to preclude it from all but the most rugged construction-work, e.g., for railway-ties, house building, etc[332 ]. It is used for street paving[46 ]. Canoes can be made from the trunk, and pestles for yam-mortars[332 ]. Tests for paper manufacture have shown cellulose content 48 .8%, fibre length 1.5 mm, and the resultant dark brown paper to be inferior, rather weak and soft, and not bleachable[332 ].

dwatta Aphrodisiac Bitter Dysentery Mouthwash Poul-tice Purgative SkinThe bark has a bitter taste and has the usual usages of bitter barks in Africa[332 ]. It is used as a purgative for treating gastro-intestinal and liver conditions; sterility; hernias; and urethral discharge[332 ]. It is considered by some to be a powerful aphrodisiac and to be beneficial in cases of senility[332 ]. It is used in an enema, or added to a baked banana in order to relieve diarrhoea and dysentery[332 ]. Applied externally, it is ground up with water for rubbing on to the body for easing pains[332 ]. It is used in mouth-washes for relieving toothache, made into a poultice and applied to sores and wounds[332 ]. Tannin has been reported present in both the bark and the roots, also a strong presence of alkaloid in the bark, though none in the roots[332 ].

nrakta Tropical Africa - Nigeria to Central African Republic, south to Congo, DR Congo and Angola. ksacta Evergreen dense, moist, lowland rain-forest[303 , 332 ].

propta Seed - it has a short period of viability and so should be sown as soon as it is ripe. Germination takes more than 14 days and the seed should first be extracted from the fruit and then dried for at least 2 days prior to sowing. A germination rate of 80% can be reached in this way[299 ]. Can be grown from stem cuttings under mist. Plants can be budded.

nwatta Management: Standard Regional Crop Staple Crop: OilA plant of the moist to wet, lowland tropics, where it is found at elevations from 200 - 500 metres. It grows best in areas where annual daytime temperatures are within the range 25 - 32c, but can tolerate 20 - 38c[418 ]. It prefers a mean annual rainfall in the range 1,500 - 3,000mm, but tolerates 1,200 - 3,300mm[418 ]. Prefers a sunny position, tolerating light shade[418 ]. It does not have any particular soil preference, though it grows well in well-drained, acidic soils[303 ]. The plant is restricted in the wild to fairly wet, well-drained loamy to clayey soils[338 ]. Prefers a pH in the range 5 - 7, tolerating 4.5 - 7.5[418 ]. Growth in young plants is very slow; later it becomes moderately fast[299 ]. The fruits are mostly gathered from the ground around each tree, or are harvested by climbing when the tree is not too tall. The next step consists of extracting kernels from seed, which is split in halves with a cutlass, and the kernel is removed with the help of a knife. The kernels are then dried in the sun or on bamboo drying racks over the fireplace in the kitchen[299 ]. Twelve year-old trees in Nigeria have yielded 1060 fruits (180 kilos) per tree, but in drier areas yields are

much lower. Good kernel yields are about 100 kilos per tree per year[299 ]. Trees are not resistant to fire[299 ]. A number of different forms are recognised in Africa. These differences are not always recognized by botanists:- In Liberia there are two: one is small-leaved with inedible seeds, and the other larger-leaved with edible seeds[332 ]. In Nigeria: var. Gabonensis has sweet edible fruit-pulp, whilst var. excelsa has bitter inedible pulp but is slimy and is added to soup for this quality[332 ]. Modern treatments distinguish these two forms as distinct species, var excelsa being separated as Irvingia excelsa Mildbr.[K ]. In Lower Dahomey a variety with a thick edible pulp is cultivated[332 ]. In Ivory Coast large-leaved and small-leaved forms are given separate vernacular names, the former being considered inedible[332 ].

### 10.2.39 Mangifera kemanga

Kemang

10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 30 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta Mangifera kemanga is a deciduous Tree growing to 30 m (98ft) by 30 m (98ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid and neutral soils. It cannot grow in the shade. It prefers moist soil.

pcista Unlike the related Mangifera caesia, the sap of this species does not cause skin irritations or blisters[894 ].

kcakta Edible Parts: Fruit Leaves SeedEdible Uses: Fruit. The very juicy, very fibrous, copious white pulp has a strong flavour that some find agreeable and others offensive[894 ]. Kemang fruit is eaten fresh when ripe, or used for home-made juice. It is used unripe to make 'rujak', a dish of sliced green fruit covered with a spicy sauce. A drink made from the juice with sugar, ice and a pinch of coffee powder is highly esteemed[894 ]. The yellowish-brown fruit is pear-shaped, containing a single, large seed[894 ]. Young leaves - raw or cooked. They are commonly eaten in 'lalab', a dish of fresh leafy vegetables to accompany rice[303 , 894 ]. Occasionally a dish is made from fresh, graded seeds, with fermented soya beans and spices[303 ]. The grated seed has been used to prepare the sambal kemang, with the addition of chili and salt[894 ].

nrakta Southeast Asia - Indonesia. ksacta Rather rare in forests, being found more frequently in periodically inundated areas and marshes[303 ].

propta Seed - It is propagated from seed, an indication that the agronomy of the crops has received little attention. Presumably grafting on seedling stock would be possible, in particular through inarching potted, decapitated rootstocks into twigs of mother trees. Grafting on Mangifera indica L. has been attempted without success, probably because this species is not closely related[303 ].

nwatta A plant of the wet, tropical lowlands, where it is usually found at elevations below 400 metres, but rarely up to 800 metres[303 ]. It requires a rainfall which is evenly distributed through the year[303 ]. The plant stands inundation well and is commonly cultivated on periodically inundated riverbanks in East Kalimantan[303 ]. Mature trees require much space, 12 - 16 metres each way being typical[303 ]. Natural hybrids between Mangifera kemanga and Mangifera caesia, showing intermediate characteristics, are found in orchards in East Kalimantan[303 ].

### 10.2.40 Attalea speciosa

Babassu, American Oil Palm, Motacu, Motacuchi

10 tlin 12 cyuc 4 kcaak 5 tcan 2 dwat 30 m hkuc htut cyutli hgattcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Attalea speciosa is an evergreen Tree growing to 30 m (98ft) by 20 m (65ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is not frost tender. The flowers are pollinated by Bees, insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought.

pista The fine silicate crystals falling off the fruit can cause serious eye damage to the collectors[ 324 ].

kcakta Edible Parts: Fruit Oil Sap SeedEdible Uses: Drink Milk Oil SaltEdible portion: Oil, Fruit, Nuts, Palm heart, Cabbage, Sap. A good quality cooking oil is extracted from the seeds[ 301 , 419 ]. It can be used to make a butter[ 419 ]. Seeds - raw or cooked. They can be eaten as a snack or made into a nut milk[ 301 ]. The ellipsoid seeds are up to 6cm long by 1 - 2cm wide, there are usually 3 - 6 seeds in each fruit[ 324 ]. The nuts are extremely hard and difficult to crack[ 324 ]. The watery endosperm from immature seeds is consumed as a drink[ 301 , 419 ]. Very nourishing[ 419 ]. A sap obtained from the stem is fermented to make palm wine[ 301 ]. The apical bud is used as a food[ 301 , 324 ]. Harvesting this bud will effectively lead to the death of the trunk because it is unable to make side branches[ 301 ]. Ashes from the burnt stem are used as a salt substitute[ 301 ]. Babassu flour, mixed with milk and sugar, makes a chocolate-like drink[ 301 ].

tcanta Basketry Charcoal Fuel Insecticide Lighting Mulch Oil Pioneer Plaster Soap making Thatching WoodOther uses rating: Very High (5/5). Agroforestry Uses: Although somewhat slow growing, the plant can regenerate very vigorously in open areas, to the extent that it is considered to be a weed of pastures. This makes it an excellent species for restoring native woodland and, with its wide range of uses, it is also a very good species to use when establishing a woodland garden[ 303 , 419 , K ]. Other Uses The leaves are commonly used for thatch and basketry[ 324 , 454 ]. Young plants produce very large leaves before the stem is formed, and it is in this state that they are generally used for thatching. The unopened leaves from the centre are preferred since, though they require some preparation, they produce a more uniform thatch. The leaf is shaken until it falls partially open, and then each leaflet is torn at the base so as to remain hanging by its midrib only, which is, however, quite sufficient to secure it firmly. They thus hang all at right angles to the midrib of the leaf, which allows them to be laid in a very regular manner on the rafters[ 454 ]. The leaf petioles are used for laths for windows and adobe walls[ 324 ]. Decayed stems and leaves are used for mulch[ 324 ]. The oil from the seed is excellent for soap production because of its high (45%) lauric acid content[ 324 ]. It is also used for making candles[ 419 ]. The epicarp (ca. 15% of the fruit) is a primary fuel source[ 324 ]. The mesocarp (ca. 20% of the fruit) is a potential source of industrial starch, glucose or alcohol[ 324 ]. The endocarp (ca. 59% of the fruit) is an important source of high grade charcoal for the steel industry as well as source of distillation by-products such as tar, acetic acid, methane, etc[ 324 ]. It also has a potential use as a substrate for hydroponics[ 324 ]. Nut waste is also used locally as a fuel for cooking and to repel insects[ 324 ]. The wood is moderately heavy, soft and of low durability if exposed to the elements[ 419 ]. It is used for construction purposes in rustic buildings[ 324 , 419 ].

dwatta Antirheumatic Febrifuge PlasterThe leaves and liquid endosperm are used in local medicine[ 324 ]. The seed kernel is used in liniments as a treatment for rheumatism[ 739 ]. Ground into a powder and combined with sugar and water, it makes a refreshing and febrifuge emulsion[ 739 ].

nrakta Northern and western S. America - Brazil, Bolivia, Guyana, Surinam. ksacta Primary rainforest, usually becoming the dominant species[ 419 ]. Lowland areas, sometimes forming thickets of thousands of plants in warm and damp areas[ 314 ]. The plant also regenerates vigorously in open areas[ 419 ].

propta Seed - when stored in the shell, the seed can have a long viability of several years[ 324 ]. Fire or heat may be necessary to break dormancy[ 324 ]. Separate kernels may germinate within a few months[ 324 ]. Early growth is slow, concentrating initially on an extensive root system and consequently requiring large bags if grown in a nursery[ 324 ].

nwatta Industrial Crop: Oil Management: Standard Regional Crop Staple Crop: OilA plant of the lowland humid tropics, where it is found at elevations up to 500 metres[ 200 ], though it also succeeds in the subtropics and has some resistance to frost[ 314 ]. It grows in areas where the annual rainfall is 1,200 - 2,500 mm with a 4 - 6 months dry season[ 324 ]. Requires a sunny position[ 324 ]. Soils range from well-drained upland soils to gallery forest, although in severely flooded areas it occurs in elevated, non-flooded areas[ 324 ]. Prefers a deep well drained fertile soil[ 303 ].

Plants can tolerate some drought[ 419 ]. In a primary forest, seedlings require up to seven years to produce the first compound leaf and up to 42 years for other leaves. When cultivated without shade and in more favorable conditions, the plants can take just 10 years to mature[ 303 ]. The plant can regenerate very vigorously in open areas, so much so that it is considered to be an invasive weed in land that has been cleared for pasture[ 419 ]. The palms begin to bear when 8 - 12 years old[ 324 ]. The plant produces bunches of fruit that can be up to 1 metre long, weighing 14 - 90 kg[ 324 ]. Each bunch contains from 100 - 600 fruits, with 200 fruits being the average[ 324 ]. Wild groves can yield 1.5 - 2.5 tonnes per ha but, where the groves are thinned, yields range from 7 - 30 tonnes per ha with an average of 16 tonnes[ 324 ]. Individual trees with 7 bunches, each bunch of 600 nuts and weighing up to 90 kg are known[ 324 ].

## 10.2.41 Artocarpus mariannensis

Seeded breadfruit, Marianas bread

10 tin 12 cyuc 4 kcaak 4 tcan 3 dwat m hukc hmimhtut cyutli hgattcup hwicli hyhsrasjut hpa7tli prikl-wissliphsom hpa7tmwatli dyat hjonli

drutta Artocarpus mariannensis is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. The plant is not self-fertile. Suitable for: light (sandy) and medium (loamy) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: Fruit Seed ShootsEdible Uses: GumEdible portion: Fruit, Seeds, Sprouts. Fruit - raw or cooked. The deep yellow pulp has a sweet aroma and taste[ 303 ]. The very ripe fruits can be eaten raw, but they, and the immature fruits, are more commonly roasted or baked[ 303 ]. Very nutritious[ 303 ]. The fruit is a small fleshy syncarp, cylindrical, kidney shaped or asymmetrical, about 15cm long and weighing about 500g[ 303 ]. Seed - cooked[ 354 ]. The roasted seed has a flavour much like a chestnut[ 354 ]. Cooked sprouted seeds are a delicacy on some atolls[ 303 ]. The seeds are high in protein, carbohydrates, low in fat, and a good source of minerals and vitamins, especially vitamin A[ 303 ]. The large, dark brown, shiny seeds are about 15mm long, with little or no endosperm. There are up to 15 seeds per fruit[ 303 ]. The latex obtained from the shoots and trunk can be used to make a chewing gum[ 303 ].

tcanta Adhesive Containers Fibre Fuel Gum Insecticide Mulch Plant support Soil stabilization String Waterproofing WoodOther uses rating: High (4/5). Agroforestry Uses: The plant naturally occurs on steep ridges, cliffs, and shallow calcareous soils where it acts as a soil stabilizer[ 303 ]. It can be inter-planted with a wide range of fruit and vegetable crops such as yam, banana, coconut, taro, papaya, sugarcane, arrowroot, beach hibiscus, Indian mulberry, citrus, soursop, medicinal plants, aroids, ginger and noni, amongst others[ 303 ]. The leaves provide abundant mulch for the tree and other plants growing beneath the canopy[ 303 ]. It is an ideal tree for home gardens on atolls because of its adaptability to calcareous soils and saline conditions and especially for the beneficial shade it produces. The tree can also be used as a trellis for yam[ 303 ]. Other Uses A sticky white latex is present in all parts of the tree[ 303 ]. It is used as a chewing gum, an adhesive, and to caulk canoes[ 303 ]. A fibre is obtained from the inner bark. It is used to make strong cordage used for fishing[ 303 ]. The inner bark was formerly used to make bark cloth (tapa). Sections of the bark were hammered flat with a wooden mallet onto a wooden surface. The more the bark was beaten, the finer the cloth that was made[ K ]. Dried male flowers can be burned to repel mosquitoes and other flying insects[ 303 ]. The flexible leaves are used to wrap foods for cooking in earth ovens, and as plates[ 303 ]. The wood is light in weight, flexible, easy to work[ 303 ]. It is used to make small canoes, carve into statues, bowls, fishing floats, and other objects, although the wood needs to be protected from direct sunlight[ 303 ]. Trunks of larger trees are used to make dug-out canoes[ 354 ]. The wood is fast

looked after, they can produce fruit in a year or two from seed[658 ]. The tree can flower and produce seeds all year round[658 ]. Several different races or types of pao nut have been selected by villagers and these trees seem to produce fruit that is similar to the seed that was planted[658 ]. Trees grown from cuttings have shorter trunks and form branches closer to the ground[658 ].

## 10.2.100 Gigantochloa hasskarliana

AwI Tela

10 tin 12 cyuc 4 kcaak 3 tcan 0 dwat 10 m hukc hmimhtut cyutli tcup hwicli hrasjutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Gigantochloa hasskarliana is an evergreen Bamboo growing to 10 m (32ft) by 5 m (16ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Shoots StemEdible Uses: Young stem - cooked[301 ]. Eaten as a side dish with rice, or cooked in soups and stews[301 ].Highly esteemed in Indonesia for their sweet flavourful qualities[301 ].

tcanta Basketry Biomass Hedge Soil stabilization WoodAgroforestry Uses: Planted extensively to prevent soil erosion on steep hills[303 , 310 ]. Often planted as a hedge[303 , 310 ]. Other Uses: The canes are used to make basketry[303 , 310 ]. The canes are 5 - 6 metres long, 30 - 50 mm in diameter at the base, with a thin wall. Very dense with large leaves and slightly weeping culms. Good two-story screener. Its lush foliage gives an excellent tropical feel to even the smallest of gardens.

nrakta E. Asia - Malaysia. ksacta A plant of the lowland tropics. In Java it grows in the lower mountain forests. It is usually in slightly shady places.

propta Seed - Division. Culm cuttings. This method is mostly used for establishing hedges and for erosion control measures[303].

nwatta Industrial Crop: Biomass Management: Managed Multistem Regional CropA plant of the lowland tropics, though it can be found at elevations up to 1,500 metres[303 ]. It prefers humid conditions[303 ]. Upright, slightly weeping, tight clumping. Bamboos have an interesting method of growth. Each plant produces a number of new stems annually - these stems grow to their maximum height in their first year of growth, subsequent growth in the stem being limited to the production of new side branches and leaves. In the case of some mature tropical species the new stem could be as much as 30 metres tall, with daily increases in height of 30cm or more during their peak growth time. This makes them some of the fastest-growing species in the world[K ]. Bamboos in general are usually monocarpic, living for many years before flowering, then flowering and seeding profusely for a period of 1 - 3 years before usually dying. Prefers tropical or subtropical climates. Full sun to part shade.

## 10.2.101 Diospyros konzattii

Zapote negro mont's, zapotillo.

10 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 10 m hukc htut cyutli kyuctcup hwicli hrasjutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Diospyros konzattii is a deciduous Tree growing to 10 m (32ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw[ 553 ]. An exquisite flavour[ 46 , 553 ]. The fruit is about 4cm wide and 2cm long, containing 5 - 10 fairly large seeds[ 553 ].

tcanta Other Uses: The wood is valuable[ 554 ]. Economic Importance: wood

nrakta Central America - southern Mexico. ksacta Dry tropical forest on coastal slopes. Also found at elevations be-

tween 220 - 2,200 metres altitude on slopes with pine-oak woodland; alder-oak forests and deciduous forests[ 554 ].

propta Seed - it has a very short viability and so should be sown as soon as possible[ 325 ]. The flesh should be removed since this contains germination inhibitors[ 325 ]. Sow the seed in a shady position in a nursery seedbed. The sowing media for ebony uses soil and fine sand at the ratio 3:1. The seed is planted horizontally or vertically with the radicle end down, with a sowing depth of 1 - 1.5x the thickness of seed. Distance between the seeds is 3 - 5cm. Seeds are very sensitive to desiccation during germination and early growth, so must be regularly watered at this time[ 325 ]. Normally the seed will germinate after one week. In one trial, fresh seed, sown one day after collection, showed 85% germination rate within 17 - 65 days[ 325 ]. As a rule fresh seeds have a high percentage of fertility. The seedlings develop long taproots at an early stage, often before any appreciable elongation of the shoot takes place. The growth of the seedling is decidedly slow[ 652 ].

nwatta It is a tropical plant. We have seen no individual confirmation for this species, but in general Diospyros species are dioecious and require both male and female forms to be grown if fruit and seed are required[ 899 ].

## 10.2.102 Gnetum buchholzianum

Jointfir

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 10 m hukc pcmhmmimhtut cyutli tcup hwicli hrasjutnyik hpa7tli flat-priklwis hpa7tmwatli dyat hjonli

drutta Gnetum buchholzianum is an evergreen Climber growing to 10 m (32ft) by 0.4 m (1ft 4in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Fruit Leaves Root Sap SeedEdible Uses: CondimentLeaves - raw or cooked[332 ]. Wherever it occurs in Africa, the leaf is valued as a tasty vegetable, usually eaten finely shredded for addition to soup or made up into condiments, or even taken raw[332 ]. To soften this rather tough vegetable, people often mix it with waterleaf (Talinum triangulare)[299 ]. Shredded leaves can be dried and preserved for later use[299 ]. The leaves have a very high nutritional value and constitute an important source of protein, essential amino acids and mineral elements[401 ]. Leafy stems remain fresh for at least a week after harvesting[299 ]. The dry matter content of the fresh leaves is much higher than for other dark or medium green leaf vegetables. This gives a feeling of firmness during preparation, hence certain consumers consider the leaves as a substitute for meat[299 ]. The leaves of this species are somewhat thicker and darker green than those of the related Gnetum africanum[299 ]. Fruit pulp[332 ]. Seed[332 ]. The mature seed is 15 - 15mm long, enclosed in a somewhat drupaceous orange-tinted envelope. The tubers are sometimes eaten - especially at times of scarcity[401 ]. Climbing members of this genus growing in Asia yield a potable sap[332 ]. This species should also be looked at in this respect[332 ].

tcanta Fibre StringOther Uses: The stem is supple and strong. It is used as a rope[299 ], made into traps and nooses for catching game, and into straps for portage[ 332 ].

dwatta Antibilious Antidematotic Antidote Antihemorrhoidal Cathartic HypotensiveThe leaf is used in the treatment of enlarged spleen, sore throat, piles, high blood pressure and as a cathartic[299 , 332 ]. It is eaten as a treatment against nausea and is considered antidotal against arrowpoison based on Parquetina nigrescens[299 , 332 ]. The leaves are chewed to mitigate the effects of drunkenness and they are taken as an enema against constipation[299 ]. Applied externally, the chopped-up leaf serves as a dressing on warts and boils to hasten maturation[332 , 401 ]. The stem is cut up into small pieces and infused to produce a tisane that is taken to ease childbirth and reduce the pain[332 ].

nrakta Western tropical Africa - Nigeria to the Central African Republic, south to the Congo. ksacta The understorey layer of humid tropical rainforests[332 ]. Thrives in a wide range of habitats, including farm fallows or abandoned farmland, secondary forests, and closed forest[401 ].

above for USDA hardiness. It is hardy to UK zone 10. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

**ksakta Edible Parts:** Fruit**Edible Uses:** Drink SweetenerFruit - eaten raw or used in ice creams, fruit salads, pies, jellies, to make drinks etc[301 ]. The yellow, oblong, aromatic fruits are highly prized for their juice[301 ]. The fruit is about 100 - 140mm long and 35 - 45mm wide[968 ]. The fruits of this species are a deep yellow to orange colour, the pulp is less aromatic and tart than the flesh of the pale yellow fruits of *Passiflora tripartita mollissima*, but is also somewhat inferior in flavour[968 ]

**nrakta S. America - Colombia.** **ksakta** Not known in a truly wild location, the plant probably arose in cultivation.

**propta Seed** - best sown as soon as it is ripe along with the pulp which will help break down the seed coat and speed up germination[262 ]. Stored seed should be soaked for 24 hours in warm water and germination time can be reduced if the seed is then mixed with the juice of a fresh passion fruit (of any species)[262 ]. Even so, it can take 12 months for stored seed to germinate[262 ]. Place the seed tray in a shady position, maintaining a temperature around 19 - 24c[262 ]. Prick the seedlings out into individual containers as soon as they are large enough to handle and plant out when large enough[262 ]. Cuttings of young shoots, taken at the nodes. Layering. Very easy[262 ]. Air layering.

**nwatta** The plant grows well at elevations between 2,000 - 3,000 metres or even more in the tropics, succeeding at lower elevations as it moves away from the Equator[968 ]. Requires a humus-rich, moist but well-drained soil and a position in dappled shade where it can grow up towards the sun[262 ]. *Passiflora* species tend to flower and fruit more freely when grown in soils of only moderate fertility[200 ]. Prefers a circumneutral soil, disliking very acid or very alkaline conditions[262 ]. Prefers a pH in the range 6 - 7, tolerating 4.3 - 8[418 ]. A vigorous and disease-resistant species, it has escaped from cultivation in some areas, particularly New Zealand and Hawaii. It can invade native habitats, especially woodlands, and has been declared a noxious weed in both Hawaii and new Zealand[968 ]. The plant shows more resistance to pests and diseases than the related *Passiflora tripartita mollissima*[968 ]. This species hybridizes easily with other species in the subgenus *Tacsonia*[968 ]. Hybrids with *Passiflora mixta* and *Passiflora tripartita* are fertile and show intermediate phenotypes[968 ]. Hybrids with *Passiflora cubensis* can also produce fertile seed[968 ].

## 10.2.98 Dioscorea cayennensis

Yellow Yam, Yellow Guinea yam

10 tin 12 cyuc 4 kcaak 0 tcan 0 dwat 10 m hkuc htut cyutli tcup hwicli hrsajlutnyk hpa7tli frusflatprikli-wisslip hpa7tmwatli dyat hjonli

**drutta** *Dioscorea cayennensis* is an evergreen Perennial Climber growing to 10 m (32ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Wind, Insects. The plant is not self-fertile. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

**pcista** Freshly cut tubers can cause skin irritation due to the presence of raphides, which are destroyed when the tubers are cooked[ 299 ].

**ksakta Edible Parts:** Leaves **RootEdible Uses:** Tea**Root** - cooked in various ways and eaten as a vegetable[ 300 , 301 ]. A palatable flavour with a dry, mealy flesh[ 301 ]. The roots are sometimes dried and milled to produce a flour for storing - this flour is then stirred into boiling water and kneaded to form a paste[ 299 ]. The roots have a rough outer skin and a pale yellow flesh[ 301 ].The roots are up to 3kg in weight[ 300 ]. The roots can contain up to 91% carbohydrate, the highest for any yam[ 332 ]. Protein content is low, about 2.5%[ 332 ]. A tea is made from the leaves[ 301 ].

**nrakta** Western Africa - possibly Dahomey. **ksakta** Not known in a truly wild situation, having arisen in cultivation.

**propta Seed** - rarely produced, they are not normally used to propagate this species. Cuttings of tubers. Small tubers can be cut into 2 - 4 sections, larger ones into 6 - 8 sections. Each section should have 2 - 3 dormant buds. The cut tuber is often left in the sun for several hours to promote wound healing and reduce the risk of fungal infection[ 300 ].

**nwatta** A plant of the moist, lowland tropics. It grows best in areas where annual daytime temperatures are within the range 20 - 32c, but can tolerate 12 - 40c[ 418 ]. Plants can be killed at temperatures of 9c[ 418 ]. It prefers a mean annual rainfall in the range 1,200 - 1,900mm, but tolerates 900 - 3,000mm[ 418 ]. It prefers a dry season of 2 months or less[ 300 ]. Succeeds in full sun and in moderate shade[ 418 ]. For best yields, this species requires a deep, well-drained, sandy loam that is not liable to water-logging[ 300 ]. Succeeds in relatively light sandy soils[ 300 ], though the soil needs to be very fertile otherwise yields can be low[ 299 ]. Prefers a pH in the range 6 - 6.7, tolerating 5.3 - 8[ 418 ]. Daylengths of more than 12 hours are preferred during the early growing season since this encourages vegetative growth; daylengths of less than 12 hours towards the end of the growing season will encourage tuber formation and development[ 300 ]. Requiring a longer growing season than other yams, mature roots are formed in 9 - 12 months from planting[ 300 ]. The tuber has a very brief resting period and does not store well[ 332 ]. It is in fact best stored, if necessary, in the earth[ 332 ]. The tubers are formed near the surface of the soil[ 332 ] and can be carefully removed from the growing plant without disturbing it, allowing the plant to continue cropping for up to three years[ 300 ]. The tubers can be dug up as required and a common practice is to expose one side of the tuber and to cut away the distal part for consumption leaving the upper part to regenerate; hence the name 'cut-and-come-again'[ 332 ]. This practice may be repeated for upward of three years[ 332 ]. Yield of 30 tonnes per hectare have been obtained in the Caribbean[ 300 ]. There are some named varieties[ 300 ]. Although occasionally monoecious, the plant is usually dioecious, therefore both male and female forms need to be grown if seed is required[ 299 ].

## 10.2.99 Barringtonia novae hiberniae

Pao Nut

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 10 m hkuc htut cyutli tcup hwicli hrsajlutnyk hpa7tli flatprikliwisslip-hsom hpa7tmwatli hjonli

**drutta** *Barringtonia novae hiberniae* is an evergreen Tree growing to 10 m (32ft) by 7 m (23ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Moths, Bats. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerate maritime exposure.

**ksakta Edible Parts:** Seed**Edible Uses:** Seed - raw or roasted[658 ]. A flavour like raw peanuts[324 ]. It has a fairly hard texture[658 ]. The seed is about 3cm long and 1 - 2cm wide[658 ].

**tcanta** Fuel WoodThe wood is light in weight. It is used for canoe paddles, casing, light construction[339 ]. The wood is used as a quick-burning firewood[339 ]. Commonly planted as ornamental and shade tree and for the fruit, seeds edible.

**dwatta** Abortifacient **Stomachic**The bark is used in the treatment of stomach ailments and gonorrhoea[339 ]. A strong tea made from the bark is claimed to induce abortion and definitive sterility[389 ].

**nrakta** Australasia - New Guinea to the Bismarck Islands, Solomon Islands and Vanuatu. **ksakta** Dense primary forest on rich alluvial soils; often near the coast but also inland to elevations of 600 metres[658 ].

**propta** Seed - best sown as soon as it is ripe. Stem cuttings[658 ].

**nwatta** Management: Standard Regional Crop **Staple Crop:** Balanced carbAs pao nuts often do well and are most common on low off shore islands and coral waterfron vil-lages, they may be particularly suited to coral and alkaline soils[658 ]. If trees are planted in suitable sites and well

burning, but generally older, less productive trees are used for fuel[ 303 ].

**dwatta** Antidiarrhoeal Antifungal Astringent Dysentery Purgative Skin StomachicAll parts of the plant are used medicinally, especially the latex, leaf tips, and inner bark[ 303 ]. The diluted latex is taken internally to treat diarrhoea, stomach-aches, and dysentery[ 303 ]. Applied externally, the latex is commonly used to treat skin ailments and fungus diseases such as thrush[ 303 ]. It is massaged into the skin to treat broken bones and sprains and is plastered on the spine to relieve sciatica[ 303 ]. The crushed leaves are commonly used as a poultice to treat skin ailments and fungus diseases such as thrush[ 303 ]. The sap from the crushed petioles (leaf stalks) is used to treat ear infections or sore eyes[ 303 ]. The root is astringent and used as a purgative[ 303 ]. When macerated, it is used as a poultice for skin ailments[ 303 ]. The bark is used to treat headaches[ 303 ].

**nrakta** Pacific - Palau. **ksakta** Found in tall native-canopy forest and secondary forest, in coral limestone and volcanic islands with steep slopes and ridges and ravine forests from coastal to lower mountain slopes[ 303 ].

**propta** Seed - it has a very short viability and should be sown as soon as it is ripe[ 303 ]. Plant out the seedlings when 125cm tall[ 303 ].

**nwatta** Management: Standard Regional Crop **Staple Crop:** Balanced carb **Staple Crop:** Basic StarchA plant of lowland tropical areas, usually found at elevations below 150 metres[ 303 ]. It grows best in areas where the mean maximum temperature of hottest month is 29 - 31c and of the coolest month 16 - 18c. It prefers a mean annual rainfall in the range 1,300 - 3,800mm[ 303 ]. Older plants grow well in a sunny position, but young plants require some shade, with seedlings requiring 20 - 50% shade[ 303 ]. Prefers a light, well drained, and volcanic and shallow calcareous soil, either sandy, sandy loams or loams, with a pH in the range 6.1 - 7.4[ 303 ]. The plant tolerates saline and coralline soils and atolls[ 303 ]. Established plants can tolerate drought for a few months[ 303 ]. Trees can begin fruiting when about 5 years old[ 303 ]. It can yield 50kg of fruit per tree per year. A fruit can weigh about 500g. The flowers require cross-pollination for seeds to be produced, but unpollinated flowers will still produce a fruit[ 303 ]. The tree is shallow-rooted[ 303 ].

## 10.2.42 Lecythis minor

Coco de mono

10 tin 12 cyuc 4 kcaak 0 tcan 0 dwat m hkuc htut cyutli tcup hwicli hrsajlutnyk hpa7tli flatprikliwisslip hpa7tmwatli hjonli

**drutta** *Lecythis minor* is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

**pcista** In some areas the seeds are reported to be somewhat toxic. The toxicity may depend on selenium concentration in the soil[317 ]. Selenium poisoning can cause temporary loss of hair and nails and nausea.

**ksakta Edible Parts:** Oil **SeedEdible Uses:** Oil**Seed** - raw or roasted[335 ]. An excellent flavour[335 ]. The seed is rich in oil, protein and B vitamins[335 ].

**tcanta** Oil**Other Uses** We have no specific information on the wood of this species. A general description of the wood from this genus is as follows:- The heartwood is light to dark salmon; the sapwood is creamy-yellow. The texture is medium fine and uniform; the grain fairly straight or slightly interlocked; lustre is mostly low but high in some species; there is no distinctive odour or taste. The wood is reported to be very durable upon exposure to both a white-rot and a brown-rot fungus confirming its reputation for high resistance to decay; it is also highly resistant to dry-wood termites and is reported to be moderately resistant to marine borer attack. It is rated as easy to moderately difficult to air season, depending on species; a slow to rapid drying rate is reported; warp and checking ranged from slight to moderate. The wood is moderately difficult to work because of its high density; however, surfaces obtained in planing, boring,

sawing, and shaping were smooth and rated as good to excellent. Silica content varies with species and dulling of cutters is also variable. The wood is used for purposes such as heavy construction, ship keels and beams, railroad cross-ties, industrial flooring and other uses requiring high impact resistance (wagon wheels, tool handles, turnery)[316 ].

**nrakta** Northwestern S. America - Colombia, Venezuela. **ksakta** Not known

**propta** Seed -  
**nwatta** Management: Standard Regional Crop **Staple Crop:** Protein-oilA plant of the hot, humid, tropical lowlands[335 ]. Prefers a deep, fertile soil[335 ].

## 10.2.43 Pouteria sapota

Sapote, Mamey Sapote

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 25 m hkuc htut cyutli tcup hwicli jlutnykfrip hpa7tli frusflatprikliwissom hpa7tmwatli hjonli

**drutta** *Pouteria sapota* is an evergreen Tree growing to 25 m (82ft) by 25 m (82ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. It is noted for attracting wildlife. Suitable for: medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and saline soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerate maritime exposure.

**pcista** The seed has stupefying properties, and this may be due to its HCN content[303 ]. One is cautioned not to rub the eyes after handling the green fruit because of the sap exuding from the cut or broken stalk[303 ]. The milky sap of the tree is highly irritant to the eyes and caustic and vesicant on the skin[303 ]. The leaves are reportedly poisonous[303 ].(Seed is poisonous if ingested Parts of plant are poisonous if ingested Handling plant may cause skin irritation or allergic reaction )

**ksakta** Edible Parts: Fruit Oil **SeedEdible Uses:** Chocolate Drink Oil TeaThe ripe fruit is eaten raw, made into sherbets, ice cream, drinks etc and can also be dried[301 ]. Unripe fruits are cooked as a vegetable[301 ]. The pulp of the ripe fruit is salmon-red to reddish-brown in colour, it has a firm, finely granular texture and a rich, sweet almond-like flavour[301 , 303 ]. The ovoid fruit varies in size from 8 - 20cm long[303 ]. The fruit of most cultivars tends to weigh within the range of 500 - 1,000g[200 ], though they can weigh up to 2.7 kilos[303 ]. Seeds[331 ]. They have a flavour similar to bitter almonds[331 ]. The ground up seeds are added to texate, made into a confection or mixed with cornmeal, sugar and cinnamon to make a nutritious beverage called pozol[301 ]. The seed can be milled to prepare a bitter chocolate[303 ]. The seed kernel yields 45 to 60% of a white, semi-solid, vaseline-like oil which is edible when freshly extracted and refined[303 ].

**tcanta** Cosmetic Furniture Hair Oil Soap making Wood-Large shade tree. Public open space. Specimen. Backyard tree. **Other Uses:** It has been used to fix the colours on painted gourds and other articles of handicraft[303 ]. (The part used is not specified[K ].) The seed kernel yields 45 to 60% of a white, semi-solid, vaseline-like oil which is edible when freshly extracted and refined. It is sometimes used in soap and considered to have a greater potential in the soap industry, in cosmetics and pharmaceutical products[303 ]. It is also used as a hair dressing, and is said to promote the growth of the hair and prevent it falling out[331 ]. The very smooth seeds were formerly much used in Central America for smoothing starched linen, like an iron, and it is stated that they are still used for this purpose in Guatemala[331 ]. The trees are seldom cut for timber, unless they bear poor quality fruit[303 ]. There is very little sapwood. The heartwood is buff or brown when fresh, becoming reddish with age; sometimes resembles mahogany but is redder and more or less mottled with darker tones. It is fine-grained, compact, generally hard and fairly heavy, strong, easy to work and fairly durable. It is rated as suitable for cabinetwork and is made into furniture, but mostly serves for building carts, and for shelving and house frames[303 ].

**dwatta** Anthelmintic Antirheumatic Astringent Bitter Digestive Diuretic Emetic Epilepsy Hypotensive Kidney Ophthalmic Pectoral Poultice SkinThe seed kernel oil is used as a skin ointment and as a hair dressing that is believed to stop



falling hair[303 ]. In 1970, clinical tests at the University of California at Los Angeles failed to reveal any hair-growth promoting activity but confirmed that the oil of sapote seed is effective in stopping hair-fall caused by seborrhoeic dermatitis[303 ]. The oil is said to be diuretic and is also employed as a sedative in eye and ear ailments[303 ]. The seed residue, after oil extraction, is applied as a poultice on painful skin afflictions[303 ]. The seed kernel is regarded as a digestive[303 ]. A seed infusion is used as an eyewash[303 ]. The pulverized seed coat is reported to be a remedy for coronary trouble and, taken with wine, is said to be helpful against kidney stones and rheumatism[303 ]. The Aztecs employed it against epilepsy[303 ]. The bark is bitter and astringent and contains lucumin, a cyanogenic glycoside[303 ]. A decoction of the bark is taken as a pectoral. A tea of the bark and leaves is administered in arteriosclerosis and hypertension[303 ]. The milky sap is emetic and anthelmintic and has been used to remove warts and fungal growths on the skin[303 ]

nrakta C. America - Panama to Mexico. ksacta Humid lowland woodland[307 ].

propta Seed - remove it from its husk before sowing[200 ]. The seed has a short viability of only 7 - 14 days[303 ]. Seeds should be collected from mature fruit and planted immediately in well-drained media[303 ]. Seeds which have a hairline crack in the seed coat appear to germinate more quickly[303 ]. Side-grafting. Air-layering may be possible[200 ].

nwatta It can succeed in the lowland moist tropics or subtropics up to elevations of 1,400 metres[303 ]. In its native range, the average temperature ranges between 25 and 28°C, though good yields and fruit quality can be obtained at temperatures between 30 and 33°C[303 ]. It is very intolerant of low temperatures, being quickly damaged or killed if temperatures drop much below 2°C[303 ]. It grows well in areas where the mean annual rainfall varies from 800 - 2,500mm[303 ]. It is very susceptible to drought[200 ]. It grows well in maritime areas, where it shows good wind resistance[200 ]. Prefers a rich, deep, moist soil and a position in full sun[307 ]. Tolerant of a wide range of soil types, including sandy and clay soils[200 ]. Requires a very well-drained soil[200 ]. Tolerates a pH in the range 5 - 7[200 ]. Seedling trees begin to bear fruit after 7 years or longer, whilst grafted trees begin to bear in 3 to 5 years[303 ]. It takes from 13 - 24 months for fruit to reach maturity and so trees may have flowers, immature fruit and mature fruit all at the same time[303 ]. The sapote is a very prolific cropper, mature trees may bear 200 to 500 fruit per year, whilst twice this amount may be obtained from large trees[303 ]. There are some named varieties[200 , 301 ]. Bloom Color: Pale Yellow White/Near White. Spacing: 30-40 ft. (9-12 m).

## 10.2.44 *Platonia insignis*

Bakuri, Bacuri

10 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 25 m hkuc htmhtut cyutli tcuphja7n hwicli hrasljutnyik hpa7tli flatprikwils hpa7tmwatli hjonli

drutta *Platonia insignis* is an evergreen Tree growing to 25 m (82ft) by 20 m (65ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist or wet soil.

kcakta Edible Parts: Fruit OilEdible Uses: OilFruit - raw or cooked to make sherbet, ice cream, marmalade or jelly[336 ]. The white, pithy pulp has a pleasant odour and an agreeable, subacid flavour[336 ]. The fruit is yellow when ripe, nearly round or ovoid, 75 - 125mm wide, weighing up to 900 g[336 ]. The rind is yellow, hard, fleshy on the inside, 1 - 2 cm thick, and contains gummy, yellow, resinous latex[336 ]. The infertile seed compartments are filled with pulp called 'filho' which is the part preferred[336 ]. The oil is unlikely to be edible.

tcanta Fibre Furniture Lighting Oil Resin Soap making String Waterproofing WoodOther Uses: A non-drying oil, known as 'bakuri oil', is obtained from the seed[46 ]. It is used for the manufacture of candles and soap[46 ]. A fibre obtained from the bark is used for cordage[378 ]. A black, viscous resin obtained from the bark is used for caulking boats[378 ]. The heartwood is dull-yellow to orange-brown

with many fine, dark, often black streaks; it is clearly demarcated from the 3 - 9cm wide band of yellowish-white sapwood. The texture is coarse to medium; the grain generally straight but at times irregular; the lustre is low. The wood is heavy; moderately hard to hard; moderately strong; elastic; durable in the soil and resistant to dry-wood borers and termites. It seasons somewhat slowly, with a high risk of checking and distortion; once dry it is poorly stable in service. It has a fairly high blunting effect, stellite-tipped and tungsten carbide tools are recommended; although hard, it is easy to work with both hand and power tools; nailing and screwing are good, but require pre-boring; gluing is correct for interior purposes only; it polishes well. It is valued for construction, high class furniture, flooring, ship-building and general carpentry[46 , 336 , 378 , 848 ].

dwatta Antidermatosis Antidiarrhoeal Astringent EczemaThe seeds contain 6 to 11% of an oil that is mixed with sweet almond oil and used to treat eczema and herpes[336 ]. The bark is astringent. A decoction is used to treat diarrhoea[348 ].

nrakta S. America - Paraguay, Brazil, Colombia, Guyana, Surinam. ksacta Seasonally flooded, humid forests[336 , 416 ]. Found mainly in open, transitional vegetation, being rare in the dense forest[419 ].

propta Seed - best sown as soon as it is ripe in a partially shaded position in individual containers. A high germination rate can usually be expected, with the seed sprouting within 20 - 40 days[419 ]. The seed has a very short viability of less than 30 days in the wild[419 ].

nwatta A plant of the moist, lowland tropics[336 ]. Succeeds in a sunny position[419 ]. Plants are tolerant of various soil conditions, including poor drainage, but dislike dry soils[335 , 419 ]. In some areas within its native range this tree is viewed as a weed because it proliferates from fallen seeds and, if felled, produces abundant suckers from the roots[336 ]. A rather fast-growing tree[419 ]. Bloom Color: Pink.

## 10.2.45 *Trichilia dregeana*

Cape Mahogany

10 tin 12 cyuc 4 kcaak 3 tcan 3 dwat 25 m hkuc htmimhtut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikwils hpa7tmwatli hjonli

drutta *Trichilia dregeana* is an evergreen Tree growing to 25 m (82ft) by 25 m (82ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The bark is very toxic. It is used in the preparation of fish poison[299 ].

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilFruit - raw or cooked[299 ]. It can be cooked and used as a vegetable, or crushed and made into a sweet drink or sauce[295 , 299 ]. Seed - boiled and eaten as a side dish[299 ]. The seedcoat contains toxins and must be removed before the seed is cooked[295 , 299 ]. The seeds provide an oil that is used for cooking even though it has a bitter flavour[299 ]. The seedcoat is poisonous and only well-prepared oil is safe for consumption[299].

tcanta OilAgroforestry Uses: The tree is grown to provide shade for coffee plantations, or is left standing as a shade tree when the forest is cleared[299 ]. Other Uses The seeds contain 55 - 65% oil. This is used as a body ointment and hair oil, as well as to make candles, soap and cosmetics[295 , 299 ]. The approximate fatty acid composition of the oil is: palmitic acid 34%, stearic acid 3%, oleic acid 51%, linoleic acid 11%, linolenic acid 1%[299 ]. To obtain the oil, the seeds are first ground into a powder and pounded, they are then boiled in water and the oil is skimmed off[299 ]. The heartwood is pale brown to pink, the sapwood whitish, though the wood darkens with age and exposure. When oiled, it darkens considerably, leaving little difference between the heartwood and sapwood. The grain is generally straight, texture medium coarse, the wood has a distinct figure[299 ]. The wood is not durable and is subject to attack by borers. It is easily worked and polishes well. It is not durable and susceptible to borer attack[299 ]. The wood is

(mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw[335 ]. A brown-yellow fruit with 1 or 2 large seeds covered in a thin, translucent, sweet and sour flavoured edible pulp[335 , 416 ]. Very tasty[419 ]. The fruit is about 3cm long and 2.5cm in diameter[335 ]. The fruit is borne in clusters of 10 - 20 fruits[377 ].

tcanta Containers WoodOther Uses: The heartwood is a light yellowish-brown; it is not clearly demarcated from the sapwood. The texture is medium; the grain is interlocked; lustre is tenuous, there is no distinctive taste or aroma. The wood is very heavy, hard; it is somewhat durable, especially if kept dry, with some resistance to insect attack but a low resistance to rot. It is used for internal work in buildings, such as ceilings, floor boards and door frames, and also for boxes, carpentry etc[363 , 419 ].

dwatta AntidoteThe roots are antidote. A decoction, taken internally and also applied topically, is used in the treatment of poisonous animals[739 ]. Combined with the fruit of annatto (*Bixa orellana*) and the fruit peel of assai (*Euterpe* spp.), it is used in the treatment of jaundice[739 ].

nrakta S. America - Paraguay, Brazil, Bolivia. ksacta Rainforests, on land that does not become inundated[416 ]. Dense primary forest as well as secondary formations, always in alluvial lowlands, at the bottom of valleys[419 ].

propta Seed - the whole fruit can be sown if done so as soon as it is ripe. If being stored for a short while then it is better to extract the seed from the pulp[419 ]. The seed is best sown as soon as it is ripe. Sow in individual containers and keep in light shade - do not allow the compost to become dry[419 ]. Most seeds germinate in 15 - 30 days[419 ]. Growth is moderate, taking 6 - 7 months before the plant is ready to be planted into its permanent position[419 ].

nwatta A plant of the hot, wet, tropical lowlands[335 ]. Grows best in a sunny position in a deep, fertile soil[419 ]. A moderately fast growing plant when young, reaching 2.5 metres when 2 years old[419 ].

## 10.2.96 *Cinnamomum verum*

Cinnamon, Ceylon Cinnamon Tree

10 tin 12 cyuc 4 kcaak 3 tcan 3 dwat 10 m hkuc htmimhtut cyutli tcup hwicli hrasljutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta *Cinnamomum verum* is an evergreen Tree growing to 10 m (32ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by insects. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Inner bark Leaves OilEdible Uses: Drink OilThe stem bark is used as a flavouring[ 296 ]. A very well-known flavouring, it is used in curries and a wide range of sweet dishes. Essential oils, obtained from the leaves and the bark, are used as food flavourings in a range of foods including sauces and pickles, baked goods, confectionery and cola-type drinks[ 301 , 303 ]. The leaves are often used in cooking to impart a cinnamon flavour[ 301 ].

tcanta Cosmetic Essential Oil Soap making WoodOther uses rating: Medium (3/5). Small shade tree, Humid shade tree, Large planter, Botanic collection, Conservatory. Other Uses: Cinnamon bark oil possesses the delicate aroma of the spice and a sweet pungent taste. Its major constituent is cinnamaldehyde but other, minor components impart the characteristic odour and flavour. It is employed mainly in the food flavouring industry but is also used in tobacco flavours and for incense. It has limited use in some perfumes[ 303 ]. Cinnamon leaf oil has a warm, spicy, but rather harsh odour; lacking the rich body of the bark oil. Its major constituent is eugenol rather than cinnamaldehyde. As a cheap fragrance, it is added to soaps and insecticides[ 303 ]. Sapwood is light brown, slightly soft; heartwood is brownish-yellow with green cast, or olive to light olive brown to blackish-brown, medium to coarse texture, satiny or silky lustre, straight and often rosy grain, spicy odour. The wood has excellent working qualities[ 303 ].

dwatta Antirheumatic Aphrodisiac Astringent Carminative Digestive Sedative TonicCinnamon bark oil is employed in a range of dental and pharmaceutical preparations[ 303 ]. Historically, cinnamon drops were regarded as a tonic, a sedative in childbirth, and a remedy for many common disorders. Cinnamon served as a breath sweetener in the past. In medieval times, cinnamon was distilled to produce cordials, ostensibly to aid in digestion. In the Orient, cinnamon and its near relatives are still widely used for local remedies, particularly for gastrointestinal and respiratory disorders and as an aphrodisiac. In the Philippines and the Pacific, it is taken to relieve headache. In Colombia, cinnamon sticks are chewed to speed parturition. In Ghana, bark of young shoots are used as a carminative and to treat catarrh (corzya), and the bark extract is an intestinal astringent. In Haiti, the essence is used as a poultice for rheumatism and is taken orally for spasms and for stomach and intestinal gas[ 303 ].

nrakta E. Asia - India, Sri Lanka, but also widely cultivated throughout the Tropics. ksacta Forests in moist, well-drained soils from sea level to 700 metres[ 254 , 307 ].

propta Seed - the seed has a short viability and is best sown as soon as it is ripe[ 200 ]. Remove the fruit pulp since this can inhibit germination[ 200 ]. Germination can take 1 - 6 months at 20°C [ 164 ]. Stored seed should be sown as soon as possible in containers[ 78 ]. The seeds may be sown in nurseries or directly in the field[ 303 ]. Nursery beds should be of well-prepared rich sandy soil free from roots and stones, with an adequate supply of fresh water nearby, and be lightly shaded[ 303 ]. After about 4 months, clumps of seedlings may be transplanted into baskets and are planted out 4 or 5 months later[ 303 ]. Alternatively, the seedlings may be left in the nursery until the final transplanting, the shade having been progressively removed and the seedlings hardened[ 303 ]. Cuttings of semi-ripe side shoots, 7cm with a heel, June/July in a frame with bottom heat[ 78 ]. Division of old rootstocks[ 303 ]. The advantage of dividing old rootstocks is that the stems are ready for cutting at about 12-18 months after planting, compared with as much as 3 years for seedlings[ 303 ].

nwatta Cinnamon can be found at elevations up to 2,000 metres, but for commercial harvesting does best at low altitudes below 500 metres[ 303 , 418 ]. It requires a warm and wet climate with an average temperatures of about 27°C and no extremes of heat or cold[ 303 ]. Rainfall should be around 2,000 - 2,500mm, well-distributed throughout the year[ 303 ]. Although there can be months in which there is less rain, no prolonged dry season should occur and rain should be received on about 150 days per year[ 303 ]. Prefers a fertile, sandy, moisture-retentive but freely draining soil in full sun or partial shade[ 200 , 307 ]. Rocky and stony ground is unsuitable[ 303 ]. Waterlogged and marshy areas should be avoided, as they result in an undesirable, bitter product, which is much less aromatic[ 303 ]. The type of soil has a pronounced effect on bark quality[ 303 ]. Fine sandy and lateritic gravely soils rather than rocky and stony substrates are best in Sri Lanka and India, but in the Seychelles and Madagascar more loamy soils are preferred[ 303 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 5 - 7[ 418 ]. The tree usually coppices well[ 303 ]. Commercial production of cinnamon bark entails cutting the stems down low after an initial establishment period and harvesting the bushy regrowth stems at regular intervals thereafter[ 303 ]. Stems are cut during the rainy season to facilitate peeling of the bark in 2 longitudinal strips[ 303 ]. In Sri Lanka, a first harvest may be obtained after 3 - 4 years, although quality and yield improve with subsequent cuttings[ 303 ]. On plantations, cinnamon is cut every 2 years, and the flush of straight shoots generated by coppicing produces the bark that is peeled for cinnamon quills[ 303 ]. The expected yield of bark is 56 - 67 kg/ha after 3 - 4 years, subsequently increasing to 168 - 224 kg/ha[ 418 ]. About 63 kg/ha of chips and approximately 2.5 tonnes/ha of undried leaves can also be obtained[ 418 ].

## 10.2.97 *Passiflora tarminiana*

banana passionfruit, banana poka

10 tin 12 cyuc 4 kcaak 0 tcan 0 dwat 10 m hkuc htmimhtut cyutli tcup hwicli jltunyk hpa7tli flatprik hpa7tmwatli hjonli

drutta *Passiflora tarminiana* is an evergreen Climber growing to 10 m (32ft) by 0.5 m (1ft 8in) at a fast rate. See



pulp occupying about a third of the space within[335 ]. Seed - used as a substitute for chocolate[420 ]. The seeds have a high amount of fat and give a good cocoa butter[317 ]. The seeds of species in this genus are generally a rich source of oil (around 50%), starch (around 15%) and protein (around 15%)[636 ]. They also contain a volatile oil and the stimulating alkaloids caffeine and theobromine[636 ].

tcanta OilOther Uses An oil, known as cacao butter, which is solid at room temperature, is obtained from the seed. In addition to being used locally as a food and medicine, cacao butter is important in the cosmetics and pharmaceutical industries[636 ]. The wood is of medium texture, straight-grained, moderately heavy and with moderate natural durability[420 ]. It is very little used, but is suitable for cabinet making and internal cladding of buildings[420 ].

dwatta The plant (part not specified, but it is almost certainly the fruit or the seed[K ]) is nutritive, stimulant and tonic[318 ]. The seeds are used in the treatment of abdominal pains[318 ]. The juiced fruit is drunk to facilitate difficult births[318 ]. Although no specific reports of medicinal use have been seen for this plant, the seed is a source of cacao powder and butter. These products have the following medicinal uses:- Cacao powder and butter, which are obtained from the seed, are nutritive[238 ]. The butter is also applied externally as an emollient[238 ]. Cacao powder is taken internally in the treatment of angina and high blood pressure[238 ]. Cacao butter is an excellent emollient, being applied to the skin to soothe and soften it[238 ]. It is used traditionally to treat chapped skin and burns, and is also rubbed into bruises[238 ]. Research has shown that it can help to counter the bacteria responsible for boils and septicaemia[254 ].

nrakta S. America - Amazonian Brazil. ksacta Rainforests, usually in areas that do not become inundated[416 ]. The lower tree storey of evergreen rainforests[636 ].

propta Seed - it has a very short viability, requiring high humidity and optimum temperatures to remain viable. There is no dormancy, the seed often germinating whilst still inside the pod[636 ]. Sow the seed as soon as it is ripe, in a semi-shaded position in individual containers[420 ]. Cover with about 15mm of soil. Germination rates of fresh seed is usually high, with sprouting taking place in 20 - 40 days[420 ]. Young plants are usually ready for planting out 5 - 6 months later[420 ].

nwatta Management: Standard Regional Crop A plant of the hot, moist, lowland tropics[636 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 30°C, tolerating 16 - 40°C[636 ]. It requires a mean annual rainfall within the range 2,000 - 8,000mm, evenly distributed throughout the year[636 ]. Requires a position where shade is provided by taller trees[420 ]. Prefers a relatively rich, circumneutral soil[636 ]. Prefers a pH in the range 5 - 6.5, tolerating 4.5 - 8.5[418 ]. The plant is not drought tolerant, being unable to withstand even short dry seasons without the protection of dense shade and local humidity[636 ]. Freshly planted young trees usually grow away moderately well[420 ]. A seedless variety of this species exists[416 ].

## 10.2.94 Barringtonia procera

Pao nuts, Cut nut

10 tin 12 cyuc 4 ckak 2 tcan 2 dwat 10 m hkuc hmimhtut cyutli tcup hwicli hyishrasjnutnyik hpa7tli flatprikwishsom hpa7tmwatli hjonli

drutta Barringtonia procera is an evergreen Tree growing to 10 m (32ft) by 8 m (26ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Moths, Bats. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant can tolerate maritime exposure.

ksakta Edible Parts: Leaves SeedEdible Uses: Seed[324 , 335 , 658 ]. The seed kernel inside the hard shell inside the fruit is about 30mm by 15 - 20mm wide[658 ]. Young leaves - cooked and eaten as a vegetable[324 ].

tcanta Fuel Plant support Shelterbelt WoodThe tree prefers light shade, which makes it a good companion to

overstorey tree species such as vi (Spondias cythera), canarium nut (Canarium spp.), and breadfruit (Artocarpus altilis). Its open canopy structure allows sufficient light penetration to the ground level for other crops such as roots, cereals and other understorey crops such as sugarcane (Saccharum officinarum) and a nutritious native leafy tree spinach called bele or edible hibiscus (Abelmoschus manihot), to be interplanted under it. It has been used as a trellis tree for the cash crop betel leaf (Piper betle), as well as for marking land boundaries and creating windbreaks[312 ]. The tree has a well formed lateral root system, yet does not appear to cause major impediments during soil preparation for understorey crops, e.g., making mounds for the root crops, nor does it seem to compete heavily with understorey crops[312 ]. It can be used in plantations to provide shade for tree crops such as cacao (Theobroma cacao), joint fir (Gnetum gnemon), and betel nut (Areca catechu)[312 ]. Other Uses The wood is light in weight. It is used for canoe paddles, casing, light construction[339 ]. The wood is used as a quick-burning firewood[339 ].

dwatta Antiinflammatory Antitussive Stomachic UrinaryThe bark is used in the treatment of stomach ailments and gonorrhoea[339 ]. Sap from the bark has been used for treating ciguatera poisoning, coughs, and urinary infections[312 ]. The leaves are used to treat inflammation of the ear and headaches[312 ].

nrakta Australasia - eastern New Guinea, Bismarck Island, Solomon Islands, Vanuatu. ksacta Secondary rainforests at low elevations[658 ]. Usually associated with human activity, in old gardens, mature coconut plantations, and coastal villages, and in remnants of secondary lowland rainforests[312 ].

propta Seed - best sown as soon as it is ripe.

nwatta Management: Standard Regional Crop Staple Crop: Balanced carbA plant of lowland wet tropical, moist tropical and wet subtropical climatic zones, it can be found at elevations up to 600 metres. The plant grows in areas where the mean annual temperature is around 27c, with the hottest moth around 29 - 34c and the coolest 20 - 23c. It cannot tolerate even light frosts. The mean annual rainfall is within the range 1,500 - 4,300mm, usually with a year-round distribution, sometimes with a short dry season[303 , 312 ]. Prefers a position in partial shade, though it can tolerate full sun[312 ]. It grows in moderate to highly fertile, coastal coral soils with light to heavy textures, tolerating rocky, shallow, saline and infertile soils The tree grows well in coastal soils high in pH (up to 8.5), but it does not tolerate waterlogged soils[312 ]. It has medium to high tolerance of steady and strong winds including cyclones. Branches and twigs do not easily snap, but they may be broken off by strong winds. The trees rarely suffer from windthrow due to their height, open canopy structure, and good lateral rooting system[312 ]. Generally, the tree grows moderately quickly, but this varies significantly depending upon trees and growth conditions. The mean annual increment (MAI) for height of trees up to 5 years is 62cm; thereafter the MAI increased to about 1 metre annually for the next 5 years. Thirty-year-old trees had an average MAI of about 1.4 metres[312 ]. Diameter at breast height appears to be relatively uniform with age. Trees aged 5, 10 , 15 , and 20 years old have all attained an MAI for diameter at breast height on the order of 14 - 16cm[312 ]. Trees begin flowering as early as 1.5 years (dwarf variety), although the average is probably 3 years[312 ]. The tree can flower and produce fruit all year round[658 ]. Annual yields of the seeds is estimated at 1.5 - 7 kilos per tree. By the age of 20 years trees can yield 370 - 550 kilos of seeds per hectare[312 ]. Trees coppice and pollard well, with young leafy shoots regrowing rapidly following cutting. Stumps as short as 10cm coppice well[312 ].

## 10.2.95 Talisia esculenta

Pitomba

10 tin 12 cyuc 4 ckak 2 tcan 2 dwat 10 m hkuc htut cyutli tcup hwicli hrasjnutnyik hpa7tli flatprikwish hpa7tmwatli hjonli

drutta Talisia esculenta is a deciduous Tree growing to 10 m (32ft) by 10 m (32ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic

particularly important as a material for making carvings, especially in southern Africa, and is also used for indoor furniture, household utensils, shelving, construction, dugout canoes etc[295 , 299 , 398 ]. The wood is used for fuel and for making charcoal[299 , 398 ].

dwatta Dysentery Eczema LeprosyThroughout Africa the seed oil, leaves, root and bark are used in similar ways uses to those of Trichilia emetica, though they are generally considered to be inferior. They are used to treat a variety of complaints ranging from lumbago to leprosy and sleeplessness[299 ]. A large number of limonoids have been isolated from the seed, especially from the seedcoat, including evodulone and priuriarin derivatives. Limonoids of other plants in this family (Meliaceae) are well known as antifeedants and growth regulators of insects, but they also have some antimicrobial and anti-inflammatory activities[299 ]. The bark, which is very toxic, contains inhibitors of the prostaglandin-synthesis, which play a role in inflammation and pain suppression[299 ]. The seed oil is rubbed into cuts made in the skin of a fractured limb in order to hasten healing[299 ]. It is used as a massage oil to treat rheumatism and as a general body ointment[299 ]. The fruit has emetic and purgative properties[299 ]. Poultices made of the leaves or fruits are applied to bruises and eczema[299 ]. A decoction of the roots is used as a general tonic; to treat fever; and as a purgative[299 ]. It is also used to induce labour in pregnant women; and to treat intestinal worms, colds and infertility[398 ]. A decoction of the bark is drunk as a purgative or abortifacient, and also to treat dysentery and diarrhoea, fevers and lumbago[299 , 398 ]. The bark is used externally as a treatment against scabies[299 ]. Decoctions of the bark, applied in the form of an enema, are used as a purgative and abortifacient, as well as to treat back pain caused by kidney problems[299 ].

nrakta Tropical Africa - Cote D'Ivoire to Ethiopia, south to Angola, Malawi, Mozambique, Zambia, Zimbabwe a ksacta The transition zone between forest-savannah mosaic and moist evergreen forest, mostly at elevations of 500 - 1,600 metres in the north of its range, but gradually descending to sea level in S. Africa[299 ].

propta Seed - it is intolerant of being dried and has a short viability, so should be sown as soon as it is ripe. Seed is sometimes sown in situ; if sowing in a nursery seedbed then choose a position with some shade. No pre-treatment is required, but removal of the fleshy outer seedcoat speeds up germination[299 ]. A rich mixture of sandy soil and compost with plenty of moisture is recommended. The seed usually sprouts within 2 - 4 weeks[299 ]. Protect the seedlings from frosts[299 ]. Natural reproduction is abundant owing to regular and copious seeding from a fairly early age, comparative immunity from damage by animals and its power of recovery from injury. Seeds germinate during the early rains and seedlings attain a length of 10 - 20cm by the end of the first year[299 ].

nwatta A plant of the moist tropics, but avoiding the wetter regions. It is found at elevations from 800 - 2,000 metres near the Equator, but descends to sea level as it enters the subtropics. It is usually found in areas where the mean annual rainfall is in the range 1,500 - 2,500 mm[299 ]. The plant is sensitive to frost, but as long as the damage is not too severe, it recovers easily[299 ]. Succeeds in full sun and dappled to fairly deep shade[295 , 299 ]. Grows best in humus-rich, fertile, moist soils[299 ]. Young trees grow fairly quickly, with a mean annual girth increment of 20 - 25mm[299 ]. Older plants are fast growing and require little or no management[299 ]. Trees growing in open positions start fruiting when about 10 years old, those in more shaded, forest-like conditions may not bear fruit before they are 20 years old[299 ]. The tree is tolerant of fire[299 ]. The tree coppices well. For ornamental purposes, it may be pruned into shrub form[299 ]. Average seed yields per tree in Mozambique are about 20 - 25 kg/year, but in a good year a large tree may produce 180 kg[299 ]. Trees that have produced heavily in one year tend to produce little in the next year[299 ]. A dioecious species, both male and female forms need to be grown if seed is required.

## 10.2.46 Chrysophyllum cainito

Star Apple, Caimito

10 tin 12 cyuc 4 ckak 2 tcan 2 dwat 25 m hkuc

htut cyutli tcup hwicli hrasjnutnyik hpa7tli frusflatprikwishsom hpa7tmwatli fyif hjonli

drutta Chrysophyllum cainito is an evergreen Tree growing to 25 m (82ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The plant is self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and saline soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerate strong winds but not maritime exposure.

pcista The seeds contain a cyanogenic glucoside.

ksakta Edible Parts: Fruit SeedEdible Uses: Drink Milk-Fruit - raw or made into preserves[ 301 ]. A sweet flavour[ 301 ]. The pleasantly acidic flesh is high in carbohydrate and is eaten fresh[ 200 ]. The fruit is about 10cm in diameter[ 296 ]. The fruit is not good unless allowed to remain on the tree until fully ripe; if picked when immature it is astringent and contains a sticky, white latex[ 303 ]. The skin needs to be removed since biting into it leaves a horrible stickiness in the mouth[ 296 ]. When opening a star apple fruit, one should not allow any of the bitter latex of the skin to contact the edible flesh[ 306 ]. The ripe fruit, preferably chilled, is cut in half and the flesh spooned out, leaving the seed cells and core. A better way of serving the fruit is to cut around the middle completely through the rind and then, holding the fruit stem-end down, twisting the top gently back and forth. As this is done, the flesh will be felt to free itself from the downward half of the rind, and the latter will pull away, taking with it the greater part of the core[ 306 ]. An emulsion of the slightly bitter seed kernels is used to make imitation milk-of-almonds or nougat and other confections[ 301 ].

tcanta Fuel Furniture Latex Paper Tannin WoodOther uses rating: Low (2/5). Large shade tree, Street tree, Screening, Specimen, Backyard tree, Large planter, Conservatory. Grown as an ornamental for the attractive golden underside to the leaves. Agroforestry Uses: The branches are used as an orchid-growing medium[ 320 ]. Other Uses: A good quality paper can be obtained from the wood pulp[ 303 ]. Tannins are extracted from the bark[ 303 ]. The sapwood and heartwood are reddish-brown to dark brown, strong, hard but not durable, with fine to medium texture, fairly straight grain; specific gravity of 0.70[ 303 ]. The wood is used for general indoor construction, such as planking, light framing, flooring, interior trim, lining, shelving, cladding, panelling and partitioning. It is also suitable for mouldings, light tool handles, inlaying, carving, joinery, furniture and cabinet making[ 303 ]. Good-quality veneer and plywood can be obtained from it[ 303 ]. The wood is sometimes used for fuel[ 404 ].

dwatta Antidiarrhoeal Antinflammatory Astringent Diuretic Dysentery Febrifuge Pectoral Stimulant Tonic VermifugeThe ripe fruit is eaten to sooth inflammation in laryngitis and pneumonia[ 306 ]. It is given as a treatment for diabetes mellitus, and as a decoction is gargled to relieve angina[ 306 ]. The fruit is used in treating haemorrhage or is cooked and used for fever[303 ]. A decoction of the rind, or of the leaves, is taken as a pectoral[ 306 ]. The undersides of the leaves are grated and applied as a poultice to wounds[ 303 ]. A decoction of the leaves is taken orally to treat hypoglycaemia[ 303 ]. A decoction of the tannin-rich, astringent bark is drunk as a tonic and stimulant, and is taken to halt diarrhoea, dysentery and haemorrhages, and as a treatment for gonorrhoea and catarrh of the bladder[ 306 , 348 ]. The bitter, pulverized seed is taken as a tonic, diuretic and febrifuge[ 306 ]. The latex of the tree is applied on abscesses and, when dried and powdered, it is given as a potent vermifuge. It is also taken as a diuretic, febrifuge and remedy for dysentery[ 306 ].

nrakta Central America - Belize; Caribbean - Cayman Islands, Jamaica. ksacta Humid woodlands at low to medium elevations[ 307 ].

propta Seed - sow in a light, sandy loam[ 303 ]. Germination rate is 70%, the seed taking up to six weeks to germinate[ 296 , 303 ]. The seed retains its viability for several months[ 306 ]. The seedlings bear fruits in 5-10 years[ 306 ]. Greenwood cuttings. The cuttings taken from mature stems root well[ 306 ], when placed over strong moist heat[ 303 ]. Air layering. Takes 4 - 7 months[ 306 ]. Grafting. Grafted trees have been known to commence bearing in their first year[ 306 ].

nwatta Star apple grows successfully in a range of tropical or near tropical areas. Throughout Southeast Asia it thrives in the lowlands, up to 400 metres elevation, and in areas with a distinct dry season[ 306 ]. If the dry period is most pronounced, undue loss of leaves and less juicy or even shrivelled fruit are evident, which indicates that the drought is too severe and irrigation is needed[ 306 ]. The temperature range for growth is reported to be 12 - 35c with the optimum between 22 - 38c[ 303 ]. Mature trees are seriously injured by temperatures below -2c and recover slowly. Young trees may be killed by even short exposure to -0.5c[ 303 ]. The annual rainfall range for growth is reported to be 800 - 2,200mm with the optimum between 1,000 - 1,400mm[ 303]. Requires a moist, well-drained soil[ 296 ]. Prefers a deep, rich loam[ 200 ]. Fertile, well drained and slightly acid soils are ideal for good growth, though the plant can succeed on almost all types of soil[ 306 ]. Prefers a sunny position[ 307 ]. Established plants are tolerant of drought[ 307 ]. Trees take about 5 - 10 years to produce fruit from seed[ 296 , 377 ]. Grafted plants can start to fruit in 2 - 4 years[ 377 ]. Some trees yield heavy crops of fruit, others bear little[ 303 ]. Yields of 70 kg or fruit per tree per year have been recorded. The fruit do not drop and must be picked. They can be stored for 3 weeks at cool temperatures. Young trees are sensitive to water stress in their first year, and growth during that time is slow. Once the tree is established, growth rate and development become more rapid. Deep mulching with straw or lawn clippings, application of fertilizer and frequent dry-season watering all seem necessary for success with this species[ 303 ]. The trees do not drop their fruit, making it necessary to climb the tree in order to harvest the crop[ 307 ]. There are many named varieties[ 301 ]. Star apple flowers are hermaphrodite, and the plants are usually self-fertile[ 335 ].

## 10.2.47 Artocarpus odoratissimus

Marang, Terap  
10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 25 m hkuc  
htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliws hpa7tmwatli hjonli

drutta Artocarpus odoratissimus is an evergreen Tree growing to 25 m (82ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil. The plant is not wind tolerant.

kcakta Edible Parts: Fruit SeedEdible Uses: Edible portion: Fruit, Seeds, Nuts. The ripe fruits are fleshy, aromatic, sweet and juicy - similar to the jackfruit (*A. heterophyllus*) but of much better quality[ 46 , 301 ]. Usually eaten as a dessert fruit, they are considered to be the finest fruit in Brunei[ 301 ]. The unripe fruit can be eaten as a boiled vegetable[ 301 ]. The roundish to oblong fruit is quite large, averaging about 16cm long and 13cm in diameter[ 306 ]. The rind of the fruit is said to be edible[ 301 ]. Thick and fleshy[ 306 ]. Seed - roasted or boiled and eaten[301,306]. Seeds boiled for 30 minutes in salty water have a delicious nutty flavour[ 303 ]. Roasted seeds have a flavour similar to sweet chestnuts[ 416 ]. The whitish seed is about 8 15mm in size[ 306 ].

nrakta Southeast Asia - Thailand, Malaysia, Indonesia, Philippines. ksacta Secondary forests up to 1,000 metres altitude on sandy clay soils in Thailand[ 306 ]. Evergreen forests[ 525 ].

propta Seed - it has a short viability and so is best sown as soon as it is ripe[ 200 , 303 ]. The seed germinates best at a temperature of 24 - 27c[ 200 ]. Germination is often 100% within 4 weeks[ 303 ]. Plants are spaced 12-14 m apart. Root cuttings. Air layering. Plants can be grafted.

nwatta A plant of lowland humid tropics, succeeding at elevations up to 1,000 metres[ 200 , 303 ], it grows best in regions with abundant and equally distributed rainfall[ 306 , 525 ]. Prefers a deep, well-drained soil[ 200 ]. Young plants need some shade, but need increasing light levels as they mature[ 200 ]. Trees as young as 4 - 6 years can begin to bear fruit[ 303 ]. Yields of 4 - 6 tonnes per hectare have been achieved[ 303 ]. The fruits are borne at the end of long flexible branches and ripe fruits are heavy, fragile and difficult to reach for harvest[ 303 ]. Mature fruits are usually harvested by hand with the help of a curved knife attached to the end

of long bamboo pole[ 303 ]. Getting at the heavy fruit at the end of slender twigs is hazardous[ 303 ]. The delicate fruit really should be caught to break the fall, it has a very short shelf life[ 303 ]. A tree produces about 180 fruit per season.

## 10.2.48 Attalea colenda

Palma real, Chivila  
10 tlin 12 cyuc 4 kcaak 3 tcan 0 dwat 25 m hkuc  
htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliws hpa7tmwatli hjonli

drutta Attalea colenda is an evergreen Tree growing to 25 m (82ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilEdible portion: Seeds, oil. An oil extracted from the seed is used for cooking[ 768 ]. Similar to coconut and African oil palm. The infructescences of this species are unusually large and heavy, with some of them weighing more than 100 kilos; an assay of the individual seeds showed 51.74% oil and 4.28% water[ 769 ].

tcanta Fibre Oil PioneerOther uses rating: Medium (3/5). Other Uses A long fibre with commercial value can be obtained from the leaf petiole margins[ 769 ].

nrakta S. America - Ecuador, Colombia. ksacta Lowland rain forest or deciduous forest, especially common in disturbed or cleared areas, at elevations up to 900 metres[ 768 ]. It normally grows between 400-500 m altitude in Ecuador. It can grow up to 1300 m altitude.

propta Seed - The seeds are large and slow and erratic to germinate.

nwatta Each tree produces one to four infructescences per year. Based on the oil content, it is estimated that 100 trees per hectare could produce 10 to 27 tonnes of seeds, or between 5 and 13 tonnes of oil per hectare per year[ 769 ]. Production: Seedling grown is quite fast.

## 10.2.49 Telfairia pedata

Oyaternut  
10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 20 m hkuc  
hmimhtut cyutli hgtattcup hwicli hrasjlutnyik hpa7tli frusflatprik hpa7tmwatli dyat hjonli

drutta Telfairia pedata is an evergreen Climber growing to 20 m (65ft) by 1 m (3ft 3in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought.

kcakta Edible Parts: Oil SeedEdible Uses: OilSeed - raw or cooked[299 ]. A soft but firm texture with an excellent flavour[63 ]. The seed can be used to replace almonds or brazil nuts in confectionery and are also used in a variety of food dishes by local people[63 ]. The seed is usually roasted[300 ]. The seed contains about 30% protein[300 ] and has a high oil content[63 ]. It is irregularly circular in shape, about 4cm in diameter and 12mm thick[63 ]. It is easily extracted from its shell[63 ]. Seeds can be stored in their shells for several years in good condition[63 ]. To remove the bitter principle, whole seeds can be soaked for 8 hours in 3 changes of water. To remove the kernel from the shell, the fibrous husk is first partly cut away, then the shell is cracked and opened using a knife[299 ]. An oil extracted from the seed has a pleasant, slightly sweet flavour[63 ]. It makes a good cooking oil[298 ]. The seed contains up to 61% oil[303 ]. It is important to remove the husk of the seed before extracting the oil since it contains an intensely bitter substance that could contaminate the oil[63 , 299 ].

tcanta Cosmetic Lighting Oil Polish Soap makingAgroforestry Uses: Oyaternut is part of the rich agroforestry systems of Mount Meru and Mount Kilimanjaro in Tanzania, where it is grown in combination with coffee and banana[299

is reportedly occasionally eaten as a vegetable[299 ]. The powdered root bark is said to be an ingredient of the cheap but dangerous 'African whiskey in sachets'[299 ].

tcanta Other Uses The roots smell of aspirin and are hung over the doorway or are placed inside the roof to keep away snakes[299 ].

dwatta Dysentery MalariaThe roots, which taste like horseradish, are used throughout central Africa to treat a wide range of conditions, but particularly to remedy several problems related to giving birth and also to deal with a range of skin problems[299 ]. Phytochemical analyses of the root have led to the isolation of urea derivatives including sulphur-containing compounds[299 ]. Carbamates obtained from the roots have shown antibacterial properties in vitro against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, and against the yeast *Candida albicans*[299 ]. The root is also rich in glucosinolates and is believed to contribute to the revitalizing of collagen and to restore skin tonicity[299 ]. Crude extracts of tubers have revealed moderately strong antiplasmodial activity in vitro, but were not as effective as chloroquine[299 ]. An aqueous extract of the root given to rats increased the weight of their testes and prostate as well as their testosterone levels[299 ]. The roots are antibacterial, aphrodisiac, cathartic, emmenagogue, laxative, purgative. They are widely used by women to assist in the birth process and also to deal with problems related to the uro-genital system. A root decoction can stimulate uterine contractions and has been used to induce abortion - it should generally be avoided by pregnant women until the later stages of the pregnancy[299 ]. A root decoction is given orally, or applied as an enema, to facilitate the expulsion of the placenta, and is also said to prevent haemorrhages after parturition[299 ]. The root bark is one of more than 20 constituents of the yellow, slimy 'nkui' sauce made by the Bamileke people of Cameroon; this sauce is given to mothers who have just given birth in order to stimulate milk production. A root decoction is given orally or applied as an enema to help in reducing pain caused by hernia[299 ]. The crushed root or root bark is applied, or an infusion drunk, to soothe the chest pain, toothache, lumbago, rheumatism and haemorrhoids. The macerated roots, either alone or mixed with other ingredients, are taken orally or applied as an enema against malaria. Capsicum pepper is added to macerated roots to prepare a drink that soothes cough. A decoction of the bark, combined with the bark and roots of other plants, is taken as a treatment against stiffness or weakness of the limbs and back. The roots and tubers are also commonly used in the treatment of intestinal problems such as dysentery, colic, urethritis, gonorrhoea and other uro-genital infections[299 ]. A decoction of the tuber, as well as the juice from macerated roots, is combined with pounded leaves and drunk as an anthelmintic. A root decoction is taken to treat pneumonia and serious bronchitis[299 ]. The fresh root is pulped, or the dry root pounded and mixed with palm oil, to make an ointment for topical application to prevent infections of the navel in newborn babies. Because the plant is vesicant, the duration of this treatment must be limited to avoid blistering[299 ]. A powder of dried root bark is applied to scarifications to treat intercostal and abdominal pains. The crushed root is used to treat several skin infections. The pulped roots are applied externally against itch and as an antiseptic, and to treat wounds, sores, ulcers and furuncles[299 ]. The roots are applied to the abdomen to treat oedema[299 ]. A root preparation, combined with the leaves of *Kalanchoe crenata*, is used as nose drops to stop epileptic crises[299 ]. A leaf decoction is used to wash the skin against scabies[299 ].

nrakta Tropical Africa - Nigeria, Cameroon, Central African Republic, Equatorial Guinea, Gabon, Congo, DR Congo. Northern Angola. ksacta Common in upland primary forest dominated by *Scorodophleus zenkeri*, and also commonly occurs on river banks and in secondary forest. In Cameroon, the plant is mainly found in forest edges bordering savannah. It is nowhere gregarious[299 ].

propta Seed - nwatta The flowers can be single-sex or bisexual[299 ]. The flowering period continues for several months; fruit production is normally low and spread out, though shrubby plants seem to have a shorter but more condensed fruiting season[299 ]. Unconsumed fruits rot on the plant, without falling. They serve as temporary nesting sites to arboreal ants[299 ]. Seed dispersal is facilitated by the contrast be-

tween the extreme sweetness of the pulp of the fruit and the unpleasant bitter taste of seeds, provoking consumers to spit out the seeds. In natural habitats, squirrels, monkeys and apes contribute to the distribution of the seed; in the vicinity of human habitation, distribution by children into secondary habitats is common[299 ]. Commercial interest in brazzein, the protein obtained from the fruit, is strong. The technology to extract the protein from the fruit pulp as well as technologies to produce brazzein by transferring the gene coding for brazzein into other organisms have been patented, without the intention of benefit sharing[299 ]. The gene encoding for brazzein has been transferred to the bacteria *Escherichia coli* and *Lactococcus lactis* and to maize. Bacterial production systems for brazzein have been developed. Mutants and sections of brazzein have been discovered with sweet-taste properties superior to those of the natural protein[ 299 ].

## 10.2.92 Annona salzmannii

Beach Sugar Apple  
10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 12 m hkuc  
hmimhtut cyutli hgtattcup hwicli hyhisrasjlut hpa7tli flatprikliwshsom hpa7tmwatli hjonli

drutta Annona salzmannii is an evergreen Tree growing to 12 m (39ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw[ 377 ]. The succulent pulp is very sweet, fibreless and very tasty[ 377 , 416 , 625 ]. The green skinned fruit can be 10cm long and 9cm wide, weighing up to 450g[ 377 , 625 ].

tcanta Charcoal FuelOther uses rating: Low (2/5). Other Uses: The wood is light in weight, with moderate resistance to insect attack, difficult to saw and cut[ 625 ]. It is only used for fuel and to make charcoal[ 625 ].

nrakta S. America - eastern Brazil. ksacta Dry forest areas on tree-covered sand dunes and in coastal forests[ 416 , 625 ].

propta Seed - it has a very hard outer layer and germinates much more easily if scarified[ 625 ]. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing. Sow the seeds in individual containers in a lightly shaded position. Germination rates of scarified seeds can above 95%, with the seeds sprouting within 40 - 50 days[ 625 ].

nwatta A plant of lowland tropical areas[ 377 , 416 ]. Prefers a sunny position[ 625 ]. Prefers a well-drained, sandy soil[ 625 ]. Succeeds on saline soils[ 625 ].

## 10.2.93 Theobroma grandiflorum

Cupuassu, Cupuacu  
10 tlin 12 cyuc 4 kcaak 0 tcan 3 dwat 10 m hkuc  
hmim cyutli tcup hwicli jlutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta Theobroma grandiflorum is an evergreen Tree growing to 10 m (32ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects, Wind. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland). It prefers moist soil.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilThe fruit contains a number of large seeds surrounded by a very aromatic, succulent pulp with a slightly acidic flavour[335 , 416 ]. This pulp can be eaten raw and is said to be delicious[317 , 335 ]. Creamy, with an exotic flavour[318 ]. Sweetish and agreeably scented[420 ]. It is also used to make fresh juice, ice cream, jam and tarts[317 , 318 ]. The brown fruit is 12 - 25cm long and 10 - 12cm in diameter, with the

up into small pieces and infused to produce a tisane that is taken to ease childbirth and reduce the pain[332 ].

nrakta Tropical west Africa - SE Nigeria and W Cameroon, extending as far south as Angola. ksacta Understorey layer of humid tropical rainforests, mostly at the periphery of primary forest and in secondary forests[299 , 332 ]. Thrives in a wide range of habitats, including farm fallows or abandoned farmland, secondary forests, and closed forest[401 ].

propta Seed - difficult to germinate in nursery conditions, though the plants self-sow successfully in the wild[401 ]. It is assumed that seeds need pre-treatment, such as passing through the intestines of a bird, fruit bat, squirrel or other animal, before they germinate[299 ]. Seed is normally found only in the tree canopy[299 ]. Seed collection is thus far from easy, a further reason why the plant is hardly cultivated[299 ]. Methods of vegetative propagation using leafy stem cuttings have recently been developed. It is recommended that leaf blades of cuttings be trimmed in half[299 ]. Nursery beds under shade and made of well-decomposed sawdust or fine river sand can be used for propagation[299 ]. Ectomycorrhizae assist the roots in absorption of nutrients; the most common species reported is *Scleroderma sinnamarense*. After about 6 weeks the rooted cuttings are transferred to polythene sleeves, bamboo pots or other containers where they remain for a further 2 - 3 months. The soil mixture for these containers consists of 25% sand and some compost, supplemented with forest soil[299 ]. Field planting, preferably next to a young tree or shrub, takes place at the beginning of the rainy season[299 ].

nwatta Management: Coppice New Crop Staple Crop: Balanced carbA plant of humid, lowland tropical rainforests, being found at elevations from sea level to 1,200 metres[299 ]. It grows best in areas where the annual rainfall is around 3,000 mm[299 ]. Succeeds in dappled shade in the woodland. Plants growing in full sun produce thinner leaves which are not so well liked by consumers[299 ]. The plant tolerates a range of habitats and environmental conditions[338 ]. Cultivated plants need to be given some support, such as a tree, to grow into[299 ]. The plant forms two distinct types of stem. Growing up from the base, the stems produce only small, scale-like leaves, and they grow rapidly towards the light. Higher up, side shoots are formed with fully-developed leaves[299 ]. The plant continues to grow during the dry season and new shoots may develop where the stem has been cut or where side shoots have been removed[299 ]. New shoots are also formed from rhizomes that spread along the forest floor[299 ]. Current methods of harvest from wild stands are very destructive[299 ]. Controlled harvesting, in which only side shoots or parts of stems are collected, allows new shoots to develop where a stem has been cut or where side shoots have been removed[299 ]. Preliminary observations indicate that 3 - 4 harvests per year are possible, still allowing for substantial regrowth. More frequent harvesting will result in thin leaves that are considered inferior[299 ]. The first harvest may take place 6 - 9 months after planting. The total lifespan of the plant is estimated at over 10 years[299 ]. Preliminary observation indicates that in cultivation during the first harvest year the fresh leaf yield may reach 20 t/ha. This may double in subsequent years[299 ]. Under wild conditions, the plant grows and forms underground tubers or roots that store plant food reserves. These can remain alive for many years when the vegetation and the plant growth above ground are cleared and the soil surface is laid bare[401 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required. Female plants are often have stronger stems, and are more vigorous and productive than male plants[299 , 303 ].

## 10.2.90 Theobroma glaucum

10 tlin 12 cyuc 4 kcaak 2 tcan 3 dwat 12 m hkuc hmim cyutli tcup hwicli jlutnyik hpa7tli flatprik hpa7tmwattl hjonli

drutta Theobroma glaucum is an evergreen Tree growing to 12 m (39ft) by 12 m (39ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects, Wind. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland). It prefers moist soil.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilThe seeds are a source of a cacao that is said to be of good quality[46 , 636 ]. The seeds of species in this genus are generally a rich source of oil (around 50%), starch (around 15%) and protein (around 15%)[636 ]. They also contain a volatile oil and the stimulating alkaloids caffeine and theobromine[636 ]. Fruit - raw. The pulp is sucked out of the fruit, or it is used to make a refreshing drink[636 ]. The pale orange pulp has a very sweet flavour[636 ].

tcanta OilOther Uses: An oil, known as cacao butter, which is solid at room temperature, is obtained from the seed. In addition to being used locally as a food and medicine, cacao butter is important in the cosmetics and pharmaceutical industries[636 ].

dwatta Although no specific reports of medicinal use have been seen for this plant, the seed is a source of cacao powder and butter. These products have the following medicinal uses:- Cacao powder and butter, which are obtained from the seed, are nutritive[238 ]. The butter is also applied externally as an emollient[238 ]. Cacao powder is taken internally in the treatment of angina and high blood pressure[238 ]. Cacao butter is an excellent emollient, being applied to the skin to soothe and soften it[238 ]. It is used traditionally to treat chapped skin and burns, and is also rubbed into bruises[238 ]. Research has shown that it can help to counter the bacteria responsible for boils and septicaemia[254 ].

nrakta Northern S. America - Brazil, Peru, Ecuador, Colombia. ksacta The lower tree storey of evergreen rainforests[636 ]. Found from the lower level of the great rivers up to elevations of 450 metres in forested hills[636 ].

propta Seed - it has a very short viability, requiring high humidity and optimum temperatures to remain viable. There is no dormancy, the seed often germinating whilst still inside the pod[636 ].

nwatta A plant of the hot, moist, lowland tropics[636 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 30°C, tolerating 16 - 40°C[636 ]. It requires a mean annual rainfall within the range 2,000 - 8,000mm, evenly distributed throughout the year[636 ]. Grows best in the dappled shade of other trees[420 ]. Prefers a relatively rich, circumneutral soil[636 ]. The plant is not drought tolerant, being unable to withstand even short dry seasons without the protection of dense shade and local humidity[636 ].

## 10.2.91 Pentadiplandra brazzeana

Joy perfume tree, j'oumbi

10 tlin 12 cyuc 4 kcaak 2 tcan 4 dwat 12 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwattl hjonli

drutta Pentadiplandra brazzeana is an evergreen Climber growing to 12 m (39ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcista The fruit is used as fish poison[299 ].

kcakta Edible Parts: Fruit RootEdible Uses: Fruit - raw or as a flavouring[299]. The red pulp is eaten as a snack, especially by children, or is sometimes used to sweeten maize porridge[299 ]. The red or mottled grey fruit is a globose berry 35 - 50mm in diameter, containing many seeds[299 ]. The protein brazzein, originally extracted from the fruit pulp, [299 ]. An extremely sweet crude protein, named pentadin, has been isolated from the fruits; in the 1990's the purified protein was isolated and called brazzein. Its temporal profile closely resembles that of sucrose, but develops somewhat more slowly and lasts longer. It is very thermo-stable and its sweetness profile does not diminish after incubation at 100°C for 4 hours. It is also stable over a wide pH range and is the most water-soluble protein sweetener discovered so far. Brazzein is reported to be between 500 and 2,000 times sweeter than sucrose depending on the method of measuring. It is being developed into a low-calorie sweetener for the food industry - however, as of early 2008, brazzein had not yet been granted GRAS (generally recognized as safe) status in the United States nor had it been granted permission for use in foods in the European Union[299 ]. The root

]. Other Uses The oil extracted from the seed can be used to make soap, candles and cosmetics[46 , 63 , 299 ]. The fibrous husk of the seed is sometimes used for polishing native earthenware pots[63 ].

dwatta Antirheumatic Galactogogue StomachicThe seeds are said to have valuable galactogogue properties and are in great demand amongst native mothers who consume them shortly after the birth of a child as a tonic in order to regain their strength and also to improve the flow of milk[63 , 299 ]. The oil obtained from the seed is used as medicine for stomach troubles and rheumatism[299 ].

nrakta Tropical Africa - Tanzania, northern Mozambique. ksacta Coastal rain and riverine forest from sea level to 1,100 metres[308 ].

propta Seed - it has a short viability and is best sown as soon as ripe. Repeated soaking and drying promotes germination[299 ]. The seed can be sown in situ or in containers[300 ]. The drip line of trees is a favoured site for planting in situ[299 ]. When grown in containers, sow 2 - 3 seeds in each container thinning to the strongest plant once they germinate. The seed usually germinates in 7 - 14 days[303 ]. Seedlings grow away quickly and are ready for planting out about 30 days after germinating[300 ]. Layering. Very easy[63 ]. Cuttings. Stemcuttings root in 2 - 3 weeks, and produce shoots 6 - 7 weeks after planting[299 ].

nwatta Management: Standard Other Systems: Multistrata Regional Crop Staple Crop: Protein-oilOysternut grows best in lowland, humid tropical areas at elevations up to 1,000 metres[300 ]. It can be cultivated at elevations up to 1,800 metres, though yields start to fall the more the elevation increases above 1,000 metres. It grows best in areas where annual daytime temperatures are within the range 23 - 28°C, but can tolerate 14 - 38°C[418 ]. It prefers a mean annual rainfall in the range 1,500 - 2,000mm, but tolerates 1,200 - 2,500mm[418 ]. Succeeds in full sun and in light shade[418 ]. Tolerant of a wide range of well-drained soils[298 , 300 ], though a humus-rich, fertile soil gives the best yields[300 ]. Prefers a pH in the range 5.5 - 6, tolerating 5 - 7[418 ]. Plants produce a deep taproot and, once established, are very drought resistant[63 , 298 , 300 ]. Plants are often trained to grow into trees[300 ]. They greatly dislike exposure to strong or cold winds[63 ]. This species has high weed potential[298 ]. Young plants grow very quickly, producing stems up to 7 metres long in 6 months and 15 metres long in 18 months[299 ]. Flowering normally commences 15 - 18 months after planting out the young plants[303 ]. Female and male plants cannot be distinguished until they flower[299 ]. The fruit takes 5 - 6 months to ripen from flowering[303 ]. When fruits ripen they split open gradually. To attain full flavour, the seeds should be allowed to ripen in the fruit and be collected 7 - 10 days after the fruit begins to split[299 ]. The plant produces up to 30 gourds in its third year and can continue production for another 20 years[299 , 303 ]. Under good conditions, two harvests per year are possible, and flowers and fruits can be present at the same time[299 ]. Annual seed yields of 3 - 7 tonnes per hectare have been achieved[63 , 299 ]. The fruits burst when ripe, scattering the seeds[63 ]. Care must be taken when growing these plants to choose sufficiently large trees for them to grow into, since their weight, especially when bearing a crop of fruits, can be enormous[63 ]. A dioecious plant, both male and female forms must be grown if seed is required[63 ]. Generally 12 - 15 males per hectare are sufficient to fertilise a plantation of females[63 ]. There are reports that female plants can produce fruit and seed in the absence of a male plant by a process called apomixis[299 ].

## 10.2.50 Attalea butyracea

Wine Palm

10 tlin 12 cyuc 4 kcaak 5 tcan 0 dwat 20 m hkuc htut cyutli kyuctcup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwattl hjonli

drutta Attalea butyracea is an evergreen Tree growing to 20 m (65ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil.

kcakta Edible Parts: Fruit Oil SapEdible Uses: Drink OilThe apical bud is eaten as a vegetable[ 297 ]. Harvesting this bud leads to the eventual death of the trunk because it is unable to produce side shoots[ K ]. Sap - fermented to yield an alcoholic beverage[ 297 ]. The sap is obtained by removing the apical bud (which is edible). The sap collects in the hollow where the bud was [297 ]. Production: Over 18-20 days the sap is collected and yields about 12 litres. Fruit - raw[ 416 ]. The pulp is fleshy and fibrous[ 416 ]. Good-tasting, with a thick - almost dry - consistency, and a mildly sweet and nutty flavour[ 510 ]. The fruit is 8cm or longer and 6cm wide[ 416 ], borne in very large racemes[ 510 ]. The seeds are eaten[ 301 ]. They are mashed and mixed with roasted cooking bananas. Rich in oil[ 416 ]. Edible oil is obtained from the seed[ 301 ].

tcanta Fibre Oil Pioneer String Thatching Weaving WoodOther uses rating: Very High (5/5). Other Uses: The leaves are used extensively for thatching roofs and for weaving into various articles[ 297 , 510 , 768 ]. If harvested at the correct time (with the leaves being neither too old nor too young), roofs made out of this material can last for four years or more[ 510 ]. The large fronds are split longitudinally, along the midrib. Then they are positioned side by side and tied to rafters made of poles. Finally, the leaflets are woven together. Generally, roofs made of palm leaves must be quite steep to encourage the runoff of rainwater and to avoid seepage and leaks[ 510 ]. A fibre obtained from the leaves can be used to make ropes and coarse fabrics[ 454 ]. An oil obtained from the seed is used in making soaps and toiletries[ 297 ]. Wood - used for construction[ 297 ]. Agroforestry Uses: This species spreads very rapidly in disturbed, human-made habitats[ 768 ]. This trait gives it excellent potential for use as a pioneer species when restoring native woodland and, given its wide range of uses, makes it especially useful when establishing woodland gardens[ K ].

nrakta S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela; Caribbean - Trinidad; Central America - Panama to Mexico. ksacta An understorey tree of woodlands and forests, most commonly on edges and in areas of disturbance; also in grassland, sometimes in large stands; frequently in flat areas alongside streams; from the coastal plains to elevations of 1,000 metres[ 297 , 510 ].

propta Seed - pre-soak for 24 hours in warm water and sow in containers[ 297 ]. The seed takes 2 - 3 months to germinate[ 297 ].

nwatta Plants succeed in moist tropical climates where temperatures never fall below 10c, the average annual rainfall is 1,500mm or more and the driest month has 25mm or more rain[ 297 ]. Grows best in a hot, sunny position[ 314 ]. Prefers a moist soil and probably does not mind poor drainage[ 314 ].

## 10.2.51 Dendrocalamus latiflorus

Sweet Bamboo, Sweet bamboo shoot, Taiwan giant bamboo 10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 20 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwattl hjonli

drutta Dendrocalamus latiflorus is an evergreen Bamboo growing to 20 m (65ft) by 10 m (32ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Shoots StemEdible Uses: Young stems - raw or cooked[ 301 ]. Unusually free of any unpleasant taste, even when raw[ 301 ]. Considered to be delicious[ 310 ]. They are also shredded and dried then used in Chinese-style snacks in Japan[ 301 ]. The stems can be 15 - 30cm in diameter[ 266 ]. Young shoots are harvested 7 - 25 days after emergence, when they are 35 - 60 cm tall. Harvesting may start in the 2nd year of growth of a clump[ 310 ]. Harvested shoots are steamed, cut lengthwise, cleaned and sterilized for 15 minutes in pure or salted boiling water before eating or canning[ 310 ]. When boiled in pure water a white compound (containing 90% tyrosine) usually precipitates, which can be removed by boiling for 1.5 hours in a 0.06 - 0.07% citric acid solution, followed by 12 hours of washing. For the production of fermented dry shoots, the middle

parts of shoots are boiled first and then left to ferment for 2 - 4 weeks, and subsequently sliced into parts of 4 - 5 cm x 2.8 mm[ 310 ]. In the Philippines harvested culms are either dried directly in the sun or shade or first kept in running water for several weeks before being air dried[ 310 ].

tcanta Basketry Biomass Fibre Fibre Packing Paper Pipes WoodOther Uses: The leaves are used to make hats, roofs for boats and as material for packing[ 310 ]. The culm is erect with a pendulous tip, growing 14 - 25 metres tall, 8 - 20 cm in diameter at the base, with a wall 5 - 30mm thick and internodes that are 20 - 70 cm long[ 310 ]. Mature culms are used as water pipes, to make small rafts for fishing in streams, to weave baskets, and are also used in house construction and for making paper pulp[ 310 ]. Harvesting of culms may start when clumps are 3 - 7 years old. To ensure sustainable yields, only over-mature and a few mature culms should be harvested at one time, and the number of harvested culms should not exceed 60% of the standing mature culms[310].

nrakta E. Asia - southern China, Myanmar, Vietnam. ksacta Not known

propta Seed - sown in containers and only just cover. Germination usually takes place readily - usually about 90% germination within 2 weeks[ 310 ]. Prick out into individual pots as soon as the plants are large enough to handle. Plant out into permanent positions when 20cm tall. Plants may remain in their low-growing juvenile state for several years - cutting the culms to the ground level can stimulate taller adult growth[ 200 ]. The seed rapidly loses its viability[ 310 ]. As seed is usually rather rare, vegetative propagation by cuttings is normal practice. The preferred cuttings are taken from 2-year-old culms, are 50 cm long (2-noded), and are planted horizontally 6 - 10 cm deep. The rooted cuttings are preferably transplanted in the rainy season when 2 years old[ 310 ].

nwatta Industrial Crop: Biomass Management: Managed Multistem Minor Global Crop Other Systems: Multistrata Other Systems: Strip intercropSucceeds in subtropical conditions, as well as in lowland to moderate elevations in the tropics[ 310 ]. It is found at elevations up to 1,000 metres in Taiwan, where it can tolerate temperatures as low as -4°C[ 310 ]. It prefers areas of high rainfall[ 310 ]. Grows best in moist, fertile soils[ 310 ]. Heavy clay, gravel alkaline or acidic soils are not suitable for the production of edible shoots[ 310 ]. Vegetatively propagated plants can develop within 3 years into clumps with 20 - 25 culms, on average 5 - 6 metres tall and 3 - 4cm in diameter[ 310 ]. Five year old plants can have a culm height in the region of 15 metres with a diameter of 7cm[ 310 ]. A 1 - 2 year-old culm can produce 5 - 10 shoots weighing 3 - 5 kg[ 310 ]. Average young shoot production per clump increases in the first 5 years after planting from 30 kg in the 2nd year to 60 kg in the 3rd year to 80 kg in the 4th year, to a maximum of about 100 kg in the 5th year[ 310 ]. Bamboos have an interesting method of growth. Each plant produces a number of new stems annually - these stems grow to their maximum height in their first year of growth, subsequent growth in the stem being limited to the production of new side branches and leaves. In the case of some mature tropical species the new stem could be as much as 30 metres tall, with daily increases in height of 30cm or more during their peak growth time. This makes them some of the fastest-growing species in the world[ K ]. The plant is used in breeding programmes to develop hybrid cultivars that grow fast and provide quality construction material with wide adaptability and high economic value, or to provide better tasting shoots[ 310 ]. Bamboos in general are usually monocarpic, living for many years before flowering, then flowering and seeding profusely for a period of 1 - 3 years before usually dying. Flowering is rare in Taiwan; though sporadic flowering and fruiting is a normal occurrence in the Philippines, Indonesia and China[ 310 ].

## 10.2.52 Borassus aethiopum

African Fan Palm, Palmyra Palm

10 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 20 m hkuc htut cythi hqtaccup hwicli hyishrasjltutyrik hpa7tli frusflatprikhwitlip hpa7tmwatli dyat hjonli

drutta Borassus aethiopum is an evergreen Tree growing to 20 m (65ft) by 5 m (16ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are

pollinated by Insects. The plant is not self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought.

pcista Plant has spines or sharp edges; use extreme caution when handling

kaakta Edible Parts: Fruit Leaves Oil Sap Seed ShootsEdible Uses: Drink Oil SweetenerEdible portion: Fruit, Cabbage, Sap, Seeds, Palm heart, Vegetable. Fruit - fresh or dried[ 335 ]. Slightly sweet, but with a mild turpentine-like flavour[ 398 ]. The fruits have a large, fibrous pulp, weighing around 500g each, that smells strongly of turpentine[ 418 ]. They are consumed raw or cooked, preferably with rice[ 418 ]. Eaten as a food supplement[ 325 ]. Rich in oil[ 301 ]. The ripe, fallen fruit are collected, peeled and the juicy pulp is squeezed in water to form a solution which is added to porridge during cooking in order to improve the flavour[ 398 ]. The fruit is 15cm in diameter and is produced in large clusters[ 335 ]. The immature seed contains a sweet juice which can be drunk like coconut water[ 301, 335 ]. As it matures, it solidifies becoming jelly-like and eventually solid. It can be eaten at all stages, the flavour gradually becoming more nut-like[ 301 ]. Young seedlings - eaten as a vegetable like asparagus[ 317 ]. Highly esteemed[ 301 ]. The mature seeds can be buried in pits and allowed to germinate, and the shoots are said to be a delicacy[ 418 ]. The tuberous portion of the first juvenile leaves are rich in starch - they make a highly prized vegetable[ 774 ]. Apical bud and young leaves - raw or cooked[ 301, 317 ]. Eaten in salads, or used as a vegetable[ 301 ]. Eating this bud leads to the eventual death of the plant since it is unable to produce side shoots[ K ]. The sap is extracted from the stem. Rich in sugars, it can be made into a refreshing beverage, fermented to make palm wine (toddy) or vinegar, or the sugars can be extracted[ 301, 317, 335 ]. The tip of the trunk is cut and excavated so that a bowl-shaped depression is made where sap accumulates. The sap is then collected and slightly fermented into a refreshing drink[ 398 ]. Destructive harvesting is sometimes employed, where the cut is renewed twice every day for 3 - 4 weeks until the tree is exhausted and dies[ 303 ]. Chemical composition: Protein (crude) = 2.8% (dry). Fat = 0.5% (dry). Ash (insoluble) = 3.5% (dry). Fibre (crude) = 16.8% (dry). Amino acids (g (16g N)-1): Aspartic acid = 9.3g. Threonine = 3.6g. Serine = 3.9g. Glutamic acid = 8.9g. Proline = 5.0g. Glycine = 5.0g. Alanine = 5.0g. Valine = 5.0g. Cysteine = 0.1g. Methionine = 1.2g. Isoleucine = 3.6g. Leucine = 6.1g. Tyrosine = 2.8g. Phenylalanine = 3.6g. Lysine = 3.9g. Histidine = 2.1g. Arginine = 2.4g. Minerals: Sulphur = 0.04% (dry). Potassium = 0.09% (dry). Magnesium = 0.10% (dry). Calcium = 0.08% (dry). Na = 0.01% (dry). Zinc = 4 mg/kg (dry). Iron = 488 mg/kg (dry). Manganese = 8 mg/kg (dry). Copper = 2 mg/kg (dry).

tcanta Basketry Broom Charcoal Fencing Fibre Filter Fire retardant Fuel Furniture Oil Potash String Thatching WoodOther uses rating: Medium (3/5). Agroforestry Uses: The tree is used to form an excellent firebreak, especially in the arid regions of West Africa, which are prone to wildfires[ 418 ]. Other Uses The leaves are used for various purposes including for shelter, thatch, making mats and baskets[ 314, 398, 774 ]. Young leaves, before unfolding, can be split into strips and woven into thin mats, baskets and other household objects[ 303 ]. Mature leaves are used for thatch[ 303 ]. A fibre obtained from the leaves is used for making nets[ 774 ]. The leaf petioles are used for making furniture, baskets, fences etc[ 774 ]. The fibre extracted from the base of the leaf stalk has valuable qualities of resistance to chemicals, termites and water[ 303 ]. The leafstalk endings can be soaked in water to provide fibres that are used as sponges or filters[ 303 ]. The leaf midribs are used to make brooms, fish traps and nets[ 303 ]. An oil is extracted from the fruit[ 418 ]. Ashes from the male flowers make a good potash[ 774 ]. The dark brown, coarsely fibrous wood is a highly prized timber locally. It is very solid, hard, heavy, very resistant to termites and fungi. It is difficult to saw, plane or sand; splits when nailed. Only the outer part of the stem, between the base and the first swelling, is suitable for use. This layer, which can be 7 - 10cm thick on male trees, but only 4 - 5cm on female trees, is used in carpentry, construction, for telegraph poles, piers, and also for household articles[ 325, 774

ckakta Edible Parts: Fruit SapEdible Uses: Drink Gum SweetenerFruit - raw[ 317 ]. Small and round, looking somewhat like a guava, with an edible sweet, fleshy pulp[ 377, 420 ]. The flavour is like a mangaba (*Hancornia speciosa*) with a hint of sapolilla (*Manilkara zapota*)[ 418 ]. The brown, globose fruit is about 4cm in diameter[ 420 ]. The latex obtained from the tree has a sweet flavour[ 418 ]. It is used as a chewing gum and also to flavour drinks[ 377 ].

tcanta Adhesive Furniture Gum Latex Straw Varnish Waterproofing WoodOther Uses: A latex is obtained from tapping the tree[ 317, 377 ]. Used traditionally for caulking boats[ 317 ]. It is used for a variety of industrial purposes, including varnishes, for ceramics, glues etc[ 317, 377 ]. The wood is fine-textured, straight-grained, moderately heavy, with moderate mechanical properties and of very low durability. It is used in cabinet-making, carpentry and general construction[ 420 ].

dwatta Anthelmintic Antidiarrhoeal Antiseptic SkinThe latex obtained from the tree is anthelmintic and antiseptic[ 418 ]. It is eaten to treat diarrhoea, worms and parasites[ 377, 418, 739 ]. The latex is applied externally to treat skin irritations[ 418 ].

nrakta S. America - lowland Amazonia in Brazil, Colombia and Venezuela. ksacta Dense forest of virgin bushes, on flooded or dry land[ 418 ]. Often grows in dry non-flood zones, in or near fields and grasslands[ 377 ].

propta Seed - best sown as soon as it is ripe in a lightly shaded position in a nursery seedbed[ 420 ]. A high germination rate can be expected, with the seeds sprouting within 20 - 40 days[ 420 ]. Transplant the seedlings into individual containers when 4 - 6cm tall, and plant out 5 - 6 months later[ 420 ].

nwatta Industrial Crop: Hydrocarbon Management: Hay Regional CropA tree of the moist, tropical lowlands where it is found at elevations up to 500 metres[ 418 ]. It grows best in areas where the temperature ranges from 20 - 30°C, but is able to tolerate a range from 15 - 35°C[ 418 ]. It prefers a mean annual rainfall of 2,000 - 4,000mm, but tolerates from 1,500 - 5,000mm, and is found in areas with a distinct dry season as well as areas of all year round rainfall[ 418 ]. Succeeds in full sun or dappled shade[ 420 ]. Grows wild on white sand soils[ 418 ]. Prefers a pH in the range 4.5 - 6, tolerating from 4 - 6.5[ 418 ]. Established plants are drought tolerant[ 420 ]. Trees have a moderate rate of growth[ 420 ].

## 10.2.88 Uapaca kirkiana

Wild Loquat

10 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 12 m hkuc hmimhtut cythi tucp hwicli hyishrasjltut hpa7tli frusflatprik hpa7tmwatli dyat hjonli

drutta Uapaca kirkiana is an evergreen Tree growing to 12 m (39ft) by 12 m (39ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy) and medium (loamy) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ckakta Edible Parts: FruitEdible Uses: DrinkFruit - raw or cooked[398 ]. Fleshy and sweet, it has a delicious flavour[398 ]. The fruit is commonly eaten fresh and is highly regarded[301, 303 ]. It can also be used for brewing a very pleasant wine or for making cakes that are fried and eaten[301 ]. The juice of the fruit is mixed with sorghum meal to form a thin, orange-flavoured porridge[301 ]. The fruit pulp is juicy, honey-like, very tasty and somewhat reminiscent of pears[301 ]. Dried fruits have a toffee-like flavour[301 ]. The fruit is about 4cm x 4cm.

tcanta Charcoal Containers Dye Fencing Fuel Furniture Repellent Soil conditioner Soil stabilization WoodAgroforestry Uses: The tree is planted for erosion control, shade, shelter, living fence and as an ornamental. It forms a mutual association with mycorrhizae and act as a soil improver and is an important agro-forestry tree[418 ]. Other Uses A blue dye is made from the roots[303 ]. The leaves are used as a cockroach repellent in homes[303, 418 ]. Wood is light with white sapwood and reddish-brown, figured heartwood. It is hard and durable, has a straight grain, saws clean and can be planed to a smooth finish. It glues well, holds nails firmly and takes a clear varnish finish. Suitable for general carpentry,

house building and domestic utensils, furniture and joinery, carvings and boxes. It is termite resistant[303 ]. The wood is used as a fuel and to make charcoal[418 ]. Charcoal made from the wood is highly regarded, and many trees are cut specifically for this purpose[303 ]. It is also a good source of firewood[303 ].

dwatta Antidiarrhoeal DysenteryAn infusion made from the roots is used to treat indigestion and dysentery[418 ].

nrakta Tropical Africa - Angola, Burundi, Tanzania and the Congo. ksacta Lowland forest, secondary miombo woodland such as clearing and gaps, and open woodland. Grows in well-drained escarpments, with infertile sand or gravel soils of acidic reaction[303 ].

propta Seed - needs to be sown fresh since it has a limited viability of about 3 weeks[303 ]. Germination is usually good, especially if the seed is scarified first[303 ]. Young seedlings need to be given some shade[303 ]. Division of suckers[303 ]. Cuttings

nwatta The plant is are found wild at an altitude of 500 - 2,000 metres in the tropics[303 ]. It grows best where the mean annual temperature is within the range of 18 - 24°C, though it tolerates 12 - 32°C. It prefers a mean annual rainfall of 700 - 1,500mm, but can tolerate 500 - 2,000mm[303, 418 ]. Plants are very intolerant of frost[323 ]. Prefers a sunny position, tolerating light shade[418 ]. Tolerant of poor, shallow, gravel and sandy loam soils[303 ]. Normally found in acidic soils with a pH 4 - 6.5[303, 418 ]. Dioecious - both male and female forms need to be grown if seed is required[303 ].

## 10.2.89 Gnetum africanum

Eru, African Jointfir

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 12 m hkuc hmimhtut cythi tucp hwicli hrasjltutyrik hpa7tli flatprikhwit hpa7tmwatli dyat hjonli

drutta Gnetum africanum is an evergreen Climber growing to 12 m (39ft) by 0.4 m (1ft 4in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ckakta Edible Parts: Fruit Leaves Root Sap SeedEdible Uses: Leaves - raw or cooked[332 ]. Wherever it occurs in Africa, the leaf is valued as a tasty vegetable, usually eaten finely shredded for addition to soup or made up into condiments, or even taken raw[332 ]. To soften this rather tough vegetable, people often mix it with waterleaf (*Talinum triangulare*)[299 ]. Shredded leaves can be dried and preserved for later use[299 ]. The leaves have a very high nutritional value and constitute an important source of protein, essential amino acids and mineral elements[401 ]. Leafy stems remain fresh for at least a week after harvesting[299 ]. The dry matter content of the fresh leaves is much higher than for other dark or medium green leaf vegetables. This gives a feeling of firmness during preparation, hence certain consumers consider the leaves as a substitute for meat[299 ]. The leaves of this species are somewhat thinner and paler than the dark green leaves of the related *Gnetum buchholzianum*[299 ]. Fruit pulp[332 ]. Seed[332 ]. The mature seed is 15 - 15mm long, enclosed in a somewhat drupaceous orange-tinted envelope. The tubers are sometimes eaten - especially at times of scarcity[401 ]. Climbing members of this genus growing in Asia yield a potable sap[332 ]. This species should also be looked at in this respect[332 ].

tcanta Fibre StringOther Uses: The stem is supple and strong. It is used as a rope[299 ], made into traps and nooses for catching game, and into straps for portage[ 332 ].

dwatta Antidermatosis Antidote Antihemorrhoidal Cathartic HypotensiveThe leaf is used in the treatment of enlarged spleen, sore throat, piles, high blood pressure and as a cathartic[299, 332 ]. It is eaten as a treatment against nausea and is considered antidotal against arrow-poison based on Parquetina nigrescens[299, 332 ]. The leaves are chewed to mitigate the effects of drunkenness and they are taken as an enema against constipation[299 ]. Applied externally, the chopped-up leaf serves as a dressing on warts and boils to hasten maturation[332, 401 ]. The stem is cut

ones[299 ].

### 10.2.84 Macadamia hildebrandii

Celebes nut

10 tin 12 cyuc 4 kcaak 3 tcan 0 dwat 14 m hkuc

htut cyutli tucphja7n hwicli hrasjutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Macadamia hildebrandii is an evergreen Tree growing to 14 m (46ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist or wet soil.

kcaakta Edible Parts: Oil SeedEdible Uses: Oil-Macadamias are eaten fresh, roasted, and in baked goods. They are 7-8% protein. Carbon Farming Solutions - Staple Crop: oil (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1].

tcanta Cosmetic Fuel Oil Plant breeding TanninPossibly similar uses to other species in this genus which include: agroforestry Uses: The decomposed husk is commonly used in potting soil[303 ]. Other Uses: Macadamia shells may be used as fuel, generating sufficient energy to dry wet, in-shell nuts[303 ]. The oil from the seed is used in cosmetics[307 ]. The green seed hulls contain approximately 14% of tannins[303 ].

nrakta Origin: Sulawesi an island in Indonesia. ksacta In or near rainforests[167].

propta Seed - best sown as soon as it is ripe in a nursery bed[188 ]. The dehusked seed germinates quickly at 25°C[200 ]. Cultivars may be grafted.

nwatta Management: Standard New Perennial Crop Staple Crop: OilClimate: tropical. Humidity: humid. A rain forest species for truly wet lowlands. Cultivation: new crop. Management: standard (Describes the non-destructive management systems that are used in cultivation) [1-1].

### 10.2.85 Barringtonia edulis

Vutu kana, Cut nut

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 12 m hkuc

hmimhtut cyutli tucp hwicli hrasjutnyik hpa7tli flatprikliwisom hpa7tmwatli hjonli

drutta Barringtonia edulis is an evergreen Tree growing to 12 m (39ft) by 8 m (26ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Moths, Bats. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant can tolerate maritime exposure.

kcaakta Edible Parts: Fruit SeedEdible Uses: TeaSeed - raw or cooked[324 , 490 , 658 ]. A flavour like raw peanuts[324 ]. The seed kernel inside the hard shell can be 3cm by 1cm in size[658 ]. Fruit - raw or cooked[324 ]. In- sipid[324 ]. Fruit of the Barringtonia edulis is a rare fruit. Suitable for snacks for children, a good source of energy.

tcanta Fuel WoodThe wood is light in weight. It is used for canoe paddles, casing, light construction[339 ]. The wood is used as a quick-burning firewood[339 ]. Attracts butterflies and hummingbirds

dwatta Abortifacient StomachicThe bark is used in the treatment of stomach ailments and gonorrhoea[339 ]. A strong tea made from the bark is claimed to induce abortion and definitive sterility[389 ].

nrakta Southwestern Pacific - Fiji, Vanuatu. ksacta Dense and open forests, woodland and grassland, at elevations up to 400 metres[490 , 658 ]. Humid sites.

propta Seed - best sown as soon as it is ripe.

nwatta Management: Standard Regional Crop Staple Crop: Balanced carbSucceeds in full sun and in partial shade.

### 10.2.86 Buchanania lanzan

Almondette, Charoli Nut

10 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 12 m hkuc

htut cyutli kyuctcup hwicli hyishrasjutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Buchanania lanzan is an evergreen Tree growing to 12 m (39ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil.

kcaakta Edible Parts: Fruit Oil SeedEdible Uses: Gum OilSeed - raw or cooked[46 , 301 , 310 ]. An excellent flavour, somewhat reminiscent of almonds or pistachios[ 63 , 301 ]. Eaten as a dessert seed and also used in sweetsmeats[ 46 , 63 ]. In some parts of India the dried fruit and seed are baked together to make a sort of bread[ 63 ]. They are ground into powders for thickening savory sauces and flavoring batters, and stewed into rich, meaty kormas. The seed contains about 50% oil[ 63 ]. The seed is fairly small, about 7mm long[ 63 ]. After the hard shell is cracked, the stubby seed within is as soft as a pine nut. The fruit hangs on the tree for quite a long while after it has ripened[ 372 ]. Fruit - a pleasant, sweetish, subacid flavour[ 301 , 335 ]. Eaten fresh, or dried for later use[ 335 ]. The fruit is 15mm long[ 335 ]. An oil is obtained from the seed[ 301 , 335 ]. Light yellow with a sweet flavour and pleasant aroma, it can be used as a substitute for almond or olive oil[ 63 , 301 ]. Carbon Farming - Staple Crop: protein-oil.

tcanta Charcoal Fuel Gum Oil Soil stabilization Tannin WoodOther uses rating: Medium (3/5). Agroforestry Uses: A good species for afforesting bare hill slopes[ 372 ]. Other Uses The bark is used in tanning[ 146 , 310 ]. The tree yields a gum copiously in large, irregular pieces[ 146 ]. It is only partially soluble in water (about 10% insoluble), but it gives a good mucilage and can be useful in cheap manufacturing processes[ 146 ]. The gum has adhesive properties[ 46 ]. An oil is obtained from the seed[ 46 ]. The greyish-brown wood has a small, dark-coloured heartwood[ 146 ]. It is moderately hard[ 146 ]. Of poor quality, it is only used as firewood and for making charcoal[ 146 , 310 ]

dwatta Acrid Antiasthmatic Antidiarrhoeal Antitussive Astringent Depurative Leprosy SkinThe gum from the tree is used against leprosy in traditional medicine[ 310 ]. Charoli seeds are used in the Ayurveda and Unani systems of medicine. The roots are acrid, astringent, cooling, depurative, and constipating. They are useful in the treatment of diarrhoea[ 372 ]. The leaves are used in the treatment of skin diseases[ 372 ]. The fruits are used in treating coughs and asthma[ 372 ].

nrakta E. Asia - southern China, India, Myanmar, Thailand, Laos, Vietnam, Malaysia. ksacta In open and dry forests on poor soils[ 310 ]. Lowland forests in southern China at elevations of 100 - 900 metres[ 310 ].

propta Seed

nwatta Management: Standard Regional Crop Staple Crop: Protein-oilA plant of mainly drier areas in the tropics and subtropics, where it is found at elevations up to 1,200 metres. It grows best in areas where annual daytime temperatures are within the range 32 - 42°C, but can tolerate 5 - 48°C[ 418 ]. It prefers a mean annual rainfall in the range 1,000 - 1,500mm, but tolerates 750 - 2,200mm[ 418 ]. Grows well in full sun but can also tolerate considerable shade, especially when small[ 418 ]. Succeeds in most soils, including dry soils[ 146 , 418 ]. Prefers a pH in the range 5.5 - 6, tolerating 4.9 - 7.2[ 418 ]. Carbon Farming - Cultivation: regional crop only. Management: standard.

### 10.2.87 Couma utilis

Sorva, Milk Tree

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 12 m hkuc

hmimhtut cyutli tucp hwicli hrasjltut hpa7tli frusflatprikliwis hpa7tmwatli hjonli

drutta Couma utilis is an evergreen Tree growing to 12 m (39ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

]. The wood is used for fuel and to make charcoal[ 303 , 418 ].

dwatta Anthelmintic Antiasthmatic Aphrodisiac Mouth-washThe roots serve for the treatment of stomach parasites, bronchitis, sore throats and asthma, as well as being used for a mouthwash[ 325 ]. The leaves are said to be an aphrodisiac[ 325 ]. The sap is reported to have many uses[ 325 ].

nrakta Tropical Africa - semi-arid and sub-humid zones of Senegal to Somalia, south to S. Africa. ksacta Riverine flats and coastal plains; open secondary forest; dense forest borders; savannah in drier areas where it is restricted to grassland with high ground water table, or along water courses, often forming dense stands in temporary flooded areas[ 325 ].

propta Seed - it has a short viability and should be sown as soon as it is removed from the fruit pulp[ 325 ]. The seed does not require pre-treatment and germinated in about 4 weeks. The plant produces a very long taproot, which can be 1 metre long when top growth is only 1cm tall, and so it is best sown in situ[325 ].

nwatta Management: Standard Other Systems: Park-land Regional Crop Staple Crop: Oil Staple Crop: SugarA plant of hot, tropical climates with low to medium rainfall, usually at elevations below 400 metres, but up to 1,200 metres in east Africa[ 335 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 35c, but can tolerate 15 - 45c[ 418 ]. It prefers a mean annual rainfall in the range 500 - 1,000mm, but tolerates 400 - 1,200mm[ 418 ]. Requires a well drained soil and a position in full sun[ 314 ]. It is usually found in sandy, well-drained soils, but prefers alluvial soils near watercourses[ 418 ]. Plants are able to extract nutrients, and thus grow, on very nutrient-poor soils[ 325 ]. Prefers a pH in the range 5.5 - 7, tolerating 5 - 7.5[ 418 ]. Established plants are drought tolerant[ 314 ]. A slow-growing but long lived tree to over 100 years old[ 325 ]. Three phases of growth are recognized. The first phase, taking around 6 - 8 years, involves leaf development, in which about 20 leaves grow in a wide crown around 3 metres by 3 metres. Very little upward growth takes place at this time. The second phase involves rapid growth of the trunk above the ground and takes place around the ages of 8 - 20 years. The bark of the tree is still rough at this stage and have many leaf stalks. The third phase, from about 20 years onwards, involves flowering and shedding of leafstalks. The trunk becomes smooth and swellings appear on it[ 303 ]. The plant usually flowers and produces fruit all year round[ 303 ]. The flowering stems are tapped for their sap, a process that starts when the tree is about 30 years old and can continue for another 30 years if managed carefully. Yields of 2 litres of sap per day can be achieved[ 774 ]. Plants are very tolerant of forest fires[ 418 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required. A female palm can produce 20-50 fruits per flower stalk. Green to orange round fruit 15 cm across. Each fruit contain 3 hard coated seeds weighing 100g each. The individual fruit is about 1 kg.

### 10.2.53 Manilkara discolor

Red milkwood, Silvery milkwood

10 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 20 m hkuc

hmimhtut cyutli kyuctcup hwicli hrasjutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Manilkara discolor is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil.

kcaakta Edible Parts: FruitEdible Uses: Fruit - raw[398 ]. The juicy, fleshy pulp is very tasty[398 ]. Eaten as a snack, especially by children and travellers, the seeds are discarded[398 ]. The yellow to red, fleshy, oval berries are up to 13mm in diameter, enclosing an oval flattened pale-coloured seed[398 ].

tcanta Fuel Latex WoodAgroforestry Uses: The tree is good for shade[398 ]. Other Uses The plant exudes a white latex[398 ]. The wood is hard[398 ]. It is used for poles, tool

handles, carvings and spoons[398 ]. The wood is used for fuel[398 ].

nrakta East tropical Africa - Kenya, Tanzania, Malawi, Mozambique, Zimbabwe, S. Africa. ksacta Lowland and up-land dry evergreen forest and well-drained sites in upland rainforest, at elevations from sea level to 2,100 metres[398 ].

propta Seed -nwatta Prefers a well-drained soil[308 ].

### 10.2.54 Irvingia wombolu

Bitter bush-mango

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 20 m hkuc

hmimhtut cyutli tucp hwicli hrasjutnyik hpa7tli frusflatprikliwis hpa7tmwatli hjonli

drutta Irvingia wombolu is a TREE growing to 20 m (65ft) by 20 m (65ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcaakta Edible Parts: Fruit Oil SeedEdible Uses: OilThe seeds are used for making a mucilaginous sauce in cooking[405 ]. The seeds are 35 - 50 mm long, 17 - 26 mm wide, 8 - 10 mm thick; with an endosperm that is almost non-existent[405 ]. The kernels from the fruit are an important ingredient in cooking and are generally preferred over those of other Irvingia spp. They are processed by grinding and crushing, and are then used to thicken soups and stews. The kernels are also made into a cake called 'dika bread' or 'odika bread' for year-round preservation and easy use[299 ]. The preparation of 'dika bread' consists of drying, roasting and grinding the kernels. The paste obtained is put in a container or 'cake tin' and left to cool for a few hours. Once solid, the cake is removed from the container and is ready for use. If well dried, it can be stored for more than a year. Sometimes women place a tin below the grid on which the dika cake is stored, to collect the oil that drips from it[299 ]. An edible oil is extracted from the seed and used in cooking. As it is solid at ambient temperatures it has been used as a substitute for cocoa butter[299 ]. The oil is extracted by boiling the ground kernels and then scooping off the oil from the top of the water[299 ]. The pulp of the fruit is very bitter and slimy, but it is occasionally added to soups as thickener[299 ]. The yellow pulp is soft, juicy and very bitter, with fairly numerous fibres[299 ]. The bright yellow then black fruit is an ellipsoid drupe, slightly laterally compressed, 45 - 80mm long and 45 - 50mm wide[299 ]. The nutritive value of the kernels per 100g edible portion is: water 4 g, energy 2918 kJ (697 kcal), protein 8.5 g, fat 67 g, carbohydrate 15 g, Ca 120 mg, Fe 3.4 mg, thiamin 0.22 mg, riboflavin 0.08 mg, niacin 0.5 mg (Platt, 1962). Drawability (sliminess) and viscosity of soups imparted by the kernels varies between kernels from different trees. The kernels of Irvingia wombolu are considered better than those of other Irvingia spp. Fat content of kernels also varies between trees and is about 37.5 - 75 g/100 g; the approximate fatty acid composition is: lauric acid 20 - 59%, myristic acid 33 - 70%, palmitic acid 2%, stearic acid 1% and oleic acid 1 - 11%. The residue obtained after separation from the fat is suitable for processing in the food industry[299 ].

tcanta Fuel Oil Soap making WoodAgroforestry Uses: The tree is commonly preserved when clearing land for agriculture so that, as well as being harvested for its seeds, it can provide shade for various crops, especially cocoa and coffee but also for annual crops[299 ]. The tree has a high agroforestry potential. In its native range it is found cultivated with other crops in farm systems[303 ]. Other Uses: An oil is extracted from the seed. Solid at ambient temperatures, it has been used for soap-making[299 ]. The heartwood is pale greenish brown or orange-yellow fading to greyish brown; the sapwood is lighter, but not always clearly differentiated. The grain is straight or interlocked, texture fine to medium. The wood is fairly heavy, it is durable and fairly resistant to termites, but susceptible to powder-post beetles and marine borers. The timber is moderately difficult to saw or plane and tools should be kept sharp; it diffuses to a smooth finish and glues well, though nailing is difficult[299 ]. The wood, called

'andok' in Cameroon, is used locally for heavy construction work and for making ships' decks, paving blocks and plank-ing. Young trees are used for making poles and stakes, while branches are made into walking sticks or thatched roof sup-ports[299 ]. Dead branches are used as firewood[299 ].

dwatta Antidiarrhoeal Antidote Febrifuge Odontalgic SkinThe medicinal uses of the various Irvingia species are many, but can hardly be assigned to an individual species[299 ]. The bark is used in the treatment of diar-rhoea[299 ]. Preparations mainly from the bark are used to treat hernia and yellow fever, and also as an antidote for poi-soning[299 ]. Preparations from the bark are rubbed on to the body in order to relieve pains; they are applied to sores and wounds and are also used against toothache[299 ]. A leaf extract is used as a febrifuge[299 ]. The kernels are used to treat diabetes[299 ].

nrakta Tropical Africa - Senegal to southern Sudan, south to Angola, DR Congo and Uganda. ksacta Evergreen lowland forest, mostly seasonally flooded, and on damp soil, beside streams; valley forest; also forest on dry land; in small patches of forest and gallery forest; at elevations around 900 - 1,170 metres[328 ].

propta Seed - it has a very short viability of around 1 month and so should be sown as soon as it is ripe[299 ].

nwatta A plant of the moist tropics, growing in areas where the mean annual rainfall exceeds 1,500mm[299 ]. The tree starts flowering when 6 - 10 years old. It does not have a clearly demarcated flowering season, but flowering peaks at the end of the rainy season or beginning of the dry sea-son, while fruiting peaks at the end of the dry season[299 ]. The fruits are mostly gathered from the ground around the tree. The next step consists of extracting the kernel from the seed, which is split in halves with a cutlass, after which the kernel is removed with the help of a knife. The kernels are then dried in the sun or on bamboo drying racks over the fire-place in the kitchen[299 ]. Good yields of kernels have been estimated at 100 kilos per tree per year[299 ]. The tree is intolerant of fire[299 ].

## 10.2.55 Poraqueiba sericea

Umari

10 tin 12 cyuc 4 kca2 2 tcan 0 dwat 20 m hkuc hmimhtut cyutli hgatkuyctup hwicli hyishras]lutnyikfrp hpa7tli flatprik]wishsom hpa7tmwatli hjonli

drutta Poraqueiba sericea is an evergreen Tree growing to 20 m (65ft) by 18 m (59ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilFruit - raw or cooked[416 ]. The fleshy pulp has a peculiar taste and aroma[416 ]. It is often served with manioc flour[3 416, and is made into a 'butter' for spreading on bread[355 ]. The fruit contains 12% oil and is rich in starch[317 ]. The yellowish fruit is around 7cm long and 5cm wide[416 ]. An edible oil is obtained from the fruit pulp and the seed[420 ].

tcanta Charcoal Fuel Oil WoodAgroforestry Uses: The tree is often interplanted with crops such as Brazil nut, cashew, uvilla, and Inga species that grow well in poor, clay soils[355 ]. Other Uses Children cut the endosperm of the fruit into thin, opaque slices to make toy glasses[355 ]. The wood is medium to thick-textured, straight-grained, moder-ately heavy, hard, with moderate mechanical properties and not durable[420 ]. It is suitable for carpentry and internal use in construction[317 , 355 ]. It is popular for making char-coal[355 ].

nrakta S. America - northern Brazil. ksacta Rainforest, on land that does not become inundated[416 ]. Usually found in deep, clayey, well-drained soils[420 ].

propta Seed - best sown as soon as it is ripe in a partially shaded position in individual containers. A medium germina-tion rate can be expected, with the seed sprouting within 28 - 42 days[420 ]. Plants should be ready to plant out 7 - 8 months later[420 ].

nwatta Succeeds in a sunny position and in dappled shade[420 ]. Trees can grow well in very poor, heavy clay

soils[355 ]. Intolerant of flooding[355 ]. Established plants are drought tolerant[420 ].

## 10.2.56 Helicostylis tomentosa

Letterhout, Letter Wood

10 tin 12 cyuc 4 kca2 3 tcan 2 dwat 20 m hkuc htut cyutli tcup hwicli hras]lutnyik hpa7tli flatprik]wis hpa7tmwatli hjonli

drutta Helicostylis tomentosa is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suit-able for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neu-tral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcista The latex of this tree is considered to be toxic when ingested[697 ].

kcakta Edible Parts: FruitEdible Uses: Fruit - raw. A deli-cious flavour[625 ]. The yellow, more or less globose fruit can be around 3cm in diameter[625 ].

tcanta Furniture Latex WoodOther Uses: The tree con-tains a yellow latex[625 ]. The heartwood is dark brown, somewhat streaked or variegated with black and yellow; it is sharply demarcated from the wide band of golden, lus-trous sapwood. Lustre is medium in the heartwood; texture medium; grain straight to roey; without distinctive odour or taste. The wood is moderately heavy, with very good me-chanical properties, durable and resistant to wood-eating in-sects. It is rated fair to good in all machining operations but does cause excessive dulling of cutting edges; takes a high natural polish. Easy to work, it is used in general con-struction for purposes such as scantlings, beams, door and window frames, floors etc; also for lathe work and making furniture[316 , 625 ].

dwatta Febrifuge Hallucinogenic StomachicThe red, milky sap from the bark is drunk as an hallucinogen in or-der to contact the spirits[348 ]. The rasped bark, mixed with alcohol, is used as a remedy for stomach cramps and pain accompanying a high fever[348 ]. Extracts prepared from the inner bark have been pharmacologically evaluated and are reported to elicit central nervous system depressant ef-fects; and certain of the effects are described as being sim-ilar to those expected with Cannabis sativa. Because of the close taxonomic relationship of this species to Cannabis, one might expect similar types of chemical constituents in both genera. Whether or not the effects are due to the presence of cannabinoids remains to be determined[630 ].

nrakta S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, the Guyanas; C. America - Panama. ks-acta A canopy tree in rainforests at elevations from sea level to 1,600 metres[338 , 625 ].

propta Seed - best sown as soon as it is ripe in a partially shaded position in a nursery seedbed. A low germination rate can generally be expected, with the seed sprouting within 40 - 60 days[625 ].

nwatta Young plants require the dappled shade of the woodland, but become more tolerant of light as they grow larger, eventually accepting full sun[625 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required[625 ].

## 10.2.57 Quararibea cordata

South American Sapote, Chupa Chupa, Matisia

10 tin 12 cyuc 4 kca2 0 tcan 3 dwat 20 m hkuc htut cyutli tcup hwicli ]lutnyik hpa7tli flatprik]wishsom hpa7tmwatli hjonli

drutta Quararibea cordata is a deciduous Tree growing to 20 m (65ft) by 16 m (52ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Insects, humming birds. Suit-able for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in saline soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: DrinkFruit - raw[301 ]. The fibrous yellow-orange pulp of the fruit is sweet and is eaten raw[301 ]. The flavour is reminiscent

long taproots at an early stage, often before any apprecia-ble elongation of the shoot takes place. The growth of the seedling is decidedly slow [ 652 ]. Budding or grafting on seedling rootstocks is the way to propagate seedless types[ 303 ].

nwatta A plant of the moist tropics and subtropics. It can be grown at elevations up to 2,000 metres, but does best below 600 metres[ 303 ]. It grows best in areas where an-nual daytime temperatures are within the range 20 - 27°c, but can tolerate 12 - 34°c[ 418 ]. Mature plants can be killed by temperatures of -2°c or lower, whilst young growth will be severely damaged at 0°c[ 418 ]. It prefers a mean annual rainfall in the range 1,200 - 1,600mm, but tolerates 1,000 - 2,400mm[ 418 ]. Prefers a sunny position, tolerating some shade[ 418 ]. The tree adapts to different soil types and sur-ives flooding, but it is rather sensitive to drought, requir-ing abundant irrigation in dry areas[ 303 ]. Plants are well adapted to calcareous soils[ 335 ]. A pH in the range 6 - 7, tolerating 5.5 - 7.5[ 418 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required[ 899 ]. Although dioecious, solitary planted female plants have been observed to produce seedless fruits in the absence of a male, and on rare occasions have produced fruit with fertile seeds[ 899 ]. Seedling trees commence bearing fruit when 5 - 6 years old, whilst grafted specimens can fruit when 2 - 3 years old[ 335 ]. Flowers are borne on the new shoots; hence the crop cycle is linked to flushing[ 303 ]. Some trees bear flowers that are self-incompatible, so it is not ad-visable to plant a solitary tree[ 303 ]. Fruit on cultivated trees is often seedless or nearly so[ 303 ]. Black persimmon is said to have 4 times the vitamin C content of sweet, and to be a good source of calcium and phosphorus. Response to the taste varies greatly between people, and the dark chocolate colour of the pulp is considered to be unattractive. Never-theless, because the tree is robust, well-adapted to the trop-ics, and heavy-bearing, a close re-examination of its poten-tial is merited[ 303 ]. There are some named varieties[ 301 ]. We have seen no individual confirmation for this species, but in general Diospyros species are dioecious and require both male and female forms to be grown if fruit and seed are required[ 899 ]. Flowering time: Mid Spring.

## 10.2.83 Telfairia occidentalis

Fluted Gourd

10 tin 12 cyuc 4 kca2 2 tcan 2 dwat 15 m hkuc pcmhmmhtut cyutli hgattcup hwicli hras]lutnyik hpa7tli frusfratprik hpa7tmwatli dyat hjonli

drutta Telfairia occidentalis is an evergreen Climber growing to 15 m (49ft) by 1 m (3ft 3in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Insects. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought.

kcakta Edible Parts: Fruit Leaves Oil Seed ShootsEdible Uses: Condiment OilSeed - cooked[46 ]. A pleasant almond-like flavour[301 ]. It can be boiled and eaten as a nut, or ground into a flour for use in soups[300 ]. Immature seeds are cooked or roasted; they can also be fermented for sev-eral days and eaten as a slurry[299 ]. Mature seeds are not consumed directly because they have a high content of antin-utrients[299 ]. The raw flour shows better water and fat ab-sorption properties than the oil, hence its useful application in baking products[299 ]. The seed contains up to 30% pro-tein and a high content of a non-drying oil[300 ]. The large seeds are up to 5cm in diameter and are contained in a fruit that can weight up to 50kg[298 ]. The seeds have a very high oil content and are used to make a cooking oil[298 ]. The main constituents of the oil are oleic acid (37%), stearic and palmitic acid (both 21%), linoleic acid (15%). Variation between samples, however, is large[299 ]. Leaves and young shoots - cooked as a potherb[46 ]. The leaves are used alone or together with okra (Abelmoschus caillei and Abelmoschus esculentus), dika nut (Irvingia gabonensis), or egusi seeds (Citruslus lanatus and other species). They can also be mixed with eru (Gnetum africanum) and Pterocarpus soyauxiil[299 ]. The young shoots, up to 50cm long, are used in stews and as

a side dish[298 ]. The fruit pulp, including the young seeds, is occasionally made into marmalade[299 ].

tcanta Fibre Oil Paint VarnishAgroforestry Uses: Fluted pumpkin is often grown as a crop in homesteads, where it is intercropped with other vegetables and food crops such as cassava, yams and maize, or is planted against fences[299 ]. Other Uses The oil from the seeds is reported to be non-drying, and also to be used as drying oil for paints and var-nishes[299 ]. The stems are macerated to produce fibres that are used as a sponge[299 ].

dwatta TonicPregnant women, and patients suffering from anaemia, use the leaf juice as a tonic to strengthen the blood[299 ].

nrakta West tropical Africa - Benin to Cameroon. ksacta Lowland rainforest and riversides[200 ]. Rain-forest; sec-ondary forest; forest edges; possibly often as a relic of for-mer cultivation; at elevations up to 1,200 metres[299 , 328 ].

propta Seed - can be sown in situ or in containers. When grown in containers, sow 2 - 3 seeds in each container thin-ning to the strongest plant once they germinate[300 ]. Seed size affects the vigour, germination rates and establishment of the seedlings. Viability varies from 63% for small seeds weighing less than 11g, up to 89% for seeds weighing 22g. Germination takes about 14 days in natural soil, but only 7 days in a sawdust medium. Vine length one week after emer-gence is on average 31cm for large seeds, whereas small size seeds grow into a corresponding vine length of 16cm Plant out container-grown plants after about 30 days[300 ]. Some seeds exhibit polyembryony, producing more than one seedling[299 ]. The seed is recalcitrant in nature. They often germinate whilst still in the fruit and have a short viability, thus seed storage is difficult[299 ]. The critical seed moisture content below which seeds cannot recover from desiccation is 40 - 60%[299 ]. Layering. Very easy[63 ].

nwatta Management: Standard Regional Crop Staple Crop: Protein-oilFluted pumpkin is a plant of the lowland, humid tropics, where it is found at elevations up to 1,000 metres[303 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 21 - 30°c, but can tolerate 19 - 38°c[418 ]. The plant can survive tempera-tures down to about 5°c[418 ]. It prefers a mean annual rainfall in the range 1,900 - 2,200mm, but tolerates 1,500 - 2,700mm[418 ]. Succeeds in shade or full sun[300 ]. Toler-ant of a wide range of soils[298, 300 ] though a humus-rich, moist, fertile soil gives best yields[300 ]. Prefers a pH in the range 5 - 6, tolerating 4.5 - 7[418 ]. Established plants are drought resistant, though yields are greatly reduced in times of drought[298 , 300 ]. Fluted pumpkin grows fast in the warm, humid tropics, producing edible leaves in the rainy season and at the beginning of the dry season, for a period of 6 - 10 months[299 ]. The plant can be managed as a short-term perennial when grown on well-drained soils, slightly shaded and well mulched. On soggy soils and in sunlit spots it can only be grown as an annual. Female plants are usually grown for their edible young shoots since males do not produce many of these[300 ]. The first harvest of these shoots occurs about 2 - 3 months after sowing the seed[300 ]. Up to 15 harvests may be obtained during the following 120 - 160 days[418 ]. Male plants start to flower about 3 months after planting, a month earlier than females plants[299 ]. Hand pollination seems to be advantageous for fruit set as it re-sulted in 35% fruit set compared to 15% fruit set in open pol-lination[299 ]. Female plants produce about 18 single fruits which set fruit, but only 1 - 4 develop into mature fruits. Out of the female plants of a population, only 35% bear fruits. A large variation occurs between and within plants in the num-ber of seeds per fruit, from 6 seeds per fruit up to 196, with an average of 62 seeds. The seeds are also unequal in size, vary-ing in weight from 1 - 68g[299 ]. Fruits are ready about 5 - 6 months after sowing[299, 300 ]. The fresh shoot yield can be as low as 500 - 1,000 kilos per hectare, but it can also reach 3 - 10 tonnes. In home gardens in Benin, one plant occupy-ing 3 metres of fence produced 2 kilos of young leaves per metre in the rainy season and 500g in the dry season with-out irrigation[299 ]. The seed yield can reach 1.9 tonnes per hctare, derived from 3,000 fruits[299 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required[299 ]. Identifying the female plants from either seeds or young seedlings has not been successful, but vine size 64 days after planting could be used as a sex indica-tor, because female plants are more vigorous than the male



is rich in vitamin C[317 ]. The ovoid fruit is about 8cm x 4cm[200 ].

tcanta RootstockOther Uses Sometimes used as a rootstock for P. edulis because it is less susceptible to soil borne disease[335 ].

dwatta Anthelmintic Bitter Narcotic Poulitice Vermifuge Vitamin CThe content of the glycoside passiflorin can produce weak narcotic effects[317 ]. (I believe this is found mainly in the leaves or roots[K.]). A cold, salted decoction of the root is said to be an effective vermifuge[348 ]. An infusion of the stems and leaves is used as a children's vermifuge[348 ]. The leaves are vermifuge[348 ]. The powdered leaves are bitter and considered to be an anthelmintic[348 ]. A poultice of the leaves is used for dressing syphilitic ulcers[348 ]. The green fruit contains acetone and a cyanogenic heteroside which disappears upon maturity of the fruit[348 ].

nrakta S. America - eastern Brazil, Peru, Venezuela, Guyanas to the Caribbean. ksacta Climbing into trees and shrubs in tropical rainforests[262 ]. Thickets and forest borders[418 ].

propta Seed - best sown as soon as it is ripe along with the pulp which will help break down the seed coat and speed up germination[262 ]. Stored seed should be soaked for 24 hours in warm water and germination time can be reduced if the seed is then mixed with the juice of a fresh passion fruit (of any species)[262 ]. Even so, it can take 12 months for stored seed to germinate[262 ]. Place the seed tray in a shady position, maintaining a temperature around 19 - 24°c[262 ]. Prick the seedlings out into individual containers as soon as they are large enough to handle and plant out when large enough[262 ]. Cuttings of young shoots, taken at the nodes. The cuttings root best in a neutral to slightly acid compost, but 100% sharp sand also produces good results[262 ]. Cuttings of fully mature wood taken at a node. They can take 3 months, but there is usually a high percentage[3 ]. Layering. Very easy[262 ]. Air layering.

nwatta A plant of the hot, wet, lowland tropics, where it is found at elevations up to 500 metres[335 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 22 - 30°c, but can tolerate 12 - 36°c[418 ]. The plant is not tolerant of frosts[418 ]. It prefers a mean annual rainfall in the range 2,000 - 3,000mm, but tolerates 1,000 - 4,000mm[418 ]. Requires a humus-rich, moist but well-drained soil and a position in dappled shade[262 ]. Passiflora species tend to flower and fruit more freely when grown in soils of only moderate fertility[200 ]. Prefers a circumneutral soil, disliking very acid or very alkaline conditions[262 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 5 - 7[418 ]. Plants produce tendrils and climb by attaching these to other plants. Plants are very tolerant of pruning and can be cut back to ground level if required to rejuvenate the plant[202 ]. Plants in this genus are notably resistant to honey fungus[200 ].

## 10.2.81 Nephelium ramboutan

Pulasan

10 tlin 12 cyuc 4 kcaak 2 tcan 1 dwat 15 m hkuc hminhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprklwis hpa7tmwatli fyif hjonli

drutta Nephelium ramboutan-ake is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: Drink OilFruit - raw or cooked. The delicious white flesh of the fruit is less juicy than the rambutan (N. lappaceum), is sweeter and has a less sprightly taste[301 ]. Much eaten out of hand, it can also be used in jams and compotes[301 ]. The fruit ranges in size from 40 to 70 mm long and 40 to 60 mm in diameter[306 ]. The seed is roasted and used in the preparation of a cocoa-like beverage[301 ]. An oil is obtained from the seed[301 ]. Used in cooking[301 ].

tcanta Lighting Miscellany Oil Plant breeding WoodOther Uses An oil obtained from the seeds is used in lamps[418 ]. The wood is hard[418 ]. A useful timber, but

rarely used because the fruit is too valuable to merit the tree being felled[418 ].

dwatta MiscellanyThe roots have medicinal properties[418 ].

nrakta E. Asia - India, Myanmar, Malaysia, Indonesia, Philippines. ksacta Found mostly in lowland primary forests, often on river banks but rarely in swamps, usually on sand or clay[303 ].

propta Seed - it has a very short viability and so needs to be sown as soon as it is extracted from the fruit[303 ]. Wash the seed first to remove traces of the fruit[303 ]. When ripe, the seed germinates very quickly and grows rapidly[296 ]. Seedlings quickly produce a large root system and so need to be planted out into their permanent positions when still young[296 ]. The seed has a very short viability and needs to be sown as soon as possible after the fruit is harvested[296 ].

nwatta Pulasan grows best in the lowland humid tropics at an elevation below 600 metres. It grows best in areas where annual daytime temperatures are within the range 26 - 32°c, but can tolerate 18 - 38°c[418 ]. The plant cannot tolerate frost. It prefers a mean annual rainfall in the range 2,000 - 3,000mm, but tolerates 1,350 - 4,100mm[418 ]. Grows best in a sunny position, tolerating some shade[418 ]. Prefers a sand or clay soil[303 ]. Succeeds in most well-drained soils[418 ]. Prefers a pH in the range 5 - 5.8, tolerating 4.3 - 8[418 ]. There are some named varieties[301 , 306 ]. Some of the varieties bear parthenocarpic fruit[335 ]. Being overshadowed by good rambutan cultivars, this species has little prospect of being developed for commercial cultivation[306 ]. However, it is a good potential genetic source in breeding programmes with the rambutan[306 ].

## 10.2.82 Diospyros digyna

Black Sapote, Chocolate Pudding Tree

10 tlin 12 cyuc 4 kcaak 2 tcan 1 dwat 15 m hkuc hminhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprklwis hpa7tmwatli dyat hjonli

drutta Diospyros digyna is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The unripe fruit is used as a fish poison[ 418 ]. kcakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked[ 296 ]. Bitter and astringent when unripe, it should not be eaten until it is fully ripe and soft[ 303 , 331 ]. Soft, rich, dark chocolate brown in colour and somewhat sweet[ 301 ]. The black mushy flesh is repulsive in appearance, reminding one of dirty axle grease[ 331 ]. Rather bland, the fruit is best mashed with a little orange, lemon or lime juice and chilled before serving[ 296 , 301 ]. The immature fruit can be boiled and used as a vegetable[ 296 ]. The fruit is rather boring on its own, but delicious when used in smoothies, jams etc[ 296 ]. The dark olive-green fruit is a flattened globose to slightly lobed berry, 5 - 15cm in diameter[ 303 ]. The fruit turns a duller colour when ripe and the persistent calyx at the base, which is pressed against the developing fruit, becomes reflexed. At this stage the fruits are still firm. They soften 3 - 14 days after harvesting, individual fruits ripening suddenly and unpredictably within 24 hours[ 303 ].

tcanta Furniture WoodOther Uses: The wood is yellowish to deep-yellow with black markings near the heart of old trunks; it is compact and suitable for cabinetwork, but is little used[ 303 ]. The wood is reported to have the qualities of typical ebony[ 331 ].

dwatta Febrifuge SkinVarious preparations of bark and leaves have been used medicinally against fever and skin disease[ 303 ].

nrakta Northern S. America - Colombia, north through Central America to Guatemala. ksacta Dry or wet mixed forest usually around sea level[ 331 ].

propta Seed - commonly propagated from seed, which remains viable for several months if stored dry[ 303 ]. Seeds germinate in about 30 days[ 303 ]. As a rule fresh seeds have a high percentage of fertility. The seedlings develop

of a very sweet pumpkin with overtones of mango and apricot[301 ]. Opinions vary widely over the quality of this fruit, with some people describing it enthusiastically as like a blend of mangoes, peaches and strawberries, whilst others have found it to be bland[307 ]. There are forms with very little fibre and these can be utilised for juice[301 ]. The fruit is up to 10cm in diameter[416 ].

tcanta Containers Houseplant Pioneer WoodSheltered seaside. Backyard tree. Public open space. Large conservatory. Agroforestry Uses: A fast-growing, natural pioneer species within its native range. With its edible fruit it could very well be useful in a mixed planting to restore native woodland or to establish a woodland garden[K.]. The large trees of this species are grown in association with avocados. This combination works well because both species have the same soil requirements, and zapote provides necessary shade for the avocados[355 ]. Other Uses The wood is coarse-textured, irregular-grained, light in weight, with a low resistance to wood-eating organisms[625 ]. It is easy to cut, but has poor mechanical properties. It is used as core material for doors and paneling, and to make light boxes[625 ].

nrakta S. America - Brazil, Bolivia, Peru, Ecuador, Colombia; C. America - Panama, Costa Rica. ksacta Rainforests on fertile soil from fairly high altitudes to lowland coastal regions[307 ]. Found both in areas that are seasonally inundated, and also areas that are not[416 ].

propta Seed - best sown as soon as it is ripe in a partially shaded position in individual containers. A high germination rate can be expected, with the seed sprouting within 20 - 30 days[625 ]. Stem cuttings.

nwatta Likes to grow in hot, humid, lowland tropical to subtropical regions with lots of rainfall[335 ]. Plants are very susceptible to frost injury[335 ]. Prefers a fertile, moisture-retentive soil and a position in full sun[307 ]. Young plants are fast-growing[625 ].

## 10.2.58 Borassus flabellifer

Palmyra Palm

10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 20 m hkuc htut cyutli hgatykuctup hwicli hyshrasjlutnyik hpa7tli flatprklwisslip hpa7tmwatli dyat hjonli

drutta Borassus flabellifer is an evergreen Tree growing to 20 m (65ft) by 6 m (19ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista Plant has spines or sharp edges; use extreme caution when handling

kcakta Edible Parts: Flowers Fruit Leaves Oil Sap Seed StemEdible Uses: Drink Oil Salt SweetenerFruit - raw or cooked[ 297 , 301 ]. The immature fruits are pickled[ 301 ]. The tender flesh of young fruits is cooked in curry[ 303 ]. The ripe fruit has a yellow edible pulp with a distinctive aroma[ 303 ]. The mature fruit is soaked in water, after which the wiry fibers are extracted, the yellow pulp mixed with rice starch, this is then folded inside a banana leaf and later steam-cooked[ 404 ]. The fruit is a globose to subglobose drupe, 15-20 cm in diameter, produced in large clusters on the tree[ 303 , 335 ]. A sugar-rich sap is obtained from the inflorescence[ 297 ]. It is obtained by first tying the developing inflorescence together to prevent it opening, then beating it daily for several days with a wooden mallet. After a few days, a slice is cut daily from the end of the inflorescence and, almost a week later, the sap begins to flow[ 297 ]. This can continue for several months so long as a fresh slice is removed each day[ 297 ]. Up to 20 litres of sap can be obtained each day from large trees[ 297 ]. The juice can be drunk, or concentrated by evaporation to form a sweet syrup or a solid palm sugar known as jaggery[ 297 ]. The soft upper 10 metres of the trunk contains some starch, which may be harvested in times of food scarcity[ 303 ]. Immature, jelly-like seeds[ 301 ]. The young solid or gelatinous endosperm of the seeds is eaten fresh or in syrup[ 303 ]. Sprouted seedlings - peeled and eaten raw or cooked[ 301 , 303 ]. They can be sun-dried for later use[ 301 ]. They may be slightly toxic, but are considered a delicacy in some areas[ 303 ]. A salt is

made from the leaves[ 46 , 301 ]. Apical bud[ 301 , 303 ]. Eating this bud effectively kills the plant since it is unable to produce side branches[ K.]. Inflorescence - cooked. Added to soups and curries[ 301 ].

tcanta Basketry Brush Charcoal Containers Fencing Fibre Fuel Oil Paper String Thatching WoodOther uses rating: Medium (3/5). Other Uses The leaves have a wide range of uses, such as thatching for house roofs and walls, weaving into baskets, mats and many other items[ 46 , 297 , 303 , 404 ]. Thatch made from the leaves is said to last at least 2 years[ 303 ]. The top young leaves are made into hats, boxes to store rice, baskets, fans, etc[ 404 ] A number of different fibres can be obtained from the plant[ 46 ]. A fibre obtained from the leaves is used to make string, rope, fencing etc[ 297 ]. The fibres of young leaves can be woven into delicate patterns[ 303 ]. The fibre obtained from the base of the petioles, or the sheathing leafstalks, is stiff, harsh and wiry. It is used to make brushes etc[ 454 ]. Petioles are often can be split into fibre, to be used for weaving and matting[ 303 ]. A fibre is obtained from the inner bark[ 46 ]. The bark fibre can be used to make strong ropes[ 404 ]. A fibre is obtained from the pericarp of the fruit[ 46 ]. The petioles are often used as poles for fencing[ 303 ]. The dried leaflets were at one time used as a paper to record Indian holy texts[ 46 , 297 ]. The lowest 10 metres of the trunk has a hard and strong wood that is heavy, very durable and very resistant to termites, insect borers and decay fungi. It is good for constructing buildings, bridges etc[ 303 , 404 ]. The somewhat softer middle part of the stem can be split into boards[ 303 ]. The whole trunk can be made into a small boat capable of carrying at least three people[ 404 ]. The wood and leaves are used as fuel[ 303 , 404 ]. The wood can be made into charcoal[ 404 ].Other uses rating: Medium (3/5).

dwatta Anthelmintic Antiinflammatory Antitussive Diuretic Dysentery Laxative Mouthwash Skin Stimulant TonicInnumerable traditional medicinal uses are known for all parts of the toddy palm[ 303 ]. The young plant is said to relieve biliousness, dysentery and gonorrhoea[ 404 ]. Young roots are anthelmintic and diuretic[ 404 ]. A decoction is given in certain respiratory diseases. Dried roots can also be smoked to heal nasal complaints[ 404 ]. The ash of the flower is taken to relieve heartburn and enlarged spleen and liver[ 404 ]. The bark decoction, with salt, is used as a mouth wash[ 404 ]. A charcoal made of the bark serves as a dentifrice[ 404 ]. Sap from the flower stalk is prized as a tonic, diuretic, stimulant, laxative and anti-phlegmatic and amoebicide[ 404 ]. Sugar made from this sap is said to counteract poisoning and it is prescribed in the treatment of liver disorders[ 404 ]. When candied, it is a remedy for coughs and various pulmonary complaints[ 404 ]. Fresh toddy, heated to promote fermentation, is bandaged onto all kinds of ulcers[ 404 ]. The apical bud, leaf petioles, and dried male flower spikes all have diuretic activity[ 404 ]. The pulp of the mature fruit relieves dermatitis. It is also useful as an anti-inflammatory and for dropsy and gastric conditions[ 404 ]. Also has potential immuno-suppressive action. Constituents are: gum, fat and albuminoids[ 404 ].

nrakta E. Asia - India, Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia, New Guinea. ksacta Hot, dry, monsoonal areas in both forested and open country, often forming large stands[ 297 ].

propta Seed - pre-soak for 24 hours in warm water and sow in containers or in situ. The seed is difficult to germinate, often taking 12 months or more[ 297 ]. Scarifying it prior to soaking may reduce germination time. When germination occurs, the massive cotyledon grows several metres down into the ground before the roots and leaves appear[ 297 ]. Seeds should thus be planted in deep containers or into a permanent position in the ground as soon as growth begins to appear[ 297 ].

nwatta Industrial Crop: Fiber Management: Standard Industrial Crop Staple Crop: Oil Staple Crop: SugarThe palmyra is a very adaptable palm that can succeed in a wide range of conditions in dry to moist tropical and subtropical climates[ 303 ]. It grows best at elevations below 800 metres[ 303 ]. It can survive with as little as 250mm of rain a year, and one month or more where rainfall is below 25mm[ 297 ], cropping satisfactorily with 500 - 900mm per year[ 303 ]. It will also grow and crop well with rainfall as high as 5,000mm per year[ 303 ]. It grows best where temperatures never fall below 10°c[ 297 ], with an optimum mean annual temperature around 30°c, but it withstands ex-

trema temperatures as high as 45°c and as low as 0°c[ 303 ]. Plants grow well in full sun, even when small[ 297 ]. Prefers a sandy soil[ 303 ], but plants are able to succeed under a wide range of conditions[ 404 ]. Established plants are quite drought resistant and also survive waterlogging quite well[ 303 ]. The palm starts flowering and fruiting 12 - 20 years after germination, usually in the dry season[ 303 ]. A dioecious species, both male and female forms need to be growing if fruit and seed are required[ 404 ]. Suitable for xeriscaping.

## 10.2.59 Canarium ovatum

Pili Nut

10 thin 12 cyuc 4 kcaak 3 tcan 3 dwat 20 m hkuc htut cyutli tcup hwicli hrasjlutnyikfripr hpa7tli frusflatprik-wissliip hpa7tmwatli dyat hjonli

drutta Canarium ovatum is an evergreen Tree growing to 20 m (65ft) by 18 m (59ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by insects. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerate strong winds but not maritime exposure.

kcaakta Edible Parts: Fruit Oil Seed ShootsEdible Uses: OilSeed - raw or cooked. A popular nut. The sweet nuts have a delicious flavour. When raw, their flavour resembles roasted pumpkin seed, when roasted their mild, nutty flavour and tender, crispy texture are superior to the almond[ 301 , 303 ]. They can also be used in confections, ice cream, nut milks etc, and as an adulterant to chocolate[ 301 , 303 ]. The coat surrounding the kernel should be removed since it can cause diarrhoea[ 63 ]. The shell is very thick and difficult to crack, though some thinner shelled forms have been found[ 63 ]. Nutritionally, the kernel contains 71.1% fat, 11.4% protein and 8.4% carbohydrates; it is high in calcium, phosphorus and potassium[ 303 ]. The kernel is a major ingredient in a famous Chinese festive dessert known as the 'moon cake'. However, kernels from some trees may be bitter, fibrous or have a turpentine odour[ 303 ]. The seed keeps very well in storage[ 307 ]. A sweet, light-yellow oil obtained from the seed is used for cooking purposes[ 301 , 303 ]. It is comparable in quality to that of olive oil, containing up to 59% oleic glycerides and 32-59% of palmitic glycerides[ 303 , 310 ]. An oil can be extracted from the fruit pulp[ 301 ]. It has a tangy, resin-like flavour[ 301 ] and can be used for cooking[ 303 ]. The fruit pulp is boiled, seasoned and eaten[ 301 , 303 , 310 ]. Rather tasteless[ 63 ]. It resembles the sweet potato in texture, it is oily (about 12%) and is considered to have food value similar to the avocado[ 303 ]. Young shoots - raw[ 301 ]. Eaten in salads[ 301 , 303 , 310 ].

tcanta Charcoal Containers Fuel Fuel Furniture Ink Oil Shelterbelt Soap making Waterproofing WoodOther uses rating: Medium (3/5). Shade tree, Street tree, Nut tree, Public open space. Agroforestry Uses: The tree makes an excellent windbreak as it resists strong winds and even typhoons[ 303 , 310 ]. Other Uses: The hard and thick shell that encloses the kernel makes an excellent fuel for cooking[ 303 , 310]. The possibility of using the shell as a source for making charcoal and activated carbon for industry has yet to be explored[ 310 ]. Polished and varnished, the stony thick shell becomes an attractive ornament[ 303 , 310 ]. The stony shells are excellent as a porous, inert growth medium for orchids and anthuriums[ 303 ]. A valuable resin, called Manila elemi or 'breabianca', is used as an ingredient in the manufacture of plastics, printing inks and perfumes[ 303 ]. It is also used by the Spaniards for ship repairs[ 303 ]. The plant contains two different oils. That obtained from the seed is of similar quality to olive oil[ 310 ]. An oil contained in the fruit pulp can be extracted and used as a substitute for cottonseed oil in the manufacture of soap and edible products[ 303 ]. It is used in making suntan lotions and cosmetics[ 307 ]. The reddish wood is hard and considered to be similar to mahogany[ 307 ]. The resin-rich wood makes good firewood[ 303 , 310 ]. This species is one of the sources of kedondong timber, which is obtained from several species in the family Burseraceae[ 884 ]. We do not have a specific description of the wood for this species, but the general description of kedon-

dong wood is as follows:- The heartwood is generally a light brown; it is not sharply demarcated from the 3 - 5cm wide band of lighter-coloured sapwood. The texture is moderately fine and even; the grain is interlocked to wavy; the surface is lustrous. The wood is light in weight; moderately hard; not very durable, being susceptible to fungi, dry wood borers and termites. It seasons somewhat slowly with only a slight risk of checking and distortion; once dry it is moderately stable to stable in service. The wood has a fairly high blunting effect, stellate-tipped and tungsten carbide tools are recommended; it is moderately easy to slightly difficult to plane; finishes smooth to rough; can be easy to very difficult to bore; slightly difficult to difficult to turn; nailing and screwing properties are good; gluing is correct. The wood is suitable for internal use as a general utility timber for planking, cladding, plywood, flooring, furniture, packing cases, pallets and general carpentry work[ 316 , 848 ].

dwatta Malaria Purgative SkinThe resin is soft, odorous and has the texture of honey. It was formerly exported for the European pharmaceutical trade as Manila or Philippine gum elemi for use as an ointment for healing wounds and as a plaster[ 303 ]. The bark is used in the treatment of malaria[ 307 ]. The leaves are used in the treatment of vertigo[ 307 ]. Raw nuts are a purgative[ 303 ].

nrakta ksacta Forests where rainfall is abundant[ 63 ]. Low to medium elevations in primary and secondary forests[ 303 ].

propta Seed - most kernels tend to stick to their shell when fresh but come off easily after being dried to 3 - 5% mc, which takes 27 - 28 hours at 30°c[ 303 ]. The pericarp is also removed prior to sowing by dipping the fruits in hot water[ 303 ]. Sow the seeds in light shade in individual containers or in a nursery seedbed. The seedlings take 40 - 50 days to emerge, and should be potted into individual containers as soon as they are large enough to handle. The transplanted seedling initially grows slowly, but soon the growth rate picks up, stem height and girth increasing rapidly and new leaves unfolding continuously. Plant out when 25 - 30cm tall. One year-old seedlings can be used for rootstock[ 303 ]. Asexual propagation is best through patch budding, which has a claimed success rate of 85 - 90% in the Philippines. Cleft grafting is also successful[ 303 ].

nwatta Management: Standard Regional Crop Staple Crop: OilPili is a tree of the hot, wet tropical lowlands, where it is usually found at elevations below 400 metres[ 303 ]. It grows best in areas where annual daytime temperatures are within the range 22 - 34°c, but can tolerate 12 - 40°c[ 418 ]. It cannot withstand low temperatures or even the slightest frost[ 303 ]. It prefers a rainfall that is distributed throughout the year with a mean annual rainfall in the range 2,000 - 3,000mm, but tolerates 1,000 - 4,000mm[ 303 , 418 ]. Succeeds in both light and heavy soils[ 310 ]. Prefers a well-drained soil[ 418 ]. Prefers a pH in the range 5 - 6, tolerating 4.5 - 6.5[ 418 ]. Mature trees can resist strong winds[ 303 ]. Trees flower all year round[ 307 ]. Young seedling trees can grow to a height of 2 metres or more in about 3 - 4 years, and do not usually produce side branches until this stage[ 310 ]. Seedling trees can produce their first flowers when about 4 years old[ 310 ]. On average, seedling trees start producing fruit 5 - 6 years after planting. Clonal trees bear fruit 3 - 4 years after planting[ 303 ]. Full production commences at around the age of 12 - 15 years[ 324 ] Yields of 140 kilos or more per tree have been obtained[ 63 ]. Wild forms usually have three, sometimes two kernels present in the nut, each in its own compartment[ 63 ]. In the case of cultivated trees, however, only one kernel is sometimes found in each nut[ 63 ]. When this is so, the kernel is proportionately larger and the nut easier to crack[ 63 ]. The tree is cultivated more or less by accident, having appeared as self-sown seedlings in hemp and coconut plantations[ 63 ]. Trees are dioecious - both male and female forms would normally need to be grown in order to produce fruit and seed. Functional hermaphrodites, however, exist within the species[ 303 ].

## 10.2.60 Cinnamomum loureiroi

Saigon Cinnamon

10 thin 12 cyuc 4 kcaak 2 tcan 3 dwat 18 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli frusflatprik-wissliip hpa7tmwatli hjonli

ity, climate and competing vegetation, the palms will stay in the rosette stage for 3.5 - 6 years, and then grow to full size in another 3 - 9 years[ 303 ]. Usually after 5 - 6 years, the fibres can be collected for the first time and after that, every 2 years[ 303 ]. When the palm begins flowering, tapping for the sweet sap can start, but farmers usually wait for the first male flowers. The sap is usually tapped only from male inflorescence stalks, because female inflorescences are said to produce sap of inferior quality, and the more fibrous stalk of the females requires extra effort to prepare. Usually, the closer to the ground the male inflorescence arises, the less sap it produces. One inflorescence can produce about 5 litres of sap a day. An inflorescence of sugar palm can be tapped for 1 - 2 months, and 2 - 4 inflorescences may be tapped at a time[ 303 ]. Since sago, the starchy layer on the inner part of the trunk, is obtained only by cutting trees, it is usually the last product obtained; trees are usually cut for sago when they are more than 30 years old[ 303 ]. The black roots are very strong, extending up to 10 metres from the stem and going as deep as 3 metres[ 418 ].

## 10.2.78 Couepia bracteosa

Pajura

10 thin 12 cyuc 4 kcaak 2 tcan 0 dwat 15 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikwis hpa7tmwatli hjonli

drutta Couepia bracteosa is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcaakta Edible Parts: FruitEdible Uses: Fruit - raw[ 416 ]. A thick, aromatic, oily pulp with a thin skin and a sweet, pleasant flavour[ 416 ]. The fruit is up to 13cm long and 10cm wide[ 416 ].

tcanta WoodOther Uses: The wood is heavy, difficult to work, very durable and only slightly susceptible to wood-eating organisms[ 625 ]. It is used for external carpentry[ 625 ].

nrakta S. America - Brazil, Bolivia, Peru, Colombia, Guyanas. ksacta Tropical, dryland forests[ 416 ]. Found in secondary forests, along rivers and in upland formations[ 625 ].

propta Seed - best sown as soon as it is ripe, in individual containers in partial shade[ 625 ]. The germination rate is usually low, with the seeds taking several weeks before they sprout[ 625 ]. The seeds are collected from very ripe fruit that have the pulp washed out. The seeds should be planted fresh.

nwatta A tropical plant. Succeeds in a sunny position or light shade[ 625 ]. Newly planted young trees grow away moderately well. A popular cultivated fruit tree.

## 10.2.79 Pouteria campechiana

Canistel, Eggfruit

10 thin 12 cyuc 4 kcaak 2 tcan 2 dwat 15 m hkuc htut cyutli hgatkyuctcuphja7n hwicli hrasjlutnyikfripr hpa7tli flatprikwishesom hpa7tmwatli hjonli

drutta Pouteria campechiana is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in saline soils. It cannot grow in the shade. It prefers dry moist or wet soil and can tolerate drought. The plant can tolerate maritime exposure.

kcaakta Edible Parts: FruitEdible Uses: The fruit is excellent when eaten raw, it can also be used in cakes, pies, ice creams, puddings etc[301 ]. It has a yellow to orange pulp that is soft and mealy in texture with a very rich, sweet flavour that is somewhat reminiscent of a baked sweet potato[301 ]. The fruit somewhat resembles the yolk of a hard-boiled egg[301 ]. It is not highly regarded by many people because it is not crispy and juicy like so many other fruits[303 ]. The fruit is extremely variable in form and size,

ranging from almost round to oval or spindle shaped[303 ]. It ranges in size from 7 - 12cm long and 5 - 7.5cm wide, though there is a shrubby form (var palmeri) where the fruits are only 2.5cm long[303 ].

tcanta Latex WoodOther Uses: The tree produces an abundant latex[331 ]. It is extracted from the tree and has been used to adulterate chicle[303 , 331 ]. The fine-grained, compact, strong, moderate to very heavy and hard timber is valued especially for planks and rafters in construction. The heartwood is greyish-brown to reddish-brown and blends into the sapwood, which is somewhat lighter in colour. The darker the colour, the more resistant to decay[303 ].

dwatta Febrifuge SkinA decoction of the astringent bark is taken as a febrifuge and is applied on skin eruptions[303 ]. A preparation of the seeds has been employed as a remedy for ulcers[303 ].

nrakta Central America - Panama, north to Mexico. ksacta Moist or wet mixed forest, sometimes in pine forests, often on limestone, at elevations that are mostly below 1,400 metres[331 ].

propta Seed - remove it from its husk before sowing[200 ]. The seeds lose viability quickly and should be germinated within a few days after removal from the fruit[306 ]. Seedlings grow rapidly and may produce fruit in 3-4 years[306 ]. Side-grafting. Air-layering may be possible[200 ]. Canistel seeds lose viability quickly and should be planted within a few days after removal from the fruit. If decorticated, seeds germinate within 2 weeks; otherwise there may be a delay of 3 - 5 months before they sprout. The seedlings grow rapidly and begin to bear in 3 - 6 years. There is considerable variation in yield and in size and quality of fruits. Vegetative propagation is preferred in order to hasten bearing and to reproduce the best selections. Side-veneer grafting, cleft grafting, patch budding and air-layering are usually successful. Cuttings take a long time to root

nwatta A plant that can succeed in the lowland moist tropics or subtropics, growing at elevations up to 1,400 metres[303 ]. In its native range it experiences an average annual temperature of 26°c, with a maximum 36.7°c and a minimum of 14.9°c[303 ]. Plants can tolerate occasional, short-lived frosts[335 ]. Average annual precipitation is approximately 1,288mm, ranging between 900 - 1,800mm[303 ]. It requires no more than moderate precipitation and does well in regions with a long dry season[303 ]. It is very susceptible to drought according to another report[200 ]. It grows well in maritime areas, where it shows good wind resistance[200 ]. Tolerant of a wide range of soil types, including sandy and heavy clay soils[200 , 303 ]. Requires a very well-drained soil[200 ]. It makes the best vegetative growth in deep, fertile, well-drained soils, but is said to be more fruitful on shallow soils[303 ]. It can be cultivated on soil considered too thin and poor for most other fruit trees[303 ]. Tolerates a pH in the range 5 - 7[200 ]. This species has become invasive in Florida[307 ]. Seedling trees can commence fruiting when 5 - 7 years old, grafted trees can fruit when 3 - 4 years old[335 ]. The mature but still firm fruits should be clipped to avoid tearing the skin. When left to ripen on the tree, the fruits split at the stem end and fall[303 ]. Some trees can produce fruit more or less continuously throughout the year[303 ]. There are some named varieties[301 ].

## 10.2.80 Passiflora laurifolia

Yellow Granadilla

10 thin 12 cyuc 4 kcaak 2 tcan 2 dwat 15 m hkuc hmimhtut cyutli tcup hwicli jlutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta Passiflora laurifolia is an evergreen Climber growing to 15 m (49ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The leaves are said to be poisonous[418 ].

kcaakta Edible Parts: FruitEdible Uses: Drink SweetenerFruit - raw or made into a refreshing drink[301 , 317 ]. The orange-yellow fruits have a fragrant, juicy, agreeably subacid pulp[301 ]. The fruit is sometimes eaten by making a hole in one end and sucking out the pulp and seeds[301 ]. The fruit

the node) and filled with vegetables, meat or rice, and water, and is then covered and placed on a fire[ 310 ]. The culms have thick walls and are very strong and durable. They are used as building material for houses and bridges, for making furniture, boards, musical instruments, household utensils, crafts, outriggers of fishing boats and for paper making[ 299 , 310 ].

nrakta Africa - Madagascar; Southeast Asia - China, Sri Lanka, Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia, Philippines, Australia. ksacta Not known in a truly wild situation

propta Seed - sow in containers and only just cover. Germination usually takes place readily. Prick out into individual pots as soon as the plants are large enough to handle. Plant out into permanent positions when 20cm tall. Plants may remain in their low-growing juvenile state for several years - cutting the culms to the ground level can stimulate taller adult growth[ 200 ]. Rhizome, culm and branch cuttings[ 310 ]. The propagules are raised in the nursery and after they have produced roots they are planted out in the field before or during the first half of the rainy season[ 310 ].

nwatta Fodder: Bank Industrial Crop: Biomass Management Managed Multistem Minor Global Crop Other Systems: Multistrata Other Systems: Strip intercrop A plant of moist areas in the tropics and subtropics, where it can be found from low elevations up to 1,500 metres, though it grows best at an elevation of 400 - 500 metres[ 310 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 27°C, but can tolerate 15 - 34°C[ 418 ]. It prefers a mean annual rainfall in the range 1,800 - 3,600mm, but tolerates 1,200 - 4,500mm[ 418 ]. Succeeds in any type of soil at least moderate fertility, though it grows better on heavy soils with good drainage[ 310 , 418 ]. In Thailand, according to local farmers, the plant will grow well on sandy and rather acidic soils[ 310 ]. Prefers a pH in the range 5 - 6.5, tolerating 4.5 - 7[ 418 ]. Bamboos have an interesting method of growth. Each plant produces a number of new stems annually - these stems grow to their maximum height in their first year of growth, subsequent growth in the stem being limited to the production of new side branches and leaves. In the case of some mature tropical species the new stem could be as much as 30 metres tall, with daily increases in height of 30cm or more during their peak growth time. This makes them some of the fastest-growing species in the world[ K ]. Initially, a young plant raised from a lateral branch cutting will produce small shoots which will develop into small culms[ 310 ]. As the plant grows older, so the culms produced each year increase in size and quantity until full-size culms appear five or six years after planting[ 310 ]. A mature clump may attain a diameter of 3 metres or more and contains about 60 culms[ 310 ]. A culm becomes mature when 3 - 4 years old[ 310 ]. A good healthy clump can produce several shoots annually[ 310 ]. Yields of 10 - 11 tonnes per hectare of bamboo shoots have been reported from Thailand[ 418 ]. Bamboos in general are usually monocarpic, living for many years before flowering, then flowering and seeding profusely for a period of 1 - 3 years before usually dying. This species usually flowers when around 100 - 120 years old[ 299 ].

## 10.2.77 Arenga pinnata

Solitary Sugar Palm

10 tlin 12 cyuc 4 kcaak 4 tcan 1 dwat 15 m hkuc hmimhtut cyutli tcup hwicli hyihshrasjltunykfrip hpa7tli frusflatprklwsslp hpa7tmwatli hjonli

drutta Arenga pinnata is an evergreen Tree growing to 15 m (49ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The fruits of most species in this genus are poisonous and are sometimes used criminally[ 310 ]. The fleshy mesocarp of the fruits usually contains many oxalate crystals, making the flesh inedible[ 310 ]. (Plant has spines or sharp edges; use extreme caution when handling )

kcakta Edible Parts: Leaves Sap SeedEdible Uses: Drink Sweetener A drink and sugar are made from the sweet sap obtained from the flowering stems[ 297 , 303 ]. It is obtained by beating and bruising the developing inflorescence, which is then cut and a juice is obtained from the cut end over a period[ 297 ]. Leaves - cooked[ 297 , 763 ]. The appical bud, known as a 'palm heart' is sometimes used for food[ 297 ]. It can be eaten raw in salads or cooked as a vegetable[ 303 ]. Removing this bud will result in the death of the plant, since it is unable to produce side shoots[ K ]. A sago-like flour can be ground from the trunk pith and used for cakes, noodles and other dishes[ 46 , 303 , 418 ]. A product typically made from the plant in West Java is known as kolang kaling - this is the cooked endosperm of young sugar palm fruits. One inflorescence yields about 4,500 endosperms. It is used for a cocktail and local refreshment known as kolak[ 303 ].

tcanta Basketry Broom Containers Fibre Filter Fuel Insecticide Paper Plant support Soil stabilization Thatching Tinder WoodOther uses rating: High (4/5). Agroforestry Uses: The plant has an extensive root system, up to 3 metres deep and 10 metres wide[ 303 ]. It has been planted, especially on slopes, for soil stabilization[ 303 ]. Other Uses The leaf sheath is a source of a tough, black fibre (gomuti or yonot fibre). It is not pliable enough to be used for purposes such as running rigging, but is very strong and durable and used chiefly for making cables and a very strong rope that is tolerant of both fresh and salt water and of fire; it is used for marine work, thatching, upholstery and brushes[ 297 , 303 , 454 ]. The hairs found on the base of the leaf sheaths are very good tinder for igniting fire[ 303 ]. The fibre, placed in the bottom of a vessel, is useful for filtering water of its physical impurities[ 454 ]. At the base of the leaves there is a woolly material used in caulking ships and stuffing cushions[ 459 ]. Old woody leaf bases, as well as the long leaves, can be used for fuel[ 303 ]. The split petioles are used for basketry and a form of marquetry[ 303 ]. The youngest leaves are sometimes used as cigarette paper[ 303 ]. The leaves are used as a source of thatching material[ 297 ]. The roots are a useful insect repellent[ 303 ]. The trunks of dead trees are allowed to rot and become hollow and are then used as water pipes[ 297 ]. The pith of the leaf rachis is an ideal shape for use as a drinking cup[ 303 ]. The very hard outer part of the trunk is used for barrels, flooring and furniture. Posts for pepper vines, boards, tool handles and musical instruments like drums are all made from the wood[ 303 ].

dwatta Roots provide medicinal products, such as a tea decoction used to cure bladder trouble[ 303 ].

nrakta E. Asia - probably India and Malaysia. ksacta Usually found close to human settlements, often as a result of human activity[ 303 ]. Otherwise it prefers secondary forest at the border of primary rainforests[ 303 ]. Often found on sites poor in nutrients and mesic sites such as denuded hillsides[ 418 ].

propta Seed - pre-soak for 24 hours in warm water and sow in deep containers. Alternatively, scratch the seed near the germination spot until the brown, inner seed-coat layer becomes visible, then soak in water overnight[ 303 ]. The seeds should then be seeded in a clean medium with good aeration, planted with the germination spot downward and covered with a 1-cm layer of sand. The sand should be kept moist at all times[ 303 ]. Within 2-3 weeks about 80% of the seeds will have germinated and can be transplanted to any type of container[ 303 ]. Germination varies from 2 - 12 months or more[ 297 ]. Direct sowing is possible but seedlings take a long time to establish well and may grow at irregular distances. Untreated seeds freely dispersed show 10-20% germination after 6 months[ 303 ]. Plants can also sometimes be propagated through suckers[ 303 ].

nwatta Industrial Crop: Fiber Management: Standard Minor Global Crop Other Systems: Multistrata Staple Crop: Sugar A plant of the moist, lowland tropics, where it is found at elevations up to 1,400 metres. It grows best in areas where annual daytime temperatures are within the range 22 - 28c, but can tolerate 16 - 32c[ 418 ]. It prefers a mean annual rainfall in the range 3,000 - 3,500mm, but tolerates 2,000 - 4,000mm[ 418 ]. Prefers a deep fertile moisture-retentive but well-drained soil[ 297 , 303 ]. Plants grow well in full sun, even when small[ 297 , 418 ]. Prefers a pH in the range 6 - 7, tolerating 5 - 8[ 418 ]. The plant usually produces its first flowers when around 10 - 12 years old, though it can flower as early as 5 - 6 years[ 303 ]. Depending on altitude and temperature and to a lesser degree on factors such as soil fertil-

drutta Cinnamomum loureiroi is an evergreen Tree growing to 18 m (59ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Flowers Fruit Inner bark OilEdible Uses: Drink OilEdible portion: Bark, Spice, Flower Buds. The bark, and an essential oil obtained from it, are much used as a flavouring in a wide range of foods[ 301 ]. Highly esteemed in China and Japan, and considered by many to be superior to the more widely used cinnamon (C. verum)[ 301 ]. The bark is sweeter than cinnamon and is used for baking and is made into a cordial[ 238 ]. The bark is usually harvested from young branches[ 418 ]. The bark is peeled from the stems and branches and set aside to dry. Some varieties are scraped. While drying, the bark curls into quills. The colour varies from light reddish brown for the thin, scraped bark to grey for the thick, unscraped bark[ 418 ]. The unripe fruits are dried and sold as cassia buds, for use as food flavourings[ 301 ]. They have a cinnamon-like aroma and a warm, sweet, pungent taste akin to that of cassia bark[ 418 ].

tcanta Essential OilOther uses rating: Low (2/5). The bark contains 1 to 7% of essential oil[ 418 ].

dwatta Aromatic Astringent Carminative Stimulant StomachicThe dried bark is aromatic, astringent, carminative, stimulant and stomachic[ 46 , 785 ]. It is often used in association with other medicines[ 785 ]. The bark contains around 2.5% essential oil, which is particularly rich in cinnamic acid[ 785 ]. Saigon cinnamon has 1-5% essential oil in content and 25% cinnamaldehyde in essential oil, which is the highest of all the cinnamon species.

nrakta E. Asia - Vietnam. ksacta Forests at low to medium elevations, occasionally ascending to 2,000 metres[ 785 ].

propta Seed - the seed has a short viability and is best sown as soon as it is ripe in a greenhouse[ 200 ]. Remove the fruit pulp since this can inhibit germination[ 200 ]. Germination can take 1 - 6 months at 20°C[ 164 ]. Stored seed should be sown as soon as possible in containers[ 78 ]. When they are large enough to handle, prick the seedlings out into individual pots and plant them out into their permanent positions when 10cm or more tall. Cuttings of semi-ripe side shoots, 7cm with a heel, June/July in a frame with bottom heat[ 78 ].

nwatta A plant of moist lowland areas in the tropics and subtropics, where it is found at elevations up to 1,000 metres[ 418 ]. It grows best in areas where the mean annual temperature is 20 - 30°C, but tolerates 17 - 34°C[ 418 ]. It prefers a mean annual rainfall of 2,500 - 3,000mm, tolerating 1,500 - 3,500mm[ 418 ]. It grows in areas with all year rainfall and also with a distinct dry season[ 418 ]. Prefers a fertile, sandy, moisture-retentive but freely draining soil in full sun or partial shade[ 200 ]. Prefers a pH in the range 5 - 6.4, tolerating 4.5 - 8[ 418 ]. Harvest of superior bark cannot usually take place until the trees are at least 10 - 12 years old[ 418 ].

## 10.2.61 Plukenetia conophora

Conophor: Nigerian walnut. Awusa nut, 10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 18 m hkuc hmimhtut cyutli tcup hwicli hrasjltunyk hpa7tli flatprklwls hpa7tmwatli hjonli

drutta Plukenetia conophora is an evergreen Perennial Climber growing to 18 m (59ft) by 0.4 m (1ft 4in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Fruit Leaves Oil SeedEdible Uses: OilEdible Portion: Nuts, Leaves, Fruit, Nuts - oil, Seeds, Vegetable. Seed - raw or cooked. The tasty seed has a pleasant odour, it is usually eaten boiled or roasted, and is often served with corn on the cob[63 , 301 ]. The seed can be ground into a powder and used with flour in making cakes[332 ]. Eaten raw they have a bitter flavour not unlike

the kola nut and are considered to be tonic[332 ]. The seed is thin-shelled and about 25mm long[63 ]. The seed yields 48 - 60% of a light golden coloured oil with a flavour resembling linseed oil[332 ]. The oil comprises linolenic acid 64%; palmitic and stearic acids 15%; oleic acid 11 %; and linoleic acid 10%[332 ]. Fruit - eaten with rice[301 ]. Leaves and young shoots - eaten with rice[301 ]. Carbon Farming Solutions - Staple Crop: protein-oil (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1].

tcanta Oil Paint VarnishThe seed yields 48 - 60% of a drying oil[46 , 332 ]. The oil dries more quickly than linseed oil[46 ]. Known as awusa oil in the paint and varnish trade, it is usable in the paint industry provided there is a certain supply and the kernels are free from excessive free fatty acids[332 ]. It is unsuitable for soap-manufacture[332 ]. The fresh oil has an iodine value of 190, which is excellent for a drying oil, but the seeds do not store well and deterioration caused by enzymatic action needs to be prevented at the time of collection by heat-treatment[332 ].

dwatta Aphrodisiac TonicThe leaves are considered a headache cure[332 ]. The raw seed is aphrodisiac and tonic[332 ]. The oil obtained from the seeds has medicinal use in massages[332 ].

nrakta Origin: Africa. Western and central tropical Africa - Togo to the Congo. ksacta A tropical plant. Rain-forest hedge in half-shady places; low bush; secondary forest; plantations at elevations from 250 - 1,400 metres[328].

propta Plants are grown from seed. It can be grown from stem cuttings.

nwatta Management: Standard Regional Crop Staple Crop: Protein-oilClimate: tropical. Humidity: humid. Cultivated in the hot and humid zones of tropical Africa around gardens and backyards, mainly for subsistence consumption. Grows on moist, deep, fertile, well-drained loam soils and in silt clay loam soils. Nut production is seasonal. The kernels can yield 50-60% oil. Carbon Farming Solutions - Cultivation: regional crop only. Management: standard (Describes the non-destructive management systems that are used in cultivation) [1-1].

## 10.2.62 Mammea americana

Mammee Apple, Mammey

10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 18 m hkuc hmimhtut cyutli hgattcup hwicli hrasjltunykfrip hpa7tli frusflatprkhsom hpa7tmwatli hjonli

drutta Mammea americana is an evergreen Tree growing to 18 m (59ft) by 16 m (52ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcista The bitter tasting seeds in the fruit are poisonous to fish, chicks and some insects[200 ].(Seed is poisonous if ingested)

kcakta Edible Parts: Flowers Fruit SapEdible Uses: Drink Gum PectinFruit - raw or cooked. A firm, thick flesh with an aromatic flavour similar to apricots[200 ]. A delicious fruit, it is used as a dessert and can also be made into jams, sauces, pies, tarts etc[301 , 307 ]. The flesh immediately surrounding the 2 - 4 seeds in the fruit is bitter[307 ]. The fruit is rich in pectin and therefore makes good preserves, these taste remarkably like apricot preserves[200 , 301 ]. The immature green fruit is high in pectin and can be added to pectin-low fruits when making jellies, jams etc[301 ]. The light brown fruit is a globose to irregular berry, 10 - 20cm in diameter[418 ]. The fruits can be as large as a child's head and weigh up to 2 kilos[200 , 303 ]. A liqueur is distilled from the fragrant flowers[46 , 301 ]. An alcoholic drink is fermented from the sap of the tree[301 ].

tcanta Containers Dye Fuel Furniture Gum Hair Insecticide Latex Pectin Plant breeding Repellent Soil stabilization Tannin WoodLarge shade tree. Large fruiting tree, Street tree. Public open space. Agroforestry Uses: The large spreading lateral roots prevent soil erosion[303 ]. Other

Uses The juice of the seed leaves an indelible stain[303 ]. The bark contains tannin[303 ]. When twisted into the shape of a cone, the leaves are used as pots for planting tobacco seedlings and protect the young plants from root-destroying insects[447 ]. The bark contains a pale yellow latex that exudes from points of damage. It has been used as an insecticide[447 ]. All parts of the plant have insecticidal properties; infusions of the powdered seeds and gum from the bark and green fruit rind are used as insecticides to kill ticks, fleas and jiggers[303 , 348 ]. Mammee leaves are wrapped around young tomato plants when setting them in the ground to protect them from mole crickets and cutworms[303 ]. Various extracts from the fruit, bark, leaves or roots are toxic to moths, beetle larvae and also to bugs[303 ]. Seed extracts are toxic to fish, chicks and hogs[303 ]. The heartwood is reddish or purple-brown; the sapwood much lighter in colour. Texture is medium; the grain is fine in one report, whilst another says that it is frequently interlocked and irregular; the surface of this attractive wood often is flecked with small, dark, oily, exudations. The wood is hard; heavy; strong; fairly resistant to decay but very susceptible to termites. Air-seasoning is moderate in rate but very difficult, and the amount of degrade is considerable. It is easy to work; has an attractive grain and polishes well; planing, turning, boring, and mortising are good; shaping and resistance to screw sjilting are excellent ; and sanding is poor. The wood is useful in cabinetwork, it is valued for pillars, rafters, decorative features of fine houses, interior sheathing, turnery and posts[303 , 447 ]. The wood is used for fuel[303 ].

dwatta Anthelmintic Antidiarrhoeal Digestive Febrifuge Skin TonicUses of mamey in folk medicine include treatment of scalp infections, diarrhoea, digestive and eye problems[303 ]. The powdered seeds are employed in the treatment of parasitic skin diseases[303 , 348 ]. An infusion of the ground seeds, minus the embryo which is considered convulsant, is employed as an anthelmintic for adults only[303 ]. The gummy latex from the bark has been used as an insecticide, to extract chiggers and insects from the skin, and to kill ticks and other parasites of dogs and other domestic animals[447 ]. An aromatic liqueur called Eau de Creole or Crème de Creole, is distilled from the flowers and said to act as a tonic or digestive[303 ]. An infusion of the fresh or dry leaves is given in cases of intermittent fever[303 ]. The plant contains coumarins, especially mameine[348 ].

nrakta Northern S. America to the Caribbean. ksacta Within its natural range, mamee is most frequently found in semi-cultivation or in areas that have been disturbed[303 ].

propta Seeds are the usual means of propagation and they germinate in 1 - 4 months with a 97% rate. Seeds sprout readily in leaf-mulch under the tree. Grown under light shade, seedlings reach 40 - 50cm and are ready to out-plant 3 - 5 months after sowing[303 ]. Greenwood cuttings with bottom heat.

nwatta Mammee apple is limited to tropical or near tropical moist to wet climates[303 ]. It grows best in the lowlands, but can succeed at elevations up to 1,000 metres[303 ]. It grows best in areas where annual daytime temperatures are within the range 24 - 30°C, but can tolerate 12 - 35°C[418 ]. When dormant, the plant can survive temperatures down to about -2°C, but young growth can be severely damaged at 0°C[418 ]. It prefers a mean annual rainfall in the range 1,200 - 1,800mm, but tolerates 800 - 2,600mm[418 ]. Prefers a position in full sun or light shade[307 ]. Prefers a deep, rich, well-drained sandy loam[200 ]. Prefers a pH in the range 6 - 6.5, tolerating 5.5 - 8[418 ]. Trees can produce their first crop in 6 - 10 years from seed[200 ]. Good trees can produce 300 - 400 fruits per year[418 ]. There are some named varieties[301 ]. One report says that the plant is dioecious[335 ], others that it is monoecious. In some forms of this plant, the flowers produced are predominantly female and the tree fruits heavily, in other forms there can be a predominance of male flowers and fruit yields are much lower[200 ]. Flowering Time: Late Spring/Early Summer. Bloom Color: White/Near White. Spacing: 20-30 ft. (6-9 m).

## 10.2.63 Mangifera rubropetala

Red petaled mango  
10 11n 12 cyuc 4 kcaak 0 tcan 0 dwat 16 m hkuc

htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprik hpa7tmwatti hjonli

drutta Mangifera rubropetala is an evergreen Tree growing to 16 m (52ft) by 16 m (52ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid and neutral soils. It cannot grow in the shade. It prefers moist soil.

ksacta Edible Parts: FruitEdible Uses: Fruit - raw[894 ]. The yellow or orange-yellow pulp is sweet and tasty with not very many, short fibres[894 ]. Similar to that of the mango (Mangifera indica), the smoth, yellow, thin-skinned fruit is 4 - 6cm long, containing a single, large seed[894 ]. tcanta Other Uses The wood is white and rather soft[894 ].

nrakta Southeast Asia - Malaysia, Indonesia. ksacta The tree has not been found in a truly wild situation[894 ].

propta Seed -

nwatta A tree of the moist, lowland tropics, growing in areas where there is no distinct dry season[894 ]. Unlike the true mango (Mangifera indica), the flowers of this species can develop successfully on rainy days[894 ].

## 10.2.64 Parinari curatellifolia

Mbola, Grys Appel

10 11n 12 cyuc 4 kcaak 3 tcan 2 dwat 15 m hkuc  
htut cyutli hgattcuphja7n hwicli jlutnyik hpa7tli flatprikliws hpa7tmwatti hjonli

drutta Parinari curatellifolia is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist or wet soil and can tolerate drought.

ksacta Edible Parts: Fruit Oil SeedEdible Uses: Drink OilFruit - raw or cooked[398 ]. It has a dry but delicious flesh[307 ]. A strawberry-like flavour[46 ]. Somewhat astringent, it is one of the best wild fruits of the area[308 ]. It has a pleasant taste when it has been stored for a few days until it is thoroughly ripe[308 , 466 ]. The fruits can be pounded with water and the liquid obtained thickened with flour to make a gruel known as 'phala la maula'[466 ]. A soft drink is prepared by peeling ripe fruits and soaking them in warm water[398 ]. A nice jam can be made from the fruit[398 ]. The russet-yellow, ovoid fruit is 3 - 5cm in diameter[307 ]. It has a high content of protein and vitamin C[418 ]. The seeds make an excellent substitute for almonds[308 ]. Often roasted[335 ]. They can be pounded and used in making soup[418 ]. The seeds contain about 40% oil (70% in the kernels)[325 ]. It is extracted and used for cooking[325 , 398 ]. The seeds are dried, roasted, crushed, boiled in water, left to cool and the oil skimmed off[398 ].

tcanta Charcoal Fire retardant Fuel Furniture Oil Paint Soap making Tannin Teeth Varnish WoodAgroforestry Uses: An important tree for bee forage[398 ]. Other Uses The bark contains tannins[418 ]. It is used as a dye in basket making[325 ]. The seeds contain around 38% oil[303 , 418 ]. It is used in making paint, varnish, soap etc[325 ]. The twigs are used as chew sticks to keep teeth and gums clean and healthy[325 ]. The pale-brown to yellow-red wood is hard, durable and heavy, but is high in silica making it somewhat difficult to saw and plane[466 ]. It is strongly fire resistant[325 ]. A locally important wood, it is very suitable for fine woodwork, building and furniture making, and is also used for poles, dugout canoes and mortars[307 , 466 ]. The wood is used for fuel[398 , 418 ] and makes a good charcoal[466 ].

dwatta Febrifuge Mouthwash Skin Vitamin CThe root is highly valued for its medicinal properties[307 ]. An infusion of the roots is used to treat toothache[325 ]. A hot fomentation of the bark is used in the treatment of pneumonia[418 ]. A leaf decoction is either drunk or used in a bath as a remedy for fevers[418 ]. The crushed or pulped leaves are used in a dressing for fractures or dislocations, and for wounds, sores and cuts[418 ].

nrakta Tropical Africa - Senegal to Kenya, south to northern SW. Africa, Botswana and the Transvaal. ksacta Char-

waterlogged soils and also periodic inundation of the soil for brief periods[ 303 ]. Plants can withstand strong winds and will re-sprout after sustaining wind damage[ 303 ]. Once established, breadnut trees can withstand a dry season of 3 - 4 months, although they prefer moist conditions. A moderately fast growing tree[ 303 ]. Trees can start producing fruit when 8 - 10 years old[ 303 ]. The tree has a shallow-rooting system, with roots often growing along the ground[ 303 ]. Trees can produce 600-800 fruits in a season.

## 10.2.75 Astrocaryum vulgare

Tucuma. Awarra palm, Tucum palm.

10 11n 12 cyuc 4 kcaak 3 tcan 2 dwat 15 m hkuc  
htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliws hpa7tmwatti hjonli

drutta Astrocaryum vulgare is an evergreen Tree growing to 15 m (49ft) by 8 m (26ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil. The plant is not wind tolerant.

ksacta Edible Parts: Apical bud Fruit Oil Sap SeedEdible Uses: OilFruit - raw[297 , 416 ]. Slightly sweet[416 ]. A flavour similar to apricots[301 ]. Used for making juices[418 ]. The mesocarp is rich in provitamin A; it provides a fatty, mashed pulp that is used to prepare the very popular French Guianan dish 'bouillon d'awara', which is traditionally eaten at Easter time[1869 ]. The orange-red, globose to ovoid fruit is 35 - 45mm long and 25 - 35mm wide with a fleshy mesocarp covering a single large seed[1874 ]. After harvesting, the fruits are stored for 3 days in sacks to ripen and allow the pulp soften slightly. They must then be eaten within 3 - 4 days before they dry and rot where bruised[324 ]. The immature endosperm gives a juice called vino de tucuma, used for a drink or in culinary preparations[418 ]. An excellent oil, used for cooking, can be obtained from the fruits[297 , 324 ]. Similar to coconut oil[301 , 418 ]. The seed contains a hard white substance from which a fine edible fat can be extracted[418 ]. The seed contains 30 - 50% oil[419 ]. The fruits and seeds of various species in this genus are reported to be used for oil production in the Amazon region[1869 ]. Existing analyses of fruit fat content show a relatively homogeneous composition among the different species, with around 20% of fat content in the mesocarp, mostly composed of oleic and palmitic acids, and 20 - 35% of fat content in the endosperm, with a predominance of lauric acid[1869 ]. The palm heart (the inner core and growing bud of the plant) is harvested[418 Ecocrop Publication Author Website <http://ecocrop.fao.org/ecocrop/srv/en/home> Publisher Year 0 ISBN Description Basic information on a wide range of useful plants, plus details of environmental needs where available. ]. It provides a crispy food, rich in nutrients, that can be eaten raw or cooked. Harvesting the heart will lead to the death of the stem it was harvested from, though in multi-stemmed plants such as this the rest of the plant will continue to grow and often produce new stems[K ]. A wine is made from the fermented sap of the spathe[418 ].

tcanta OilAn oil can be obtained from the fruits[297 ]. It is used in soap making[324 , 418 ]. A fine, soft, strong and durable fibre can be obtained from the unopened leaves[297 , 454 ]. It is used for weaving and cordage[297 ]. It is said to be the strongest fibre that can be produced in Amazonia and is widely used for making hammocks, ropes, bags, clothes etc[324 , 418 , 454 ]. The fibre is resistant to rot and damage and was therefore in use on sail-ships in the earlier centuries[418 ]. Fibre can be extracted from the petiole after soaking it in water[1874 ]. The leaflets are used in making baskets[1869 The genus Astrocaryum (Arecaceae) Publication Rev. peru. biol. 15(supl. 1): 031- 048 (Noviembre 2008) Author Kahn F. Publisher Year 2008 ISBN 1727-9933 Description ]. The shell of the kernel is used for making handicrafts such as rings, bracelets and collars[418 ]. The oils extracted from the fruit and the seed are used as ingredients in commercial cosmetic preparations as emollients and skin conditioners[1243 ]. The wood is moderately heavy, very hard, strong and durable[297 , 419 ]. It is used locally in making houses[297 ]. The stems are used as poles for fences, corrals, and rural housing[418 ]. Its resistance to diseases

and high productivity make this species an alternative for the production of biodiesel, since the operating costs of an orderly plantation are much less than that of the oil palm.

dwatta A decoction of the root is used to treat furunculosis and syphilis[348 ]. The oil from the seed is laxative[348 ]. It is used to treat rheumatism, pain and earache. It is used in a preparation for treating furuncles and is also swabbed onto aching feet and rubbed on feverish people to assist perspiration[348 ]. The fruit can be utilized against the eye disease xerophthalmia (also called ophthalmoxerosis) of which the deficiency of vitamin A is the main reason[418 ]. The whole fruit is used to calm colicky babies[348 ]. The pulp of the fruit is used to treat coughs and as a breath freshener[348 ].

nrakta S. America - northern Brazil and the Guyanas. ksacta Rainforest[297 ]. Especially in disturbed sites[324 ]. Found in the rainforest of the Amazon and the savannahs of Surinam on flat to gently rolling terrain[418 ]. Occurs mainly on land that is not subject to periodic inundation[419 ].

propta The seed is enclosed in a hard endocarp which makes germination slow and erratic[297 ], and also has a short viability in storage[419 ]. It may benefit from scarification before sowing to speed up germination. This can usually be done by pouring a small amount of nearly boiling water on the seeds (being careful not to cook them!) and then soaking them for 12 - 24 hours in warm water. By this time they should have imbibed moisture and swollen - if they have not, then carefully make a nick in the seedcoat (being careful not to damage the embryo) and soak for a further 12 hours before sowing. It is best to sow the seed as soon as it is ripe in a partially shaded position in a nursery seedbed or in individual containers. A high germination rate can usually be expected, with the seed sprouting within 90 - 150 days[419 ]. When the seedbed-sown seedlings are 5 - 8cm tall, pot them up into individual containers and they should be ready to plant out 6 - 9 months later[419 ].

nwatta Management: Standard Regional Crop Staple Crop: OilA plant of the moist tropical lowlands, where it is found at elevations up to 150 metres. It grows best in areas where annual daytime temperatures are within the range 20 - 28c, but can tolerate 18 - 30c[418 ]. It can be killed by temperatures of 2c or lower[418 ]. It prefers a mean annual rainfall in the range 1,300 - 1,800mm, but tolerates 1,000 - 3,000 mm[418 ]. Requires a sunny, sheltered position[297 ]. Seedlings require some shade, whilst larger palms thrive in full sun[418 ]. Plants do not like dry conditions at their roots[297 ]. Prefers a pH in the range 5 - 7, tolerating 4 - 8[418 ]. Plants regrow very vigorously from their roots after being cut down or after a fire. They are considered to be a serious weed species of pasture land[419 ]. Young plants have a moderate rate of growth[419 ]. Although usually spiny, occasional spineless forms exist in nature[418 ].

## 10.2.76 Dendrocalamus asper

Giant Bamboo, Dragon bamboo, Sweet bamboo  
10 11n 12 cyuc 4 kcaak 3 tcan 0 dwat 15 m hkuc  
htut cyutli tcup hwicli hrasjlutnyik hpa7tli frusfatprikliwssipp hpa7tmwatti hjonli

drutta Dendrocalamus asper is an evergreen Bamboo growing to 15 m (49ft) by 5 m (16ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers moist soil.

ksacta Edible Parts: Shoots StemEdible Uses: Young stems - cooked. Free of bitterness[ 310 ]. Harvested before they emerge from the soil, they are tender and sweet[ 301 , 310 ]. They are used as a vegetable, pickled or preserved[ 301 ]. They can be cut into strips and used as a substitute for macaroni in soups[ 301 ]. The edible portion of young shoots is about 34%; they weigh on average 5.4 kilos before peeling and 1.8 kilos after peeling[ 299 ].

tcanta Biomass Containers Fodder Furniture Musical Paper WoodOther Uses: The upper internodes of the culm, which are longer than the lowermost ones, are used as containers for water or to collect juice being tapped from palm inflorescences[ 310 ]. The internodes of this and other bamboo species are also used as ready-made cooking pots in the field[ 299 , 310 ]. The internode is opened at one end (or

## 10.2.72 Dictyosperma album

Hurricane Palm, Princess Palm, Red Palm  
10 tin 12 cyuc 4 kcaak 0 tcan 2 dwat 15 m hkuc  
hmimhtut cyuti tcup hwicli hrasjlutnyik hpa7tli prikrlwish-  
som hpa7tmwatli hjonli

drutta Dictyosperma album is an evergreen Tree growing to 15 m (49ft) by 8 m (26ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant can tolerate maritime exposure.

ksakta Edible Parts: Apical bud LeavesEdible Uses: Leaves - cooked[ 299 ]. The apical bud of this plant is highly valued as a food[ 299 ]. This palm is single-stemmed and unable to form sideshoots - harvesting the apical bud leads to the death of the plant[ K ].

dwatta DiureticA root decoction is used as a diuretic[ 299 ].

nrakta Africa - Mauritius, Réunion. ksacta Coastal forests[ 314 ]. Grows at low elevations generally up to 600 metres[ 299 ].

propta Seed - sown fresh, it germinates within 60 - 120 days[ 423 ].

nwatta Plants are able to tolerate occasional light frosts with temperatures down to -1°c[ 423 ]. Prefers a position in light shade or full sun[ 299 , 314 ]. Grows best in a well-drained soil. Tolerant of saline conditions[ 299 , 314 ]. Usually growing near the coast, the plant can withstand the strongest of winds, including salt-laden hurricanes[ 299 , 314 ]. A moderately fast growing plant[ 299 ]. Blooms repeatedly

## 10.2.73 Pouteria caimito

Abiu, Yellow Star Apple

10 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 15 m hkuc  
hmimhtut cyuti tucpha7n hwicli hrasjlutnyik hpa7tli frus-  
flatprik hpa7tmwatli fyif hjonli

drutta Pouteria caimito is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil.

ksakta Edible Parts: FruitEdible Uses: The fully ripe fruit has a delicious flavour - it is eaten raw or used in sherbets and ice cream[301 , 317 ]. It goes particularly well in fruit salads, especially if they contain orange slices to add acidity[301 ]. A lovely bright yellow fruit with a whitish, translucent flesh that has a jelly-like consistency and a sweetish flavour[301 ]. The fruit has a flavour somewhat like a rambutan[296 ]. It is up to 10cm in diameter[296 ]. Fruit that is not fully ripe can contain a milky latex that sticks to the lips[301 ]. The fruit has a thin skin that bruises easily, so the fruit will not store for more than a few days[296 ].

tcanta WoodOther Uses: The wood is heavy, hard, straight-grained, of medium texture[420 ]. It is moderately resistant to insect attack, and moderately durable[420 ]. It is used for construction and external work[420 ].

nrakta S. America - Brazil, Bolivia and Peru, north to the Caribbean and through C. America to Costa Rica. ksacta Forests, especially in areas that are seasonally flooded, and by the coast, at elevations from sea level to 1,500 metres[420 ].

propta Seed - remove it from its husk before sowing[200 ]. Best sown as soon as it is ripe[420 ]. Sow in a nursery seedbed in semi-shade. When sown fresh, the seed usually germinates in 4 - 6 weeks, with a reasonable percentage germinating[377 , 420 ]. Side-grafting. Air-layering may be possible[200 ].

nwatta A tree of the hot, wet, tropical lowlands, it requires a year-round moist and warm climate[335 , 377 ]. Plants are intolerant of frost[335 ]. Succeeds in full sun and in dappled shade[420 ]. Grows well in wet soils[377 ]. Prefers an acid soil[335 ]. Seedling trees take up to 8 years before they start to fruit, and some are very shy fruiter[296 ]. It is therefore best to propagate vegetatively from good fruiting forms[296 ]. Grafted plants can fruit in

3 - 4 years[335 ]. Good forms can fruit twice a year[296 ]. Mature trees may produce anywhere from 100 - 1,000 fruits a year[377 ]. A large tree, it is best kept pruned to about 4 metres tall in order to make fruit harvest easier[296 ]. There are some named varieties[301 ]. The quality of the fruits is much higher in recent selected strains[317 ]. Some forms are self-fertile, though others need cross-pollination[335 ].

## 10.2.74 Artocarpus camansi

Breadnut, Kamansi

10 tin 12 cyuc 4 kcaak 3 tcan 1 dwat 15 m hkuc  
htut cyuti hgattcup hwicli hrasjlutnyik hpa7tli flatprik-  
wisslip hpa7tmwatli hjonli

drutta Artocarpus camansi is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very alkaline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

ksakta Edible Parts: Fruit Oil SeedEdible Uses: OilFruit - usually cooked[ 303 ]. A sweet aroma and taste[ 303 ]. The fruits are nutritious and usually consumed when immature; thinly sliced and boiled as a vegetable in soups or stews[ 303 ]. The greenish-yellow, oval or ovoid fruit is 7 - 12cm in diameter and weighs about 800g[ 303 ]. Seed - cooked[ 303 ]. When roasted they are similar to chestnuts in texture and flavour. They can be canned in brine, or processed into nut butter or nut paste, flour, or oil[ 303 ]. The seeds are high in protein and relatively low in fat compared to nuts such as almond, Brazil nut, and macadamia nut; they are a good source of minerals and contain more niacin than most other nuts[ 303 ]. The seeds are about 25mm long, with from 12 - 150 seeds per fruit, each seed weighing 7 - 10g and, in total, comprising 30 - 50% or more of the total fruit weight[ 303 ].

tcanta Fuel Insecticide Latex Mulch Oil Plant support Soil stabilization WoodOther uses rating: Medium (3/5). Agroforestry Uses: Breadnut can be interplanted with a wide range of crops and plants, such as yam, banana (Musa spp.), coconut (Cocos nucifera), sugarcane, medicinal plants, aroids, ginger, Indian mulberry (Morinda citrifolia, noni), small fruit trees, and field and vegetable crops such as corn, beans, peanut, tomato, and eggplant[ 303 ]. The large leaves of breadnut provide abundant mulch for the tree and other plants growing beneath the canopy[ 303 ]. Breadnut naturally occurs on frequently flooded river banks, where it helps to stabilize the soil[ 303 ]. The tree is planted in home gardens to provide beneficial shade to other plants. It could also be used as a trellis tree for yam (Dioscorea species)[ 303 ]. Other Uses A sticky, white, milky latex is present in all parts of the tree[ 303 ]. Dried male flowers can be burned to repel mosquitoes and other flying insects[ 303 ]. The wood is light in weight, flexible, and easy to work and carve[ 303 ] It is made into statues, bowls, fishing floats, and other objects[ 303 ]. The wood is fast burning, but generally only older, less productive trees are used for fuel[ 303 ].

dwatta No specific medicinal uses are reported for this species, but it tree probably has medicinal properties similar to the breadfruit (Artocarpus altilis)[ 303 ].

nrakta Southeast Asia - Indonesia to Papua New Guinea. ksacta Alluvial forests in lowland areas, it is one of the first species to appear on the tops of frequently flooded banks of rivers[ 303 ].

propta Seed - it has a very short viability and needs to be sown as soon as it is ripe[ 303 ].

nwatta Management: Standard Minor Global Crop Other Systems: Homegarden Other Systems: Multi-strata Staple Crop: Balanced carbA plant of low to moderate elevations in the moist tropics, where it is found at elevations from sea level to 1,550 metres[ 303 ]. It grows best in areas where the mean maximum temperature of the hottest month is no more than 32 - 38c and the mean minimum temperature of the coolest month is no less than 16 - 18c[ 303 ]. It prefers a mean annual rainfall in the range 1,300 - 3,800mm with no distinct dry season[ 303 ]. Established plants can grow in full sun, but young plants need 20 - 50% shade[ 303 ]. Grows best in a deep, light, fertile, well drained soil[ 303 ]. Prefers a pH in the range 6.1 - 7.4[ 303 ]. Plants can tolerate

acteristic of wooded grassland with a high water-table and poor drainage[308 ]. Deciduous woodland; scattered in upland grassland, often persisting in secondary bushland and cultivated land, sea level to 2,100 metres[398 ].

propta Seed - it remains viable in normal storage for at least 4 years[325 ]. The seeds should be sown in river sand in flat seed trays. Press the seeds down until they are level with the soil surface and cover with a thin layer of sand. Germination is very poor and prolonged, commencing after about 5 weeks. Seedlings should be transplanted in the 3-leaf stage. Be careful when transplanting the seedlings, the taproot is easily damaged[325 ]. Plant out when about 30cm tall. Root suckers.

nwatta Industrial Crop: Oil Management: Standard Regional Crop Staple Crop: OilA plant of the tropical and subtropical savannah, growing at elevations of 900 - 1,500 metres in areas with a pronounced dry season[466 ]. It grows best in areas where the mean annual temperature falls within the range 14 - 30°c, but can tolerate 10 - 36°c[418 ]. It prefers a mean annual rainfall in the range 400 - 1,000mm, tolerating 100 - 2,700mm[418 ]. Prefers a deep soil in a sunny position[307 ]. Grows best in light soils[335 ]. Often found on light yellowish-brown to reddish-yellow, gritty, sandy clay loams and red to dark red friable clays with lateritic horizon[418 ]. Prefers a pH in the range 5.5 - 7, but tolerates 5 - 7.5[418 ]. It can tolerate small concentrations of copper in the soil[418 ]. Dislikes cold winds[418 ]. Trees can be coppiced[325 ]. Because of its resistance to fire it features prominently in fire-maintained wooded grassland, especially in upland areas on the former site of montane forest[308 ].

## 10.2.65 Pachira insignis

Malabar Chestnut

10 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 15 m hkuc  
hmimhtut cyuti tcup hwicli jlutnyik hpa7tli flatprikwis  
hpa7tmwatli hjonli

drutta Pachira insignis is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ksakta Edible Parts: Flowers Leaves Oil SeedEdible Uses: Chocolate Drink OilSeeds - raw or cooked[301 , 377 ]. Eaten raw, they are said to taste a bit like peanuts, whilst the cooked seeds are like chestnuts[377 ]. The seeds can be roasted and used like cocoa[301 , 317 ]. The seeds can also be ground into a powder and used as flour-substitute in bread[362 ]. The seeds contain about 50% oil[317 ]. The large seeds can be up to 8cm in diameter, and are contained in a woody capsule that can be 30cm in diameter and weigh more than 3 kilos[377 , 625 ]. Young leaves[301 ]. Flowers[301 ].

tcanta Containers Oil Paper WoodOther Uses The wood is light, straight-grained, coarse-textured, easy to cut but with a low resistance to rot[625 ]. A low value timber, it is used to make toys, boxes, door and panel fillings etc[625 ]. It is useful for the production of paper[317 ].

nrakta S. America - Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, the Guyanas; Caribbean - West Indies. ksacta Humid upland rainforests, mainly in dense primary forest or late-stage secondary formations in Brazil[625 ]. Wet, lowland, tropical rainforests at elevations up to 500 metres[362 ].

propta Seed - best sown as soon as it is ripe. Sow the seed in a partially shaded position in individual containers. Germination rates are usually extremely good, with the seeds sprouting within 10 - 15 days. The seedlings develop quickly[625 ]. Cuttings Air layering.

nwatta A plant of the moist tropics. It is said to be able to tolerate occasional drops in temperature to just below freezing[377 ]. Grows well in a sunny position and in partial shade[377 , 625 ]. Prefers a clay, well-watered soil[625 ]. Prefers a well-drained soil[362 ]. Plants can tolerate periodic inundation, but also need some time when the soil becomes drier[377 ]. They grow well on the banks of rivers[377 ]. A fast-growing tree[625 ]. Bloom Color: White/Near White.

## 10.2.66 Paullinia yoco

Yoco

10 tin 12 cyuc 4 kcaak 0 tcan 2 dwat 15 m hkuc  
hmimhtut cyuti tcup hwicli hrasjlutnyik hpa7tli flatprikwis  
hpa7tmwatli hjonli

drutta Paullinia yoco is an evergreen Climber growing to 15 m (49ft) by 2 m (6ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ksakta Edible Parts: Inner bark Sap StemEdible Uses: Coffee DrinkThe softer tissues of the bark, stems and wood are used to extract the white or brownish sap which has been shown to contain 2.73% caffeine. The native people in adjacent Colombia regularly used this product as a stimulating breakfast beverage[434 , 521 ]. The stem is cut into pieces 30 - 100cm long, and the epidermis, cortex, and phloem are rasped. The scrapings thus obtained are squeezed to express the caffeine-bearing sap into cold water (hot or warm water is never used with yoco), the rasped tissues being then discarded. The liquid, of a cloudy milky-white or light chocolate-brown colour, is drunk cold. The beverage, which is taken early every morning, allays hunger and supplies muscular stimulation[476 ]. Lianas of Paullinia Yoco, which have a stout stem at least 8cm in diameter at the base, are utilized. Usually several trees must be felled before the liana falls to the ground. Starting at the root, the stem is then cut into pieces which may vary from 30 - 100cm in length. These pieces are stored in cool corners of Indian houses and can retain their stimulating properties for a month or even longer[928 ].

dwatta Antibilious Febrifuge Malaria StimulantA beverage made from the stem (see edible uses), is taken medicinally as a febrifuge and as a curative for a bilious disease[476 , 928 ]. In addition to its use as a stimulant, yoco is employed, in larger dosages, as an anti-malarial febrifuge and as a medicine in the treatment of a bilious disease which is frequent in the Putumayo[928 ].

nrakta S. America - Peru, Ecuador, Colombia. ksacta Not known  
propta Seed -  
nwatta Not known

## 10.2.67 Passiflora quadrangularis

Giant Granadilla, Badae

10 tin 12 cyuc 4 kcaak 0 tcan 2 dwat 15 m hkuc  
hmimhtut cyuti tcup hwicli jlutnyik hpa7tli flatprik  
hpa7tmwatli dyat hjonli

drutta Passiflora quadrangularis is an evergreen Climber growing to 15 m (49ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The raw root is a potent narcotic and poisonous[262 , 348 ]. The noxious effects of the poison can be counteracted by a decoction of Petiveria alliacea, Cassia sp., Andropogon sp., and 'bois-trompette'[348 ]. (Parts of plant are poisonous if ingested)

ksakta Edible Parts: Fruit RootEdible Uses: Drink SweetenerFruit - raw, cooked or used to make drinks[301 ]. Sweetly acid[262 ]. Very palatable[46 ]. The largest fruit of the genus, it is up to 30cm long and has a mild, melon-like flavour[296 , 301 ]. The immature fruit is used as a vegetable - it can be steamed or boiled or added to soups[301 ]. The thick rind of the fruit is cooked in various ways and used as a vegetable[262 ]. The fruit is often used to made juices[317 ]. The roots of old plants are baked or roasted and eaten like yams (Dioscorea spp)[262 , 301 ]. Some caution is advised, since the raw root is narcotic and poisonous[262 ].

dwatta Anthelmintic Antiasthmatic Antidiarrhoeal Antiscorbutic Diuretic Dysentery Emetic Narcotic Poulitce Sedative Stomachic VermifugeThe root is diuretic, emetic, narcotic and vermifuge[262 ]. It contains passiflorine, an anthelmintic that also causes lethargy[262 ]. When powdered

and mixed with oil, the root is used externally as a soothing poultice[262 ]. The leaves are powdered and mixed with oil then used externally as a soothing poultice[262 ]. They are also used in this form to treat liver complaints[262 ]. The fruit is antiscorbutic and stomachic[262 ]. The rind of the fruit is sedative[262 ]. It is used in the treatment of headaches, asthma, diarrhoea, dysentery, neurasthenia and insomnia[262 ].

nrakta Original range unknown, it is widespread in the Tropics. ksacta Flood plains in the rainforests[416 ].

propta Seed - best sown as soon as it is ripe along with the pulp which will help break down the seed coat and speed up germination[262 ]. Stored seed should be soaked for 24 hours in warm water and germination time can be reduced if the seed is then mixed with the juice of a fresh passion fruit (of any species)[262 ]. Even so, it can take 12 months for stored seed to germinate[262 ]. Place the seed tray in a shady position, maintaining a temperature around 19 - 24c[262 ]. Prick the seedlings out into individual containers as soon as they are large enough to handle and plant out when large enough[262 ]. Cuttings of young shoots, taken at the nodes. The cuttings root best in a neutral to slightly acid compost, but 100% sharp sand also produces good results[262 ]. Cuttings of fully mature wood taken at a node. They can take 3 months, but there is usually a high percentage[3 ]. Layering. Very easy[262 ]. Air layering.

nwatta Succeeds in the hot, wet, lowlands to moderate elevations in tropical to subtropical climates[262 , 335 ]. Plants require a temperature no lower than around 16°C when they are flowering in order to ensure fruit set[200 ]. They can be damaged if temperatures fall much below 10°C[262 ]. Requires a humus-rich, moist but well-drained soil and a position in dappled shade where it can grow up towards the sun[262 ]. Prefers a circumneutral soil, disliking very acid or very alkaline conditions[262 ]. Passiflora species tend to flower and fruit more freely when grown in soils of only moderate fertility[200 ]. Seedling plants can commence fruiting when only 1 - 2 years old, whilst cuttings have been known to fruit in their first year of growth[335 ]. Plants can flower and fruit all year round[262 ]. A self-sterile species[200 ]. Plants are very tolerant of pruning and can be cut back to ground level if required to rejuvenate the plant[202 ]. Plants in this genus are notably resistant to honey fungus[200 ]. Flowering Time: Blooms repeatedly. Bloom Color: Red Violet/Lavender White/Near White. Spacing: 24-36 in. (60-90 cm).

## 10.2.68 Anacolosa frutescens

Galo Nut, Kopi gunung, Tangki leuweng, Belian landak. 10 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 15 m hkuc pcmhmit cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwattli hjonli

drutta Anacolosa frutescens is an evergreen Tree growing to 15 m (49ft) by 15 m (49ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in full shade (deep woodland) or semi-shade (light woodland). It prefers moist soil.

kcakta Edible Parts: Fruit SeedEdible Uses: Edible portion: Nut, Fruit, Seeds. Seed - raw or cooked[ 301 ]. The thin-shelled nuts are of good flavour and quality, they are said to have the flavour of a mixture of sweet corn and chestnuts[ 301 , 324 ]. They contain 3.9 - 11.1% protein, 1.8 - 8% fat and 33.4 - 39.5% carbohydrate[ 301 ]. Fruit - raw or cooked[ 310 ]. Young fruits are delicious when boiled[ 301 ]. The pulp of mature fruits can be eaten cooked[ 301 ]. The yellow or orange fruit is a drupe, 15 - 25mm long, 12 - 20mm in diameter with a thin layer of pulp up to 6mm thick surrounding a single seed[ 324 ].

tcanta WoodOther uses rating: Low (2/5). Other Uses: The pale, reddish-brown wood is hard and heavy, but not durable. It is used for house posts[ 324 , 451 ].

nrakta Southeastern Asia - Myanmar, through Malaysia to Indonesia and the Philippines. ksacta Lowland and submontane forest, mixed Dipterocarp forest, by streams in kerangas forest, sometimes in peat swamp forest and secondary forest, occasionally on limestone, from sea-level to 700 metres, rarely to 1,400 metres[ 451 ].

propta Seed - germination takes more than 100 days[ 324 ]. Cleft-grafting onto seedlings 1 year old or more is highly successful[ 324 ]. Air layering. Takes about 4 months[ 310 ].

nwatta A plant of the moist tropical lowlands, usually growing at elevations up to 700 metres, exceptionally to 1,400 metres. It prefers a climate without a pronounced dry season[ 310 ]. Prefers a position with some shade[ 310 ]. The trees appear to be highly variable, with some high-yielding forms having been noted[ 324 ]. Seedlings grow slowly, taking about a year to reach grafting size[ 310 ]. Germination and early growth is slow. A mature fruit weighs 8-16 g. A kernel weighs 0.8-2.8 g.

## 10.2.69 Pourouma cecropiifolia

Amazon Grape

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 15 m hkuc hmimhtut cyutli tcup hwicli jlutnyik hpa7tli flatpriklwis hpa7tmwattli hjonli

drutta Pourouma cecropiifolia is an evergreen Tree growing to 15 m (49ft) by 7 m (23ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: DrinkFruit - raw or cooked[301 ]. The purple, grape-like fruits are up to 4cm in diameter, with a large seed and a sweet, juicy, white pulp that has the flavour of a grape[46 , 301 ]. They can be made into wine, jams and jellies[301 ]. The fruits are produced in clusters[335 ].

tcanta Containers WoodOther Uses: The wood is light, soft and easy to work[420 ]. It has a thick texture, poor mechanical properties and is not very durable[420 ]. It is used for linings, boxes, toys and plywood[420 ]. It is also pulped for cellulose[420 ].

dwatta PoulticeThe warmed bark is used as a poultice for treating hard boils[348 ].

nrakta S. America - Western Amazon in Brazil, Peru, Colombia and Ecuador. ksacta Rainforests, in areas that do not usually become inundated[420 ].

propta Seed - best sown as soon as it is ripe in a seedbed in a sunny position[420 ]. Less than 50% of the seeds usually germinate, normally within 3 - 5 weeks[420 ].

nwatta A tree of the hot, humid, tropical lowlands, where it is found at elevations up to 1,000 metres[335 , 420 ]. It is not tolerant of frost[335 ]. Succeeds in full sun or dappled shade[420 ]. Found in the wild on fertile, clayey soils[420 ]. A relatively fast-growing plant, it can commence fruiting when three years old[301 ]. A dioecious species, both male and female forms need to be grown if fruit and seeds are required.

## 10.2.70 Myrianthus arboreus

Giant yellow mulberry, Monkeyfruit

10 tin 12 cyuc 4 kcaak 2 tcan 3 dwat 15 m hkuc htut cyutli tcuphja7n hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwattli dyat hjonli

drutta Myrianthus arboreus is an evergreen Tree growing to 15 m (49ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist or wet soil.

kcakta Edible Parts: Fruit Leaves Oil SeedEdible Uses: OilYoung leaves - cooked[332 ]. They are commonly eaten in a vegetable-soup - the soup being so highly considered by the local people as to evoke the saying that 'one will kill his child for the sake of ibishere soup'[332 ]. Fruit - raw[332 , 398 ]. The fruit contains 5 - 15 seeds, each surrounded by a sweet or acidulous pulp which is generally well-liked and commonly eaten[301 , 332 , 398 ]. The fruit is heart-shaped and may attain 10 - 15 cm in diameter, it is very hard and green when unripe, but turns yellow and soft when mature[332 ]. Seed - cooked[332 ]. The seed contains about 45% oil, of which linoleic comprises about 93% of the whole[332 ]. The kernel

is about 10mm long by 5 - 7mm wide, it is enclosed in a woody pericarp amounting to 60 - 65% in weight of the whole[332 ]. The seed also contains about 19% sugars and 30% proteins[332 ]. The protein is unusually rich in cystine, which is of potential value to a population suffering from a chronic deficiency of sulphur-bearing amino acids[332 ].

tcanta Fencing Fuel Mulch Oil Parasiticide Repellent Soap making Soil conditioner Teeth WoodAgroforestry Uses: The leaves are enormous, to 70 cm across, digitately compound of 7 - 9 leaflets, the largest attaining 50 cm length by 25 cm breadth. When they fall and lie on the ground they form a good groundcover retaining moisture and rotting down to form a thick humus[332 ]. Other Uses Lye can be extracted from the ash of the wood and this is used in making soap[299 , 303 , 332 ]. Extracts of the plant have been shown to deter the termite *Reticulitermes lucifugus*[299 , 303 ]. The yellowish-white wood is moderately light, soft, fibrous and difficult to work[332 , 364 ]. It is used to make domestic utensils[364 ]. Though perishable it is also used for fencing[332 ]. The wood is used for fuel[332 , 398 ].

dwatta Antidiarrhoeal Antihæmorrhoidal Antitussive Cholagogue Dysentery Febrifuge Malaria Odontalgic ParasiticideThe bark is said to be antidysenteric, cholagogue and taenifuge[332 ]. It is used in the treatment of chest-complaints[332 ]. Scrapings of the bark, cooked in palm-oil, are taken to relieve sore-throat[332 ]. The leaves are chopped up small are eaten raw with salt for treating heart-troubles; pregnancy complications; dysmenorrhoea; and incipient hernia[332 ]. An extract of the leaves, combined with Alchomea spp., is used in the treatment of dysentery, and the leafy shoots are chewed for this same purpose[332 ]. The liquid in which young leaf-flushes and a peeled green banana have been boiled is a medicine taken little and often to stop diarrhoea and vomiting[299 , 332 ]. The leaves are an ingredient of a febrifuge given to small children[299 , 332 ]. The leaf or leaf-petiole is beaten into a plaster for application to boils[332 ]. Sap from the young leaves, or the terminal buds, is applied topically to toothache; applied to the chest to treat bronchitis; or is used as a throat-paint for laryngitis or sore throat[332 ]. It is used as an analgesic for muscular pains, and is put into enemata for hæmorrhoids[332 ]. When combined with the leaves of *Holarthra floribunda* and a chilli, it is used in an enema to relieve pain in the back and loins[332 ]. The aerial roots yield an abundant amount of sap when cut up. This is drunk as an anti-tussive and anti-diarrhoeic, and as a remedy for hæmaturia and blennorrhoea[332 ]. A vapour-bath made from the diced roots, combined with maleguetta pepper, is used in the treatment of headache[332 ]. The whole fruit is boiled in sap from the tree or in palm wine or other fruit ferments to take as an emeto-purgative[332 ]. It is preferred to the less active bark or leaves which may also be used for the same purpose[332 ]. Several pentacyclic triterpenoids have been isolated from the wood and the roots[299 ]. Euscaphic acid, myrianthic acid, tormentic acid, ursolic acid and a derivative of ursenoic acid have been isolated from stems[299 ]. Myrianthanic acid was isolated from the bark[299 ]. The wood also contains myrianthiphyllin, a lignan cinnamate[299 ]. Bark extracts of *Myrianthus arboreus* have shown antiplasmodial, antimycobacterial and antitrypanosomal effects in vitro, which supports some of its uses in traditional medicine, e.g. To treat malaria[299 ].

nrakta Tropical Africa - Guinea to Central African Republic and Uganda, south to Angola, DR Congo and Tanzania. ksacta Secondary vegetation; more or less open places in rain-forests; damp places in forest; forest gallery and clearings; stream or lagoon and lake sides; flooded ground; sometimes in villages[328 ]. At elevations from 700 - 1,200 metres in Tanzania[398 ].

propta Seed - best sown as soon as it is ripe[398 ]. About 40% of the seed germinates within 1 month, but this rate can be improved by soaking the seed for 12 hours in warm water prior to sowing[299 ]. The seed also germinates better if it has passed through the gut of an animal[303 ]. Bud grafting and stem cuttings have been successfully used for propagation in experiments[299 ].

nwatta A plant of moderate elevations in the moist tropics, being found from 700 - 1,200 metres. It is found in areas where the mean annual temperature is in the range 16 - 26°C and the mean annual rainfall is 1,400 - 4,000mm[303 ]. Prefers a damp soil[303 ]. Young plants can begin producing fruit when 4 - 5 years old from seed[398 ]. The plant

has mycorrhizal associations, thus helping to enrich the soil with nitrogen[299 , 303 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required.[299 , 303 ]

## 10.2.71 Dioscorea alata

Water Yam, Purple yam, Greater yam, White yam

10 tin 12 cyuc 4 kcaak 2 tcan 1 dwat 15 m hkuc hmim cyutli tcup hwicli hysihrasjlutnyik hpa7tli flatpriklwis hpa7tmwattli dyat hjonli

drutta Dioscorea alata is an evergreen Perennial Climber growing to 15 m (49ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Wind, Insects. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland). It prefers moist soil.

pcista Edible species of Dioscorea have opposite leaves whilst poisonous species have alternate leaves[ 174 ]. The uncooked tuber of this species is toxic, and is said to produce narcosis[ 332 ]. Saponin is present and cooking renders the tubers safe to eat[ 332 ].

kcakta Edible Parts: RootEdible Uses: ColouringRoot - cooked[ 300 ]. Usually boiled or baked and used as a vegetable[ 300 , 301 ]. An average of 3 roots are produced by the plants, these usually each weigh in the range of 5 - 10kg, though exceptionally they can weigh up to 60 kg[ 300 ]. The root needs to be properly cooked, it can be toxic if eaten raw[ 332 ]. The plant produces aerial tubers and these can be eaten in the same way as the tubers[ 301 ].

tcanta Dye FodderFodder/animal feed. Agroforestry. Ornamental. Medicinal: Traditional/folklore. Purple variety colour is due to various water-soluble anthocyanin pigments and is used as a food colouring agent.

dwatta The tuber is grated, mixed with brown stout vinegar, then spread onto paper and placed on the small of a woman's back to prevent or forestall a threatened miscarriage[ 348 ]. Although available as a dietary supplement and used in folk medicine, there is no clinical evidence that *D. alata* has any therapeutic properties. *D. alata* supplements may have adverse effects in people taking estrogens, anticoagulant drugs or during pregnancy and breast-feeding. *D. alata* has relatively high levels of oxalates (486-781 mg/100 g dry matter).

nrakta Probably arose in cultivation in E. Asia - Malaysia. ksacta Not known in a wild state.

propta Seed - rarely produced in cultivation, they are not normally used to propagate this species. Cuttings of tubers. Small tubers can be cut into 2 - 4 sections, larger ones into 6 - 8 sections. Each section should have 2 - 3 dormant buds. The cut tuber is often left in the sun for several hours to promote wound healing and reduce the risk of fungal infection[ 300 ]. Aerial tubers can also be used, they usually produce vigorous plants[ 300 ].

nwatta Plants grow best in lowland tropical areas up to an elevation of 1,000 metres with a temperature around 26 - 34°C, a well-defined dry season of 4 - 5 months; and a total rainfall of 1,000 - 1,500mm evenly distributed throughout the remainder of the year[ 300 ]. Plants are not frost tolerant[ 418 ]. Amongst the many cultivars of this species, there are forms that are tolerant of a wide range of environmental conditions[ 300 ]. For best yields, this species requires a deep, well-drained, sandy loam that is not liable to water-logging[ 300 ]. It also grows well in medium to clay loams[ 300 ]. Although more tolerant of poor soils than most other members of this genus, plants respond well to the application of organic matter[ 300 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 4.8 - 8.5[ 418 ]. Daylengths of more than 12 hours are preferred during the early growing season since this encourages vegetative growth; daylengths of less than 12 hours towards the end of the growing season will encourage tuber formation and development[ 300 ]. Plants take 7 - 10 months to mature a crop[ 300 ]. Yields of 20 - 25 tonnes per hectare have been obtained[ 300 ]. There are some named varieties[ 300 , 301 ]. A dioecious species, both male and female plants need to be grown if seed is required.



kcakta Edible Parts: Fruit Edible Uses: Fruit. A delicious flavour[307 ]. The plum-sized fruit has a thick skin[307 ].

nrakta S. America - Venezuela; C. America - Panama and Costa Rica. ksacta Pastures along roadsides[307 ].

propta Seed - Cuttings Side-veneer grafting nwatta This Jaboticaba relative is a slow growing, beautiful ornamental shrub that grows up to 6 ft. It bears a dark purple, almost bluish fruit with thin, sweet flesh surrounding one or two large seeds. Flowering Time: Blooms repeatedly. Bloom Color: White/Near White Inconspicuous/none. Spacing: 4-6 ft. (1.2-1.8 m).

## 10.2.106 Caryocar brasiliense

Pequi, Souari nut

10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 10 m hkuc htut cyutli hgatkyuctcup hwicli hyishrasjlutnyikfrip hpa7tli flatprikhwis hpa7tmwatli hjonli

drutta Caryocar brasiliense is a deciduous Tree growing to 10 m (32ft) by 15 m (49ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bats, Insects. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

pcista The seed has a large number of small spines which can injure the mucous membranes of the mouth[ 419 ].

kcakta Edible Parts: Fruit Oil Seed Edible Uses: Oil Edible portion: Fruit, Nut. The oily, mucilaginous fruit is nutritious[ 324 ]. A strongly scented, fleshy pulp[ 416 , 419 ]. It has a sweet flavour, but is an acquired taste and is mainly used as a flavouring or as a famine food[ 324 ]. The fruit is eaten fresh or used for sweets and liqueur. The fruit, including the seed, is cooked with rice[ 419 ]. A kind of butter and suet are extracted from the fruit[ 419 ]. The kernel is rarely eaten because of endocarp spines[ 324 ]. The seed has a large number of small spines which can injure the mucous membranes of the mouth[ 419 ]. The seeds are the source of an edible oil that is mainly used for flavouring[ 324 ]. The high melting point of the oil may give it potential as a cocoa butter substitute[ 324 ]

tcanta Charcoal Fencing Fuel Furniture Oil Soap making Tannin Wood Other uses rating: Low (2/5). Other Uses The oil from the seed is used in the cosmetic industry and locally for making soap, as an illuminant and lubricant[ 324 ]. The leaves, bark and fruit pulp are a source of tannin[ 324 ]. The wood is moderately heavy, soft, of good natural durability. It is used for engraving, construction, wooden machinery parts, furniture, fences etc[ 324 , 419 ]. The wood is used for fuel and to make charcoal[ 324 ]. Attractive to bees, butterflies and/or birds. Suitable for xeriscaping.

dwatta Diuretic Febrifuge The flowers, fruits and seeds are used in local medicine[ 324 ]. The bark is diuretic and febrifuge[ 739 ]. The fruits are used in the treatment of the common cold and bronchitis[ 739 ]. The seed oil, combined with honey, is used in the treatment of the common cold and bronchitis[ 739 ]. The leaves contain triterpenes, sterols and ellagic acid[ 739 ].

nrakta S. America - northern Argentina, southern, eastern, central and northern Brazil, Paraguay and Bolivia. ksacta Forms pure groves in the plateaux and valleys of the savannah, elsewhere it is usually found as scattered individuals[ 324 ]. Found in both primary and secondary formations[ 419 ].

propta Seeds - they contain a germination inhibitor and can take one year to germinate[ 324 , 419 ]. Stratification of the endocarp with mesocarp removed is recommended[ 324 ]. Alternatively, immerse the seeds in warm water for 48 hours, changing the water every 12 hours[ 419 ]. Sow the seed in individual containers in a sunny or lightly shaded position. Pre-soaked seed can sprout within 30 - 50 days with a moderate germination rate[ 419 ]. Seedlings can be planted out when 25 cm tall[ 324 ]. Good results can be obtained from grafting and marcottage[ 324 ].

nwatta Management: Standard Regional Crop Staple Crop: OilA plant of the drier tropics and subtropics, it grows naturally in areas with an annual rainfall of 1,000 - 1,500 mm and a dry season of 3 - 5 months, with a relative humidity as low as 13%[ 324 ]. Requires a sunny position[ 419 ]

J. Adapted to nutrient poor, heavy clays, especially iron and aluminium rich soils[ 324 ]. Established plants are drought tolerant[ 324 , 419 ]. Large trees may yield up 2,000 fruits[ 324 ]. A fairly slow-growing tree, reaching a height of up to 1.5 metres when two years old[ 419 ]. The tree has potential as an oil crop for the drier regions of the world, being well-adapted to nutrient poor soils and long dry seasons[ 324 ]. A cultivated fruit tree.

## 10.2.107 Antidesma bunius

Bignay, Bignai

10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 10 m hkuc hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli frusflatprikhwissliphsom hpa7tmwatli dyat hjonli

drutta Antidesma bunius is an evergreen Tree growing to 10 m (32ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Flies, insects. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid, very alkaline and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista The bark contains a toxic alkaloid[ 303 ].

kcakta Edible Parts: Fruit Leaves Edible Uses: Edible portion: Fruit, Leaves, Spice/flavoring. The fruit can be eaten raw or cooked and used in jellies, preserves etc[ 301 ]. When fully ripe, the thin but tough-skinned fruit is juicy and slightly sweet[ 200 , 301 , 303 ]. The fruit is likened by some people to cranberries and is eaten mainly by children[ 303 , 307 ]. The round fruit is up to 8mm in diameter with a relatively large seed, it is used mainly for jams and jellies, though it needs extra pectin added for it to jell properly[ 298 , 303 ]. The fruit is carried in redcurrant-like clusters of 20 - 40 near the shoot tips[ 200 ]. Some tasters detect a bitter or unpleasant aftertaste, unnoticeable to others[ 303 ]. If the extracted bignay juice is kept under refrigeration for a day or so, there is settling of a somewhat astringent sediment, which can be discarded, thus improving the flavour[ 303 ]. Young leaves can be eaten raw in salads or steamed and used as a side dish with rice[ 301 , 303 , 307 ]. A slightly sour flavour, the leaves turn brown when cooked but retain their texture well[ 298 ]. They can be cooked with other foods in order to impart their sour flavour[ 301 ].

tcanta Fibre Paper Pioneer Shelterbelt String Wood Other uses rating: Medium (3/5). Screening, Wind-breaks, Public Open Space, Small Street Tree, Backyard Tree. Agroforestry Uses: A natural pioneer species, often common in the early stages of secondary forest succession and also invading marginal grassland[ 327 ]. The tree has occasionally been employed in reforestation projects[ 303 ]. This species seems to be an excellent choice as a pioneer for establishing a woodland, preferably used within its native range because of its tendency to invade habitats[ K ]. Other Uses The bark yields a strong fibre for rope and cordage[ 303 ]. The timber has been experimentally pulped for making cardboard[ 303 ]. The timber is reddish and hard. If soaked in water, it becomes heavy and hard[ 303 ]. Valued for general building, even though it is not very durable in contact with the soil and is also subject to attacks from termites[ 307 , 327 ].

dwatta Tonic The leaves are sudorific and employed in treating snakebite in Asia[ 303 ]. The leaves and roots are used as medicine for traumatic injury[ 266 ].

nrakta E. Asia - China, India, Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, northern Australia to the Pacific Islands. ksacta Wet evergreen forest, dipterocarp forest and teak forest; on river banks, at forest edges, along roadsides; in bamboo thickets; in semi-cultivated and cultivated areas; in shady or open habitats; usually in secondary but also in primary vegetation[ 327 ].

propta Seed - Whenever the seeds are used, they need about one month of after-ripening and can then be sown under shade without pre-treatment[ 303 ]. Fresh seeds need pre-treatment with sulphuric acid for 15 min followed by soaking in water for 24 hours[ 303 ]. The viability is about 3 - 70%[ 303 ]. Depulped and dried fruits of A.bunius may be stored for 2 - 5 years in airtight containers without a serious decrease in seed viability[ 303 ]. Vegetative propaga-

tion is preferred because seedlings are of uncertain sex and they do not commence cropping for a number of years[ 303 ]. Greenwood cuttings. Air layering. Plants can begin producing when three years old[ 303 ]. Grafting.

nwatta Grows best in the hot, humid tropical lowlands[ 200, 335 ]. It thrives at elevations up to 1,200 metres in Java[ 303 ]. The tree is not strictly tropical for it has proved to be hardy up to central Florida[ 303 ]. Plants can tolerate occasional light frosts[ 335 ]. Grows best in a sunny position or light shade in a fertile, moisture-retentive soil[ 307 ]. Plants can succeed in a variety of soil conditions[ 335 ]. Prefers a pH in the range 6 - 7, tolerating 5.5 - 8[ 418 ]. Wind-protection is desirable when the trees are young[ 303 ]. An abundant and invasive species in the Philippines[ 303 ]. Trees can start producing fruit in 5 - 6 years from seed, or as little as 2 - 3 years from grafted plants[ 335 ]. The heavy fragrance of the flowers, especially the male, is very obnoxious to some people[ 303 ]. Plants are dioecious - there are separate male and female forms. However, female forms fruit freely even when there is no male present for pollination[ 200 ]. One male tree should be planted for every 10 to 12 females to provide cross-pollination[ 303 ].

## 10.2.108 Borassus akeassii

African Fan Palm

10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 10 m hkuc htut cyutli hgatyuctcup hwicli hyishrasjltunyk hpa7tli frusflatpriklwisslip hpa7tmwatli hjonli

drutta Borassus akeassii is an evergreen Tree growing to 10 m (32ft) by 5 m (16ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

kcaakta Edible Parts: Fruit Sap ShootsEdible Uses: DrinkThe apical bud is hollowed out and the resulting sap is collected and fermented. The wine is made for sale enhancing local earnings), to drink at traditional ceremonies, as well as forming a part of the balanced diet in many rural areas, and used for aphrodisiac preparations[ 325 ]. Excessive tapping of the sap kills the plant[ 325 ]. Fruit - fresh or dried[ 335 ]. Eaten as a food supplement[ 325 ]. The fruit is 15cm in diameter and is produced in large clusters[ 335 ]. The endosperm of immature seeds - raw[ 335 ]. Young seedlings - eaten as a vegetable like asparagus[ 317 ]. The terminal bud of the palm is used as palm cabbage[ 317 ]. Eating this bud leads to the eventual death of the plant since it is unable to produce side shoots[ K ].

tcanta WoodOther uses rating: Medium (3/5). Other Uses The leaves are used for various purposes including for shelter[ 314 ]. The dark brown, coarsely fibrous wood is a highly prized timber locally[ 325 ]. It is very resistant to termites and fungi, and is used in carpentry, construction and also for household articles[ 325 ].

dwatta Anthelmintic Antiasthmatic Aphrodisiac MouthwashThe roots serve for the treatment of stomach parasites, sore throats and asthma, as well as being used for a mouthwash[ 325 ]

nrakta Semi-arid and sub-humid zones of Africa from Senegal to Sudan. ksacta Savannahs, often in close proximity to human settlements[ 325 ].

propta Seed - it has a short viability and should be sown as soon as it is removed from the fruit pulp[ 325 ]. The seed does not require pre-treatment and germinated in about 4 weeks. The plant produces a very long taproot, which can be 1 metre long when top growth is only 1cm tall, and so it is best sown in situ[ 325 ].

nwatta It is found in areas with a mean annual rainfall in the range 800 - 1,100mm[ 325 ]. Requires a sunny position and a well-drained soil[ 325 ]. Plants are able to extract nutrients, and thus grow, on very nutrient-poor soils[ 325 ]. Established plants are drought tolerant[ 314 ]. Established plants can resist fires[ 325 ]. A slow-growing but long lived tree to over 100 years old[ 325 ]. It does not start flowering until middle-aged[ 325 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required

## 10.2.109 Moringa stenopetala

African horseradish tree, cabbagetre

10 tlin 12 cyuc 4 kcaak 4 tcan 3 dwat 9 m hkuc hmimhtut cyutli kyuctcup hwicli hrasjltunyk hpa7tli frusflat-priklwis hpa7tmwatli hjonli

drutta Moringa stenopetala is a deciduous Tree growing to 9 m (29ft) by 9 m (29ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil.

pcista The glucosinolates in the leaves were found to cause goitre but to a lesser extent than expected on the basis of their concentration. However, in a diet poor in iodine it may be a contributing factor[299 ].

kcaakta Edible Parts: Flowers Fruit Leaves Oil Seed-podEdible Uses: OilYoung leaves - raw or cooked and eaten as a vegetable[301 , 317 ]. A larger leaf with a milder flavour than the leaves of M. Oleifera[301 ]. Traditionally, the leaflets are separated from the rachis and plunged into boiling water. Salt or sodium carbonate is added to the water. While the leaves are cooking, a mixture of flours is prepared, then kneaded and made into balls 2 - 5cm in diameter. These are tossed into the water as well and after about 10 minutes the balls and the leaves are ready to serve[299 ]. The addition of fat (grease or butter), small-sized cereal balls and a large amount of leaves are considered to make this dish a good-quality meal[299 ]. The young, soft fruits can also be added, but the slightly bitter taste restricts the use to periods when food is in short supply[299 ]. Flowers - cooked and eaten as a vegetable[418 ]. Seedpods - cooked[418 ]. This probably refers to the young seedpods, as mentioned above, which have a bitter flavour[K ].

tcanta Charcoal Cosmetic Fencing Filter Fuel Oil Paper Shelterbelt Soap Soil stabilization WoodAgroforestry Uses: The tree is used as a living fence[317 ]. Although in cultivation the primary goal is vegetable production, the tree can also play a role in erosion control, as a live fence, as a windbreak, for shade and as a bee plant[299 ]. Traditionally, the trees are mainly grown in home gardens of up to 0.1 ha with 5 - 15 trees per garden. Other crops usually grown in these gardens are papaya, coffee, banana, cassava, maize, sugar cane, cotton and Capsicum peppers[299 ]. Other Uses The seeds of this species are very effective for water purification[299 , 317 ]. The seed contains a protein (cationic polyelectrolyte) that acts as a flocculent in water purification. It can be extracted from the ground seed with salt water[299 ]. Even very muddy water can be cleared when the crushed seeds are added[418 ]. Solid matter and some bacteria will coagulate and then sink to the bottom of the container of water[418 ]. The cleaned water can then be poured off and boiled[418 ]. The seed oil is used as a lubricant, in perfumery and in soap production[299 ]. The wood is very soft and is useful for making paper[299 ]. The wood makes low-grade firewood and poor-quality charcoal[299 ].

dwatta Anthelmintic Antiasthmatic Antidiarrhoeal Antitussive Epilepsy Hypoglycaemic Hypotensive Leprosy MalariaAn infusion of the leaves is used as a remedy against leprosy[299 ]. They are also used to treat hypertension, retained placenta, asthma, colds, as an anthelmintic, to induce vomiting and to promote wound healing[299 ]. The leaves of certain trees of this species are renowned for their effectiveness against diarrhoea. The smoke of burning roots is used as a treatment for epilepsy[299 ]. The smoke is said to be inhaled by women in Sudan during a difficult labour, but as the species has not been collected so far in Somalia, this record is probably incorrect[299 ]. The leaves and roots are used as a cure for malaria, stomach problems and diabetes[299 ]. The bark is chewed as a treatment against coughs, and is also used to make fortifying soups[299 ]. Ethanol extracts of the leaves and roots have shown promise in control of Trypanosoma brucei and Leishmania donovani in in-vitro experiments[299 ]. The leaf extract causes increased uterine smooth muscle contractions[299 ]. The medicinal use of leaves to expel a retained placenta may be related to these increased contractions[299 ]. A crude seed extract strongly inhibited growth of Staphylococcus aureus, Salmonella typhi, Shigella sp. And Candida albicans[299 ]. An aqueous extract

of the leaves has been found to lower blood glucose concentration although it was less potent than glibenclamide. The effect was observed to increase with time and with increasing dose of the extract[299 ].

nrakta East tropical Africa - Ethiopia and Kenya. ksacta Acacia tortilis woodland, riverine woodland of Hyphaene, Acacia, etc.; Acacia, Delonix, Commiphora associations, scrub and succulent steppe; usually on rocky ground by permanent water; at elevations from 390 - 1,200 metres[328 ].

propta Seed - sow in individual pots in a semi-shaded position, placing the seed 1cm deep in a mixture of sand and loam enriched with compost[299 ]. Do not allow the compost to become dry. Germination rates of fresh seeds approaches 100%, they germinate fastest at 25 - 30°C. Transplanting to permanent positions can be done when the plants are 20cm tall or 6 months old, and with proper water supply (about 25 litres of water every 3 - 4 days) all plants should survive[299 ]. Seeds of up to 1 year old have a germination rate close to 100%; germination of older seeds is variable and declines as a function of age and storage method[299 ]. The most common practice in traditional cultivation is to transplant seedlings that have become established under old trees. Before transplanting, branches and roots are cut and the seedlings are left to dry for a week, roots are covered with ash and upper parts with dung[299 ]. Cuttings can be used, but trees established from cuttings were found to have a poor root system[299 ].

nwatta Management: Coppice Management: Standard Regional Crop Staple Crop: OilA plant of the arid to moist tropics, where it can be grown at elevations from 390 - 2,200 metres. It grows best in areas where annual daytime temperatures are within the range 25 - 35°C, but can tolerate 15 - 48°C[418 ]. Plants can tolerate light frosts, even heavier frosts do not always kill the plant since it is able to resprout from the base[299 , 418 ]. It prefers a mean annual rainfall in the range 500 - 1,500mm, but tolerates 200 - 2,800mm[418 ]. Grows best in a sunny position, but tolerates light shade[385 , 418 ]. Prefers a well-drained soil with a high groundwater table, but it can also withstand dry conditions well, and consequently it is found in both wetlands and dry areas[299 , 385 ]. Prefers a pH in the range 6 - 8, tolerating 5 - 9[418 ]. Plants are very drought tolerant, remaining green and continuing to grow even during exceptionally long dry seasons[418 ]. In experimental plantings in Sudan, plants reached a height of 3 metres within 14 months. The first flowers appeared 30 months after sowing.[299 ]The first leaves can be harvested after about 3 years[299 ]. Trees are pruned every 5 years during the rainy season[299 ]. The leaves are preferably left on the trees during the rainy season when other vegetables are in ample supply[299 ]. The leaves have a better taste in the dry season than during the rains[299 ]. Yield estimates are scarce. Annual production can reach 2,000 fruits or 6 kg of seed per tree under ideal conditions[299 ]. At elevations of over 1,650 m no fruits at all are harvested and leaf production is poor[299 ]. The taste of the leaves differs between trees and ranges from sweet to bitter[299 ].

### 10.2.110 Macadamia ternifolia

Macadamia Nut, Gympie nut

10 tlin 12 cyuc 4 kcak 2 tcan 0 dwat 8 m hkuc

htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta Macadamia ternifolia is an evergreen Tree growing to 8 m (26ft) by 6 m (19ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Oil SeedEdible Uses: Milk Oil-Macadamias are eaten fresh, roasted, and in baked goods. They are 7-8% protein. Carbon Farming Solutions - Staple Crop: oil (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1].

tcanta Cosmetic Fuel Oil Plant breeding TanninPossibly similar uses to similar species which include: agroforestry Uses: The decomposed husk is commonly used in potting soil[303 ]. Other Uses: Macadamia shells may be used as fuel, generating sufficient energy to dry wet, in-shell nuts[303 ]. The oil from the seed is used in cosmetics[307

]. The green seed hulls contain approximately 14% of tannins[303 ]. Carbon Farming Solutions - Other Systems: multistrata.

nrakta Origin: E. Australia. The Small-fruited Queensland Nut is endemic to Queensland. ksacta Occurs in south-facing gullies with fertile, basalt-derived krasnozem soils or the interface between sandstone and basalt krasnozems.

propta Seed - best sown as soon as it is ripe in a nursery bed[188 ]. The dehusked seed germinates quickly at 25°C[200 ]. Cultivars may be grafted.

nwatta Management: Standard Minor Global Crop Staple Crop: OilClimate: subtropical, tropical highlands. Prefers a fertile, sandy loam to light clay soil slightly acid (pH 5.5-7.0) and well drained. Found on moderate to steeply inclined hillslopes as well as steep slopes at 100-320m (mostly less than 200m) above sea level (asl) in altitude. Can live for over 100 years. Humidity: semi-arid to humid. Carbon Farming Solutions - Cultivation: minor global crop. Management: standard (Describes the non-destructive management systems that are used in cultivation) [1-1]. The species can be found in cultivation. Nut yield 2.2 t/ha. Hybridisation between the Small-fruited Queensland Nut and the Macadamia Nut (M. tetraphylla) has been recorded in Queensland.

### 10.2.111 Gymnanthemum amygdalinum

Bitterleaf

10 tlin 12 cyuc 4 kcak 2 tcan 3 dwat 8 m hkuc

htut cyutli hgatyuctup hwicli hrasjlutnyik hpa7tli flatprik-wis hpa7tmwatli hjonli

drutta Gymnanthemum amygdalinum is an evergreen Shrub growing to 8 m (26ft) by 7 m (23ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

kcakta Edible Parts: Leaves ShootsEdible Uses: ConditionYoung leafy shoots - cooked[299 , 301 ]. Eaten as a potherb or added to soups[301 ]. The leaves often have an intensely bitter flavour, but forms exist that are nearly free of bitterness[301 ]. The plant should be harvested by trimming off the ends of whole shoots[299 ]. This encourages new growth whereas simply removing leaves can slow down growth[299 ].

tcanta Charcoal Fencing Fuel Hedge Parasiticide Plant breeding Soil stabilization Teeth WoodAgroforestry Uses: The plant is sometimes grown as a hedge[299 ]. The branches are termite resistant and are used as stakes to line out fields and as a live fence[299 , 418 ]. The tree is sometimes planted to prevent soil erosion[418 ]. Other Uses: Bitterleaf is useful as a control agent against diseases in plants[299 ]. The ash from burnt branches is used to control seed-borne fungi, thus ameliorating seed viability and germination capacity[299 ]. Young twigs are used as toothpicks or chewing sticks[299 ]. They have been shown to contain substances that have a marked activity against bacteria that cause gum diseases[299 ]. They also act to stimulate the appetite[418 ]. The wood is used for timber[418 ]. The wood is used for fuel and to make charcoal[303 , 418 ]. Dry stems and branches provide fuel[299 ].

dwatta Antidiarrhoeal Bitter Dysentery Febrifuge Infertility Laxative Malaria Mouthwash Parasiticide Stomachic TonicBitterleaf is commonly used in traditional medicine in Africa. Leaf decoctions are used to treat fever, malaria, diarrhoea, dysentery, hepatitis and cough, as a laxative and as a fertility inducer[299 ]. They are also used as a medicine for scabies, headache and stomach-ache. Leaves are placed on a wound as a substitute for iodine[299 ]. The bitterness in the leaves is caused by sesquiterpene lactones and steroid glucosides. Some of these compounds have significant antiparasitic activity, especially vernodalin and vernonoside B1. Vernolepin showed platelet anti-aggregating properties. Vernodalin and vernomygdin have cytotoxic activity[299 ]. Young twigs are chewed as a stomachic tonic and appetite stimulant[301 ]. One of the most common medicinal uses of Vernonia amygdalina is as a treatment against intestinal worms including nematodes[299 ]. Not only humans but also

chimpanzees ingest the bitter pith of *Vernonia amygdalina* for the control of intestinal nematode infections[299 ]. Root extracts are used as treatment against malaria and gastrointestinal disorders[299 ]. In Zimbabwe a root infusion is used to treat sexually transmitted diseases[299 ]. Bark infusions are also taken to treat fever and diarrhoea, dried flowers against stomach disorders[299 ]

**n**rakta Tropical Africa - widespread, in most countries from Guinea to Mali and south to Angola, Botswana, Zimbabwe and Mozambique. **ks**acta Along rivers and lakes, in forest margins, woodland and grassland, at elevations up to 2,000 metres. Often found in disturbed localities such as abandoned farmland and in secondary woodland[299 ].

**pro**pta Seed - takes 2 - 3 weeks to germinate[299 ]. Cuttings of mature wood.

**n**watta A plant of the tropics, where it is found at elevations from 600 - 2,800 metres. It grows best in areas where annual daytime temperatures are within the range 20 - 26°C, but can tolerate 16 - 35°C[418 ]. It prefers a mean annual rainfall in the range 750 - 2,000mm, but tolerates 600 - 2,400mm[418 ]. Requires a position in full sun[299 ]. Succeeds on most soil types, though it grows best in well-drained, humus-rich soils[299 , 418 ]. Plants prefer a moist environment, though they are fairly drought tolerant once established[299 ]. Prefers a pH in the range 5.5 - 7, tolerating 5 - 7.5[418 ]. Plants can be coppiced[303 ]. Cultivated forms have been selected that are less bitter than the wild plant[299 ]. Flowering is induced by short days[299 ].

### 10.2.112 Borojoa patinoi

Borojo

10 thin 12 cyuc 4 kcaak 0 tcan 2 dwat 8 m hkuc  
pcimhmim cyutli tcup hwicli hrasljutnylkrfrip hpa7tli flatprikli-  
wis hpa7tmwatli hjonli

**dr**utta Borojoa patinoi is an evergreen Tree growing to 8 m (26ft) by 6 m (19ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in full shade (deep woodland) or semi-shade (light woodland). It prefers moist soil.

**kc**akta Edible Parts: FruitEdible Uses: DrinkFruit - eaten raw or made into jellies, preserves, sauces, ice cream etc[ 301 ]. A sweet, aromatic flavour with some bitterness[ 335 ]. The green to brown fruit is 7 - 12 cm in diameter with a brown pulp that is very acid and dense[ 418 ]. The fruit pulp is used to prepare juice (jugo del amor), compotes, marmalades, candies and wine[ 418 ].

**dw**atta AphrodisiacThe fruit is prized for its tonic and cure-all qualities[ 418 ]. It is famous in western Colombia for its supposed aphrodisiac properties[ 418 ].

**n**rakta Northwestern S. America - Colombia and Brazil, north through Central America to Nicaragua. **ks**acta Lowland rainforests, usually at elevations up to 700 metres but occasionally to 1,200 metres[ 418 ]..

**pro**pta Seed

**n**watta A plant of warm tropical lowlands usually at elevations up to 700 metres, but sometimes to 1,200 metres[ 418 ]. It grows best in areas where annual daytime temperatures fall within the range 20 - 28°C, though it can tolerate 15 - 32°C[ 418 ]. Temperatures in its native region may reach up to an absolute maximum of 41°C[ 418 ]. It prefers a mean annual rainfall in the range 3,000 - 6,000mm, tolerating 2,500 - 9,000mm[ 418 ]. It thrives with high air humidity average up to almost 90%[ 418 ]. Succeeds in heavy soils[ 335 ]. Prefers a pH in the range 4.5 - 6.5, tolerating 4 - 7[ 418 ]. The fruit takes more than one year to ripen after flowering. A dioecious species, both male and female forms need to be grown if fruit and seed are required[ 418 ].

### 10.2.113 Averrhoa carambola

Carambola, Star Fruit

10 thin 12 cyuc 4 kcaak 2 tcan 2 dwat 8 m hkuc  
htut cyutli hgattcup hwicli hrasljut hpa7tli frusflatprikli-  
wisslip hpa7tmwatli dyat hjonli

**dr**utta Averrhoa carambola is an evergreen Tree growing to 8 m (26ft) by 8 m (26ft) at a slow rate. See above for

USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees, Flies, Butterflies. The plant is not self-fertile. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

**pc**ista The fruit contain soluble oxalates.

**kc**akta Edible Parts: Flowers Fruit LeavesEdible Uses: CondimentEdible portion: Fruit, Flowers, Leaves. Fruit - raw. The fruit is crisp and juicy with a waxy yellow skin when ripe[ 296 ]. The best forms are delicious on their own, they also go very well in fruit salads, juiced and mixed with other fruits etc[ 296 ]. The fruit flavour is enhanced by peeling off the 'wing' edges, which removes most of the oxalic acid[ 303 ]. A quince-like fragrance[ 200 ]. Plants can produce fruit all year round[ 296 ]. Fruit quality is variable, though they are normally juicy. Sour forms, and slightly immature fruits, are pickled or made into a relish[ 301 ]. The orange-yellow fruit is a large, indehiscent berry, 5-8 cm long with a characteristic shape in cross-section resembling a 5-pointed star[ 303 ]. The fruit is up to 12.5cm x 6cm[ 200 ]. Flowers - raw[ 301 ]. An acid flavour, they are added to salads[ 301 ]. They can also be made into conserves[ 301 ]. Leaves - raw or cooked[ 301 ]. An acid flavour, they are used as a sorrel substitute[ 301 ].

**tc**anta Dye Fuel Mordant Rust WoodOther uses rating: Low (2/5). Backyard tree, Small flowering tree, large container tree, Courtyard, Large conservatory. Other Uses In some countries, the fruit juice is used to remove stains, for example iron rust from linen cloth[ 303 ]. It can also be used for polishing brass. The fresh juice is an effective stain remover[ 307 , 418 ]. Unripe fruits contain potassium oxalate, which is used in dyeing[ 303 ]. The whitish wood is soft. Generally only available in small dimensions, it is sometimes used for timber in construction and for making small implements, furniture etc[ 272 , 303 , 404 ]. The wood is a suitable candidate for firewood[ 303 ].

**dw**atta Abortifacient Antiasthmatic Antirheumatic Antitussive Emmenagogue Febrifuge Galactagogue Hypotensive SkinThe fruit can be a laxative on account of the oxalic acid it contains[ 303 ]. It is also used in traditional medicine for skin disorders and fevers[ 303 , 348 ]. It is valued by Chinese communities as a remedy for high blood pressure, whilst it is also said to reduce blood sugar levels and so is of help to diabetics[ 307 ]. The flowers are used to relieve coughs[ 307 ]. The leaves are used to treat rheumatism[ 307 ]. The seed is emmenagogue, galactagogue and abortifacient[ 272 ]. The powdered seed is a good anodyne for treating asthma, colic and jaundice[ 272 ].

**n**rakta E. Asia - Malaysia. **ks**acta Humid forests and woodland on sandy loam[ 307 ].

**pro**pta Seed - sow in a nursery seedbed and transplant into individual containers when large enough to handle. Seeds are planted in a seed bed and planted out when 15-20 cm high. They should be ready to plant out when around 6 - 12 months old[ 404 ]. The seed has limited viability. Cool temperatures damage the seeds. Viability can be maintained for 6 months with partially dried seeds at 5°C[ 404 ]. Because seeds are produced by cross pollination, variation is common. It is therefore better to use budding or grafting. Taking buds off good trees, or grafting twigs from them, onto 1 year old seedling roots, is the commonest method. Greenwood cuttings Budding on to 12 month old seedlings[ 404 ] Grafting Layering. This method can produce fruiting plants within 10 months[ 200 ]. Marcottage or air layering can also be used, although it is difficult. A spacing of 6 m x 6 m is suitable. Trees need to be grafted if sweeter kinds of fruit are to be selected.

**n**watta Plants grow best in the hot humid tropics up to an elevation of around 1,200 metres, though they will tolerate some cool weather and can be grown in subtropical areas[ 200 , 303 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 24 - 30°C, but can tolerate 5 - 39°C[ 418 ]. Mature plants can be killed by temperatures of -2°C or lower, although young growth is badly damaged at -1°C[ 418 ]. It prefers a mean annual rainfall in the range 1,200 - 2,000mm, but tolerates 600 - 3,000mm[ 418 ]. Prefers a position with some shade[ 418 ]. Prefers a well-drained soil, plants are intolerant of water-logging[ 296 ]. Plants are tol-

Myrciaria vexator , 96  
Myrianthus arboreus , 80

Nephelium lappaceum , 46  
Nephelium ramboutan, 86

Ocimum tenuiflorum , 112  
Ophioglossum reticulatum , 114  
Oryza hybrids , 10  
Oryza sativa , 56

Pachira insignis , 79  
Pachyrhizus erosus , 17  
Pandanus conoideus , 108  
Pandanus julianettii , 109  
Parinari curatellifolia , 78  
Parkia biglobosa , 38  
Passiflora antioquiensis , 108  
Passiflora edulis , 29  
Passiflora laurifolia , 85  
Passiflora ligularis , 23  
Passiflora popenovii , 101  
Passiflora quadrangularis , 79  
Passiflora tarminiana , 93  
Passiflora tripartita mollissima , 59  
Paullinia cupana , 96  
Paullinia yoco , 79  
Pentadiplandra brazzeana , 90  
Persea americana , 19  
Phaseolus coccineus , 4  
Phaseolus lunatus , 40  
Phoenix dactylifera , 12  
Physalis peruviana , 55  
Physalis pubescens , 113  
Piper nigrum , 106  
Pithecellobium dulce , 36  
Platonia insignis , 68  
Plukenetia conophora , 77  
Poraqueiba sericea , 74  
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erant of a wide range of soils so long as they are slightly acid[ 335 ]. This somewhat contradicts the reports that the plant prefers a pH in the range 5.5 - 6.5, tolerating 5 - 8.5[ 418 ]. Requires a position sheltered from strong winds[ 418 ]. Plants can tolerate dry periods and some wind if it is not too cold[ 303 ]. When young, the carambola is delicate and requires careful attention[ 303 ]. Because it is a fast-growing tree, it requires pruning and thinning of excess fruit at an early stage[ 303 ]. Flowering continues throughout the year and fruit is available most of the year[ 303 ]. The fruit can be very variable when plants are grown from seed, with the best forms being large and sweet and others being small and tart[ 296 ]. Three crops per year can be obtained[ 200 ]. Seedling varieties should start to crop in 3 - 8 years, whilst selected grafted varieties can start in only 1-2 years[ 303 ]. Plants can crop prodigiously[ 307 ], and yields of up to 900 kg/year are common for 10-year-old trees[ 303 ]. There are many named varieties[ 301 ]. Some Brazilian cultivars have a very high content of vitamin C as well as an applicable amount of provitamin A[ 303 ]. Production: Seedling trees fruit after 4-5 years. They can produce 400 fruit per tree. Flowers open after 14-21 days and fruit mature after 14-15 weeks. Trees live for a long time and some fruit is produced at most times of the year. Flowers and fruit can be found on the tree at most times, although there is often 2 or 3 main flushes of flowering and fruiting. Fruiting tends to be seasonal about March to May in the southern hemisphere. The tree does not require pruning or any special care once established. Flowers are cross pollinated by bees, flies and other insects. Hand pollination does not help fruit set much. Fruit once ripe will keep for 7-20 days but can be stored longer at 12°C.

## 10.2.114 Vitex payos

Chocolate Berry  
10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 8 m hkuc  
htut cyutli kyuctcup hwicli hrasjltutnyik hpa7tli flatprikwis hpa7tmwatli hjonli

drutta Vitex payos is a TREE growing to 8 m (26ft) by 8 m (26ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil.

kcaakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked[308 , 323 ]. Sweet, with a mealy texture[303 ]. It can be made into jam[323 ]. Each fruit is about 2 cm long, with pointed tips and a chocolate brown or black skin. The juicy pulp surrounds a single hard stone. A very popular fruit in parts of Africa, it is definitely an acquired taste for people who have not eaten it previously. Westerners are typically offended by the flavour, the powdery texture, the oily feel in the mouth, and the strong smell[323]. The fruits have a rather unpleasant smell, and leave a temporary black stain on the teeth, but they are much eaten by children and herdsmen[398 ].

tcanta Fuel Mulch Soil conditioner WoodAgroforestry Uses: The leaf fall of the tree acts as a mulch to improve soil condition[303 ]. Other Uses The wood is very hard. It is used for poles and spoons[398 ]. The wood is used for fuel[303 , 398 ].

dwatta Appetizer SkinA decoction of the root is used as a remedy for stomach problems[398 ]. The pounded bark is used to treat threadworm and skin problems[398 ]. The leaves are boiled and the liquid drunk by patients who have lost their appetite[398 ].

nrakta Tropical Africa - DR Congo, Kenya, Tanzania, Angola, Zambia, Malawi, Zambia, Zimbabwe, Mozambique. ksacta Open woodland, wooded grassland and on rocky outcrops at elevations from 50 - 1,500 metres[308 ]

propta Seed - it has a hard seed coat which hinders germination[303 ]. In the wild the seedcoat is broken by annual fires[303 ].

nwatta Vitex payos is a species of the tropics, growing in hot, low and semi-arid places with a high water table. In more arid zones it is found near rock outcrops. It grows in areas where the mean annual rainfall is within the range 650 - 850 metres[303 ]. The tree coppices well[303 ].

## 10.2.115 Passiflora popenovii

Granadilla de Quijos  
10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 8 m hkuc  
hmimhtut cyutli tcup hwicli jltutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta Passiflora popenovii is an evergreen Climber growing to 8 m (26ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcaakta Edible Parts: FruitEdible Uses: Drink SweetenerFruit - eaten raw or made into drinks. The juicy fruit has a sweet pulp with a rich, penetrating aroma and an exquisite flavour[301 ]. It is considered to be one of the best in the genus for eating out of hand[301 ].

nrakta Western S. America - Ecuador ksacta Not known  
propta Seed - best sown as soon as it is ripe along with the pulp which will help break down the seed coat and speed up germination[262]. Stored seed should be soaked for 24 hours in warm water and germination time can be reduced if the seed is then mixed with the juice of a fresh passion fruit (of any species)[262 ]. Even so, it can take 12 months for stored seed to germinate[262 ]. Place the seed tray in a shady position, maintaining a temperature around 19 - 24c[262 ]. Prick the seedlings out into individual containers as soon as they are large enough to handle and plant out when large enough[262 ]. Cuttings of young shoots, taken at the nodes. The cuttings root best in a neutral to slightly acid compost, but 100% sharp sand also produces good results[262 ]. Cuttings of fully mature wood taken at a node. They can take 3 months, but there is usually a high percentage[3 ]. Layering. Very easy[262 ]. Air layering.

nwatta Plants require a temperature no lower than around 16c when they are flowering in order to ensure fruit set[200 ]. Requires a humus-rich, moist but well-drained soil and a position in dappled shade where it can grow up towards the sun[262 ]. Prefers a circumneutral soil, disliking very acid or very alkaline conditions[262 ]. Passiflora species tend to flower and fruit more freely when grown in soils of only moderate fertility[200 ]. Plants are very tolerant of pruning and can be cut back to ground level if required to rejuvenate the plant[202 ]. Plants in this genus are notably resistant to honey fungus[200 ].

## 10.2.116 Boscia senegalensis

Aizen, Boscia  
10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 8 m hkuc  
pcimhmimhtut cyutli hgattcup hwicli hyishrasjltutnyikfrrip hpa7tli frusflatprikhwisslip hpa7tmwatli hjonli

drutta Boscia senegalensis is an evergreen Shrub growing to 8 m (26ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought.

pcista Poison: The leaves are used to protect stored food against parasites in granary. Leafless twigs contain glucosinates, which can hydrolyze to mustard oils, which are highly toxic and irritant to mucous membranes.

kcaakta Edible Parts: Fruit Leaves Root SeedEdible Uses: Coffee Drink SweetenerEdible portion: Seeds, Leaves, Fruit (Caution), Vegetable. The yellow cherry-sized berries (up to 15mm in diameter) are borne in clusters. When newly ripe, their rather sweet pulp is translucent and jelly-like. However, in the desiccating air it quickly dries out, turning into something not unlike caramel before ending up a brittle, brown, and quite sugary solid[ 323 ]. Despite its good taste, this toffee-like treat is difficult to separate from the seed[ 323 ]. Besides being eaten fresh, the ripe fruits are often boiled[ 323 ]. The juice is sometimes extracted, filtered, and boiled down into a semisolid, which is commonly mixed with millet and curdled milk to make cakes[ 323 ]. The dried seeds

are used as a substitute for millet or lentils[ 323 ]. They require lengthy preparation and must be eaten cooked[ 323 ]. The traditional procedure involves soaking the seeds for a week (changing the water daily) to remove bitter components[ 323 ]. Less commonly, the seeds are boiled for 3 hours (and rinsed at least twice with new water)[ 323 ]. In either case, they are subsequently dried and ground into flour and used in making porridge[ 323 ]. The roasted seed is used as a substitute for coffee[ 323 ]. Young roots, scraped of bark, may be ground, sieved, mixed with cereals, and boiled into a thin gruel or thick porridge[ 323 ]. They are very sweet[ 323 ]. The roots can be sun-dried and stored for later use[ 323 ]. The root tissues are also boiled slowly for several hours to make a sweet syrup[ 323 ]. The leaves, although just above the most leathery and least appealing foodstuffs on earth, are also consumed[ 323 ]. Most are dropped into soups or boiled and mixed into cereal products such as gruel or couscous[ 323 ]. The plant is particularly useful this way because it is an evergreen and provides food and nutrients when other plants are bare[ 323 ]. An important food in the Sudan and Mali. The seeds are used as a famine food in emergencies. Chemical composition (after Berry-Koch) (g/mg/mcg per 100g) (dried): Protein = 21g. Fat = 1.6g. Calcium = 123 mg. Fe = 6.8 mg. Beta carotene = 165 mcg Vitamin B1 = .02 mg. Vitamin B2 = .03 mg. Niacin = 8.8 mg. Vitamin C = 5 mg. Kcal = 341; (cooked): Protein = 5.4g. Fat = 0.2g. Calcium = 33 mg. Fe = 2.8 mg. Beta carotene = 25 mcg. Vitamin B1 = .01 mg. Kcal = 92. (after Abdelmuti) (un-debittered): Protein (crude) = 29.3%. Oil = 0.7%. Ash = 3.5%. Fibre (crude) = 2.7%. Carbohydrate (soluble) (starch) = 39.5%; (sugars): Sucrose = 4.3%. D-glucose = 0.2%. D-fructose = 0.7%. Amino acids (g (16g N)-1): Aspartic acid = 7.7g. Threonine = 1.7g. Serine = 2.3g. Glutamic acid = 9.0g. Proline = 6.5g. Glycine = 3.5g. Alanine = 3.2g. Valine = 4.5g. Cysteine (performic acid oxidation) = 1.3g. Methionine (performic acid oxidation) = 1.8g. Isoleucine = 2.9g. Leucine = 7.0g. Tyrosine = 2.3g. Histidine = 1.3g. Lysine = 1.5g. Arginine = 15.1g. Minerals: Sulphur = 2.20 mg/kg-1 (dry). Potassium = 0.15%-1 (dry). Magnesium = 0.10% (dry). Calcium = 0.14% (dry). Na = 0.01% (dry). K = 1.03 mg/kg-% (dry). Zinc = 42 mg/kg-1 (dry). Iron = 10.5 mg/kg-1 (dry). Manganese = 17 mg/kg-1 (dry). Copper = 8 mg/kg-1 (dry).

tcanta Filter Fuel Shelterbelt Soil stabilization WoodOther uses rating: Medium (3/5). Agroforestry Uses: Aizen is a promising plant for establishing famine-food reserves, for protecting erodible soil, for stabilizing dunes, for windbreaks, and for other utilitarian purposes in the harshest of harsh sites[ 323 ]. Its foliage is unpalatable to livestock and other herbivores, who only eat it in times of direst need. Thus the trees are able to survive without the need for protection[ 323 ]. Other Uses The leaves are added to granaries in order to protect stored foods against pests[ 774 ]. This long-standing traditional process seems to work[ 323 ]. Leafless twigs contain glucosinates, which can hydrolyze to mustard oils, which are highly toxic and irritant to mucous membranes[ 303 ]. The plant contains natural coagulants. The bark, twigs, leaves, and roots are used to scavenge suspended and colloidal compounds from unclean water (such as that from ponds churned up by storms or from baobab-tree cisterns contaminated with soil). Normally the plant parts are sliced up and placed on the water surface. Compounds leach out and catch the clay and other particulates like magnets, causing them to clump and settle to the bottom. It is reported that truly turbid water can be safely drunk after just a day of such treatment[ 323 ]. For even faster results, aizen branches are swirled in the water[ 323 ]. Aizen wood is soft and easy to work when boiled[ 303 ]. It is cut for poles, notably those holding up houses[ 323 ]. Although smoky and stinky, the wood is used as cooking fuel when nothing better is at hand (which in the harshest areas is all too often)[ 323 ]. This plant is attractive to bees, butterflies and birds. Suitable for growing in containers.

dwatta Ophthalmic Stomachic Vermifuge Vitamin CThe leaves are used as a treatment against bilharziosis, guinea-worm sores, haemorrhoids, intestinal complaints, headaches, colic and ulcers[ 774 ]. An emulsion of the leaves is used as an eyewash[ 46 ]. The roots are vermifuge[ 774 ]. The fruits are used in the treatment of syphilis[ 774 ]. The plant (part not specified) is used in the treatment of jaundice and swellings[ 774 ].

nrakta Africa - Senegal and Mauritania east through the Sahel to Egypt, Somalia and Kenya. ksacta It occupies most

types of arid-land environment including stony slopes, sand dunes, and cracking-clay plains[ 323 ]. It often occurs in desiccated, barren, hard, and even fire-scorched sites[ 323 ]. It often sprouts directly out of termite mounds[ 323 ].

propta Seed - Although the seeds germinate readily, the seedlings have so far proved difficult to transplant from nursery to field. Thus, it is recommended that direct-seeding trials be established to find out how to establish healthy populations in situ[ 323 ] There are claims that root and shoot cuttings have been used to propagate aizen[ 323 ]. This could be a vital lead because with them superior plants can be replicated[ 323 ]. The possibility of grafting should be explored, because it would allow elite aizen types to be grafted onto the wild trees now so prevalent and widespread. That in turn would ensure rapid quality-fruit production. Also, it would provide lasting benefits because of the rootstock's obvious adaptability to the site[ 323 ].

nwatta A plant of the arid tropics and subtropics where it can be found at elevations up to 1,450 metres[ 303 ]. This plant's endurance is remarkable. It tolerates shade temperatures as high as 45°C, a level not rare in its habitat; it also survives in areas receiving as little as 100mm annual rainfall, although it grows best where there is at least 250 - 500mm[ 323 ]. Requires a sunny position. Prefers sandy-clayey soils, fixed dunes, abandoned croplands and termite mounds[ 774 ]. Succeeds even in very dry, poor, sandy, rocky, worn-out laterite, or clay soils[ 323, 774 ]. Contributing to the plant's built-in drought tolerance is its remarkable leaf structure: the cuticle is up to 20 microns thick, the stomata are sunk in deep cavities, and each stomata has thickened walls and a protective armouring of papillae[ 323 ]. The flowers provide bee forage, often in areas where little else capable of sustaining honeybees is available[ 323 ]. Although the fruit is a seasonal food, its season differs from the norm and comes at the beginning of the rains, a time when farm crops are just being planted and anything to eat is usually difficult to find[ 323 ]. Suitable for growing in containers. Suitable for xeriscaping.

### 10.2.117 *Garcinia gardneriana*

Bacupari, achacha  
10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 8 m hkc  
hminhtut cyullt hcw hwlci hrasjlutnyik hpa7tli flatprilkwis  
hpa7tmwatli hjonli

drutta *Garcinia gardneriana* is an evergreen Tree growing to 8 m (26ft) by 6 m (19ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kaakta Edible Parts: FruitEdible Uses: Fruit - raw[416 ]. An acidic, pulpy flesh[416 ]. A sweet, white pulp[419 ]. A very tasty fruit but it has little edible pulp[419 ]. The fruit is around 5cm in diameter[416 ].

tcanta Fencing Furniture WoodOther Uses: The wood is soft, moderately heavy, moderately durable under natural conditions[419 ]. It is used for the manufacture of tool handles, fence posts, general construction etc[419 ]. We do not have any more information on the wood of this species, but a general description of the wood for trees in the Americas which were formerly considered to be in the genus *Rheedia* is as follows:- The heartwood is dark yellow-brown, grayish- or pinkish-brown, merging gradually into the sapwood; surfaces are sometimes specked with resinous exudations. The texture is medium to coarse; the grain straight to irregular and roey; luster medium to rather low; it is free from discernible odour or taste. Species in Surinam are rated durable to attack by decay fungi and fairly resistant to dry wood termites. Species in Colombia are resistant to a brown-rot fungus but not the white-rot in a laboratory assay. Under field conditions the wood was susceptible to decay and attack by insects. It dries rapidly, but is reported to be moderately difficult to air season, tending to warp and check. Reports on workability vary with species from moderate to high resistance to cutting to machining fairly well; reports on ease of finishing are also variable. The wood is used for purposes such as furniture, flooring (quarter sawn), heavy construction, and general carpentry[316 ].

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]. A rosette grows from the seed, out of which a new bole and new suckers may be formed[303 ]. Division of suckers[297 ]. The suckers have the advantage of being readily available and of producing homogeneous offspring, which allows selection of superior forms[303 ].

nwatta Agroforestry Services: Windbreak Fodder: Insect Industrial Crop: Fiber Management: Managed Multistem Regional Crop Staple Crop: Basic StarchSago palm succeeds in wet, lowland tropical climates where it is found at elevations from sea level to 700 metres[297 , 303 ]. It grows best in areas where annual daytime temperatures are within the range 25 - 36°C, but can tolerate 18 - 40°C[418 ]. When dormant, the plant can survive temperatures down to about 10°C[418 ]. It prefers a mean annual rainfall in the range 3,000 - 4,500mm, but tolerates 2,100 - 5,800mm[418 ]. Plants grow well in full sun, even when small[297 ]. They grow best in clay soils with a high organic-matter content[303 ]. In the wild, the plant grows on mineral rich soils with a pH of 4.5 or more[303 ]. Prefers a pH in the range 5.5 - 6.5, tolerating 4.5 - 8.5[418 ]. Plants can be grown in soils with very high water tables, succeeding even in swamps. They can even tolerate occasional flooding with saline water[418 ]. Sago palm is hapaxanthic[303 ]. Each trunk lives for a number of years without flowering but, once it has flowered and fruited, the leaves senesce and the trunk dies completely. However, one or more suckers develop from the base and take over[303 ]. The vegetative growth phase lasts for at least 8 years before the tree flowers[303 ]. A single palm may yield about 180 - 350 kilos of sago[418 ]. It has been calculated that the labour requirement for each kilo of starch obtained from this plant is far less than for any other starch producing plant[297 ]. There are hermaphroditic and male flowers[303 ]. The palm can be classified as a nearly complete obligatory cross-breeder, with easy vegetative multiplication[303 ]. Spacing: 15-20 ft. (4.7-6 m) 20-30 ft. (6-9 m) 30-40 ft. (9-12 m).

### 11.0.11 Amorphophallus paeoniifolius

Elephant Yam, Whitespot giant arum  
11 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 0.8 m hkuc  
hmimhtut cyutli tcup hwicli hras]lut hpa7tli flatprik]wis hpa7tmwatli hjonli

drutta Amorphophallus paeoniifolius is a PERENNIAL growing to 0.8 m (2ft 7in). See above for USDA hardiness. It is hardy to UK zone 10. The species is monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and is pollinated by Flies. Suitable for: light (sandy) and medium (loamy) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista Although no specific mention has been seen for this species, it belongs to a family where most of the members contain calcium oxalate crystals. This substance is toxic fresh and, if eaten, makes the mouth, tongue and throat feel as if hundreds of small needles are digging in to them. However, calcium oxalate is easily broken down either by thoroughly cooking the plant or by fully drying it and, in either of these states, it is safe to eat the plant. People with a tendency to rheumatism, arthritis, gout, kidney stones and hyperacidity should take especial caution if including this plant in their diet[238].

kcaakta Edible Parts: Leaves RootEdible Uses: Corm - cooked[2 , 4 , 103 , 105 ]. Acid raw[2 ], it must be thoroughly boiled or baked (see notes above on 'Known Hazards'[K ]) [46 , 61 ]. A very large root, it can be up to 50cm in diameter[200

, 243 , 266 ]. Corms are usually harvested when three years old, at this stage they can weigh up to 9kg[300 ]. The corms can be stored for several months at 10°C[300 ]. Some caution is advised, see notes above on toxicity. The fresh corms are turned into curd, or are chopped then dried[472 ]. The curd is relatively tasteless, but it absorbs flavours well and so can be used as a carbohydrate element in a wide range of other foods[472 ]. Young leaves and petioles - cooked and used as a vegetable[300 ]. They must be thoroughly cooked[105 , 183 ]. Caution is advised, see notes above on possible toxicity.

tcanta Plants are often grown as an understory crop in woodlands or in plantations of betel (*Areca* spp.), coconuts (*Cocos nucifera*), bananas (*Musa* spp.) or coffee (*Coffea* spp.) [472 ].

dwatta Carminative Dysentery Expectorant Restorative Stomachic TonicThe root is carminative, restorative, stomachic and tonic[240, 243]. It is dried and used in the treatment of piles and dysentery[240, 243]. The fresh root acts as an acrid stimulant and expectorant, it is much used in India in the treatment of acute rheumatism[240, 243]. Some caution is advised, see the notes above on toxicity.

nrakta E. Asia - China, Indian subcontinent, Myanmar, Thailand, Laos, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, north Australia, western Pacific ksacta Loose leafy detritus in moist shady habitats[200]. Tropical conditions in secondary forests, shrub forests and grasslands in arid valley areas at elevations below 750 metres[266].

propta Seed - best sown in a pot in a warm greenhouse as soon as it is ripe and the pot sealed in a plastic bag to retain moisture. It usually germinates in 1 - 8 months at 24°C[133]. When large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for at least a couple of years. Plant them out in late spring or early summer, after the last expected frosts, and give them some protection such as a cloche until they are growing away strongly.

nwatta A temperature in the range of 25 - 35°C is required with an annual rainfall of 1,000 - 1,500mm[300

]. Corm development is promoted during dry periods[300

]. The best crops are produced on deep, fertile, alluvial soils that are slightly acid[300

]. Dislikes heavy clay soils[300

]. Plants require some shade, especially when young[300

]. Members of this genus generally require a moist but well-drained, humus-rich, fertile soil and a position in dappled shade[472

]. The plants are usually grown on a three year cycle[300

]. An interesting technique used in Indonesia is to dig up the tuber after one year and then replant it upside down. This stimulates the lateral buds into growth and increases the overall size of the tuber[472

]. Yields of 20 tonnes per hectare can be achieved[300

]. There are many cultivated forms, some of which have a lower content of calcium oxalate crystals and less or no alkaloids[472

]. The plant produces one or two enormous leaves and one short flowering stem annually. When ripe for pollination, the flowers have a foetid smell to attract carrion flies and midges. This smell disappears once the flowers have been pollinated[245

]. Like many species in the family Araceae, this plant has the ability to heat the flowering spadix as the pollen becomes ready for fertilization. This heat greatly increases the strength of the aroma released by the plant, thus attracting more pollinating insects. It can also have the effect of making the insects more active, thus increasing the level of fertilization[472

].

nrakta S. America - Paraguay, southern, eastern, central and northern Brazil, Bolivia, Peru, Ecuador, Venezuela. ksacta Rainforests, usually on land that does not get inundated[416 ]. Often found in gallery forests[419 ].

propta Seed - best sown as soon as it is ripe, in a shady position in individual containers. A germination rate in excess of 80% is usually achieved with the seed sprouting in 60 - 80 days. The seedlings grow away slowly[419 ].

nwatta Although in nature the tree grows in the shade of the rainforest, it produces more fruit when growing in a sunny position[419 ]. Trees can withstand periodic inundation[419 ]. Newly planted young trees are slow to establish and grow away[419 ]. Young trees, planted in a sunny position, commence fruiting sooner than plants growing in shady positions[419 ].

## 10.2.118 Chamaedorea tepjolote

Pacaya Palm, Palmito dulce

10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 7 m hkuc

pcimhmim cyutli tcup hwicli hras]lutnyik hpa7tli flatprik]wis hpa7tmwatli dyat hjonli

drutta Chamaedorea tepjolote is an evergreen Tree growing to 7 m (23ft) by 5 m (16ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in full shade (deep woodland) or semi-shade (light woodland). It prefers moist soil.

pcista The juice of the fruit of most members of this genus is said to be an irritant to the skin[ 297 ].

kcaakta Edible Parts: Flowers LeavesEdible Uses: Edible portion: Cabbage, Palm heart, Male flower, Bracts. The immature, male inflorescence is eaten raw or cooked[ 301 , 314 , 423 ]. The male flower is eaten while immature in salads. It is also boiled or fried in egg batter. It is harvested before the inflorescence opens, at which stage it looks like an ear of corn[ 423 ]. Added to salads ( traditionally eaten in Guatemala on the Day of the Dead) or cooked as a vegetable (called "rellenos de pacaya," and is often served with tomato sauce, like chiles rellenos.) [ 297 , 301 ]. A bitter flavour, it is sometimes cooked in several changes of water[ 301 ]. Leaves - cooked[ 763 ]. The apical bud, often known as a 'palm heart', is eaten as a vegetable[ 763 ]. Eating this bud leads to the death of the tree because it is unable to make any side shoots[ K ].

nrakta Northwestern S. America - Colombia; C. America - Panama to Mexico. ksacta Moist, humus-rich soils in the understory of the rainforests[ 200 , 297 ]. Forests, often on limestone soils, at elevations up to 1,600 metres[ 786 ].

propta Plants are grown from seed.

nwatta A plant of the moist tropics, where it is found at elevations up to 1,600 metres. It grows best in areas where annual daytime temperatures are within the range 20° - 28°C, but can tolerate 15° - 32°C[ 418 ]. It can be killed by temperatures of 2°C or lower[ 418 ]. Plants can tolerate occasional light frosts[ 423 ]. It prefers a mean annual rainfall in the range 1,000 - 2,500mm, but tolerates 700 - 3,000mm[ 418 ]. An easily grown plant if its basic requirements are met[ 297 ]. It requires at least moderate shade, and can tolerate deep shade[ 297 ]. It requires a well-drained, moist, humus-rich soil[ 297 , 314 ]. Prefers a pH in the range 6.5 - 7.5, tolerating 6 - 8[ 418 ]. A variable plant in the wild, with some forms growing 7 metres or more tall and others only 2 metres[ 297 ]. A fast-growing plant, producing flowers and fruit when only a few years old[ 297 ]. A dioecious species - both male and female forms need to be grown if fruit and seed are required[ 297 , 768 ].

## 10.2.119 Argania spinosa

Argan Tree, Spiny Argania, Morocco Ironwood

10 tlin 12 cyuc 4 kcaak 3 tcan 2 dwat 7 m hkuc

htut cyutli hgattcup hwicli hyishras]lutnyik hpa7tli flatprik]wis hpa7tmwatli hjonli

drutta *Argania spinosa* is an evergreen Tree growing to 7 m (23ft) by 12 m (39ft). See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Butterflies. It is noted for attracting wildlife. Suitable for:

light (sandy), medium (loamy) and heavy (clay) soils and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil and can tolerate drought.

pcista Plant has spines or sharp edges; use extreme caution when handling

kcaakta Edible Parts: Fruit Leaves Oil SeedEdible Uses: Chocolate OilEdible portion: Nut - oil, Leaves, Fruit. An edible oil is obtained from the seed [ 418 ]. The white seeds contain up to 50% of a light brown oil[ 303 ]. This oil is an excellent source of vitamin E, and has a high nutritional value in the human diet. The locals mix oil with almonds and honey to make an almond butter; it also mixed with wheat germ and honey to make gruel[ 303 ]. The residue from the kernels, after oil extraction, is a thick chocolate-coloured paste called 'amlou' which is sweetened and served as a dip for bread at breakfast time in Berber households. Its flavour is similar to that of peanut butter [ 303 ]. The fruit are pressed for the oil which has an aroma and is used in cooking. The oil is cold pressed from the fruit. The oil is used like olive oil for cooking, frying and salad dressing.

tcanta Charcoal Fencing Fuel Lighting Oil Shelterbelt Soap making Soil reclamation Soil stabilization WoodOther uses rating: Medium (3/5). Agroforestry Uses: *Argania spinosa* shields thin soils from erosion, especially in over-grazed lands. Its deep roots help to bind the soil, facilitate water infiltration and replenish groundwater, thus helping to stabilise environmental conditions[ 303 , 418 ]. The tree provides valuable shade for humans and livestock as well protecting pasture grasses from the extreme evapotranspiration that would result from direct exposure to sunlight[ 303 ]. Argan woodlands form a green belt that functions as a buffer against desert advancement in southern Morocco[ 303 ]. The plant is used for fencing and windbreaks Other Uses: An oil obtained from the seed is used for lighting and to make soap[ 418 ]. The wood is very hard, heavy and durable. It is very resistant to damage from wood-eating organisms[ 303 ]. It is used in carpentry, for making agricultural implements and building poles[ 418 ]. The wood is a good fuel and makes a very good charcoal[ 303 , 418 ]. The seed shells are also burnt as a fuel[ 303 ]. Suitable for xeriscaping

dwatta Anticholesterolemic Digestive Tonic VasodilatorThe oil from the seeds is rich in vitamin E and has properties which lower blood-cholesterol levels, stimulate circulation of the blood, facilitate digestion and strengthen the body's natural defences. It is used as a cure for chicken pox, to treat juvenile acne and help remove stretch marks on pregnant woman[ 303 ].

nrakta Northwest Africa - Algeria, Morocco, Western Sahara, Mauritania. ksacta Slopes of rough hills, seeming to thrive between the rocks on poor soil, at elevations up to 1,500 metres[ 303 ].

propta Seed

nwatta Management: Standard New Crop Staple Crop: OilA plant of very arid areas, mainly in the subtropical areas of northwest Africa, but just entering the tropics in Mauritania, where it is found at elevations up to 1,500 metres [ 418 ]. It grows best in areas where annual daytime temperatures are within the range of 20° - 30°C, but can tolerate 10° - 35°C[ 418 ]. Mature plants can be killed by temperatures of -2°C or lower, but new growth is severely damaged at 0°C[ 418 ]. It prefers a mean annual rainfall in the range of 200 - 300mm, but tolerates 100 - 400mm[ 418 ]. Requires a sunny position[ 418 ]. Succeeds in a wide range of soils, including very poor, dry soils[ 418 ]. The tree is well suited to calcareous soils, sandy deposits and relatively poor semi-desert soils conditions but not drifting sands or water-logged soils[ 303 ]. Prefers a pH in the range 6.5 - 7.5, tolerating 6 - 8[ 418 ]. Established plants are very drought tolerant - they can shed their foliage and remain in a state of dormancy for several years during prolonged droughts[ 418 ]. Trees may start to bear when 5 - 6 years old from seed, and reach maximum production at the age of 60 years[ 418 ]. The average fruit yield maybe about 8 kg per tree[ 418 ]. A long-lived species, with trees living for 200 - 400 years[ 418 ]. Trees respond very well to coppicing[ 303 ].

## 10.2.120 Dovyalis abyssinica

Abyssinian Gooseberry

10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 6 m hkuc

htut cyutli tcup hwicli hrasljutnyik hpa7tli frusflatprik hpa7tmwatli dyat hjonli

drutta Dovyals abyssinica is an evergreen Shrub growing to 6 m (19ft) by 6 m (19ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Fruit Root StemEdible Uses: Fruit - raw or cooked[ 398 ]. The fruit has a thin, tender skin and a juicy melting flesh with an aroma and flavour faintly suggestive of apricots[ 301 ]. When fully ripe it makes a very agreeable jelly[ 301 ]. The fruit is about 25mm in diameter[ 200 ]. Roots and stems are eaten in a tonic soup[ 301 ].

tcanta Other Uses: The wood is hard. It is used for tool handles, spoons and bedsteads[ 398 ]. The wood is used for fuel[ 398 ].

dwatta The leaves are pounded, soaked in water and the liquid taken as a treatment for indigestion[ 398 ]. The roots are used for treating indigestion and VD[ 398 ].

nrakta Eastern Africa - Ethiopia and Somalia, south to Malawi and Mozambique. ksacta Highland forest over 1,800 metres[ 307 ]. Rain-forest to riparian forest and scrub; dry evergreen forest; sometimes in open wooded grassland; semi-evergreen or deciduous bushland; rocky limestone slopes; at elevations from 600 - 3,050 metres[ 328 ].

propta Seed - Layering[ 200 ]. Graft or shield-bud desirable varieties on to seedling rootstocks[ 200 ].

nwatta A plant of the hot, dry, tropics, though it also succeeds in areas of higher rainfall[ 335 ]. Grows best in a fertile, humus-rich, well-drained soil[ 200 ]. Dislikes calcareous soils[ 335 ]. Plants begin bearing when about 4 - 5 years old from seed[ 200 ]. Dioecious - both male and female plants must be grown if fruit is required. One male is sufficient for about 30 female plants[ 200 ].

## 10.2.121 Ancylobotrys petersiana

Mbohoya, Mwungo-wungo.

10 tlin 12 cyuc 4 kcak 2 tcan 0 dwat 6 m hkuc hmimhtut cyutli hgatkyuctcup hwicli hrasljutnyik hpa7tli flat-priklwis hpa7tmwatli hjonli

drutta Ancylobotrys petersiana is an evergreen Climber growing to 6 m (19ft) by 6 m (19ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw[ 323 ]. The pulpy flesh is delicious[ 308 ]. The flavour has been likened to guavas[ 323 ]. The fruit is more or less round, with numerous seeds embedded in the soft pulp[ 323 ]. It is eaten when both ripe and nearly ripe[ 323 ]. The ripe fruit is eaten skin and all, but the semi-ripe fruit must be first peeled[ 323 ]. The pulp of the fruit is soaked in water, squeezed and filtered. The juice is then sweetened with sugar and drunk after being cooled[ 398 ]. It is also frozen and eaten as iced blocks. The fruit is around 5cm in diameter, yellow or light orange when fully ripe[ 308 ]. Fruit can be stored for about 2 weeks.

tcanta Latex StringOther uses rating: Low (2/5). Other Uses: The stem produces a white latex, which is tapped and used for making balls[ 398 ]. The stems are flexible and used for ropes[ 398 ].

nrakta Eastern Africa - Somalia and Kenya, south to S. Africa. ksacta In dune scrub, among boulders on rocky hillsides, in mixed woodland[ 308 ]. Open bushland or woodland, coastal evergreen forest, dry forest, at elevations from sea level to 400 metres[ 398 ].

propta Seed and Root suckers.

nwatta The plant produces sweetly-scented white flowers[323].

## 10.2.122 Eugenia uniflora

Brazil Cherry

10 tlin 12 cyuc 4 kcak 3 tcan 3 dwat 6 m hkuc

hmimhtut cyutli hgatkyuctcup hwicli hrasljutnyik hpa7tli frusflatprikhsom hpa7tmwatli hjonli

drutta Eugenia uniflora is an evergreen Shrub growing to 6 m (19ft) by 3 m (9ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees, butterflies and birds. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

pcista The seeds are extremely resinous and toxic[ 303 ].(Pollen may cause allergic reaction)

kcakta Edible Parts: Fruit LeavesEdible Uses: Drink TeaThe ripe fruit is eaten fresh. It can be cooked or used for jams and other products. The leaves are used as a substitute for tea. Unripe fruits can be used to make relishes and chutneys. Fruit - used when fully ripe, it is delicious when eaten raw, and can also be made into jams, jellies, pies, juices, sherbets etc [301]. The ripe fruit is crimson to purplish-black in colour with a juicy, aromatic, subacid flesh [301]. Very rich in pectin and vitamin C [296,307], it has a tangy and sometimes rather bitter flavour with a weird aftertaste [296] Opinions on the quality of the fruit seem to be mixed with some people finding it utterly delicious, sweet, juicy and slightly spicy, whilst others find it too peppery, sour or resinous [307]. Much of this difference is due to the variation in the fruit itself, with some forms quite acid and others very sweet, and the degree of resin in the flavour also varying [416]. One fruit a day is said to provide all the vitamin C a body requires [296]. Unripe fruits can be used to make relishes and chutneys [301]. Some forms can fruit for up to 7 months a year [296]. The fruit is 15 - 30mm long [302]. The aromatic leaves are used as a tea substitute [301].

tcanta Hedge Houseplant Repellent Tannin WoodContainer, Pest tolerant, Hedge, Screen, Standard, Superior hedge, Specimen. Agroforestry Uses: Plants are tolerant of shearing and can be grown as a hedge[ 302 ]. The plant becomes densely branched when trimmed regularly[ 303 ]. Other Uses The leaves are used as an insect repellent[ 200 ]. The crushed leaves release a pungent oil which is used as an insect repellent[ 46 , 303 ]. The bark is rich in tannin, containing 20 - 28% tannin[ 303 ]. The wood is moderately heavy, hard, compact and very durable[ 419 ]. Of small dimensions, it is only used locally for items such as tool handles[ 419 ]. Can be used as a house plant.

dwatta Antitussive Astringent Febrifuge Hypotensive Skin Stomachic Tonic Vitamin CThe leaves are astringent, febrifuge, stomachic and tonic [ 303 , 348 ]. An infusion is used to remedy head colds, influenza, chest colds, coughs and fevers [ 348 ]. An infusion is drunk shortly before childbirth [ 348 ]. Crushed and steeped in boiling water, they are used as a wash to soothe irritated skin [ 307 ]. The fruits are used to reduce blood pressure [ 303 ]. They are made into a syrup that is used to treat influenza [ 348 ]. Compounds in the stems and leaves show possible antimicrobial activity [ 348 ].

nrakta S. America - Argentina, Paraguay, Uruguay, southern central and eastern Brazil, Bolivia. ksacta Light sandy stream banks [200]. Limestone thickets in lowland areas [307]. Semi-deciduous forests and also on coastal levees [416].

propta Seed - Unblemished fruit must be significantly overripe before harvesting seed; clean and dry seeds. Keeps its viability for only about 1 month[ 303 ]. It is best sown as soon as it is ripe in a partially shaded position in individual containers. A germination rate of around 80 % can be expected, with the seed sprouting within 20 - 50 days[ 419 ]. Seed can be planted 1-2 cm deep in nursery beds than transplanted when 20-30 cm tall. Layering. Grafting. Ground layering and suckers could probably be used to produce new plants. Tips from trees with better fruit types can be grafted onto seedling root stocks. It can be trained as a hedge.

nwatta Brazil cherry succeeds in warm temperate to tropical areas, up to an elevation of 1,800 metres in the tropics [ 303 ]. The temperature range for growth is reported to be 12 - 32°C, with the optimum between 21 - 27°C[ 303 ]. It is rather cold-tolerant and will stand several degrees of frost unharmed, with older plants suffering only superficial injury at -5°C [ 303 ]. The annual rainfall range for growth is reported to be 700 - 2,700mm, with the optimum between 1,200

are used to treat diarrhoea, jaundice and stomach-ache[299 ]. Bark infusions have medicinal and antimicrobial properties, e.g. against dysentery[299 ]. They are applied as an eyewash to counteract spitting-cobra venom[299 ]. A bark decoction has been used in baths to facilitate childbirth and stimulate lactation among feeding mothers[299 ]

nrakta Tropical Africa - Senegal to Sudan, and to western Ethiopia and Uganda. ksacta Open sites and parkland savannah[303 ]. A characteristic of the West African savannah, though it is also present in the southern Sahell[299 ].

propta Seed - should not be dried, but sown as soon as possible because their viability is very short. When fresh seed is used, germination is 90 - 97% at 25 - 30°C[299 ]. Storing seed at 25°C for 70 days and 140 days resulted in 96% and 88% germination, respectively[299 ]. Seed can be planted directly in the field or in the nursery. Seed-beds are made of a mixture of organic compost and sand[299 ]. Seeds are planted at 1 - 5 cm depth[299 ]. After 1 year, seedlings are transplanted in the nursery or planted directly in the field[299 ]. Those grown in containers are transplanted after 1 - 2 years[299 ]. Vegetative propagation has only been successful in experiments. Grafting can accelerate the fruiting of the tree. In experiments in Burkina Faso, some grafted seedlings started to bear fruit one year after grafting[299 ]. Latex exudation interferes with rooting of cuttings and with grafting. A 25% success rate can be achieved in grafting if the scion is soaked in water for a few hours to allow the latex to drain[299 ]. Marcotting has been tried with some success; growth hormones improved the success rate[299 ].

nwatta Management: Standard Minor Global Crop Staple Crop: OilShea butter tree is a plant of the drier lowland tropics, usually at elevations up to 600 metres, though it can also be cultivated at elevations up to 1,500 metres[303 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 24 - 38°C, but can tolerate 18 - 43°C[418 ]. It prefers a mean annual rainfall in the range 500 - 1,000mm, but tolerates 300 - 1,800mm[418 ]. Grows best in a sunny position, tolerating light shade[418 ]. Succeeds on a variety of soils such as clay; sandy clay; sand; stony soil and laterites. It prefers colluvial slopes with moderately moist, deep soils, rich in organic matter[299 ]. Plants can also succeed in poor, lateritic soils[335 ]. Prefers a pH in the range 6 - 7, tolerating 5.5 - 8[418 ]. There are two main forms of the plant: - Ssp. Paradoxa grows at lower elevations, mostly at 100 - 600 metres, though can be found as high as 1,300 metres[299 ]. The mean annual temperature in its range is 25 - 29°C, with a mean annual rainfall of 600 - 1,400mm and 5 - 8 months dry season where the precipitation is less than 50 mm[299 ]. Ssp. Nilotica is found at the somewhat higher elevations of 450 - 1,600 metres where the mean annual rainfall is 900 - 1,400 mm and there are only 3 - 5 dry months[299 ]. Shea butter trees have been protected by farmers for many centuries in the West African savannah, particularly where cattle are scarce. Productive trees are retained when new fields are cleared, leading to areas in Sudan where more than 40% of the trees are Shea butter. Natural regeneration is favoured by fallow of at least 5 years. Shortening the fallow period leads to insufficient regeneration. In areas of cultivation, shea butter tree is found in association with annual crops, such as pearl millet, sorghum, groundnut, cotton, cassava, yams and vegetables[299 ]. The tree produces a taproot up to 1, occasionally 2 metres long; with shallow lateral roots that are concentrated at a depth of 10 cm and extend up to 20 metres outward from the tree; and secondary lateral roots growing downwards to the same depth as the tap root[299 ]. The taproot and secondary root system strongly develop during the first few years of growth. This enables the seedling to produce new shoots when the original ones are damaged by drought or fire[299 ]. Early stem growth is slow; branching occurs after 4 - 7 years. The tree begins flowering at the age of 10 - 25 years. Early flowers may be sterile. Maturity is reached at 20 - 45 years and the total lifespan is around 200 - 300 years[299 ]. Leaf fall, flowering, flushing and the onset of fruiting occur during the dry season. Leaves drop mostly at the beginning of the dry season. Trees are rarely completely leafless, or only for relatively short periods. Flowering occurs from the beginning to the middle of the dry season. About 25% of the flowers set fruit. Fruits develop in 4 - 6 months; maturation peaks in the rainy season[299 ]. Productivity of the trees is variable. In a sample taken in Burkina Faso, the best 25% of the trees produced 60% of the yield, while the poorest

30% of trees produced little fruit[299 ]. A good tree can bear on average 15 - 30 kg fruits per year. In a good year this may be as much as 50 kg, but then only about 15 kg in the next two years[299 ] Although a clear production cycle is not confirmed, observations show a tendency for trees to give only 1 good harvest every 3 - 4 years[299 ]. Although the trees are fire tolerant, their growth and fruiting are affected by fire. Therefore, trees must be protected by ring weeding[299 ]. The tree is an important source of honey. Beehives placed in its branches are assured a good supply of nectar and pollen[299 ].

## 11.0.10 Metroxylon sagu

Sago Palm

11 tlin 12 cyuc 4 kcak 3 tcan 0 dwat 10 m hkuc htut cyutli tcuphja7n hwicli hrasljutnyikfrip hpa7tli frusflat-priklwishsom hpa7tmwatli dyat hjonli

drutta Metroxylon sagu is an evergreen Tree growing to 10 m (32ft) by 10 m (32ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in very heavy clay soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and saline soils. It cannot grow in the shade. It prefers moist or wet soil. The plant can tolerate maritime exposure.

pcista Plant has spines or sharp edges; use extreme caution when handling

kcakta Edible Parts: Apical bud Fruit StemEdible Uses: The pith of the stem is rich in starch. This has been widely used to make sago[297 ]. The stem is cut down shortly before the tree flowers, since the carbohydrate content is then at its highest[314 ]. It is chopped into sections and the fibrous inside is washed to extract the starch[200 , 297 ]. Hot water is poured over the slightly sour wet starch and stirred. The resulting glue-like mass is eaten with fish and vegetable dishes[303 ]. Usually, the wet starch extracted from the stems is boiled, fried or roasted, alone or mixed with other foodstuffs[418 ]. It is also used industrially in the manufacture of cakes, noodles, kerupuk and custard powders[418 ]. The fully ripe fruit is astringent, but is eaten as a delicacy by local people[301 ]. Apical bud - raw or cooked[418 ]. It is commonly steamed and eaten as a side dish with rice or added to stews[301 ]. Harvesting this bud effectively eventually kills the individual trunk because it is unable to make side branches[301 ].

tcanta Alcohol Fencing Fertilizer Fibre Fodder Fuel Nails Paper Shelterbelt Soil stabilization Thatching Weaving WoodAgroforestry Uses: Sago palm has been planted in buffer zones as a method of rehabilitating degraded lands, for instance the coastal plains of Indonesia where thousands of hectares of land had been abandoned[303 ]. Especially when in wetter soils, the roots help to stabilize the soil by trapping silt[312 ]. Young palms, with their numerous spines, act as effective barriers for livestock and potential trespassers. As the palms mature and develop above-ground stems, new palms may be planted adjacent to the juveniles to maintain the spinness of the fence[312 ]. Other Uses The leaves, and the fibres obtained from them, are commonly used for thatching, weaving mats etc[297 , 303 ]. It is said that thatch made from this plant will last for at least 5 years[314 ]. Processing of the pith to yield starch produces a fibre[303 ]. The waste from pith processing is used as a fertilizer[303 ]. Dextrose sugar extract from sago palm starch can be processed to yield alcohol for use as a biofuel[303 , 418 ]. The starch obtained from the stems is also used for various other products including to make a sizing paste for paper and textiles[418 ]. The cortex of the trunk is also used for firing in paper mills[303 ]. The bark may be used as a domestic fuel after drying[303 ]. The frond rachis is often used for fastening between horizontal posts in walls[303 ]. The bark may be used as a flooring material[303 ]. The hard outside of the trunk is used for building purposes[297 ].

nrakta E. Asia - Malaysia. ksacta Lowland rain forest[297 ]. Dominates mainly in permanent or seasonal lowland freshwater swamps, preferably on mineral soils with a pH higher than 4.5[303 ].

propta Seed - pre-soak for 24 hours in warm water and sow in containers[297 ]. Germination usually takes several months. The seed germinates only under wet conditions[303

long, 6-20 mm thick, and it is joined to rootstock of the same diameter about 6.5-10 cm above the soil

nwatta Langsat is an ultra-tropical plant[303 ]. It is a tree of tropical lowland forest and even in its native range it cannot be grown at elevations above 650 - 750 metres[303 ]. The temperature range for growth is reported to be 12 - 40°c with the optimum between 20 - 35°c[303 ]. It needs a humid atmosphere, plenty of moisture and will not tolerate long dry seasons[303 ]. The annual rainfall range for growth is reported to be 1,000 - 3,000mm with the optimum between 1,400 - 2,200mm[303 ]. It can cope with a dry season, if shade and moisture supply are adequate[303 ]. In Java, for example, the tree grows in areas with 6 - 12 wet months if there is over 100 mm rainfall monthly[303 ]. Plants can tolerate full sun, but some shade is beneficial especially during the early years[307 ]. Grows best in a slightly acid, humus-rich, well-drained, fertile soil[307 , 404 ]. Dislikes heavy soils[404 ]. Prefers a pH in the range 6 - 6.5, tolerating 5.5 - 7.5[418 ]. A slow-growing plant, the seedlings take 12 - 20 years before they bear their first crop[303 , 307 ]. Trees do not always grow and fruit well outside Asia. There are successful commercial orchards in Surinam, though the plant has been unfruitful in Honduras. It succeeds in Trinidad and Puerto Rico[303 ]. In the Philippines, a productive tree averages 1,000 fruits per year, where it is grown in half shade interplanted with coconut[303 ]. There are two distinct botanical varieties; var. Pubescens, the typical wild langsat which is a rather slender, open tree with hairy branchlets and nearly round, thick-skinned fruits having much milky latex and var. Domesticum, called the duku, doekoe, or dookoo, which is a more robust tree, broad-topped and densely foliated with conspicuously-veined leaflets; the fruits, borne few to a cluster, are oblong-ovoid or ellipsoid, with thin, brownish skin, only faintly aromatic and containing little or no milky latex. The former is often referred to as the wild type but both varieties are cultivated and show considerable range of form, size and quality. There are desirable types in both groups. Some small fruits are completely seedless and fairly sweet[303 ]. Flower Time: Pale Yellow White/Near White. Bloom Color: Pale Yellow White/Near White. Spacing: 20-30 ft. (6-9 m).

## 11.0.9 Vitellaria paradoxa

Shea Butter Tree

11 tin 12 cyuc 4 kcaak 4 tcan 5 dwat 15 m hkuac hmimhtut cyutli kyuctcup hwicli hyhrasjltunyk hpa7tli flat-prikliwis hpa7tmwatli fyif hjonli

drutta Vitellaria paradoxa is a deciduous Tree growing to 15 m (49ft) by 15 m (49ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil.

kcakta Edible Parts: Flowers Fruit Inner bark Oil Sap SeedEdible Uses: Gum OilThe kernel of the seed (often incorrectly called 'nut') contains a vegetable fat known as shea butter[63 , 299 , 301 ]. Shea butter from fresh seeds is white, odourless and of high quality, while that from stale seeds is dark, and tastes bitter[299 ]. High quality shea butter is consumed throughout West Africa as a cooking fat. It is refined fat has been marketed as margarine and baking fat. It is used for pastries and confectionery because it makes the dough pliable[63 , 299 ]. It is a useful cocoa butter substitute because it has a similar melting point (32 - 45°C) and high amounts of di-stearin (30%) and some stearo-palmitine (6.5%) which make it blend with cocoa butter without altering flow properties[299 ]. In rural areas, seeds are traditionally processed by hot water extraction, usually the job of women. The fruit pulp is first removed for food, or by fermentation or boiling. The seeds are then boiled and later sun- or kiln-dried. Sun-drying may take 5 - 10 days. Seeds are cracked using mortar and pestle, or stones; the kernels are removed by trampling and redried before being crushed, ground and kneaded to form a paste; the paste is put in water, heated or boiled and the boiling mass is churned until a grey, oily fat separates from the emulsion. The fat is skimmed off from the surface and washed to remove impurities. The congealed fat may

subsequently undergo further refining before being moulded in to various forms[299 ]. This traditional method of processing is inefficient and labour intensive. Mechanization of the various operations, in particular the use of hydraulic or continuous screw expellers or application of solvent extraction, will improve oil extraction efficiency considerably. Pre-treatment of the kernel paste with enzymes (e.g. proteases and cellulases) may also result in higher extraction rates[299 ]. In spite of their slightly laxative properties, mature fresh fruits are considered an important local food[299 ]. They are commonly eaten in savannah regions because they ripen during the land preparation and planting season[299 ]. The pulp has a sweet flavour[299 ]. The flowers are also considered an important local foods[299 ] They are sometimes made into fritters[299 ]. The reddish latex which exudes from deep cuts in the bark is used as a chewing gum[299 ].

tcanta Charcoal Cosmetic Fertilizer Filter Fuel Furniture Gum Hair Mulch Oil Soap making Teeth WoodAgro-forestry Uses: The tree regenerates well, and is traditionally favoured and protected by farmers. As a result, it has played a significant role in soil and water conservation and environmental protection in semi-arid West Africa[303 ]. The husks of the seeds make a good mulch and fertilizer[303 ]. Studies on the by-products of shea-butter processing have shown that heavy-metal ions can be removed from aqueous solutions, for example waste water, using Vitellaria seed husks[303 ]. The tree combines well with many cereal crops[303 ]. Other Uses Shea butter is a vegetable fat obtained from the seed[63 , 299 ]. Many cosmetic products, especially moisturizers, lotions and lipsticks, use it as a base because its high unsaponifiable matter content imparts excellent moisturizing characteristics[299 ]. The high proportion of unsaponifiable matter, consisting of 60 - 70% triterpene alcohols, gives shea butter creams good penetrative properties that are particularly useful in cosmetics. Allantoin, another unsaponifiable compound, is responsible for the anti-inflammatory and healing effect on the skin. It is used in toothpastes and other oral hygiene products, in shampoos, lipsticks, cosmetic lotions and creams, and other cosmetic and pharmaceutical products[299 ]. Low-quality shea butter, often mixed with other oils, is a base material for soap[299 ]. Shea butter is also very suitable for making candles because of its high melting point[299 ]. As a waterproofing agent, shea butter is used as daubing for earthen walls, doors and windows[299 ]. The black sticky residue, left after oil extraction, is used to fill cracks in walls and also as a waterproofing material[299 ]. Waste water from shea butter production has pesticidal properties[299 ]. The press cake and the husks remaining after oil extraction are potential fertilizers and fuels[299 ]. The leaves, soaked in water, produce a good lather for washing[299 ]. The reddish latex (gutta shea or red kano rubber) which exudes from deep cuts in the bark is made into glue, chewing gum and balls for children's games[299 ]. Musicians use it to repair drums[299 ]. Only unproductive and unhealthy trees are cut for timber[299 ]. The wood is moderately heavy and hard. It is liable to crack on drying and needs to be seasoned slowly. It is difficult to work and tends to split on sawing, but it polishes well. It glues, nails and screws well, but pre-boring is recommended to avoid splitting. It is durable and resistant to termites. Both sapwood and heartwood are resistant to impregnation with preservatives[299 ]. The wood is used for poles, house posts, rafters, flooring, domestic utensils and furniture[299 ]. It is an excellent fuel wood, burning with great heat, and a source of charcoal[299 ].

dwatta Antibacterial Antidermatosis Antidiarrhoeal Anti-inflammatory Antirheumatic Dysentery Odontalgic Ophthalmic SkinShea butter is a suitable base for topical medicines. Its application relieves rheumatic and joint pains and heals wounds, swellings, dermatitis, bruises and other skin problems[299 ]. The high proportion of unsaponifiable matter, consisting of 60 - 70% triterpene alcohols, gives shea butter creams good penetrative properties[299 ]. Allantoin, another unsaponifiable compound, is responsible for the anti-inflammatory and healing effect on the skin[299 ]. The fat is used traditionally to relieve inflammation of the nostrils[299 ]. Clinical tests with patients suffering from rhinitis, and having moderate to severe nasal congestion, showed that shea butter may relieve nasal congestion better than conventional nasal drops[299 ]. The leaves are used to treat stomach-ache[299 ]. They are also added to vapour baths to treat headache and as an eye bath[299 ]. Ground roots and bark

- 2,000mm [ 303 ]. It is well adapted to areas of high relative humidity but can also withstand a long dry season[ 303 ]. Prefers a fertile, moist soil in a sunny to partially shaded position[ 302 ]. Adaptable to a range of soil types, but intolerant of alkaline soils[ 200 ]. Succeeds in alkaline soils according to another report[ 307 ]. Prefers high levels of organic matter in the soil [ 200 ]. A position in full sun is required for the plant to maintain its best shape [ 302 ]. Plants are deep rooted and can withstand drought [ 303 , 307 ]. Plants can become invasive in some areas, spreading by means of their roots[ 307 ]. A fairly slow-growing plant [ 419 ]. Flowering and fruiting may start when plants are 2 years old under favourable circumstances, usually it starts when 3 - 6 years old, on the flushes of the previous season or basal part of the shoots of the current season [ 303 ]. Flowering and fruiting continue over an extended period (6 - 8 weeks) and, depending on the climate, there may be several crops in a year [ 303 ] In India pruned bushes yielded 2.7 - 3.6 kg fruit per plant[ 303 ]. The highest yield obtained in Israel was 11 kg fruit from one untrimmed plant [ 303 ]. Two main types are distinguished: the most common form has bright cerise fruit and red-tinged foliage; the other form has dark-red to black berries and similarly tinted leaves; the latter form is rarer and tends to be sweeter and less resinous[ 303 , 416 ]. There are several named varieties [ 301 ]. Fruit are mature 5-6 weeks after flowering. The fruit is about 3 cm across. Plant Spacing 10 -12 ft. (3 - 3.6 m).

## 10.2.123 Garcinia brasiliensis

Bacupari

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 6 m hkuac hmimhtut cyutli tcup hwicli hrasjltunyk hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Garcinia brasiliensis is an evergreen Tree growing to 6 m (19ft) by 5 m (16ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw. The aril-like translucent subacid white pulp has an excellent flavour, suggesting that of the mangosteen[46 , 301 ]. A highly prized fruit, usually eaten fresh but also makes an excellent jam[46 , 301 ]. The ovate fruit may be 32 - 40mm long, with an orange-yellow, pliable, leathery, tough skin, 3 mm thick that is easily removed[332 ].

tcanta Fuel Furniture WoodOther Uses: The wood is irregular-grained, coarse-textured, heavy, moderately susceptible to rot[625 ]. It is suitable only for rural construction[625 ]. The wood is used for fuel[625 ]. We do not have any more information on the wood of this species, but a general description of the wood for trees in the Americas which were formerly considered to be in the genus *Rheedia* is as follows:- The heartwood is dark yellow-brown, grayish- or pinkish-brown, merging gradually into the sapwood; surfaces are sometimes specked with resinous exudations. The texture is medium to coarse; the grain straight to irregular and roey; luster medium to rather low; it is free from discernible odour or taste. Species in Surinam are rated durable to attack by decay fungi and fairly resistant to dry wood termites. Species in Colombia are resistant to a brown-rot fungus but not the white-rot in a laboratory assay. Under field conditions the wood was susceptible to decay and attack by insects. It dries rapidly, but is reported to be moderately difficult to air season, tending to warp and check. Reports on workability vary with species from moderate to high resistance to cutting to machining fairly well; reports on ease of finishing are also variable. The wood is used for purposes such as furniture, flooring (quarter sawn), heavy construction, and general carpentry[316 ].

dwatta Narcotic PoulticeThe seeds contain 8 to 9% oil (by weight), which is used in poultices on wounds, whitlows, tumours and, externally, over an enlarged liver[336 ]. An infusion of the pulp has a narcotic action with an effect like that of nicotine[336 ]. The root bark extract contains rheedixanthone and a polyprenylated benzophenone, other lesser constituents, and 3 new prenylated xanthenes[336 ].

nrakta S. America - Argentina, Paraguay, eastern Brazil, Bolivia, Peru, French Guiana. ksacta Mainly found in

secondary forests, by rivers, floodplains, coastal moist broadleaved forests etc[625 ].

propta Seed - best sown as soon as it is ripe. Place the seed on its side in a nursery seedbed or individual containers in a semi-shaded position[625 ]. A germination rate above 50% can be expected, with the seeds sprouting within 15 - 25 days[625 ]. The seed can only be kept for about 4 months.

nwatta An understory tree. It can be in seasonally flooded forest. A cultivated fruit tree. The fruit are popular. Fruit are sold in local markets. A plant of the moist tropics. Succeeds in full sun or light shade[625 ]. It does best and fruits more readily in full sun. Plants can tolerate at least some inundation[625 ]. Newly planted young trees establish and grow away fairly slowly[625 ].

## 10.2.124 Citrus aurantiifolia

Lime, Key Lime, Mexican Lime, Mexican Thornless Key Lime 10 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 6 m hkuac htut cyutli tcup hwicli hrasjltunyk hpa7tli frusflatprikliwis hpa7tmwatli hjonli

drutta Citrus aurantiifolia is an evergreen Tree growing to 6 m (19ft) by 4 m (13ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It cannot grow in the shade. It prefers moist soil.

pcista Plant has spines or sharp edges; use extreme caution when handling

kcakta Edible Parts: Fruit LeavesEdible Uses: Condiment DrinkFruit - raw, cooked or used as a flavouring. A thin-skinned, very acid, juicy, fragrant fruit[ 200 , 303 ], it is mainly used to add flavour and as a garnish[ 301 ]. The rich flavour and acid taste make lime a favourite for hot and spicy dishes, either fresh or in the form of pickles and sauces[ 303 ]. They can also be made into jams, marmalades, jellies and juices (usually combined with other fruits)[ 238 , 301 , 317 ]. Dried limes are widely used in Persian cuisine[ 301 ]. The ovate fruit is 3 - 6cm in diameter[ 200 ]. The chopped peel is used to make a sweetmeat[ 301 , 317 ]. The leaves are sometimes added to soups[ 301 ]. Used as a condiment in Javanese dishes[ 317 ].

tcanta Cosmetic Essential Hair Hedge Soap makingAgroforestry Uses: The lime is especially well adapted for hedges. It grows readily either from seed or from cuttings. It sends up stout vertical shoots from the roots and forms dense thickets if left undisturbed[ 459 ]. Other Uses An essential oil, obtained from the peel and known as lime oil, is a good source of chitral[ 238 , 317 ]. It is used in the manufacture of perfume, soap, chewing gum, food, and sweets. Another essential oil, known as lime-leaf oil, is obtained from the leaves[ 317 ]. A semi-drying oil is obtained from the seed[ 46 ]. Used in making soap[ 46 ]. Attractive to bees, butterflies and/or birds

dwatta Abortifacient Anthelmintic Antidiarrhoeal Aromatic Astringent Contraceptive Digestive FebrifugeThe lime is an aromatic, astringent, cooling herb. Various part of the plant are used medicinally, especially the leaves, fruit, peel and essential oils[ 238 ]. An infusion of the leaves is taken internally in the treatment of minor complaints such as bilious headaches and colds[ 238 , 348 ]. An infusion of the leaves, combined with *Renalemia guianensis* leaves, is drunk to induce an abortion[ 348 ]. The leaves are combined with the leaves of *Begonia glabra* and *Ocimum campechianum* to make a bath for very hot feet[ 348 ]. The juice of the fruit is used to treat 'viccis', a fever that leads to a desire to sleep and uncontrollably relaxed digestive muscles[ 348 ] The juice is added to various medicinal preparations, especially for the treatment of diarrhoea, chest colds and fevers[ 238 , 348 ]. It is mixed with grated garlic and some water and drunk for snakebite[ 348 ]. Applied externally, the juice is used to cleanse wounds[ 348 ]. It is mixed with oil and rubbed on the stomach to relieve sagging muscles of the sexual organs[ 348 ]. It is used for the treatment of ground itch and for dandruff [ 348 ]. The root is anthelmintic and contraceptive[ 348 ]. It is used for treating haemorrhages and venereal disease[ 348 ]. The roots are boiled, the water mixed with alcohol, and drunk to abort a foetus up to six weeks old[ 348 ].

nrakta Tropical Asia. ksacta Not known in a truly wild situation.

propta The seed is best sown in containers as soon as it is ripe, after thoroughly rinsing it[ 164 , 200 ]. Sow stored seed in containers as soon as possible]. Germination usually takes place within 2 - 3 weeks at 13°C. Seedlings are liable to damp off so they must be watered with care and kept well ventilated. The seed is usually polyembryonic, two or more seedlings arise from each seed and they are genetically identical to the parent but they do not usually carry any virus that might be present in the parent plant[ 200 ]. When large enough to handle, prick the seedlings out into individual pots and grow them on until they are 10cm or more tall before planting out into their permanent positions. Cuttings of half-ripe wood, July/August in a frame. This species grows easily from cuttings[ 200 ]. Air layering[ 303 ].

nwatta Three main climates are suitable for commercial citrus production - tropical climates, subtropical with winter rain such as in the Mediterranean and semitropical with summer rainfall as found in Florida and southern Brazil[ 200 ]. Limes grow at elevations up to 2,200 metres[ 303 ]. The optimal temperatures for their cultivation range between 25 - 30°C, with the coldest month having an average minimum of at least 15°C[ 200 ]. Growth generally ceases below 13°C and above 38°C[ 200 ]. They are most competitive in areas that receive from about 700 to 1,000 mm of mean annual precipitation[ 303 ]. If there are dry periods of more than three months, then irrigation will be necessary[ 200 ]. Prefers a deep, well-drained but moisture-retentive loamy soil in full sun[ 200 ]. The tree is quite drought-resistant[ 303 ]. Prefers a pH in the range 6 - 6.5, tolerating 4.8 - 8.3[ 200 ]. Plants can flower and produce fruit all year round[ 303 ]. Layered trees can produce fruit in the second year after planting, but growers aim at maximum growth to get a more substantial crop in the third year[ 303 ]. The average yield of lime in Thailand during the 1988/1989 season was 2,400 kg/ha. In India trees are expected to bear 600 - 1,500 fruits per year[ 303 ]. A high incidence of bacterial canker is a limiting factor for growing limes in the wet tropics[ 303 ]. Limes hybridize freely with other Citrus species, and many hybrids are known, e.g. Lemonimes (lime x lemon), Limequats (lime x kumquat)[ 303 ]. Limes are divided horticulturally into acid and sweet limes[ 303 ]. There are many named varieties[ 200 , 301 ].

## 10.2.125 Chrysobalanus icaco

Coco Plum, Paradise Plum

10 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 6 m hkuc hmimhtut cyutli hgattpuc hwicli hrasjlutnyik hpa7tli frusflatprklwshsom hpa7tmwatli hjonli

drutta Chrysobalanus icaco is an evergreen Tree growing to 6 m (19ft) by 8 m (26ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilEdible portion: Fruit, Kernel, Seeds, Nut. Fruit - raw or cooked. A fairly sweet, white, spongy flesh[ 307 ]. They are stewed in sugar, dried like prunes or made into jams and jellies[ 301 ]. The ovoid fruit is 2 - 5cm long[ 200 ]. The purple or red-skinned fruits are considered to have a superior flavour to white forms[ 307 ]. Seed - raw or cooked[ 301 ]. A delicious flavour[ 200 ]. They are roasted and eaten[ 301 ]. When preserving the fruits, they are pierced right through the centre, including the seed. This allows the juice of the fruit to penetrate the seed and, after separation from the shell, the nut-like kernel is eaten[ 301 ]. An edible oil can be extracted from the seed[ 307 ].

tcanta Dye Hedge Lighting Oil Soil stabilization TanninOther uses rating: Medium (3/5). Seaside tree, Backyard tree, Screening, Hedging, Dune stabilization, Planter, Topiary, Xerophytic, Border, Espalier, Pollard, Planted as an ornamental shrub. Agroforestry Uses: Plants can be grown as a hedge[ 307 ]. They are particularly well suited for use by

the sea[ 307 ]. The plant often forms large, rambling, impenetrable thickets and so it has been used to stabilize sand dunes[ 307 ]. Other Uses: An oil can be obtained from the seed[ 307 ]The seeds are so rich in oil that they can be strung on sticks and burnt like a candle[ 307 ]. The bark is rich in tannins[ 307 ]. A black dye can be obtained from the fruit[ 307 , 510 ]. A black dye can be obtained from the leaves[ 510 ].

dwatta Antidiarrhoeal Astringent Dysentery SkinThe root, bark, fruit and leaves all contain tannins and are astringent[ 307 , 348 ]. They are used internally in the treatment of diarrhoea, dysentery and dyspepsia[ 307 , 348 ]. They are used externally as a wash to treat skin complaints[ 307 ]. The juice of the roots and leaves, mixed with oil, is used to contract the sphincters of the vulva by women wishing to simulate virginity, and the same preparation is used by men for treating flaccid scrotum[ 348 ].

nrakta S. America from Brazil, north to the Caribbean, Mexico and southern Florida. West tropical Africa - coastal areas from Senegal to Angola. ksacta Forests near the shore line[ 200 ]. Coastal shoreline and sandy thickets[ 307 ]. Usually found where the soil is moist or flooded[ 335 ].

propta Seed - best sown as soon as it is ripe in a partially shaded position in a nursery seedbed. A moderate germination rate can be expected, with the seed sprouting within 20 - 25 days[ 420 ]. When the seedlings are 4 - 5cm tall, pot them up into individual containers and they should be ready to plant out 6 - 7 months later[ 420 ]. Soft nodal cuttings. Woody stem cuttings. Layering.

nwatta Agroforestry Services: Living fence Managemen Standard Regional Crop Staple Crop: Protein-oilA plant for the humid lowland tropics[ 307 ]. Prefers a position in full sun or light shade[ 307 ]. Succeeds in ordinary garden soil[ 200 ]. Plants can succeed in both poor and fertile soils[ 335 ]. Requires a well-drained soil[ 307 ]. Established plants are very drought tolerant[ 307 ]. Very tolerant of salt-laden winds[ 307 ]. Plants have escaped from cultivation and become naturalized in some areas[ 307 ]. There is at least one named form[ 301 ]. Plants usually flower in two or more flushes per year[ 335 ], and can flower intermittently throughout the year[ 307 ].

## 10.2.126 Piper nigrum

Black Pepper

10 tin 12 cyuc 4 kcaak 2 tcan 3 dwat 6 m hkuc hmim cyutli tcup hwicli hrasjlutnyik hpa7tli flatprklwis hpa7tmwatli hjonli

drutta Piper nigrum is an evergreen Climber growing to 6 m (19ft) by 1 m (3ft 3in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland). It prefers moist soil. The plant is not wind tolerant.

kcakta Edible Parts: Fruit Oil SeedEdible Uses: Condi- ment OilThe pungent fruits, known as peppercorns, are dried, ground into a powder known as black pepper, and used as a condiment[296 ]. A hot flavour. The globose, red fruit is 4 - 6mm in diameter[418 ]. A milder flavoured spice, known as white pepper, can be obtained if the outer coverings of the fruit are removed[301 ]. Unripe green fruits are pickled in vinegar and used as a relish[301 ]. An essential oil obtained from the seed is used as a flavouring various foods[46 ].

tcanta Essential Houseplant Oil TeethOther Uses: An essential oil obtained from the fruits is used in perfumery to add bouquets of oriental types producing spicy notes[46 ].

dwatta Antibacterial Antidiarrhoeal Antirheumatic Antiseptic Cholera Dysentery Epilepsy Expectorant Febrifuge Odontalgic Stimulant StomachicBlack pepper fruits contain an essential oil (comprising beta-bisbolene, camphene, beta-caryophyllene and many other terpenes and sesquiterpenes), up to 9% alkaloids (especially piperine which is responsible for the acrid taste), about 11% protein and small quantities of minerals[254 ]. They are a pungent, aromatic, warming herb that lowers fever, is antiseptic and improves digestion[238 , 254 ]. Black pepper is regarded as a stimulating expectorant in Western and Ayurvedic medicine, and as a tranquilizing and anti-emetic in Chinese medicine[238 ]. The seed is used internally to treat indigestion and wind in western herbalism[238 ]. In Chinese medicine it is used as a warming herb

pollen is sticky. Insects visit the scented male inflorescence, not the female ones, which lack nectar [ 303 ].

## 11.0.7 Syzygium aromaticum

Clove, Zanzibar Redhead

11 tin 12 cyuc 4 kcaak 3 tcan 4 dwat 20 m hkuc hmimhtut cyutli tcup hwicli hrasjlut hpa7tli frusflatprkhsom hpa7tmwatli fyif hjonli

drutta Syzygium aromaticum is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees. The plant is self-fertile. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant can tolerate maritime exposure.

kcakta Edible Parts: Flowers Fruit OilEdible Uses: Condi- ment Oil TeaFlower buds - dried and used as a spice in a variety of foods such as cakes, baked apples and mince-meat[301 , 303 ]. The buds are sometimes chewed after meals[301 ]. An essential oil obtained from the plant is used as a flavouring in a wide range of foods such as bakery products, chewing gums, ice cream, sauces and candies[301 ]. Fruit pulp[301 ].

tcanta Cosmetic Essential Insecticide Oil Parasiticide Pot-pourri TeethOther Uses: Clove oil is extracted by water distillation and mixes well with cinnamon, cedar, lavender, rose and bergamot. Essential oil content in good quality cloves may exceed 15%. The oil is dominated by eugenol (70-85%), eugenol acetate (15%) and beta-caryophyllene (5-12%). Cloves contain about 2% of the triterpene oleoanolic acid[303 ]. It is used in perfumery, as a flavouring and medicinally[238 ]. The cloves are used in potpourris and pomanders[238 ].

dwatta Antiarthritic Antiasthmatic Antibilious Antirheumatic Antiseptic Digestive Odontalgic Parasiticide Skin Skin Stimulant StomachicCloves, and the essential oil contained in them, are often used medicinally[238 ]. A spicy, warming, stimulant herb, it is strongly antiseptic, relieves pain, controls nausea and vomiting, improves digestion, protects against intestinal parasites, and causes uterine contractions[238 ]. Cloves are taken internally as a tea in the treatment of internal parasites, stomach upsets, chills and impotence[238 , 303 ]. The flower buds are chewed to freshen the breath or ease the pain of toothache[303 ]. The essential oil is applied externally in the treatment of toothache, headache, cold, arthritis and rheumatism[238 , 303 ]. It is also useful for treating ulcers, bruises, burns, bronchitis, asthma, minor infections and colic. It is sometimes used to ease nausea[303 ]Two little-known compounds in clove oil have shown 'strong activity' against bacteria associated with plaque formation and gum disease[303 ]. Clove oil is very potent and can cause gum irritation, it is advisable to dilute it with equal amounts of vegetable oil. For infants an even milder dilution is required. Use should be avoided during pregnancy, or if with sensitive skin[303 ]. An infusion of the shoots and the unopened, dried flower buds (cloves) is used for an excitant[348 ].

nrakta E. Asia - Malaysia. ksacta Maritime forests in deep, well-drained sandy, acid loams with a pH as low as 4.5[200 ].

propta Seed - the seed has a short viability of about 2 weeks so should be sown as soon as it is ripe in shady nursery beds, placing the seeds about 25mm deep in the soil[303 ]. About 70% of the seeds germinate, usually after 1 - 6 weeks[303 ]. Plant out when they are about 25cm tall[303 ]. Cuttings of terminal leafy softwood, kept in a frame at high humidity until they have rooted[200 ].

nwatta Cloves thrive in lowland humid tropical areas where the temperature is fairly steady, growing best in an island setting at elevations below 300 metres[200 ]. Notions about the ecological requirements of the clove vary, perhaps because of an underlying dilemma: a climate with a marked dry season promotes flowering, but the tree does not cope at all well with stress[303 ]. There are two ways out of this dilemma. The first is to choose a climate with a pronounced dry season, but to limit stress by going for deep fertile soils, providing water and shade during the early years[303 ]. The

other way is to choose a wet climate with a short dry season[303 ]. The best quality cloves for use as a spice are grown in the wetter climates where annual rainfall is in excess of 1,500mm and usually in the range 3,000 - 4,000mm[303 ]. Requires a light, well-drained soil, requiring some shade, especially when young[200 ]. Growth can be sustained on poor and acid soils, but waterlogging is very harmful[303 ]. Requires shelter from the wind[303 ]. The clove tree is monoecious, flowers are hermaphrodite and self-pollinating. The tree matures between 8-10 years after planting[303 ]. Clove trees live for more than 100 years, the oldest tree recorded is aged 375 years in Indonesia[303 ]. Generally, it takes 20-30 years for clove to attain full bearing[303 ]. Bloom Color: White/Near White(orange, yellow).

## 11.0.8 Lansium domesticum

Langsat, Lansa, Lankan

11 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 15 m hkuc hmimhtut cyutli tcup hwicli jlutnyik hpa7tli frusflatprkl-wisslip hpa7tmwatli hjonli

drutta Lansium domesticum is an evergreen Tree growing to 15 m (49ft) by 12 m (39ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Insects. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

pcista An arrow poison is made from the fruit peel and the bark of the tree. Both possess a toxic property, lansium acid, which, on injection, arrests heartbeat in frogs. The seed contains a minute amount of an unnamed alkaloid and two bitter, toxic principles[303 ]. (Parts of plant are poisonous if ingested)

kcakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked[301 ]. Juicy, aromatic and subacid[301 ]. As well as being eaten out of hand, they can be candied, preserves in syrup etc[301 ]. The fruits are borne in clusters of 2 - 30 and are about 37mm in diameter[303 ]. Each fruit contains 5 or 6 segments of aromatic, white, translucent, juicy flesh, with 1 - 3 relatively large and very bitter seeds in each fruit[303 ]. These seeds can sometimes cling very tightly to the flesh and can then impart their bitterness to the fruit[303 ]. The peel of the langsat is easily removed and the flesh is commonly eaten out-of-hand or served as dessert, and may be cooked in various ways[303 ]. Varieties with much latex are best dipped into boiling water to eliminate the gumminess before peeling[303 ]. The peeled, seedless or seeded fruits are canned in syrup or sometimes candied[303 ].

tcanta Insecticide Tannin WoodSmall shade tree. Street tree in high rainfall areas. Backyard tree. Specimen. Agroforestry Uses: The tree is used in reforestation of hilly areas[303 ]. Other Uses The peel is reportedly high in tannin[303 ]. The fresh peel contains 0.2% of a light-yellow volatile oil, from the dried peel, a dark, semi-liquid oleo-resin composed of 0.17 % volatile oil and 22% resin is obtained[303 ]. The dried peel is burned in Java, the aromatic smoke serving as a mosquito repellent and as incense in the rooms of sick people[303 ]. Wood tar, derived by distillation, is employed to blacken the teeth[303 ]. The wood is light-brown, medium-hard, fine-grained, tough, elastic and durable, weighing 840 kg/cu m. It is utilized in Java for house posts, rafters, tool handles and small utensils[303 ].

dwatta Antidiarrhoeal Astringent Dysentery Febrifuge Malaria Ophthalmic Stings VermifugeThe resin is non-toxic and administered to halt diarrhoea and intestinal spasms[303 ]. The pulverized seed is employed as a febrifuge and vermifuge[303 ]. The bark is poulticed on scorpion stings[303 ]. An astringent bark decoction is taken as a treatment for dysentery and malaria[303 ]. Leaves may be combined with the bark in preparing the decoction[303 ]. The leaf juice is used as eye-drops to dispel inflammation[303 ].

nrakta E. Asia - Thailand, Malaysia, Indonesia. ksacta Rainforests and humid river valleys[ 307 ].

propta Langsats are commonly grown from seeds, which must be planted within 1-2 days after removal from the fruit[303 ]. Cleft-, side- and approach-grafting give good results. The budwood should be mature but not old, 6.5-9 cm

a flour[317 ]. The fruit is 4 - 6cm long[335 ]. A juice made from the pulp of the fruit is eaten with sugar and cassava meal[301 ]. The pulp is also widely used in the production of juice, jam, liqueurs and other exotic drinks with a high vitamin C content[314 ]. A favourite native beverage is produced from the fruits. They are soaked in water till they begin to ferment, and the scales and pulpy matter strained and can be easily rubbed off in water[314 ]. When straffed through a sieve it is ready for use, and has a slight acid taste and a peculiar flavour of the fruit at first rather disagreeable to European palates[314 ]. The fruit is made into a cheese-like paste that is sometimes eaten for remedying bowel problems, or to allay hunger when desperate[348 ]. An edible starch is obtained from the pith of the trunk[46 , 301 ]. Used as a sago[317 , 419 ]. Leaves - cooked[763 ]. The apical bud, often known as a palm heart', is eaten as a vegetable[763 ]. Eating this bud leads to the death of the tree because it is unable to make sideshoots[K ]. A sap obtained by tapping the young, unopened inflorescence can be drunk, boiled down to make a sugar or fermented to make palm wine[301 , 317 ]. A sweet alcoholic drink called 'item' is prepared from the sap[348 ]. The terminal bud is eaten as vegetable[317 ]. Eating this bud will effectively kill the tree since it is unable to produce side branches[K ].

tcanta Basketry Buttons Fencing Fibre Oil Paper Roofing String WoodOther Uses The leaves are used for covering roofs[46 , 317 ]. A full-grown fallen leaf of this tree is a grand sight. The expanded sheathing base is 30cm in diameter; the petiole is a solid beam 3 - 3.6 metres, and the leaf itself is up to 3 metres in diameter. An entire leaf is a load for one person[314 ]. A fibre is obtained from the leaves[46 ]. Used to make fishing nets, ropes, hammocks, belts, hats, mats, and baskets[317 , 768 ]. The leaf sheathes are used to make sandals[46 ]. A spongy material, obtained from the petioles of the palm, is made into bottle-stoppers, mats and sandals or is used for paper production[317 , 768 ]. The hard seeds are made into buttons and other small objects[46 , 317 ]. The wood is moderately hard and heavy, but of low durability when exposed[419 ]. The trunks are used as posts and floating bridges, and in the construction of rural buildings[46 , 419 ]. The peripheral parts of the stems serve, like the dried petioles, for the construction of rafts[317 ].

dwatta Antidiarrhoeal Dysentery Emollient Skin Tonic Vitamin CThe oil from the seed is high in vitamin A and is frequently used to treat burns, because of its soothing qualities and its ability to promote the formation of scar tissue[314 ]. A pap prepared from the pith is used to treat dysentery and diarrhoea[348 ]. The fruit is made into a cheese-like paste that is sometimes eaten for remedying bowel problems, or to allay hunger when desperate[348 ]. The leaves are used in baths as an emollient[739 ]. The sap from young stems is considered tonic[319 ].

nrakta Northern S. America - Brazil, Bolivia and Peru northwards to the Guyanas and Caribbean. ksacta Riverine swamps[314 ]. Found in poorly drained or periodically flooded soils[335 ]. Usually in permanently swampy areas, often forming extensive, high-density stands; also in gallery forests; usually at elevations below 500 metres, occ. to 900 metres[768 ].

propta Seed - best sown as soon as it is ripe in a partially shaded position in a nursery seedbed or in individual containers. A moderate germination rate can be expected, with the seed sprouting within 90 - 150 days[419 ]. The seedlings develop slowly[419 ].

nwatta Industrial Crop: Fiber Management: Standard Regional Crop Staple Crop: OilA plant of hot, wet, tropical lowlands[335 ], it can also succeed in the warm subtropics[314 ]. It grows best in areas where annual daytime temperatures are within the range 22 - 30°C, but can tolerate 18 0 34°C[418 ]. When dormant, the plant can survive temperatures down to about 10°C[418 ]. It prefers a mean annual rainfall in the range 2,000 - 4,500mm, but tolerates 1,100 - 6,300mm[418 ]. In areas with less than 2,000 mm of annual rainfall, or with a dry season, water must be available throughout the year[418 ]. Requires a position in full sun, with lots of water[314 ]. Tolerates a range of fertile, acid soils[418 ]. Succeeds in poorly drained soils and acid soils[335 ]. Prefers a pH in the range 4 - 5, tolerating 3.5 - 5.5[418 ]. A very vigorous grower whose roots will normally out compete any nearby plant[314 ]. A slow-growing tree?[419 ]. A dioecious species, both male and female forms need to be grown if fruit and seed are required[768 ]. Spac-

ing: 8-10 ft. (2.4-3 m) 10-12 ft. (3-3.6 m) 12-15 ft. (3.6-4.7 m).

## 11.0.6 Artocarpus integer

Champedak

11 tlin 12 cyuc 4 kcak 3 tcan 0 dwat 20 m hkuc htut cyutli tcup hwicli hrasjutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Artocarpus integer is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by insects, wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Fruit Leaves SeedEdible Uses: Edible portion: Fruit, Seeds, Leaves. Fruit - raw or cooked. The pulp of the ripe fruit is golden-yellow, it is rather slimy and strongly odoriferous, almost like that of the durian[ 301 ]. The flavour is sweet, resembling durian and mango[ 306 ]. It is eaten fresh, fried with flour, or made into a type of pudding[ 301 ]. The unripe fruit is used as a cooked vegetable or is added to soups[ 301 ]. The fruit is up to 9cm long[ 200 ]. The almost globose fruit is 20 - 35cm long x 10 - 15cm wide[ 303 ]. Each fruit can weigh from 600 - 3,500g[ 418 ]. Ripe seeds - roasted or boiled and eaten as a delicacy[ 301 ]. Rich in starch, they have a nutty flavour[ 303 , 306 ]. Young leaves - cooked and used as a vegetable[ 301 , 320 ].

tcanta Dye Fibre Fuel String Tannin Varnish WoodOther uses rating: Medium (3/5). Agroforestry Uses: The tree is well suited for reforestation projects in association with other species[ 303 ]. Other Uses A fibre obtained from the bark can be used to make rope[ 303 , 306 , 320 ]. A resin obtained from the tree is used as a varnishing material[ 303 ]. The latex obtained from the plant has no value[ 303 ]. It can be used for making lime[ 320 ]. The bark contains tannin. With alum, the extract of heartwood provides a yellow dye that is moderately fast on silk. This dye is used in colouring the saffron-coloured robes of Buddhists[ 303 ]. The dark yellow to brown wood is strong and durable and is used for building construction, furniture and boats[ 306 ]. Sold under the trade name jack, is as strong as teak (Tectona grandis), takes a good polish, saws and works easily, and is durable under water[ 303 ]. It is generally not attacked by fungi and termites[ 303 ]. The tree is a good fuel wood; the calorific value of moisture-free heartwood is 5369 kcal/kg of wood[ 303 ].

nrakta Southeast Asia - Thailand, Malaysia, Indonesia. ksacta A common, sub-canopy tree in secondary forests and locally abundant in primary lowland rainforest, often on wet hillsides in Thailand[ 306 ]. Usually found at elevations up to 450 metres, occasionally to 1,200 metres[ 525 ].

propta Seed - best sown as soon as it is ripe[ 200 ]. The seed germinates best at a temperature of 24 - 27c[ 200 ]. It can be raised by direct sowing or planting nursery-raised container seedlings[ 303 ]. Fresh seeds record germination rates of about 75%[ 303 ]. Root cuttings. Air layering.

nwatta Industrial Crop: Hydrocarbon Management: Standard Regional Crop Staple Crop: Balanced carb Staple Crop: Basic StarchA plant of the lowland humid tropics, growing best at an altitude below 1,200 metres [ 200 , 303 ], in its native range it is always restricted to regions without a distinct dry season[ 303 , 306 ]. It grows best in areas where annual daytime temperatures are within the range 22 - 38c, but can tolerate 16 - 47c[ 418 ]. It prefers a mean annual rainfall in the range 2,200 - 3,500mm, but tolerates 1,250 - 4,500mm[ 418 ]. Prefers a deep, well-drained fertile soil[ 200 , 306 ]. Young plants need some shade, but need increasing light levels as they mature [ 200 ]. Prefers a fairly high water table[ 306 ], it can survive periodic flooding even with acid swamp water[ 306 ]. Prefers a pH in the range 4.5 - 6, tolerating 4 - 6.5[ 418 ]. The tree usually fruits prolifically and is capable of very high yields [ 306 ]. Seedlings start bearing fruit after 3 - 6 years; clonal trees bear after 2 - 4 years. Flowers may be found at any time of year, but bloom is concentrated around one period of the year[ 303 ]. Female flower heads are found only on cauliflorous shoots; most male heads are formed on shoots in the periphery of the canopy. This may facilitate pollination by wind, although the

to treat stomach chills, food poisoning, cholera, dysentery, diarrhoea and vomiting caused by cold[238 ]. It is used externally in Ayurvedic medicine to treat nasal congestion, sinusitis, epilepsy and skin inflammations[238 ]. The essential oil is antiseptic, antibacterial and febrifuge[254 ]. It has been used to ease rheumatic pain and toothache[254 ].

nrakta E. Asia - Indian Subcontinent. ksacta Not known propta Seed - Cuttings - very easy[296 ]. Use shoots of wood, about 45cm long, taken from parts of the plant that have already flowered[296 ].

nwatta A plant of the hot and humid lowland tropics, where it grows best at elevations up to 500 metres, but can be grown up to 2,000 metres. It grows best in areas where annual daytime temperatures are within the range 22 - 35°C, but can tolerate 10 - 40°C[418 ]. It prefers a mean annual rainfall in the range 2,500 - 4,000mm, but tolerates 2,000 - 5,500mm[418 ]. Grows best in sheltered positions in semi-shade[296 ]. Prefers a neutral soil rich in organic matter[296 ]. Prefers a pH in the range 6 - 7, tolerating 5 - 7.5[418 ]. Level ground is most suitable for the production of pepper, provided there is no flooding, but it is often grown in rolling country or on hill slopes of varying steepness[418 ]. The plant begins to bear in 3 - 4 years, can reach full production after 7 years and has an economic life of about 12 - 20 years[418 ]. Optimum yields at low capital input are 6 tonnes per hectare of the unprocessed (green) peppers; 2 tonnes of the sundried (black) peppers; or 1.67 tonnes of the washed and dried (white) peppers[418 ]. In gardens with higher inputs, yields may be 8 - 9 tonnes of green pepper in the first harvest and 12 - 20 tonnes in the sixth or seventh harvest[418 ]. The root system can be 4 metres or more deep[418 ]. Flowering time: Mid Summer. Bloom Color: White/Near White. Spacing: 12-15 ft. (3.6-4.7 m).

## 10.2.127 Malpighia glabra

Escobillo, Acerola

10 tlin 12 cyuc 4 kcak 2 tcan 1 dwat 6 m hkuc hmimhtut cyuti hgattcup hwicli hrasjutnyik hpa7tli frusflatprikshom hpa7tmwatli dyat hjonli

drutta Malpighia glabra is an evergreen Shrub growing to 6 m (19ft) by 6 m (19ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Bees. The plant is not self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: FruitEdible Uses: DrinkFruit - raw or cooked[301 ]. The bright red fruit can range in flavour from sweet to somewhat acid[296 , 301 ]. As well as being eaten out of hand, they can also be stewed, made into juices, sauces, jellies, jams, wines or purees[301 ]. The ovoid fruit is 10 - 35mm in diameter[335 ].

tcanta Hedge Tannin WoodAgroforestry Uses: The plants are suitable for hedges[303 ]. Other Uses The bark has been used as a source of tannin[303 ]. The wood is hard and heavy[303 ]. It can be used for making small utensils[303 ].

dwatta Antidiarrhoeal Antitussive Dysentery Pectoral Vitamin CThe fruits are considered beneficial against liver problems, diarrhoea, dysentery, coughs and colds[303 ]. The bark exudes a gum that is recommended as a pectoral[348 ]. Known historically as a natural source of ascorbic acid (Vitamin C). Ascorbic acid levels in fresh acerola fruit are in the range of 1.5 to 4% by weight. A glass of acerola juice (180-ml) contains 35mg/ml of ascorbic acid the same as 14 litres of orange Juice.

nrakta C. America - Mexico to northern S. America and the Caribbean. ksacta Rocky limestone, from sea level to 1,000 metres[307 ]. Thrives at elevations between sea level and 800 metres, but it can be found at elevations up to 1,700 metres[418 ].

propta Seed - germination is slow, with only 5 - 50% of the seed germinating[303 ]. Cuttings Layering Grafting

nwatta A plant of the subtropics to hot, tropical, lowland areas with medium to high rainfall[303 , 335 ]. It can

be found at elevations up to 1,700 metres, but does best below 800 metres[418 ]. It grows best in areas where annual daytime temperatures are within the range 24 - 30°C, but can tolerate 5 - 34°C[418 ]. When dormant, the plant can survive temperatures down to about -2°C, but young growth can be severely damaged at -1°C[418 ]. It prefers a mean annual rainfall in the range 1,300 - 2,000mm, but tolerates 700 - 2,400mm[418 ]. Tolerates seasonally dry periods[335 ]. Easily grown in a good soil and a sunny position[296 ]. Prefers a rich, deep and well drained soil but is able to tolerate a variety of soil conditions[303 , 335 ]. Sandy soils carry an increasing risk of nematode infection[418 ]. Prefers a pH in the range 5.5 - 7.5, tolerating 5 - 8[418 ]. Requires a pH in excess of 5.5[303 ]. Established plants are drought-tolerant[307 ]. Plants are fairly tolerant of salt-laden winds[307 ]. Seedlings can fruit when only 2 - 3 years old, but are not always of as good quality as their parents[296 ]. Trees start to produce well 3 - 4 years after planting and continue for 15 years[303 ]. Plants can produce several flushes of flowers each year[307 ]. The flowers are very attractive to bees[307 ]. Plants can produce 2 - 3 crops of fruit a year[296 ]. Individual trees can produce 15 - 30 kilos of fruit each year[303 ]. Yields of 6.7 - 105 tonnes per hectare have been recorded[418 ]. Plants usually require cross-pollination to ensure a good fruit set[335 ], though there are some reports of self-fertilization[303 ]. Flowering time: Mid Spring Late Spring/Early Summer. Bloom Color: Rose/Mauve. Spacing: 15-20 ft. (4.7-6 m).

## 10.2.128 Vangueria infausta

African medlar

10 tlin 12 cyuc 4 kcak 2 tcan 2 dwat 5 m hkuc hmimhtut cyuti hgatkyuctcup hwicli hrasjutnyik hpa7tli flatprikhwi hpa7tmwatli hjonli

drutta Vangueria infausta is a deciduous Shrub growing to 5 m (16ft) by 5 m (16ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

kcakta Edible Parts: FruitEdible Uses: Fruit - raw[46 , 301 , 418 ]. A soft, fleshy pulp[418 ]. An acid, somewhat sweetish-sour flavour[301 ]. The brown pulp round the seeds tastes somewhat like stewed dried, apple-rings[466 ]. The pulp is sometimes soaked in water and then dried for later use[418 ]. The green fruit usually ripens to a dull orange-brown or purplish colour. It is 15 - 47mm in diameter[308 ]. Seeds - raw[301 ]. They can also be made into a relish[301 ].

tcanta Fuel WoodOther Uses The wood can be used as poles for houses, tool handles and agricultural implements[303 ]. The wood is considered a good fuel in some areas, though in others it is said to bring bad luck if burnt[295 , 303 , 418 ].

dwatta Anthelmintic Antidote Antinflammatory Antitusive Malaria Odontalgic PurgativeThe root is anthelmintic, antidote and purgative[418 ]. A popular snake-bite remedy, it is also used to treat a variety of complaints such as malaria, pneumonia, coughs and other chest troubles[418 ]. A warm decoction of the roots is considered to be an effective remedy for heart ailments in Namibia[775 ]. The leaves are applied externally as a treatment for swellings on the legs; inflammation of the navel in children; abdominal pain; and for the relief of dental pain[418 ].

nrakta Tropical Africa - Cameroon to Kenya, south to Namibia, Zambia, Zimbabwe, Mozambique and northern S. ksacta Grassland, thicket and open woodlands, often on termite mounds, in rocky places and even dunes at elevations from near sea level to 1,500 metres[308 ].

propta Seed - best sown as soon as it is ripe[295 ]. It can be stored for up to 12 months if dried properly[303 ]. Cuttings.

nwatta A tree of the subtropics to tropics, usually growing in areas with a distinct dry season at elevations up to 1,500m [308 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 17 - 28°C, though it can tolerate 12 - 36°C[418 ]. The plant is fairly frost-tolerant and is able to withstand temperatures down to -5°C when it is dormant, though even light frosts can damage the young

growth[418 ]. It prefers a mean annual rainfall of 800 - 1,200mm, but tolerates 700 - 1,500mm[418 ]. Succeeds in full sun to light shade[418 ]. Succeeds in most soils so long as they are well drained[418 ]. Established plants are drought tolerant[418 ]. Prefers a pH in the range 5.5 - 7, tolerating 5 - 7.5[418 ]. A slow growing plant, usually increasing height by less than 50cm a year[295 , 303 ].

### 10.2.129 Pandanus conoideus

Marita, Red fruit, Pandan

10 tin 12 cyuc 4 kcaak 2 tcan 1 dwat 5 m hkuc hmimhtut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Pandanus conoideus is an evergreen Perennial growing to 5 m (16ft) by 4 m (13ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Fruit OilEdible Uses: OilEdible Portion: Fruit, Spice. The red fruit is high in oil. The ripe fruit is cooked then the juice mixed with water to make a sauce. To do this, a ripe marita fruit is normally split into 3 sections along its length. Then the central yellow stalk and pith area are dug out. The outside hard red layer is then cooked. Preferably it is cooked using hot stones although sometimes it is boiled in a saucepan. After cooking for about half an hour the hard pits are squeezed from the soft red juice by squeezing through the hands. Water is added to make an oily red soup. The soup is then eaten. Sometimes it is eaten by dipping green leaves or sago into the soup. At other times it is eaten with a spoon made from the marita leaf. Some people just suck the cooked juice from the seeds. As well, some people use the oily juice to cook food in. The pits or seeds are thrown away, normally to pigs. A harvested marita fruit will only keep for about one week. After cooking it will only last for about 12 hours. Carbon Farming Solutions - Staple Crop: oil (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1].

tcanta OilLeaves, stem bark, and roots are used to create a rope, seat covers, and as a bed for sleeping. Used for handicraft industry including rope and yarn. Leaves wattled as mats. Young leaves are used as a substitute cigarette wrap.

dwatta Traditionally believed to be a good supplement as a skin and eye medicine, and as worm treatment. The variant merah panjang (long red) is used.

nrakta Origin: New Guinea, Moluccas. Limited to New Guinea and some of the islands to the west (Ceram, Buru and Ternate) in Indonesia to West Pacific. A rare plant outside its native range. ksacta A tropical plant. It grows throughout PNG from sea level up to 1650 m altitude. It becomes common above 500m. It can be up to 2,500m above sea level.

propta Marita pandanus are normally planted from suckers or cuttings. The cuttings are using ends of branches. Suckers produce more quickly. A new shoot normally sprouts out of the branch just below where the end was cut off. The cutting will soon develop roots and become established when it is planted. A more popular method is to use a sucker or shoot growing from the plant down near the ground. The sucker is separated from the parent plant then replanted in its new place. These suckers grow more quickly and can bear fruit after 18 months to 2 years. A cutting off a branch may take up to 4 or 5 years before it produces a fruit.

nwatta Management: Standard Regional Crop Staple Crop: OilClimate: tropical, tropical highlands. Humidity: humid. It grows throughout PNG from sea level up to 1650 m altitude. It becomes common above 500 m. It can be up to 2,500 m above sea level. Marita is often planted along the roads and walking tracks. It is also planted in most gardens and serves as a reminder that the land is owned by the person who planted the marita. So plants are dispersed instead of being grown in a plantation. A marita fruit is harvested when the colour starts to change to a brighter red or yellow. Sometimes it also starts to crack slightly at this stage. The fruit is cut from the branch. Marita is a seasonal crop but the fruiting season is not a short clearly marked one. The main season goes from about October to March but

individual trees can bear almost throughout the year. Near the sea the marita season is longer and more spread out but as the places increase in altitude above sea level the season becomes more distinct. Carbon Farming Solutions - Cultivation: regional crop only. Management: standard (Describes the non-destructive management systems that are used in cultivation) [1-1].

### 10.2.130 Passiflora antioquiensis

Banana Passionfruit

10 tin 12 cyuc 4 kcaak 0 tcan 0 dwat 5 m hkuc hmimhtut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Passiflora antioquiensis is a CLIMBER growing to 5 m (16ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: FruitEdible Uses: Drink Sweet-enerFruit - raw or used for making drinks[301 ]. A sweet flavour[335 ]. The best flavoured passion fruit in the genus[262 ]. The yellow, ellipsoid fruits have an aromatic pulp[301 ]. A vanilla-like flavour[310 ]. The fruit is 4 - 5cm long[335 ].

nrakta Western S. America - Colombia. ksacta Found at elevations of 2,000 - 3,000 metres[262 ].

propta Seed - best sown as soon as it is ripe along with the pulp which will help break down the seed coat and speed up germination[262 ]. Stored seed should be soaked for 24 hours in warm water and germination time can be reduced if the seed is then mixed with the juice of a fresh passion fruit (of any species)[262 ]. Even so, it can take 12 months for the stored seeds to germinate[262 ]. Place the seed tray in a shady position, maintaining a temperature around 19 - 24°C[262 ]. Prick the seedlings out into individual containers as soon as they are large enough to handle and plant out when large enough[262 ]. Cuttings of young shoots, taken at the nodes. The cuttings root best in a neutral to slightly acid compost, but 100% sharp sand also produces good results[262 ]. Cuttings of fully mature wood taken at a node. They can take 3 months, but there is usually a high percentage[3 ]. Layering. Very easy[262 ]. Air layering.

nwatta A plant of higher elevations in the moister tropics[335 ]. It can also be grown successfully at lower elevations in the tropics and subtropics[262 ]. Tolerant of occasional slight frosts[262 ]. Requires a humus-rich, moist but well-drained soil and a position in dappled shade[262 ]. Prefers a circumneutral soil, disliking very acid or very alkaline conditions[262 ]. Passiflora species tend to flower and fruit more freely when grown in soils of only moderate fertility[200 ]. Plants require a temperature no lower than around 16°C when they are flowering in order to ensure fruit set[200 ]. Plants produce tendrils and climb by attaching these to other plants. Plants are very tolerant of pruning and can be cut back to ground level if required to rejuvenate the plant[202 ]. Plants in this genus are notably resistant to honey fungus[200 ].

### 10.2.131 Hylocereus undatus

Dragon Fruit, Red Pitaya

10 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 4 m hkuc hmimhtut cyutli hkaakyuctcup hwicli hyishrasljutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Hylocereus undatus is an evergreen Shrub growing to 4 m (13ft) by 2 m (6ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bats. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in nutritionally poor soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil and can tolerate drought.

pcista Plant has spines or sharp edges; use extreme caution when handling

kcakta Fruit - raw or cooked[335 ]. Delicious[317 ]. A sweet, pleasant flavour[335 ]. The red fruit is 7 - 12cm long,

kill one stem, not the plant[ K ]. An important food in South America.

tcanta Basketry Cosmetic Dye Fibre Needles Oil Paper Plant support Shelterbelt Soap making Thatching WoodOther uses rating: High (4/5). Other Uses An oil is obtained from the seed. This species may turn out to be a better economic option than most other American oil palms. Oil levels of up to 62% of the dry weight have been reported, and there are reports that a large pot of boiling fruit can produce 2-3 kg of oil[ 303 ]. The oil separates easily when the fruits are cooked. As with other palms, it is a potential source of lauric oils. The seed is rich in saturated fatty acids, and could be used to manufacture cosmetics and soap[ 303 ]. The leaves yield thatch for houses and basket materials[ 303 ]. The spines of the plant are used in tattooing[ 46 ]. (Probably as needles[ K ]) The leaves provide a green dye for colouring fabrics[ 303 ]. The roots provide a vermicide[ 303 ]. The whole plant, including the leaf and stem parts, produces a valuable fibre for manufacturing paper[ 303 ]. Cellulose may be produced for cellophane paper and rayon[ 303 ]. Wood - exceptionally hard and strong, it has many uses[ 297 ]. Used in construction[ 46 ]. It is a durable material for bows, arrows, fishing poles, harpoons and carvings[ 303 ]. The Amerindians use the wood for flooring and panelling their houses and also fashion long spines into needles[ 303 ]. In rural Amazonia, the stem is valued for parquet, furniture, carvings and home construction[ 303 ].

dwatta AntirheumaticThe oil from the seeds is used as a rub to ease rheumatic pains[ 739 ]. The fruit are high in Vitamin A. The red variety has 2.76 mg of carotene while the yellow variety has 0.835 mg.

nrakta Central and northern S. America. ksacta Not known in a truly wild location[ 300 , 200 ]. Plants are found in disturbed natural ecosystems, principally along riverbeds and primary forest gaps[ 303 ].

propta Seed - pre-soak for 24 hours in warm water and sow in containers. Germination takes 2 months or more[ 297 ]. The seed has a limited viability and needs to be sown as fresh as possible[ 297 ]. Seedlings require about 6 - 9 months in the nursery; planting out should be done when the soil is humid and the potential evapotranspiration rate is low[ 303 ]. Seeds are recalcitrant. They rapidly lose viability when dried and should not be exposed to direct sunlight during germination[ 303 ]. Fresh seed has 45-50% mc, and if this falls below 38-40%, germination is reduced[ 303 ]. Seed is rarely formed in this species[ 297 ]. Division of suckers from a mature palm after it has produced four stems[ 314 ]. Suckers should have produced roots and be 7 to 8 cm in diameter at the base and 1 to 1.5 metres high[ 314 ]. Mycorrhizae attached to the roots give fast growth rates.

nwatta Agroforestry Services: Crop shade Agroforestry Services: Living trellis Agroforestry Services: Wind-break Management: Managed Multistem Other Systems: Homegarden Other Systems: Multistrata Regional Crop Staple Crop: Balanced carb Staple Crop: OilPlants succeed in moist tropical climates with heavy rainfall and poor soils[ 303 ]. They grow in lowland areas below 800 metres, where temperatures never fall below 10°C, the average annual rainfall is 1,500mm or more and the driest month has 25mm or more rain[ 297 , 303 ]. They can withstand relatively hot dry seasons of 3 - 4 months[ 303 ]. Requires a fertile, moist, but well-drained soil, a humid atmosphere and some protection from strong sun[ 200 ]. Seedlings develop very slowly under forest shade conditions, and mature plants require full sunlight for optimal production of flowers, fruits and offshoots[ 303 ]. Plants are most productive when grown on relatively deep, fertile, well-drained soils, clay soils, and highly eroded laterites with 50% aluminium-saturated, acid soils[ 303 ]. Prefers a pH in the range 5 - 6.5, tolerating 4 - 7.5[ 418 ]. The spiny stem of the tree grows rapidly in height, attaining 15 - 20 metres in just 10 years[ 303 ]. Plants begin flowering when 3 - 5 years old, and can produce two fruit crops a year for the next 50 - 75 years[ 303 , 418 ]. Fruit yields may be as high as 10 - 30 tonnes/ha, but are often only about 2 - 3 tonnes/ha[ 418 ]. Yields of 50 - 100 kilos per trunk per year are not unusual[ 418 ]. For palm hearts the yield ranges from 4,000 - 10,000 hearts/ha per year[ 418 ]. Plants sometimes produce just a solitary trunk, at other times they can have several trunks[ 297 ]. Plants produce rings of needle-like spines 5cm long[ 301 ]. This can make harvesting the fruit and buds rather unpleasant. There is at least one named form, called 'Spineless', that is entirely free

of these spines[ 301 ]. There are other forms that have seedless fruits[ 46 , 768 ]. A shallow-rooted plant[ 418 ]. Under subsistence conditions palms are often widely spaced but for intensive agriculture it is planted at 400-500 plants/ha for fruit and 3000 to 20 000 plants for heart-of-palm.

### 11.0.4 Durio dulcis

Durian Marangang, Merangang, Red Durian, Tutong, La-hong

11 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 30 m hkuc htut cyutli tcup hwicli hrasljutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta Durio dulcis is an evergreen Tree growing to 30 m (98ft) by 25 m (82ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcista Seed is poisonous if ingested

kcakta Edible Parts: Fruit SeedEdible Uses: Fruit. The aril around the seeds is very sweet and fragrant[ 303 ]. An attractive, dark purplish-red colour when fully ripe, with a bright yellow aril that has a soft, creamy texture and a delicious flavour reminiscent of pineapple cream without the acidity[ 301 ]. Very strong smelling[ 303 ]. An extremely offensive odour[ 301 ]. This species of durian has the sweetest tasting and most ill-smelling fruits of the genus[ 301 ]. The globose fruit is up to 15 cm in diameter[ 303 ]. The fruit case is dark red to dark brown-red with slender 15-20 mm long spines, inside are a number of brown seeds each completely covered by a dark yellow tasty aril[ 303 ]. Seed - cooked[ 301 ]. They can be boiled or roasted[ 301 ].

tcanta Containers Furniture WoodOther Uses: The heartwood is pink-brown[ 303 ]. The wood is probably one of the most important sources of durian timber in Sarawak[ 338 ]. The relatively durable wood is used in interior construction and for making cheaper types of furniture and packing cases[ 303 ]. We do not have any more information on the wood of this species. However, a general description of the wood for species in this genus is as follows:- The heartwood is pink-brown, red, or deep red-brown; it is not always sharply demarcated from the white, pale yellow-brown or light reddish-yellow sapwood. The texture is coarse; the grain straight to interlocked; somewhat lustrous; it is reported to have a foetid odour. The wood is not durable, and not resistant to termite attack; the sapwood is prone to powder-post beetle attack. It dries rapidly, but thin boards may tend to cup. The wood saws easily and generally dresses smoothly; nailing qualities are good. It is used for purposes such as furniture components, veneer and plywood, light construction[ 316 ].

nrakta Southeast Asia - Malaysia, Indonesia. ksacta Lowland mixed dipterocarp forest, at elevations up to 800 metres[ 303 , 338 ].

propta Seed -

nwatta A tree of the moist lowland tropics, it is found at elevations up to 800 metres[ 303 ]. Plants are found in the wild on sandy clay soils and friable clay loam[ 303 ]. The flowers are produced in short inflorescences that are clustered on older branches[ 303 ].

### 11.0.5 Mauritia flexuosa

Buriti Palm, Aguaje Palm

11 tin 12 cyuc 4 kcaak 3 tcan 2 dwat 25 m hkuc hmimhtut cyutli tucphja7n hwicli hyishrasljutnyik hpa7tli frusflatprik hpa7tmwatli dyat hjonli

drutta Mauritia flexuosa is an evergreen Tree growing to 25 m (82ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is not self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in nutritionally poor soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil.

kcakta Edible Parts: Apical bud Fruit Leaves Oil Sap StemEdible Uses: Drink OilAn edible oil is obtained from the fruit[46 , 301 ]. The fleshy fruit is eaten raw[317 ]. Rich in vitamins and oil[317 ]. The fruit is also dried and ground into



to 70mm long and 30mm wide[ 332 ]. The seed kernel is also rich in oil of the same fatty acids and approximately in similar amounts[ 332 ]. Carbon Farming - Staple Crop: protein-oil.

tcanta Adhesive Biomass Cosmetic Dye Essential Fuel Lighting Oil Resin Soil conditioner Waterproofing WoodAgroforestry Uses: The leaves and the remains of the fruits can provide considerable quantities of biomass to improve soil fertility. Research carried out in the forest humid lowland of south Cameroon, showed that the peasant farmers use the tree as a good indicator of soils fertility[ 303 ]. The plant's canopy can allow its integration into the traditional farming systems involving food crops, mainly shade tolerant species such as *Xanthosoma sagittifolium*, *Colocasia esculenta* etc[ 303 ]. Other Uses: The bark is aromatic and on injera yields a resin[ 46 , 332 ]. This is used in various ways - in perfumery; as an adhesive for mending broken earthenware; as a waterproofing the inner surface of calabashes; it can also be burnt as a primitive lamp-oil or bush-candle[ 332 ]. The resin, under steam distillation, has been reported to yield a peppery essential oil rich in sabinene, -phellandrene and limonene, and a non-volatile fraction of crystalline canaric acid, a keto acid and the corresponding hydroxy acid[ 332 ]. The fruit contains about 1.5% essential oil. Its main constituents are: myrcene (45%), alpha-pinene (9%), alpha-terpineol (8%) and germacrene-D (4%); minor compounds include: E-alpha-cadinol, sigma-cadinol and beta-udesmol[ 299 ]. The wood contains an oil that on petrol-ether extraction has been found to be composed of fatty acids and their esters[ 303 ]. The fresh pulp is rich in lipids (35-65%) with a considerable amount of palmitic and linoleic acid. The tree can produce 7 - 8 t/ha of oil[ 303 ]. The leaves are the source of a dye[ 332 ]. The heartwood is greyish white to pinkish; it is not clearly demarcated from the sapwood. The wood is moderately heavy and elastic, the texture moderately coarse[ 299 , 303 , 332 ]. It is somewhat difficult to work due to the presence of silica, rapidly blunting tools during sawing; planing may be problematic due to the interlocked grain; staining, polishing and gluing properties are good, it can be peeled satisfactorily. It is used for axe-handles, occasionally for mortars, and is suitable for carpentry, etc[ 299 , 332 ]. The wood is used mainly for fuel[ 299 ]. Other Systems: homegarden, multistrata.

dwatta Antiemetic Dysentery Emmenagogue Mouth-washThe resin from the bark is used to treat parasitic skin diseases, jiggers etc[ 46 , 332 ]. A bark-decoction is taken powdered with maleguetta pepper as an anti-dysenteric, and for anaemia, spitting blood and as an emmenagogue[ 303 ]. The decoction is also used for making gargles and mouth-washes, for treating tonsillitis[ 332 ]. The pulped-up bark is used as a wound cicatrizant[ 332 ]. Combined with palm-oil, it is applied topically to relieve general pains and stiffness and to treat cutaneous conditions[ 332 ]. The leaves are eaten raw with kola nut as an antiemetic[ 332 ]. The leaf-sap is instilled into the ear for ear-trouble[ 332 ]. A leaf-decoction is prepared as a vapour-bath for treating feverish stiffness with headache[ 332 ].

nrakta Southern and western Tropical Africa - Ghana to the Congo. ksacta Swamp forest[ 308 ]. Evergreen forest[ 332 ]. A shade-loving species of non-flooded forests in the humid tropical zone[ 303 ]. Where there is a well-marked season, it is found only in gallery forest and on swampy ground[ 303 ].

propta Seed - it has a short viability, its germination rate drops sharply unless its water content (42% of fresh weight) can be maintained. Unless sown within a week, germination and vigour are greatly reduced[ 299 ]. Sow the seed in light shade in a nursery seedbed or in individual containers. Germination starts about 2 weeks after sowing and is epigeal. Early growth is vigorous - the seedlings growing rhythmically, extending by flushes. During a flush, the leaf form changes abruptly from cataphylls (0 - 3 per flush) to normal leaves (with 11 - 19 leaflets). The flush is usually brought to an end by the sudden transition from normal leaves to severely reduced leaves in which only one or two basal pairs of leaflets are extended[ 299 ]. Cuttings have proved difficult[ 299 ]. Air layering. Up to 80% success has been reported. It takes 4 - 6 months before the layer is ready to remove from the parent, and this should be done when the plant is not in active growth[ 299 ].

nwatta Management: Standard Other Systems: Homegarden Other Systems: Multistrata Regional Crop Staple Crop: Protein-oilA plant of the relatively dry tropical savan-

nah, where it is found at elevations up to 1,000 metres. It grows best in areas where annual daytime temperatures are within the range 18 - 28c but can tolerate 14 - 35c[ 418 ]. It prefers a mean annual rainfall in the range 1,200 - 3,000mm, but tolerates 1,000 - 5,000mm[ 418 ]. The plant can be cultivated in a wide range of areas, since it adapts well to differences in day length, temperature, rainfall, soils and altitude[ 303 ]. Seedlings can thrive in quite dense shade, but older trees grow well in partial shade or full sun[ 418 ]. Grows in a wide range of soils, even succeeding in leached, infertile ferrallitic soils and swampy soils[ 299 , 303 , 418 ]. Prefers a pH in the range 5 - 6.5, tolerating 4 - 8[ 418 ]. Seedling plants can commence fruiting when about 5 - 6 years old[ 335 ]. Flowering time and duration depend on latitude and genotype. Some trees flower early, while others flower late and may produce blossoms continuously for several months[ 303 ]. Yields of 20 - 50 kilos of fruit can be expected from each tree, with reports of 110 kilos from 20 year old trees[ 299 ]. The flowers open in the morning and pollen is shed within 1 - 2 hours, so pollination has to be effected quickly[ 299 ]. Trees can be male, female, or hermaphroditic[ 303 ]. Male trees may produce a limited number of female flowers, and thus some fruit[ 303 ]. Blooms all year. Blooms repeatedly. Carbon Farming - Cultivation: regional crop. Management: standard.

### 11.0.3 *Bactris gasipaes*

Peach Palm, Pupunha

11 tlin 12 cyuc 5 kcak 4 tcan 2 dwat 15 m hkuc  
hmimhtut cyutli hgattcup hwicli hyishrasjlutnykfrip hpa7tli frusflatprikhwisslip hpa7tmwatli hjonli

drutta *Bactris gasipaes* is an evergreen Tree growing to 15 m (49ft) by 7 m (23ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The flowers are pollinated by Insects, wind. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils, prefers well-drained soil and can grow in heavy clay and nutritionally poor soils. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

pcista The stems are usually heavily armed with rings of very sharp, black spines about 5 cm long[ 314 ].(Plant has spines or sharp edges; use extreme caution when handling.)

kcakta Edible Parts: Flowers Fruit Oil Seed ShootsEdible Uses: Condiment Oil SaltEdible portion: Fruit, Flower shoots, Cabbage, Palm heart, Vegetable. Fruit - cooked[ 297 ]. An acquired taste, mealy and nutty in flavour[ 200 ]. The flavour is variable, ranging from bland to strong[ 303 ]. Inedible raw, it is boiled in salt water for 30 - 60 minutes, when it becomes floury-textured, oily and pleasant tasting with good nutritious qualities[ 297 , 303 ]. The fruit is always cooked, because of the presence of an alkaloid, pupunhadine[ 303 ]. The fruit is highly nutritious, being very rich in carbohydrate and protein[ 200 ]. The fruits are also ground into a flour for baking bread, cakes etc[ 297 ]. The ovoid fruit is about 6cm long[ 200 ]. The fruit palm is an energy-rich source of carbohydrates and oil; the pulp contains all the essential amino acids and is an excellent source of quality protein[ 303 ]. The mesocarp is rich in beta-carotene[ 303 ]. It is regarded as probably the most nutritionally balanced of tropical fruits; has twice the protein content of the banana and can produce more carbohydrate per ha than maize[ 324 ]. An edible oil is obtained from the seed[ 301 ]. It is called oil of macanilla[ 301 ]. The mesocarp oil has a relatively high proportion of unsaturated fatty acids, notably oleic acid, and contains no cholesterol[ 303 ]. It is used for cooking[ 303 ]. Seed - eaten raw or made into a meal to flavour drinks[ 301 ]. Consumed as nuts[ 303 ]. A salt substitute is made by cooking the spadix[ 301 ]. The cooked male flowers are used as a condiment[ 303 ]. The apical bud is cooked and eaten as a vegetable[ 301 , 763 ]. A delicacy, in some areas it is eaten as a salad[ 303 ]. Fresh, dried and canned palmito is being marketed for use in salads, soups and fillings and as roasted chips[ 303 ]. Eating the bud effectively kills the trunk since it is unable to produce side shoots[ 301 ]. Some plants in this species form multi-trunks and so harvesting the apical bud will only

covered in prominent scales[335 ]. Unopened flower buds can be cooked and eaten as a vegetable[377 ].

nrakta Central America - Mexico southwards, also in the West Indies. ksacta An epiphytic or terrestrial plant, growing in thickets, hedges, on rocks or rock walls, at elevations up to 2,000 metres[335 ].

propta Seed - Stem cuttings. The cuttings are usually dried out for a week or two. The plants are self sterile and have to be pollinated by bats and moths. Hand pollination is recommended for good fruit production.

nwatta A plant of the warm tropical lowlands with low to high rainfall[335 ]. It grows best in areas where annual daytime temperatures are within the range 18 - 28c, but can tolerate 12 - 34c[418 ]. It succeeds with a mean annual rainfall in the range 300 - 3,500mm[418 ]. Often an epiphytic plant, though it also grows on the ground. Requires a well-drained soil and a pH of 6 or lower[200 ]. Prefers a pH in the range 5.3 - 6.7, tolerating 5 - 7.5[418 ]. Widely cultivated in the tropics and subtropics, it has often escaped from cultivation and become naturalised. It has been classified as 'invasive' in some areas, where it often spreads vegetatively[305 ]. Plants grow well, but do not always set fruit well, when growing in the wetter areas of the tropics[377 ]. They can have 4-6 fruiting cycles per year. Flowering Time: Late Summer/Early Fall. Bloom Color: Green White/Near White. Spacing: 12-15 in. (30-38 cm).

### 10.2.132 *Baccharoides hymenolepis*

Baccharoides

10 tlin 12 cyuc 4 kcak 3 tcan 2 dwat 4 m hkuc  
htut cyutli tcup hwicli hrasjlutnyk hpa7tli flatprikhwiss hpa7tmwatli hjonli

drutta *Baccharoides hymenolepis* is an evergreen Shrub growing to 4 m (13ft) by 3 m (9ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 9. The flowers are pollinated by Insects, Wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: LeavesEdible Uses: CondimentLeaves - raw or cooked. Eaten in salads, as a potherb or used as a garnish[ 299 ]. The leaves can be dried for later use[ 299 ]. The leaves are less bitter than related species that are used in the same ways, such as bitterleaf (*Gymnanthemum amygdalinum*) [ 299 ].

tcanta Fuel Hedge Soil stabilizationOther uses rating: Medium (3/5). Agroforestry Uses: The plant is sometimes planted as a hedge around homes and gardens, both for vegetable use and for the ornamental value of the large white or purple flowering heads[ 299 ]. The plants help to stabilize the soil, especially on slopes[ 299 ]. Other Uses Dry branches and stems serve as fuel[ 299 ].

dwatta Antidiarrhoeal Antitumor PurgativeThe plant is used medicinally as a cure for pneumonia[ 299 ]. Juice from the crushed leaves is used to treat jaundice, and also diarrhoea in babies[ 299 ]. A hot leaf placed on a wound is said to stop bleeding[ 299 ]. A root decoction is used as a purgative and to treat abdominal pains[ 299 ]. The sesquiterpene lactone vernolepin was isolated from plant material collected in Ethiopia. This compound showed antitumor activity and platelet anti-aggregating properties[ 299 ].

nrakta Tropical Africa - Sudan, Ethiopia, eastern DR Congo, Uganda, Kenya, Rwanda, Tanzania, Mozambique, ZI ksacta Along rivers and roadsides, in forest margins, old cultivation sites and bushed grassland, also in montane forest and often found in disturbed habitats; usually at elevations from 1,200 - 3,000 metres, sometimes descending to 600 metres[ 299 , 610 ].

propta Seed - it can be sown in situ, but is more commonly sown by broadcasting, or by sowing in lines, on raised nursery beds - these are shaded to prevent excessive evaporation. Germination commences within 5 days. When the seedlings are 2 - 3 weeks old, with 4 - 6 leaves, they are pruned by nipping the growing point and are then transplanted with a ball of soil to their permanent positions[ 299 ]. Cuttings. Stems with 4 buds, taken from mature plants, are used; they are planted slanting. Rooting of the cuttings is not always successful and plant growth is much slower than

in seedlings, so that this method is only used in home gardens when a particular plant type is appreciated[ 299 ].

nwatta *Baccharoides hymenolepis* is a plant of moderate elevations in the tropics where it can be grown up to 3,000 metres. The plants thrive at temperatures of less than 30°C. The minimum mean annual rainfall required is 840mm[ 299 ]. Generally, the plants grow well in a loose, moist soil that is rich in humus. The degree of soil fertility greatly influences leaf size[ 299 ]. The plant is very sensitive to drought[ 299 ]. Seedlings are tasted when they are being planted out and the more bitter seedlings are discarded. This selection process not only secures a better quality crop, but also serves to reduce bitterness in the next generations[ 299 ]. Early growth of young plants during the rainy season is so rapid that they grow as tall as 40 - 50cm in just 4 weeks. This rapid growth continues as long as there is ample moisture in the soil[ 299 ]. Harvesting the leaves starts 4 - 6 weeks after sowing or 6 - 8 weeks after transplanting. Harvesting is done either by cutting the young shoots or gathering the leaves only. Although the harvest of leaves only is often preferred, this system may adversely affect the development of the plant[ 299 ]. Best results are obtained during the rainy season by cutting the shoots at 5 - 10cm above the soil, which will then be replaced by one or two side shoots. These side shoots could be harvested 3 - 4 weeks later and, depending on soil moisture and fertility, this process could be repeated two or three times[ 299 ]. In the dry season, when new shoots develop only slowly if at all, farmers pick the leaves only[ 299 ]. The highest yields are obtained during the rainy season. An initial harvest of stems yields about 1 kilo per square metre, this decreases to about 500 grammes on the third harvest[ 299 ]. Flower initiation begins with the onset of the dry season or during periods of drought[ 299 ].

### 10.2.133 *Pandanus julianettii*

Karuka

10 tlin 12 cyuc 4 kcak 3 tcan 0 dwat 4 m hkuc  
hmimhtut cyutli tcup hwicli hrasjlut hpa7tli frusflatprikhsom hpa7tmwatli hjonli

drutta *Pandanus julianettii* is an evergreen Shrub growing to 4 m (13ft) by 3 m (9ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: Leaves Oil Root SeedEdible Uses: OilSeeds[418 ]. The seeds are oily and contain a fair amount of protein[418 ]. Sometimes the inner leaves and the tips of the aerial roots are eaten cooked[317 ].

tcanta Fibre OilA fibre obtained from the plant is used for making textiles[418 ].

nrakta Australasia - New Guinea. ksacta Not known propta Seed - best pre-soaked for 24 hours prior to sowing[299 ]. Commonly vegetative cuttings of the top section of a branch is used for planting. This is suitable for a tree that has several branches. Sometimes karukas develop young suckers or shoots near the ground. When these are seen, they are broken off and replanted from these vegetative suckers. Trees from cuttings produce after 5-8 years. Seedling trees are slower to produce and have a taller straighter trunk.

nwatta Management: Standard Regional Crop Staple Crop: OilA plant of the humid tropics, where it is found at elevations from 1,700 - 2,900 metres[418 ]. Plants grow best in areas where the mean annual temperature is within the range 13 - 24c, but can tolerate 6 - 30c[418 ]. They may tolerate temperatures as low as 0c for short periods and down to 3c for prolonged periods[418 ]. They prefer a mean annual rainfall in the range 3,000 - 4,000mm, tolerating 2,500 - 4,000mm[418 ]. Succeeds in sunny positions and in light shade[418 ]. Prefers a well-drained, humus-rich, light to medium soil[418 ]. Prefers a pH in the range 4.5 - 5.5, but tolerates 3.5 - 5.6[418 ]. Plants can be harvested for their fibre the first time 6 - 8 years from planting, with an economical life of 20-40 years and with a total lifespan of up to 70 years[418 ]. Require 90-120 days from flowering to fruiting and have no obvious seasonality[418 ]. This species has potential for commercial use[317 ]. Branches do not have

dormant buds and so will not resprout if cut back into the old wood[423 ]. A dioecious species, both male and female forms need to be grown if fruits and seed are required.

### 10.2.134 *Malpighia emarginata*

Acerola, Barbados Cherry  
10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 4 m hkuc  
hmimhtut cyutli hgactup hwicli hrasjlutnyik hpa7tli frusflat-prikhsom hpa7tmwatli hjonli

drutta *Malpighia emarginata* is an evergreen Shrub growing to 4 m (13ft) by 4 m (13ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil and can tolerate drought. The plant can tolerate strong winds but not maritime exposure.

ksakta Edible Parts: FruitEdible Uses: DrinkFruit - raw or cooked[301 ]. The bright red fruit can range in flavour from sweet to somewhat acid[296 , 301 ]. As well as being eaten out of hand, they can also be stewed, made into juices, sauces, jellies, jams, wines or purees[301 , 317 ]. The fruits are very rich in vitamin C (1 - 4 g per 100 g juice)[296 , 317 ]. They are widely used in the preparation of vitamin tablets and other nutritional supplements[301 ]. The juice is added to other juices in order to improve their nutritional value[317 ]. Plants can produce 2 - 3 crops of fruit a year[296 ].

dwatta Dysentery Vitamin CThe fruits are considered beneficial against liver problems, diarrhoea, dysentery, coughs and colds[303 ]. The bark exudes a gum that is recommended as a pectoral[348 ]. Known historically as a natural source of ascorbic acid (Vitamin C). Ascorbic acid levels in fresh acerola fruit are in the range of 1.5 to 4% by weight. A glass of acerola juice (180-ml) contains 35mg/ml of ascorbic acid the same as 14 litres of orange Juice.

nrakta C. America - Mexico to northern S. America and the Caribbean. ksacta Not known

propta Seed - Cuttings

nwatta Easily grown in a good soil and a sunny position[296 ]. Seedlings can fruit when only 2 - 3 years old, but are not always of as good quality as their parents[296 ]. Flowering Time: Mid Spring Late Spring/Early Summer. Bloom Color: Pink. Spacing: 15-18 in. (38-45 cm) 18-24 in. (45-60 cm) 24-36 in. (60-90 cm) 36-48 in. (90-120 cm) 4-6 ft. (1.2-1.8 m) 6-8 ft. (1.8-2.4 m).

### 10.2.135 *Dioscorea trifida*

Cush Cush Yam, Sweet yam

10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 3 m hkuc  
hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikwiss hpa7tmwatli hjonli

drutta *Dioscorea trifida* is an evergreen Perennial Climber growing to 3 m (9ft) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Wind, Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

ksakta Edible Parts: RootEdible Uses: Root - cooked[ 300 ]. Boiled or baked, some forms have an excellent flavour[ 300 ]. The cooked flesh is smooth in texture, attractive and of an unusually rich flavour that is readily appreciated and sufficiently moist in the mouth[ 301 ]. Roots are about 15 - 20cm long and 6 - 8cm in diameter[ 300 ]. The tuber is about 38% waxy starch that lacks amylose and has potential uses as a binder and thickener in food processing.

tcanta Vines of other *Dioscorea* species are grown as ornamentals.

nrakta Northern S. America - Brazil, Peru, Ecuador, Colombia, Venezuela, the Guyanas; C. America - Panama to Guatemala; eastern Caribbean. ksacta Not known

propta Seed - sown in containers and planted out at the beginning of the growing season[ 300 ]. Cuttings of tubers. Small tubers can be cut into 2 - 4 sections, larger ones into 6 - 8 sections. Each section should have 2 - 3 dormant buds.

The cut tuber is often left in the sun for several hours to promote wound healing and reduce the risk of fungal infection[ 300 ].

nwatta A plant of the moist tropics and subtropics. It grows best in areas where annual daytime temperatures are within the range 18 - 26°C, but can tolerate 10 - 36°C[ 418 ]. It can be killed by temperatures of 7°C or lower[ 418 ]. It prefers a mean annual rainfall in the range 1,200 - 2,600mm, but tolerates 1,000 - 4,000mm[ 418 ]. This species grows better at lower temperatures than most tropical yams[ 300 ]. Prefers a sunny position, tolerating some shade[ 418 ]. For best yields, most yams require a deep, well-drained, sandy loam that is not liable to water-logging[ 300 ]. This species will succeed in a wide range of soils so long as there is plenty of organic matter and they are well drained[ 300 ]. Prefers a pH in the range 6 - 6.7, tolerating 5.3 - 8[ 418 ]. Daylengths of more than 12 hours are preferred during the early growing season since this encourages vegetative growth; daylengths of less than 12 hours towards the end of the growing season will encourage tuber formation and development[ 300 ]. Crops can be obtained in 9 - 11 months from planting, yields of 15 - 20 tonnes per hectare have been achieved[ 300 ]. Plants produce groups of 5 - 50 tubers from enlarged stolons or runners[ 300 ]. This is perhaps the only cultivated yam species that has retained its full reproductive potential through seed formation[ 300 ]. There are some named varieties[ 46 , 300 ]. A dioecious species, both male and female plants need to be grown if seed is required.

### 10.2.136 *Vasconcellea x heilbornii*

Babaco

10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 2 m hkuc  
htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikwiss hpa7tmwatli fyil hjonli

drutta *Vasconcellea x heilbornii* is an evergreen Tree growing to 2 m (6ft) by 1.5 m (5ft) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. The plant is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

ksakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked[301 ]. Fragrant and flavourful[196 ]. The flavour has been likened to the taste of strawberry, with a hint of pineapple[196 ]. The fruit is usually seedless and can weigh 2 kilos[196 ].

nrakta S. America - Andes. ksacta Not known

propta Seed - unlikely to breed true since this is a hybrid species. Seeds are sometimes produced when the flowers are fertilized, these can be used to propagate the plant. Sow the seed in individual containers or in a nursery seedbed in light shade. Germination can be slow and difficult, taking about 30 days[670 ]. Seedlings can be planted out when 4 - 6 months old[670 ]. Cuttings work fairly well and maintain female lines that do not need pollination in order to produce fruit..

nwatta A plant of the highland tropics, where it is usually found at elevations of 1,400 - 2,50 metres[196 ]. It can also be grown at lower elevations in subtropical and warm, essentially frost-free temperate areas. Yields of over 100 tonnes per hectare are possible[196 ]. There are several named varieties[301 ]. The plant coppices well[196 ]. Although this species is dioecious (male and female flowers on separate plants), fruits are usually produced parthenocarpically, without the need of pollen for fertilisation[301 , 670 ]. A few viable seeds will often be produced, however, if the flower is pollinated[670 ].

### 10.2.137 *Calathea allouia*

Sweetcorn Root, Guinea Arrowroot

10 tlin 12 cyuc 4 kcaak 1 tcan 0 dwat 2 m hkuc  
hmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli frusflatprik-wissliip hpa7tmwatli hjonli

drutta *Calathea allouia* is an evergreen Perennial growing to 2 m (6ft) by 1 m (3ft 3in) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral

## 11 11 tlin

### 11.0.1 *Garcinia mangostana*

Mangosteen, Manggis

11 tlin 12 cyuc 5 kcaak 2 tcan 2 dwat m hkuc  
hmimhtut cyutli tcup hwicli jlutnyik hpa7tli frusflatprik hpa7tmwatli fyif hjonli

drutta *Garcinia mangostana* is an evergreen Tree growing to 12 m (39ft) by 10 m (32ft) at a slow rate. See above for USDA hardiness. It is hardy to UK zone 10 and is frost tender. The plant is self-fertile. Suitable for: medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil. The plant is not wind tolerant.

ksakta Edible Parts: Fruit SeedEdible Uses: Condiment-Fruit - raw. The white fruit is delicious[296 ]. The fruit is aromatic, juicy, with a texture so soft it almost melts in the mouth and a sweet, delicate flavour[301 ]. About the size of an apple, the skin can be removed to reveal about 6 kernels of white pulp with a flavour that is tart and sweet, like a cross between grapes and strawberries. The fruit is a globose berry 34 - 75mm in diameter[303 ]. The best table fruits are those with the highest number of stigma lobes at the apex, for these have the highest number of fleshy segments and the fewest seeds[303 ]. Seed - occasionally eaten after boiling or roasting[301 ]. They add a delicious nutty flavour to preserves when cooked with the pulp[301 ].

tcanta Dye Furniture Tannin Teeth WoodSmall fruit tree, Humid shade garden, Bonsai, Botanic collection. Other Uses The fruit rind is a source of tannins[418 ]. It contains 7 - 14% catechin tannin and rosin[303 ]. The tannins can be used as a black dye[303 , 418 ]. The twigs are used as chewsticks[303 ]. The fruit hulls show anti-fungal and anti-protozoal activity[303 ]. The dark-brown wood is strong; heavy to the point that it almost sinks in water; and is moderately durable[303 , 418 ]. Usually only available in small sizes, it has been used in construction and cabinetwork, to make handles for spears and rice pounders[303 ].

dwatta Antidermatosis Antidiarrhoeal Antifungal Astringent Dysentery Eczema Febrifuge Skin UrinaryThe rind is astringent and has been used internally to treat dysentery, diarrhoea, cystitis and gonorrhoea. It is applied externally to treat eczema and other skin disorders[303 ]. The rind of partially ripe fruits yields a polyhydroxy-xanthone derivative termed mangostin. That of fully ripe fruits contains the xanthenes, gartanin, 8-disoxygartanin, and normangostin. A derivative of mangostin, mangostin-e, 6-di-O-glucoside, is a central nervous system depressant and causes a rise in blood pressure[303 ] A decoction of the leaves and bark is used as an astringent, febrifuge and to treat thrush, diarrhoea, dysentery and urinary disorders[303 , 345 ]. A bark extract called 'ambiasine', has been marketed for the treatment of amoebic dysentery[303 ] An infusion of the leaves, combined with unripe banana and a little benzoin, is applied to the circumcision wound[303 ]. A root decoction is taken to regulate menstruation[303 ].

nrakta E. Asia - Malaysia. ksacta The tree is mostly known from cultivation, but is also probably wild on hillsides and ridges in undisturbed mixed dipterocarp forests at elevations up to 200 metres[653 ].

propta Seed. - it has a very short viability and should be sown as soon as it is ripe[303 ]. Technically, the so-called 'seeds' are not true seeds but adventitious embryos, or hypocotyl tubercles; there has been no sexual fertilization[303 ]. When growth begins, a shoot emerges from one end of the seed and a root from the other end. But this root is short-lived and is replaced by roots which develop at the base of the shoot. The process of reproduction being vegetative, there is naturally little variation in the resulting trees and their fruits[303 ]. Some of the seeds are polyembryonic, producing more than one shoot. The individual nuclear embryos can be separated, if desired, before planting[303 ]. The percentage of germination is directly related to the weight of the seed, only plump, fully developed seeds should be chosen for planting[303 ]. Because of the long, delicate taproot and poor lateral root development, transplanting is notoriously difficult. It must not be attempted after the plants reach 60cm[303 ]. At that time the depth of the taproot may exceed the height of the plant[303 ]. There is

greater seedling survival if seeds are planted directly in the nursery row than if first grown in containers and then transplanted to the nursery[303 ]. The nursery soil should be 1 metre deep, at least. The young plants take 2 years or more to reach a height of 30cm, when they can be taken up with a deep ball of earth and set out[303 ]. Seeds are recalcitrant and should be stored in their fruit at room temperature, or in moist peat moss, even these will lose viability in 5 days after removal from the fruit, though they are viable for 3 - 5 weeks in the fruit. Viability can be maintained for 1 - 2 months in moist storage at 20°C, storage temperature of 10°C is damaging[303 ]. Cuttings of greenwood. Budding on to seedlings[200 ].

nwatta The mangosteen is an ultra-tropical plant, usually only grown in areas without a dry season and within 10 degrees of the equator. It is usually grown from sea level up to 1,000 metres elevation, but the growth rate is higher in lowland areas[303 , 418 ]. It grows best in areas where annual daytime temperatures are within the range 20 - 30°C, but can tolerate 15 - 40°C[418 ]. It cannot tolerate temperatures below 4°C, nor above 38°C[303 ]. It prefers a mean annual rainfall in the range 1,600 - 2,000mm, but tolerates 1,100 - 2,800mm[418 ]. Succeeds in full sun and in light shade[418 ]. Requires a good, deep, rich organic soil that retains moisture but is also well-drained[296 ]. Grows best in a fertile clay with good drainage[200 ]. Prefers an acid soil[307 ]. Prefers a pH in the range 5 - 6, tolerating 4.3 - 7.5[418 ]. Plants are intolerant of drought[296 ]. The mangosteen must be sheltered from strong winds and salt spray[303 ]. It takes at least 8 years before a tree commences bearing fruit, but yields of 200 - 1,500 fruits per tree have been recorded from mature specimens[200 ]. In cooler climates it can take 15 - 20 years for plants to produce their first fruit from seed[296 ]. Trees produce an economical yield of fruit for about 50 years[418 ]. Stress should be avoided; a tree which is visibly suffering seldom recovers[303 ]. Plants resent root disturbance[200 ]. Only female forms of this plant are known, but they are able to produce fruit without fertilization[200 ]. There are some named forms[301 ]. The plants grow very well when banana plants are grown around them to provide wind shelter and plenty of mulch material[296 ]. Some of the most fruitful mangosteen trees grow on the banks of streams, lakes, ponds or canals where the roots are almost constantly wet. However, dry weather just before blooming time and during flowering induces a good fruit-set[303 ]. Spacing: 20-30 ft. (6-9 m).

### 11.0.2 *Dacryodes edulis*

Bush Butter Tree, Butterfruit, African Plum, bush pear, bush plum, safou

11 tlin 12 cyuc 5 kcaak 3 tcan 2 dwat 20 m hkuc  
hmimhtut cyutli tcuphja7n hwicli hysihrasjlutnyik hpa7tli frusflatprikwissliip hpa7tmwatli dyat hjonli

drutta *Dacryodes edulis* is an evergreen Tree growing to 20 m (65ft) by 20 m (65ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Bees, Insects. The plant is not self-fertile. It is noted for attracting wildlife. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and can grow in nutritionally poor soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil.

ksakta Edible Parts: Fruit OilEdible Uses: OilFruit - raw or cooked[ 301 ]. A pleasant, subacid flavour[ 335 ]. The leathery shelled stone is surrounded by a pulpy, butyraceous pericarp about 5 mm thick which is the portion eaten, either raw, or cooked for to form a sort of 'butter'[ 332 ]. When placed in hot water it softens and swells and all the flesh then slides easily off the seed[ 301 ]. The fruit flesh is softened by cell-wall-degrading enzymes. At temperatures of 60 - 85c this is accomplished in a matter of minutes; at room temperature, it takes 7 - 10 days, with bruising and microbes reducing this period to 3 days[ 299 ]. Boiling inactivates the enzymes so that the pulp hardens[ 299 ]. The fruit is usually salted and tastes like a warmed ripe avocado with a slightly sour flavour[ 301 ]. It has a mild smell of turpentine and is oily with palmitic acid 36.5%, oleic acid 33.9%, linoleic acid 24.0% and stearic acid 5.5%[ 332 ]. The fruit contains 7% protein, which is very high for a fruit[ 301 ]. The fruit is up

Sierra Leone the leaves are also popular and are made into a sauce with groundnut paste[ 299 ]. In Australia it is eaten as a salad green, either cooked or raw[ 299 ]. Roots - eaten with chilli sauce in Thailand[ 301 ].

tcanta Fodder Repellent TanninAgroforestry Uses: Cras-socephalum crepidioides has been used successfully as a trap plant to collect adult corn weevils in banana plantations. Other Uses: Fodder/animal feed.

dwatta Epilepsy Skin StomachicThe leaves are used to treat indigestion[ 299 ]. The leaf sap is given to treat upset stomach[ 299 ]. A leaf lotion or decoction is used to treat headaches[ 299 ]. A mixture of the leaf sap, combined with Cymbopogon giganteus, is used orally and externally for the treatment of epilepsy[ 299 ]. Applied externally, the leaf sap is used as a treatment for fresh wounds[ 299 ]. The dried leaf powder is applied as a snuff to stop nose bleeding and smoked to treat sleeping sickness[ 299 ]. Tannin found in the roots of the plant is used to treat swollen lips[ 299 ].

nrakta Through most of tropical Africa, it has become naturalised in many other parts of the Tropics. ksacta A weed in abandoned farm land, waste places, plantations and backyard gardens[ 299 ].

propta Seed and Cuttings.

nwatta Grows well in soils that are rich in organic matter[ 299 ]. An easy to grow vegetable, especially suited to shady localities in home gardens and tree plantations[ 299 ]. Often cultivated as a food crop in the tropics, the plant has light, plumed seeds that are easily distributed by the wind. It has escaped from cultivation in many areas and become an invasive weed in some places[ 305 ].

## 10.2.146 Ophioglossum reticulatum

Adder's tongue fern

10 tlin 12 cyuc 4 kcaak 1 tcan 2 dwat 0.2 m hkuc hmimhtut cyutli tcuphja7n hwicli hrasjlut hpa7tli flatprik hpa7tmwatli hjonli

drutta Ophioglossum reticulatum is a deciduous Fern growing to 0.2 m (0ft 8in) by 0.1 m (0ft 4in) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils. Suitable pH: mildly acid and neutral soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil.

pcista Although we have found no reports of toxicity for this species, a number of ferns contain carcinogens so some caution is advisable[200 ]. Many ferns also contain thiaminase, an enzyme that robs the body of its vitamin B complex. In small quantities this enzyme will do no harm to people eating an adequate diet that is rich in vitamin B, though large quantities can cause severe health problems. The enzyme is destroyed by heat or thorough drying, so cooking the plant will remove the thiaminase[172 ].

kcakta Edible Parts: LeavesEdible Uses: Young fronds are commonly eaten as a salad or vegetable[332 ]. A sweet flavour[46 ]. The leaves should be blanched only; if boiled too much they turn into slime[299 ].

tcanta Pots. Plants are not normally cultivated as a food crop, but are sometimes grown in pots for medicinal use[299]. The presence of alkaloids, arbutin, amygdalin, saponin, formic acid and oxalic acid has been shown.

dwatta Antiinflammatory SkinA warm decoction of the rhizome is used topically on boils[299 ]. The leaf juice is drunk against spasms of the heart[299 ]. The leaves, boiled in oil, are applied to wounds[299 ]. The plant is used as an anti-inflammatory medicine[299 ].

nrakta Pantropical. ksacta Grassland in open damp sandy soil at elevations up to 1,500 metres in Africa[200 , 299 ]. Moist sandy soils, seasonally wet soils, along roads, on termite hills, in montane grassland among rocks and forest margins, from sea-level up to 2,500 metres[299 ].

propta Spores - very difficult to germinate[200 ]. Division with care since the rhizome is brittle[200 ].

nwatta The plant can become a weed of agriculture, but does little harm because of its small size[299 ]. When grown from spores, plants can be harvested for their leaves after 1 - 2 years[299 ]. When grown from rhizomes collected from the wild, harvesting may start after about 6 months[299 ]. The fronds are irresistible to insects and molluscs[200 ].

## 10.2.147 Alternanthera sissoo

Brazilian Spinach, Sambu, Samba lettuce

10 tlin 12 cyuc 4 kcaak 3 tcan 0 dwat 0.4 m hkuc pcmhmmimhtut cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Alternanthera sissoo is an evergreen Perennial growing to 0.4 m (1ft 4in) by 0.4 m (1ft 4in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: LeavesEdible Uses: Leaves - cooked and used as a spinach[ 298 ]. The shoots are harvested when 15 - 25cm long - frequent harvesting stimulates new growth and increases overall yields[ 298 ].

tcanta Other uses rating: Good (3/5). Agroforestry Uses: A fast-growing, weed-excluding ground cover plant. Barrier.

nrakta S. America - Brazil. ksacta Not known

propta Seed is not produced. Cuttings - very easy.

nwatta Plants can thrive in 50% or more shade. Prefers a well-drained soil with a high organic content[ 298 ]. A fast-growing, spreading plant, but it does not produce seed and is not considered to be invasive. The plant can suffer severe insect damage to the leaves in some areas[ 298 ].

## 10.2.148 Limnocharis flava

Sawah Lettuce, Sawah Flowering Rush

10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 0.6 m hkuc

htut cyutli tcuphja7nhs6s hwicli hrasjlutnyik hpa7tli frusflatprik hpa7tmwatli hjonli

drutta Limnocharis flava is an evergreen Perennial growing to 0.6 m (2ft) by 0.6 m (2ft in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: mildly acid and neutral soils and can grow in very acid soils. It cannot grow in the shade. It prefers moist or wet soil and can grow in water.

kcakta Edible Parts: Flowers LeavesEdible Uses: Leaves, leaf stems, flower stalks and young inflorescences are eaten cooked[317 ]. They can be steamed like endive or spinach, added to soups or mixed with other vegetables[301 ]. The young leaves and tops of the plant are boiled or cooked in mixed soups[413 ]. The vegetable contains relatively high levels of Calcium, Iron and vitamin A, which are nutrients that are frequently insufficient in the diets of women in low-income countries[413 ].

nrakta Southern S. America - Argentina, Paraguay, north through Central America to Mexico. ksacta In or at the edge of water[331 ]. Shallow swamps, ditches, pools and wet rice fields, occurring usually in stagnant fresh water[413 ].

propta Seed - seed must be kept damp or it loses viability[200 ]. Sow in a constantly damp medium at 20c, cover with silver sand and immerse in 1cm of water once the seedlings have germinated[200 ]. Division

nwatta Grows best in shallow, neutral to slightly acidic water[200 ]. If allowed to grow unchecked, the plant may become a very invasive environmental weed of streams and wetlands. It has become a serious weed in rice fields, irrigation canals and wetlands in South-East Asia[413 ]. Clumps of the weed provide a congenial breeding site for disease-vectors, including mosquitoes, which encourages the spread of diseases such as Japan fever and dengue fever[413 ]. Plants are reproduced mainly by seeds - these are dispersed via the production of fruitlets, which are buoyant and carried by water to new localities, dispersing seeds along the way[413 ]. Fruiting takes place throughout the year, with a single fruit producing about 1,000 seeds and a single plant producing about 1,000 fruits per year[413 ]. Bloom Color: Bright Yellow White/Near White. Spacing: 18-24 in. (45-60 cm).

and basic (mildly alkaline) soils and can grow in very acid and very alkaline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Flowers Leaves RootEdible Uses: Edible portion: Tubers, Root, Flowers, Leaves - flavour, Vegetable. Root - cooked[ 46 ]. Rich in starch[ 317 ]. The crisp cooked tubers are very agreeable with a flavour like sweet-corn[ 301 ]. It is used in salads, stews and fish dishes. Their unique texture makes them a gourmet item[ 301 ]. Used in similar ways to potatoes[ 200 ]. A commercially cultivated vegetable. The tubers are 2 - 8cm long and 2 - 4cm in diameter[ 418 ]. Young tender flower spikes - cooked[ 301 , 331 ]. The leaves are used for wrapping tamales and other foods, to which they impart flavour[ 301 , 331 ]. Tubers are 6.6% protein on a dry matter basis.

tcanta BasketryOther uses rating: Low (1/5). In former times, the plant played a more important role for making blankets, mattresses, pillows, baskets and umbrellas[ 317 ].

nrakta S. America, north to Mexico and the Caribbean. ksacta Moist or wet, mixed forest, at elevations of 1,400 meters or less, most frequent at low elevations[ 331 ].

propta Seed - Division of tubers Cuttings of basal shoots. nwatta A plant mainly of the moist, lowland tropics, where it is found at elevations up to 1,400 metres. It grows best in areas where annual daytime temperatures are within the range 22 - 31c, but can tolerate 16 - 35c[ 418 ]. It prefers a mean annual rainfall in the range 1,000 - 2,000mm, but tolerates 700 - 2,800mm[ 418 ]. Grows best in full sun or light shade[ 418 ]. Prefers a moist, humus-rich, freely-draining soil[ 200 ]. Prefers a pH in the range 6 - 7, tolerating 5.5 - 7.5[ 418 ]. Crops are produced in about 9 - 14 months from planting out the roots[ 418 ]. Tuber yields of 2 - 15 tonnes/ha have been reported[ 418 ].

## 10.2.138 Dioscoreophyllum cummin-sii

Serendipity Berry, Guinea potato

10 tlin 12 cyuc 4 kcaak 0 tcan 0 dwat 1.8 m hkuc

pcmhmim cyutli tcup hwicli hrasjlutnyik hpa7tli flatprik hpa7tmwatli hjonli

drutta Dioscoreophyllum cumminsii is an evergreen Climber growing to 1.8 m (6ft) by 0.2 m (0ft 8in) at a medium rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid and neutral soils. It can grow in full shade (deep woodland) or semi-shade (light woodland). It prefers moist soil.

kcakta Edible Parts: Fruit RootEdible Uses: Sweetener-Fruit - raw. The intensely sweet, mucilaginous pulp of the fruit is considered to be the sweetest known naturally occurring substance - it is up to 3,000 times sweeter than sucrose[ 301 ]. It has been recommended as a non-carbohydrate sugar substitute[ 301 ]. The fruit can keep for several weeks at room temperature[ 301 ]. Roots. Small and yam-like[ 301 ].

dwatta The fruit contains monellin, an intensely sweet protein with potential use as a sugar replacement for diabetics. For humans, monellin is 100,000 times sweeter than sucrose on a molar basis and around 3,000 times on a weight basis.

nrakta Western, central and northeastern tropical Africa. ksacta Dense rain-forest and galleried forest, often in old cultivation sites[ 332 ].

propta Plants can be grown from seed or tubers. Seeds need to germinate in the dark. Plants can be grown from stem cuttings.

nwatta A tropical dioecious rainforest vine with tuberous underground stems. The fruit can be stored. It will keep for several weeks at room temperature.

## 10.2.139 Solanum pimpinellifolium

Currant Tomato

10 tlin 12 cyuc 4 kcaak 2 tcan 2 dwat 1 m hkuc

htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatpriklwis hpa7tmwatli fyif hjonli

drutta Solanum pimpinellifolium is a ANNUAL/BIENNIAL growing to 1 m (3ft 3in) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. The flowers are pollinated by Insects. The plant

is self-fertile. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

pcista All green parts of the plant are poisonous[19 , 76 ]. Although providing many well-known foods for people, including the potato, tomato, pepper and aubergine, most plants in the family Solanaceae also contain poisonous alkaloids. Unless there are specific entries with information on edible uses, it would be unwise to ingest any part of this plant[K ].

kcakta Edible Parts: Fruit Oil SeedEdible Uses: OilFruit - raw, cooked or dried for later use[ 1 , 105 , 183 ]. Sweet and delicious, it makes an excellent dessert fruit and is also used in savoury dishes as a vegetable[K ]. The red, globose fruit is rather small and fiddly, about 10 - 15mm in diameter, but it is produced in quite large bunches and is well worth the effort of picking[K ]. An edible oil is obtained from the seed[46 , 61 ]. The seed is small and it would be very fiddly to utilize. It is only viable to use the seed as a source of oil if large quantities of the plants are being grown for their fruits and the seed is not wanted.

tcanta OilAgroforestry Uses: The strong aroma of this plant is said to repel insects from nearby plants[7 , 18 , 20 ]. Other Uses A semi-drying oil is obtained from the seed. Used in making soap[46 , 61 , 171 ]. See the notes above regarding utilization.

dwatta The pulped fruit is an extremely beneficial skin-wash for people with oily skin. Sliced fruits are a quick and easy first aid treatment for burns, scalds and sunburn[201 ]. A decoction of the root is ingested in the treatment of toothache[218 ]. The skin of tomato fruits is a good source of lycopen, a substance that has been shown to protect people from heart attacks. It seems to be more effective when it is cooked and so can be obtained from food products such as tomato ketchup and tinned tomatoes[246 ]. A homeopathic remedy is made from the plant[7 ]. It is used in the treatment of rheumatism and severe headaches[7 ].

nrakta Original habitat is obscure, probably Western S. America as a cultivated form of L. Cerasiforme. ksacta Not known in a truly wild situation.

propta Seed - sow in situ The seedcoat may carry tomato mosaic virus. However, by sowing the seed 15mm deep the seedcoat will remain below the soil surface when the seed germinates and the disease will be inactivated[124 ].

nwatta Plants are not frost-hardy. They can be grown outdoors in Britain as a spring-sown annual started off under glass in the spring. In cool wet summers the total yields are likely to be low[K ]. Requires a rich well-drained soil in a sunny position. The plant has been introduced as a crop into the Galapagos, where it has shown a tendency to invade disturbed areas. It is of particular concern there due to possible hybridization with native Solanaceae[305 ]. There are some named varieties[183 ].

## 10.2.140 Tylosema esculentum

Marama Bean

10 tlin 12 cyuc 4 kcaak 2 tcan 0 dwat 1 m hkuc

htut cyutli hgatkuyctcup hwicli hrasjlut hpa7tli flatpriklwis hpa7tmwatli hjonli

drutta Tylosema esculentum is an evergreen Perennial growing to 1 m (3ft 3in) by 0.2 m (0ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers dry or moist soil and can tolerate drought.

kcakta Edible Parts: Oil Root SeedEdible Uses: Coffee Drink OilSeed - cooked. After roasting, the seeds have a delicious, nutty flavour similar to coffee beans or roasted cashews[301 ]. They may be boiled with maize meal or ground into flour to prepare a porridge or a coffee- or cocoa-like drink[299 ]. The roasted seeds have sometimes been used as a culinary substitute for almonds[299 ]. The seeds have a protein content around 30% (approaching that of the soya bean) and an oil content around 40% (approaching that of the peanut)[301 ]. The immature seeds and stems may be eaten cooked as a vegetable or in soups[299 ]. A coffee-like beverage can be made from the seeds[317 ]. An edible oil is

obtained from the seed[301 ]. Similar to almond oil in consistency and taste[299 , 301 ]. Golden-yellow, with a nutty odour and a pleasant, although slightly bitter flavour[299 ] Tuber - cooked. The sweet-tasting tuber can be baked, boiled or roasted[301 , 317 ]. Young tubers have a sweet and pleasant taste and the texture has been described as similar to that of artichoke[299 ]. Tubers older than 2 years become fibrous and bitter and are usually not eaten, but they are an important emergency source of water for humans and animals[299 ].

tcanta Cosmetic OilAgroforestry Uses: Marama bean may have potential as an ornamental ground cover plant[299 ]. Other Uses: The seeds and kernels yield up to 50% by weight of a golden yellow, transparent oil that can be used in cosmetic preparations[1309 ].

nrakta Southern Africa - Kalahari desert and neighbouring sandy regions. ksacta Localized in patches in grassland and wooded grassland vegetation in sandy and limestone (including dolomite) soils, but not on soils developed over granite or basalt[299 ].

propta Seed it should not be pre-soaked, though germination might be improved by scarification[299 ]. Germination starts to take place after about 9 days[299 ].

nwatta Management: Standard New Crop Staple Crop: Protein Wild Staple CropA plant of the drier tropics, marama bean occurs naturally in an extreme environment with high temperatures and very low rainfall[299 ]. It can be found at elevations up to 1,500 metres. It grows best in areas where annual daytime temperatures are within the range 22 - 30°C, but can tolerate 16 - 50°C[418 ]. It prefers a mean annual rainfall in the range 300 - 600mm, but tolerates 150 - 1,600mm[398 , 418 ]. The plant probably survives droughts by drawing on water stored in the tuber, which shrinks greatly in dry years[418 ]. Requires a sunny position. Grows best in a deep, loose, sandy soil[418 ]. Prefers a pH in the range 5.5 - 7, tolerating 5 - 7.5[418 ]. An extremely drought-tolerant plant, it can grow in areas where rainfall is so slight and erratic that in some years almost no rain falls at all[418 ]. In its native habitat surface water is usually available only for 8 weeks a year, though in the fine-grained sandy soils water may remain in the root zone for as long as 2 months after a rainfall[418 ]. Unlike most members of this plant family, this species does not form nitrogen nodules on the roots[299 ].

## 10.2.141 *Ocimum tenuiflorum*

Sacred Basil

10 tin 12 cyuc 4 kcaak 2 tcan 4 dwat 1 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta *Ocimum tenuiflorum* is an ANNUAL/PERENNIAL growing to 1 m (3ft 3in) by 0.5 m (1ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil.

kcakta Edible Parts: Flowers Leaves SeedEdible Uses: Leaves - raw or cooked[301 ]. Sweetly spicy, with a sharp, pronounced clove scent and pungency[301 ]. Used in salads, they can also be cooked as a potherb or used as a flavouring in a variety of dishes[301 ]. A refreshing tea can be made from the leaves[301 ]. Fresh flowers[301 ]. The mucilaginous seeds are made into a sweet, cooling beverage[301 ].

tcanta Other Uses The stems are cut into beads for rosaries[238 ]. The essential oil from the plant is used as an insect repellent[238 ].

dwatta Sacred basil is a very important herb in the Ayurvedic tradition[254 ]. A pungently aromatic, warming, antiseptic herb; it induces perspiration; lowers fevers; relaxes spasms; eases pain; clears bacterial infections; strengthens the immune and nervous systems; reduces inflammations; and benefits the digestive system[238 , 254 , 272 , 348 ]. Research has shown that the herb has the ability to lower blood sugar levels[254 ]. The essential oils from the leaf have shown antibacterial and antifungal activity. They contain methylchavicol, eugenol and other volatile, commercial oils[238 ]. The plant is used internally in the treatment of feverish illnesses (especially in children), colds, influenza,

sinusitis, headaches, rheumatism, arthritis, digestive disorders, including abdominal distension and cramps; low libido and negativity[238 ]. It has been found helpful in some types of diabetes[254 ]. The herb is used externally as an antiseptic to treat skin infections, spots etc[238 , 348 ]. The juice of the plants is used to treat insect bites and ringworm[254 ]. The juice is dropped into the ear to treat earaches[348 ]. The leaves can be harvested during the growing season and used fresh or dried for later use[238 ]. The seeds are used as a tonic[238 ].

nrakta E. Asia - China, Indian subcontinent, Myanmar, Thailand, Cambodia, Laos, Vietnam, Malaysia, Indonesia, Philippines, New Guinea, northern Australia. ksacta Naturalized in waste places or in settled areas and thickets[418 ].

propta Seed -

nwatta A plant of the moist to wet, lowland tropics, where it is found at elevations up to 1,000 metres. It grows best in areas where annual daytime temperatures are within the range 20 - 28°C, but can tolerate 15 - 35°C[418 ]. When dormant, the plant can survive temperatures down to about -1°C[418 ]. It prefers a mean annual rainfall in the range 1,000 - 3,000mm, but tolerates 700 - 7,600mm[418 ]. Prefers a moist but well-drained soil in a sunny position[302 ]. Prefers a rich, light, well-drained to dry soil and a position in full sun[238 ]. Prefers a pH in the range 6 - 7.5, tolerating 5 - 9[418 ]. Cool, humid, overcast weather causes the plants to succumb to grey mould[418 ]. The twigs can be harvested only one month after planting out the young plants, and thereafter at periods of every two weeks during the growing season[418 ]. The plant attains full bloom stage (maturity) 65 - 70 days after transplanting[418 ]. There are several named varieties[301 ]. In garden design, as well as the above-ground architecture of a plant, root structure considerations help in choosing plants that work together for their optimal soil requirements including nutrients and water. The root pattern is fleshy. Thick or swollen - fibrous or tap root [2-1].

## 10.2.142 *Triticum aestivum*

Bread Wheat, Common wheat

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 1.5 m hkuc htut cyutli tcup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwatli xre7t hjonli

drutta *Triticum aestivum* is an ANNUAL growing to 1.5 m (5ft). It is not frost tender. It is in flower from June to July, and the seeds ripen from August to September. The species is hermaphrodite (has both male and female organs) and is pollinated by Wind. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It cannot grow in the shade. It prefers moist soil. The plant can tolerate strong winds but not maritime exposure.

kcakta Edible Parts: SeedEdible Uses: Seed - cooked. The seed can be cooked as a whole grain but it is more usually ground into a powder and used as a flour for making bread, fermented foods, pasta, cakes, biscuits etc[1 , 13, 34, 57, 183]. High in gluten, it is the most common flour used for making bread. The seed can also be sprouted and then added to salads or juiced to make a healthy drink[183]. A nutritional analysis is available[218].

tcanta Biomass Mulch Paper Size Starch ThatchingThe straw has many uses, as a biomass for fuel etc, for thatching, as a mulch in the garden etc[13, 100, 141, 171]. A fibre obtained from the stems is used for making paper[189]. The stems are harvested in late summer after the seed has been harvested, they are cut into usable pieces and soaked in clear water for 24 hours. They are then cooked for 2 hours in lye or soda ash and then beaten in a ball mill for 1½ hours in a ball mill. The fibres make a green-tan paper[189]. The starch from the seed is used for laundering, sizing textiles etc[46, 61].

dwatta Antibilious Antihydrotic Antipruritic Antipyretic Antivinous Sedative Skin StomachicThe young stems are used in the treatment of biliousness and intoxication[218]. The ash is used to remove skin blemishes[218]. The fruit is antipyretic and sedative[218]. The light grain is antihydrotic[176]. It is used in the treatment of night sweats and spontaneous sweating[176]. The seed is said to contain sex hormones and has been used in China to promote female

fertility[218]. The seed sprouts are antibilious, antivinous and constructive[218]. They are used in the treatment of malaise, sore throat, thirst, abdominal coldness and spasmic pain, constipation and cough[176]. The plant has anticancer properties[218].

nrakta Of uncertain origin, perhaps the Middle East or Armenia. ksacta Not known in the wild.

propta Seed - sow early spring or autumn in situ and only just cover the seed. Germination should take place within a few days[K].

nwatta Management: Standard Staple Crop: Balanced carb Under DevelopmentAn easily grown plant, it prefers a sunny position in a rich well-drained soil. Wheat is widely cultivated in most parts of the world, but less so in Asia, for its edible seed[13]. There are many named varieties[183]. This is a hexaploid species. Grows well with maize and with camomile in small quantities[18]. Dislikes dogwood, cherry, tulips, pine and poppies[18]. For polyculture design as well as the above-ground architecture (form - tree, shrub etc. and size shown above) information on the habit and root pattern is also useful and given here if available. The plant growth habit is a clumper with limited spread [1-2].

## 10.2.143 *Distichlis palmeri*

Nipa. Palmer saltgrass, NyPa Wild Wheat

10 tin 12 cyuc 4 kcaak 2 tcan 0 dwat 0.4 m hkuc hmimhtut cyutli hgattcuphja7nhs6s hwicli hrasjlutnyik hpa7tli prikwiissliphsom hpa7tmwatli hjonli

drutta *Distichlis palmeri* is a PERENNIAL growing to 0.4 m (1ft 4in) by 0.2 m (0ft 8in) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils. Suitable pH: neutral and basic (mildly alkaline) soils and can grow in very alkaline and saline soils. It can grow in semi-shade (light woodland) or no shade. It prefers moist or wet soil and can grow in water and can tolerate drought.

kcakta Edible Parts: SeedEdible Uses: Edible Portion: Seeds, Cereal. Originally a major food source of the Cocopah tribe in the western United States. The grains are cooked as a cereal. They are roasted or used in muffins or stuffings. Carbon Farming Solutions - Staple Crop: balanced carb (The term staple crop typically refers to a food that is eaten routinely and accounts for a dominant part of people's diets in a particular region of the world) [1-1]. A deep root system reaches down at least 1.5m. It is ideally suited to areas saline discharge zones, where it can readily access the saline water, and dry out the soil profile, while producing a valuable grain. The grain that is produced is ideally suited for human consumption, with an amino acid balance that is more favorable than wheat, and it is also gluten free and has a pleasant nutty flavor. Work with the grain in Australia has shown it to have a higher yield of flour to grain than wheat, it's starch rapidly retrogrades an behaves as an emulsifier. The United Nations Environment Report (2006) says of the plant: "It is a strong candidate for a major global food crop and could become this desert's greatest gift to the world." Some varieties of *D. palmeri* have been the subjects of US patents.

tcanta FodderSaltgrass is grazed by both cattle and horses and it has a forage value of fair to good because it remains green when most other grasses are dry during the drought periods and it is resistant to grazing and trampling.

nrakta Mesoamerica. ksacta Along coastlines and on salt flats and disturbed soils, as well as forest, woodland, montane, and desert scrub habitats. Grows easily in salty and alkaline soils, excreting salts from its tissues via salt glands.

propta Seed

nwatta Management: Fodder Management: Standard Staple Crop: Balanced carb Wild Staple CropClimate: tropical. Humidity: humid, aquatic. Grows along coastlines and on salt flats and disturbed soils, as well as forest, woodland, montane, and desert scrub habitats. Grows easily in salty and alkaline soils, excreting salts from its tissues via salt glands. It is drought resistant and can absorb seawater. As a halophyte, the salt it absorbs is excreted from specialised cells on the leaf surface. A breeding program in the US has increased yields to 2 tonnes/ha. Carbon Farming Solutions - Cultivation: wild staple, under development. Management: standard, fodder (Describes the non-destructive management systems that are used in cultivation) [1-1].

## 10.2.144 *Physalis pubescens*

Ground Cherry, Husk tomato

10 tin 12 cyuc 4 kcaak 0 tcan 1 dwat 0.5 m hkuc hmimhtut cyutli kyuctup hwicli hrasjlutnyik hpa7tli flatprikliwis hpa7tmwatli xre7t hjonli

drutta *Physalis pubescens* is an ANNUAL growing to 0.5 m (1ft 8in). See above for USDA hardiness. It is hardy to UK zone 7. The species is hermaphrodite (has both male and female organs) and is pollinated by Insects. Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in semi-shade (light woodland) or no shade. It prefers dry or moist soil.

pcista Although no specific mention has been seen for this species, it belongs to a genus where many of the members have poisonous leaves and stems, though the full ripe fruits are usually edible[19, 65].

kcakta Edible Parts: FruitEdible Uses: Fruit - raw or cooked in pies, preserves etc[62, 85, 132, 183]. A delicious bitter sweet flavour. The fruit falls from the plant before it is fully ripe and should be left for a week or two until the husk has dried and the fruit has turned a golden-yellow[207]. Delightful when fully ripe[102]. When dried in sugar, the fruit is excellent in fruit cakes, some cooks preferring them to raisins or figs[183]. Yields up to 0.5 kilo per plant[170]. The plant conveniently wraps up each fruit in its own 'paper bag' (botanically the calyx) to protect it from pests and the elements. This calyx is toxic and should not be eaten. The fruit will store for several weeks if left in the calyx[207]. The fruit is a berry about 15mm in diameter[200].

dwatta Antipyretic Depurative Diuretic Pectoral Vermifuge Vitamin CThe whole plant is antipyretic, depurative, diuretic, pectoral, vermifuge[147]. A decoction is used in the treatment of abscesses, coughs, fevers, sore throat etc[147, 218].

nrakta N. America - Wisconsin, Virginia, Ohio. Indiana and southwards. ksacta Damp to dry open woods, sand dunes and disturbed soil[43]

propta Seed - sow March/April in a greenhouse only just covering the seed. Germination usually takes place quickly and freely. Prick out the seedlings into individual pots of fairly rich soil when they are large enough to handle and plant them out after the last expected frosts. Consider giving them some protection such as a cloche until they are growing away well. Diurnal temperature fluctuations assist germination[170].

nwatta Succeeds in any well-drained soil in full sun or light shade[200]. Cultivated for its edible fruit in the Ukraine[50]. There are some named varieties[200]. 'Cossack Pineapple' has a small pineapple-flavoured fruit[200]. 'Goldie' has medium-sized fruits that are borne prolifically on a well-branched plant[200].

## 10.2.145 *Crassocephalum crepidioides*

Okinawa Spinach, Redflower Ragleaf, Fireweed

10 tin 12 cyuc 4 kcaak 2 tcan 2 dwat 0.8 m hkuc pcmhmimhtut cyutli tcup hwicli hrasjlut hpa7tli flatprikliwis hpa7tmwatli hjonli

drutta *Crassocephalum crepidioides* is a PERENNIAL growing to 0.8 m (2ft 7in) by 0.3 m (1ft) at a fast rate. See above for USDA hardiness. It is hardy to UK zone 10. Suitable for: light (sandy) and medium (loamy) soils and prefers well-drained soil. Suitable pH: mildly acid, neutral and basic (mildly alkaline) soils. It can grow in full shade (deep woodland) semi-shade (light woodland) or no shade. It prefers moist soil.

kcakta Edible Parts: Leaves RootEdible Uses: A commercially cultivated vegetable. Leaves - raw or cooked. A distinctive, pine-like flavour[ 298 ]. The leaves are fleshy, somewhat mucilaginous with a nutty flavour[ 301 ]. The tender and succulent leaves and stems of ebolo are mucilaginous and are used as a vegetable in soups and stews, especially in West and Central Africa[ 299 ]. It is much appreciated for its special flavour, which is sharp but not bitter[ 299 ]. It is especially popular in south-western Nigeria. Here the leaves are lightly blanched, excess water is drained off, and the leaves are then cooked with peppers, onions, tomatoes, melon and sometimes fish or meat to make soups and stews[ 299 ]. In