Further Additions to the Flora of Guam[1]

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Abstract—This study was conducted in order to document and determine the extent of recently introduced plant species to the island of Guam. Throughout this investigation, 98 species were collected, but only 79 were considered new records and, therefore, constituted additions to the flora of Guam. Of these 79 species, 56 were established and are consequently described. All new taxa were regularly monitored for a minimum of two years in an effort to obtain phenological data.

Introduction

The flora of Guam has been studied periodically since 1792, but the first thorough investigation was published by Safford (1905). Subsequent contributions were made by Merrill (1914), Fosberg (1960), and Stone (1970). The latter described 931 species and was the most comprehensive evaluation of Guam's flora. Because plants are constantly introduced from one region to another, a floristic study, regardless of its entirety, will require updating at some future time. Since 1970, numerous species have been introduced to Guam; some for research purposes, but most were introduced by returning residents or immigrants. The purpose of this investigation was to document these new additions, and to verify the presence of taxa questioned by Stone (1970). This work was limited to tree species with potential conservation or economic utility.

Materials and Methods

The species documented in this survey were monitored at several sites around the island. These locations included Agana, Barrigada, the Cotal Conservation Reserve, Dededo, Mangilao, Mt. Santa Rosa, Piti, Talafofo, Toto, Tumon and Yona. The Cotal Conservation Reserve in the Windward Hills area, the Ypiga Conservation Reserve in Dededo, and the Department of Agriculture in Mangilao are research sites where plant materials were specifically introduced. Plants located at these sites were continually watched for a minimum of three years (1979 to 1982) to a maximum of six years (1978 through 1983). Where appropriate, data were collected on the tolerance or resistance to

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diseases, drought, fire, insects, and strong winds. Information on soil adaptation, growth rate and habit was also obtained. The other sites were discovered when residents brought "unusual" specimens to the authors for identification. An on-site visit often yielded more than one "unusual" taxa which prompted us to include them (38 of the 79) in our study. The plants found at these sites were routinely examined once every 30 to 60 days. All species were monitored for phenological data.

Voucher specimens of each taxon were deposited in the University of Guam Herbarium, and duplicates were sent to the National Herbarium in Washington D.C. Additionally, taxa not located at one of the research sites were, if possible, propagated and planted at the Dept. of Agriculture, Mangilao.

Results and Discussion

The total number of species collected in this study was 98, but only 56 were considered established by virtue of their reproduction or distribution throughout the island. These established taxa are from 41 genera (21 of which are new records) in 23 families. An additional 23 species are also new records, but were not considered established (Table 1). These latter plants were either represented by single specimens or failed to produce reproductive organs within the evaluation period. The remaining 19 taxa were listed by

Table 1. Additional new records collected but not described because they are not established in Guam.

Species	Common Name	Uses
Podocarpus neriifolius D. Don	Podocarp	Ornamental
P. macrophyllus var. *maki* Endl.	Southern Yew	Ornamental
Araucaria columnaris (Forstf.) Hook.	New Caledonia Pine	Timb/Ornm.
A. cunninghamii D. Don	Hoop Pine	Timb/Ornm.
Heliconia psittacorum L.f.	Panot's Flower	Ornamental
Brya ebenua DC.	Brya	Ornamental
Cassia surattensis Burmf.	Senna	Ornamental
C. portoricensis (Jacq.) Benth.	Powderpuff	Ornamental
C. siamea L.	Kassod Tree	Ornamental
C. spectabalis DC.	Tree Senna	Ornamental
Citrus sinensis (L.) Osbeck) X *Poncirus trifoliata* (L.) Raf.	Troyer Citrange	Rootstock
Passiflora mollimissa (HBK.) Bailey	Banana Passionfruit	Fruit
Lagerstroemia speciosa L.	Pride of India	Ornamental
Eucalyptus tesselaris F. Muell.	Carbeen	Timber
Tristania conferta R.Br.	Brisbane Box	Ornamental
Jasminium laurifolium Roxb.	Jasmine	Weed/Ornm.
J. mesnyi Hance	Primrose Jasmine	Ornamental
Vitex quinata (Lour.) F.N. Williams	Vitex	Ornamental
Solanum hyporhodium A. Br. & Bouche	Cocona	Fruit
S. quitoense Lam.	Naranjilla	Fruit
Kigelia pinnata (Jacq.) DC.	Sausage Tree	Ornamental
Parmentiera cerifera Seem.	Candle Tree	Ornamental
Galium sp.	Bedstraw	Weed

Stone (1970). Of all the new records, the Fabaceae and Myrtaceae each contributed 14 species with five new genera in the former and two from the latter. Additionally, four new records were collected from the Meliaceae; each from a new and different genus.

The taxa described here include 26 fruit trees and 30 conservation/forest species. Most of the fruit trees were introduced by people from Hawaii, Palau, and the Philippines for culinary purposes. Twenty-one of the forest species were introduced for conservation purposes. The other nine were introduced by local residents as landscape plants, but are also suitable for soil conservation.

The descriptions provided below are presented in taxonomic order.

GYMNOSPERMAE

ARAUCARIACEAE

1) ***Araucaria heterophylla*** (Salisb.) Franco X *Araucaria columnaris* (Forst.) Hook.

Araucaria HYBRID

A tall cone to pyramid-shaped tree up to 60 m with branches in tiers of five without internodes; bark light brown on new growth but turning darker with age. Branchlets (leafy twigs) set in two rows along the branches, pointing upward on juvenile growth and becoming distichous to pendent with age. Leaves spirally arranged, scale-like, overlapping, imbricate, narrowly triangular, sharp pointed, 8–12 mm long and oriented outward 40–60 degrees. Seed cone massive with one large seed under each scale.

Seeds of this tree were obtained from Hawaii in 1974, and over 5,000 seedlings have since been distributed around the island. Because of its acceptable form, growth rate, and timber, this tree has become popular on Guam. It is a chance hybrid which likely originated in the Foster Gardens of Honolulu, and is now the source of all Norfolk Island Pine grown in Hawaii (Skolmen, pers. comm., 1980).

The parent species are not easily distinguished from the hybrid progeny during the vegetative phase. This is due to the similarity of morphological traits which vary considerably with environmental conditions (deLaubenfels, 1980). One useful criterion was found to distinguish *A. heterophylla* from the hybrid during the cotyledon stage; *A. heterophylla* has cotyledons 6 mm wide and straight while the hybrid has cotyledons 3 mm wide and somewhat twisted. Although this hybrid produces fertile progeny it has failed to produce seed in Guam's environment.

PINACEAE

2) ***Pinus caribaea*** var. ***hondurensis*** Barr. & Gold.

CARIBBEAN PINE

A large tree to 45 m in height and up to 1.4 m in diameter, usually straight-stemmed with ascending branches when young, and becoming horizontal to somewhat drooping with age. Bark scaly, dark gray to brown. Leaves needle-like, crowded and spreading at twig ends, 15–25 cm long and 1–2 mm wide, rigid, serrulate, dark green to yellowish

green with stomata in whitish lines on all surfaces, in fascicles of three (sometimes 2, 4 or 5), and remaining attached for two years. Mature cones 6–14 cm long, usually reflexed, symmetrical, conical when closed, more than twice as long as broad, usually deciduous. Cone scales thin, flat and dark brown on inner surfaces; apophysis with a transverse ridge, tan colored and shiny; umbo small. Seeds with articulate wings becoming detached.

This pine species is successfully established throughout the lowland tropics and was introduced to Guam in the mid-1970's. Two years after field planting at the Cotal Reserve this species was established on acid soils, but only before first being innoculated with mycorrhizal forming fungi. Plantings on limestone derived soils developed poorly, however.

ANGIOSPERMAE

MORACEAE

3) ***Allaeanthus luzonicus*** (Blanco) Vill.
***Morus luzonica* Blanco**

HIMBABAO; ALUKON

A semideciduous tree to 10 m in height with yellowish-brown and parchment-like, fine, smooth bark. Leaves alternate, 10–15 cm long, 5–8 cm wide, apex acuminate, obliquely ovate to oblong, base cordate, pale green, and tomentose along the margin with petioles to 1 cm in length. Infloresence axillary catkins, dioecious; male infloresence cylindrical, 10–30 cm long, 4–8 mm wide, yellowish green, with numerous florets arranged longitudinally; calyx 4-lobed, corolla absent, stamens 4 and longer than the calyx; female inflorescense globose with many congested flowers, calyx 4-lobed and fleshy, corolla absent, stigma thin. Fruit fleshy, composite berry with one small flattened seed in each fruitlet.

First collected in Dededo, this species was presumably introduced as a cutting from the Philippines in the mid-1960's. It is cultivated primarily by the local Filipinos who prepare a salad with the male catkins and the new leaves which appear at the onset of the wet season. Blanco (1837) reported that Filipinos also make rice mortars from the hard wood. Flowering usually began in May and preceded the development of new foliage. Only male specimens have been found in Guam.

4) ***Ficus lyrata* Warb.**
F. pandurata Sander.

FIDDLE LEAF FIG

An evergreen tree up to 12 m tall with somewhat ascending branches. Bark medium brown, peeling longitudinally, curling and persistent throughout. Leaves large, 30–35 cm long, 15–25 cm wide, fiddle-shaped, acute apex, overlapping cordate base, margin entire and wavy, dark green above, light green beneath with prominent veins, petioles stout and 3–4 cm long; stipules lanceolate, 2–3 cm long, persistent and drying brown. Flowers minute, axillary. Figs sessile, solitary or paired, globose, green dimpled surface, 3–5 cm diameter with an ostiole.

This species was collected in Toto, and along Tumon Bay, where it was introduced during the late 1960's as an ornamental. It is native to tropical Africa, and grown mostly for its unique foliage rather than the marginally edible fruit. Fruits matured in June and July.

ANNONACEAE

5) ***Annona montana*** Macf.

WILD SOURSOP

A small deciduous tree to 6 m tall with an irregular spreading crown; bark grayish-brown, smooth, becoming slightly rough and fissured, with lenticels; twigs brown and glabrous. Leaves alternate, 8–18 cm long, 3–9 cm wide, entire, in two rows, oblong to elliptic, leathery, dark green and shiny above, pale green beneath with pores along the midrib; apex acuminate; base rounded to cuneate; petioles stout and 10 mm long. Flowers single or paired, pedunculate, greenish; sepals 3, broad and pointed, puberulent; petals 6, in two sets, the outer ones thick, fleshy, broad, apiculate, concave, and 25–35 mm long while the inner ones being rounded, stalked, overlapping, and 25 mm long; stamens many; styles numerous and crowded in a central mass. Fruit an aggregate of many united carpels, globose to ovoid, 15 cm in diameter, green to greenish-yellow, thick-skinned outer layer with many short straight fleshy spines, the edible pulp fleshy and pale yellow in color.

This tropical South American species was introduced in the late 1950's from Hawaii, and a small orchard, extant today, was established in the village of Talofofo. The fruit is inferior to other species of the genus *Annona,* but it is often used as a root-stock. Flowering usually occurs in September and October; fruits mature from March to April.

ROSACEAE

6) ***Eriobotrya japonica*** Lindl.
Mespilus japonica Thumb.

LOQUAT

An evergreen tree up to 7 m tall (usually less on Guam) with a short trunk, low branches, rounded crown, and dense compact foliage; branchlets rust colored and tomentose. Leaves alternate, simple, obovate to elliptic-oblong, 15–25 cm long, 3.5–7.5 cm wide, stiff, remotely toothed to pectinate, apex acute to acuminate, base cuneate, glossy above and tomentose beneath, short petiole, stipulate. Infloresence terminal panicles, 8–15 cm long with up to 50 yellowish flowers, calyx and corolla in fives, stamens 20, ovary inferior. Fruit a round to pyriform pome, 4–8 cm long, pale yellow to orange, thin skinned, pubescent, with 1–5 seeds. Seeds 1 cm wide, brown, and smooth.

This taxon is native to Japan and was introduced from Hawaii about 1960. Although rare in Guam, specimens of this tree were collected in Barrigada and Agana, and were seen in flower during November. They produced mature fruit, sparingly, the following August and September. The largest specimen found was only 5 m tall.

FABACEAE

7) ***Acacia auriculaeformis*** A. Cunn. ex Benth.

SICKLE-LEAVED ACACIA

An evergreen tree up to 15 m tall with a thin rounded crown and dull green appearance; bark light grey, fissured; twigs green. Seedling leaves pinnate changing to phyllodes. Mature leaves phyllodes, narrowly oblong with tapered ends, 10–20 cm long, 2–5 cm wide, falcate, leathery textured and dull green in color with faint longitudinal veins. Flowers tiny, sessile, yellow, fragrant, and crowded on 8 cm long axillary racemose spikes. Fruit pods brown and woody when ripe, 1 cm wide, flat and irregularly twisted or curled; funiculus bright yellow to orange, 2–4 cm long, folded. Seeds dark brown to black, shiny, hard, 5 mm long.

This species is indigenous to Thursday Island in northern Australia, and was planted at the Cotal Conservation Reserve in 1976 for site rehabilitation. It was also planted at the Ypiga Conservation Reserve in 1980. The tree has grown rapidly (3 m in two years) on well drained coralline soils, and somewhat well on eroded acid soils where it was used for site rehabilitation. The plants flowered two years after planting during the months of March and May/June. Seeds matured three months after flowering.

8) ***Acacia mangium*** A. Cunn.

BROAD-LEAVED ACACIA

An evergreen tree with rigid triangular ascending branches; bark thin, greenish-gray, with lenticels. Leaves alternate in a spiral, and modified into phyllodes, 15–28 cm long, 5–15 cm wide, glossy, light green with four prominent longitudinal veins that are visible on both surfaces; petioles short, thickened, and reddish brown. Flowers small, pale yellow and fluffy on axillary spikes. Fruit pods slender, but more curled and twisted than *A. auriculaefiormis*. Seeds similar in all respects to the above species but slightly smaller.

This species was introduced from Australia in 1977 and planted at the Cotal Conservation Reserve in order to reforest impoverished sites. After six years (1978–1983) of evaluation, it has been considered one of the most promising conservation trees. It has exhibited a greater tolerance of low soil pH and possesses better form than its close relative, *A. auriculaeformis,* but lacks the fire hardiness. Plants flowered in June/July and had mature seeds in November.

9) ***Acacia simplex*** (Sparm) Ped.
A. laurifolia Willd.

SIMPLE ACACIA

An unarmed evergreen tree up to 10 m tall (3–4 m on Guam) with a dark green appearance; branches stout; bark smooth, silverish-grey, and thin. Mature leaves leathery phyllodes, alternate, simple, entire, broadly elliptic to ovate, 6–13 cm long, 3–5 cm wide, asymmetric, apex acute, base oblique, several veined, shortly petioled; gland 2–5 mm from the base on upper margin. Inflorscence axillary heads, single or paired; flowers

bright yellow, round, 8–10 mm in diameter; sepals 5, ciliate; stamens many. Fruit pods linear, flat, brown, 5–12 cm long, 1 cm wide, slightly constricted between seeds; funiculus 2–3 mm long, whitish, club-shaped, half as long as the seed, not folded. Seeds brown, oblong, shiny, and 4–8 per pod.

This species is native to New Caledonia and the New Hebrides, and is now naturalized throughout the Pacific basin. The trees are commonly found in littoral plant communities, and are used for soil stabilization. Introduced to Guam in 1970 and planted at the Dededo Arboretum, there remain ten specimens with an average height of 4 m. Flowering usually begins with the onset of the rainy season.

10) ***Albizia falcataria*** (L.) Back.
A. moluccana Miq.

ALBIZZIA, PLAKATA

A vast conical to flat topped evergreen tree up to 50 m tall with a girth of 1 m or more, and superficial main roots; bark greyish-white, smooth with flattened lenticels. Branches widespread, horizontal to mostly ascending; twigs olive green with scattered white lenticels. Leaves alternate, bipinnate, 30–60 cm long, 28–30 cm wide on 4–8 cm stalks which are swollen at the base; pinnae 12–21 primary pairs, 10–15 cm long with a gland at the first two basal pairs; pinnules 18–26 pairs, 12–20 mm long, 5–7 mm wide, oblong, asymmetric, slightly curved, acute, oblique at base, sessile, and midrib near the upper margin. Infloresence axillary, 13–20 cm long panicles, faintly fragrant; flowers white, sessile, borne singly, campanulate with many exserted stamens. Fruit a brownish, thin woody pod, 10–13 cm long, 2 cm wide, with 10–14 seeds visible as transverse swellings of the dehiscent pod. Seeds brown, adhering to the pod.

This species is of Malaysian origin but is now found throughout the tropics where it is used for forestry purposes. Seeds were obtained from Hawaii in 1979 and plantings were established at the Cotal Reserve. It is an extremely fast growing species on fertile soils where ample rainfall is received. The tree produces a light wood suitable for pulping, but has greater application in agroforestry where it is used to shade crops such as coffee and cacao. Because of its ability to fix nitrogen, it is also intercropped with pasture and other forest species.

11) ***Ceratonia siliqua*** L.

CAROB, ST. JOHNS BREAD

A medium sized evergreen tree up to 10 m in height with a dense glossy crown; branches somewhat contorted; bark reddish-brown with many lenticles. Leaves alternate, paripinnate, 10–20 cm long, 8–12 cm wide; leaflets 2–4 pairs on 5 mm stalks, ovate to orbicular, 3–5 cm long, 2–3 cm wide, emarginate apex, obtuse at the base, glaborous, glossy, dark green above, paler beneath. Infloresence 2–5 cm long, single or clustered lateral racemes borne on old wood; flowers bi-or unisexual, red changing to cream colored; calyx tubular, 5 lobed; petals none; stamens 5. Fruit pods 10–30 cm long, flattened, thick, dark brown at maturity, leathery, indehiscent. Seeds 5–15 per fruit, hard, dark brown, and imbedded in a sweet mealy pulp.

This slow growing species is indigenous to Asia Minor, and was domesticated long ago as a source of food and forage. The seed pods are high in sugar, and often are prepared into a syrup or fermented to a liquor; they are also used as a chocolate substitute. Carob has nearly the same cultural requirements as *Citrus* but is not as specific. It is adapted to semi-arid conditions and a wide range of soil types. A few specimens were introduced about 1970, and are located in Dededo. Flowering and fruit set have not been observed.

12) ***Enterolobium cyclocarpum*** (Jacq.) Griseb.

ELEPHANT'S EAR, EARPOD, GUANACASTE

A very large semi-deciduous tree with a wide-spreading crown, an immense gray trunk, and huge branches. In Guam it grows 18–24 m tall with a trunk-diameter to 2 m. Bark light gray and thin for tree size. Leaves alternate, twice pinnately compound with 4–9 pairs of leaflets, each leaflet with 10–30 pairs of asymmetrical, whitebacked pinnules, each about 1 cm in diameter. Flowers many, whitish, clustered in heads 2–3 cm across; corolla tubular, 5-toothed and light cream; calyx tubular, 5-toothed and light green; stamens numerous, threadlike, and whitish. Fruit a large pod curved in a circle or disk 8–12 cm in diameter (suggesting the form of a human ear), shiny green when young to blackish-brown when mature, flat but thicker around the seeds. Seeds dark brown, cylindrical, to 1 cm long.

The wood of this species is excellent for craftwood and cabinetry; it also withstands water and is suitable for canoes and water troughs. The fruit and bark both yield tannin, and pods serve as cattle feed in tropical America. A specimen, 18 m tall with a 2 m trunk diameter, is currently growing in the Plaza de Espana despite being blown over during a 1962 typhoon. This tree has flowered profusely during the month of April but seed pods were never seen. Other specimens with heights up to 18 m and diameters of 1.5 m are located adjacent to the bell tower in Merizo, and at Ipao Beach Park in Tumon. Because of their size, these trees may have been imported by Safford (1905) at the same time he introduced *Samanea saman*.

13) ***Lonchocarpus pentaphyllus*** (Poir.) DC.
L. latifolius (Willd.) HBK.

RETAMA

A medium sized semi-deciduous tree to 10 m tall (7 m in Guam) with a spreading crown and moderately ascending branches; bark brownish-gray, smooth to slightly fissured; branchlets brown, tomentose. Leaves alternate, imparipinnate, 15–30 cm long, 10–20 cm wide, with 5–9 leaflets set on a puberulous green rachis; leaflets opposite, ovate to oblong, to 10 cm long and 6 cm wide, on 5 mm stalks, larger leaflets distal, apically acuminate, basally cunneate-obtuse, upper surface dark green and glabrous, paler and puberulus beneath. Inflorescences axillary racemes to 12 cm long; flowers several to numerous, fabaceous, 8 mm long on very short penducles; calyx 5-toothed, rust colored and sericeous; corolla greenish-purple to reddish-purple; stamens 10. Pod flat, light

brown, 4–7 cm long, 2 cm wide, apiculate, indehiscent, 1–3 seeded. Seeds flat, reniform, brown and smooth.

Retama is a native of the Caribbean region where the hard heavy wood is used for posts and pilings, and both its roots and fruits are processed into the insecticide rotenone. The natural habitat of this tree is the moist coastal and/or limestone areas. It was introduced to Guam about 1970 as an ornamental. Specimens were found in the abandoned Dededo Arboretum where it commonly flowered in late May or June with seeds maturing in November or December.

14) ***Parkia*** sp.

PARKIA

A 12 m tall unarmed tree with an open growth habit; bark grayish-brown, somewhat thin, with lenticels; twigs greenish, rusty tomentulose with lenticels and prominent leaf scars. Leaves alternate, large, 75–100 cm long, 30–45 cm wide, fernlike, evenly bipinnate, 45–50 pairs of subopposite pinnae 9–22 cm long, 3–4 cm wide, with 40–100 pairs of pinnulae to 2 cm long, 3–4 mm wide, lanceolate, asymmetric, basilary eared on the lower margin, sessile, single veined, somewhat tomentulose, lighter green beneath. Inflorescences of mimosa type.

This taxon was introduced around 1972 and a 7 m tall specimen was found in the Dededo Arboretum. It is extremely susceptible to the flame tree looper (*Pericyma cruegeri*) which periodically defoliates the tree. Neither flowers nor fruit were ever observed.

15) ***Serianthes kanehirae*** var. ***kanehirae*** Fosb.

SERIANTHES

A medium sized evergreen tree with a spreading branch habit; twigs greenish with prominent leaf scars, lenticellate; bark silverish-gray with horizontal lenticels, thin. Leaves, alternate, bipinnate, 18–30 cm long, 16–26 cm wide; pinnae 12–16 pairs, nearly sessile, opposite, 10–13 cm long, 2–3 cm wide with 18–25 pinnulae; pinnules oblong to rectangular, 10–15 mm long, 4–6 mm wide, asymmetric at the base, apex rounded, midrib nearly diagonal across the leaflet, essentially glabrous; stipules obsolete; leaf rachis 14–24 cm long, thinly brown tomentulose with oval elevated glands near the base. Inflorescences in axillary panicles, sparsely branched, up to 10 cm long, rusty tomentulose; flowers yellowish-white; corolla with 5 equal petals, usually less than 20 mm long; stamens many, fused at the base, exserted; style elongated. Pods 13–15 cm long, 4–5 cm wide, oblong, irregularly cross veined, margins somewhat thickened.

Seeds of this species were imported from Palau in 1978 and planted in the Cotal Conservation Reserve. After five years (1979–1983), the trees averaged six meters in height. Flowering was not observed, but mature pods with viable seed were collected in December, 1983. This tree is very susceptible to attack by the mealybug (*Nipaecoccus vastator*).

RUTACEAE

16) ***Citrofortunella mitis*** (Blanco.), J. Ingram and H. E. Moore

KALAMANSIT, CALAMONDIN

A small (5–6 m) evergreen tree with upright habit and dense bright green crown; bark brown with gray mottles, rough, not fissured; branches somewhat angular; twigs green, spineless or with short sharp spines at the axils. Leaves glossy, bright green, smooth, elliptic with acute apex and cuneate base, 5–10 cm long. Flowers 1–2, axillary, white, fragrant, perfect, with peduncle; calyx 5-lobed, cuplike; petals 5, reflexed at maturity; stamens 20–30, filaments more or less united at the base. Fruit aromatic, leathery-skinned hesperidium, bright orange, thin skinned (2–3 mm), depressed globose, 3 cm diameter, with acid pulp, 7–10 segments, edible along with the skin.

This species is indigenous to China and is now widely cultivated throughout the tropics and subtropics. It is believed to be a natural hybrid between *Citrus reticulata* and a *Fortunella sp.*, and tends to bear heavier in alternating years. This plant is widely cultivated in Guam for fresh fruit, juice consumption, and as an ornamental. The juice is also used in the preparation of the local foods kelaguen and finadene. Flowering is intermittent, and mature fruits are found continuously. The time of introduction was not determined.

17) ***Murraya koenigii*** (L.) K. Spreng.
M. foetidissima Teijsm. and Binn.

CURRY LEAF

An evergreen tree 4–6 m tall with a fairly dense rounded crown. Bark brown, glabous with slightly puberulous twigs. Leaves alternate, 20–30 cm long, 5–10 cm wide, imparipinnate, with glandular dots on rachises; leaflets 11–21, alternate, oblong-lanceolate to ovate, 2–5 cm long, 1–2 cm wide, asymmetric to nearly falcate, on short puberulous stalks, bluntly acuminate apex, oblique base, and finely notched margin, mostly glabrous, very fetid. Inflorescence terminal or axillary, 4–5 cm corymbs with many flowers; flowers greenish white, 10–15 mm wide on short pedicels; calyx 5-toothed; petals 4 or 5, lanceolate, 7 mm long; stamens 8–10, longer than the pistil. Fruit drupaceous, ellipsoid, apiculate with surface oil glands, juicy, 2 locules, 1 or 2-seeded. Seeds bluish-black, and 1–2 mm wide.

This species is indigenous to Ceylon and India where it is widely cultivated for the curry flavor imparted by its leaves. It is occasionally cultivated as a garden specimen by Indians living on the island. A specimen was also collected at the defunct Dededo arboretum. It is likely a recent introduction (mid-1960's to early-1970's) which flowers in May and has mature fruit by August or September.

MELIACEAE

18) ***Azadirachta indica*** A. Juss.
Melia azadirachta L.
M. indica Brand

NEEM TREE

A glabrous evergreen tree 12–15 m tall with a straight short bole and rounded crown; bark relatively smooth, light gray, lenticulate; twigs moderately stout, reddish-brown lenticulate with prominent leaf scars. Leaves alternate, crowded near branch ends, imparipinnate, 20–35 cm long, 15–20 cm wide, with 9–15 leaflets; leaflets 2–10 cm long, 1–3 cm wide, opposite to subopposite, obliquely falacate to lanceolate, apex acuminate, bast obtuse, glabrous, serrate, and shortly petiolate. Inflorescence axillary, paniculate, shorter than the leaf; flowers white, 4–5 mm long, honey-scented; calyx 5-lobed, obtuse to rounded; petals 5, and shortly ciliate. Fruit an oblong drupe, 1–2 cm long, yellow becoming purple, kernel cartilaginous, one-celled, one-seeded, and fleshy.

This tree is a native of India where it can be found in the dry open forests on most soil types. Imported from India in 1978, specimens planted in the Windward Hills area were 5 m tall in 1983. The bark and fruit have medicinal uses, and the oil extracted from the seeds is used in toothpaste, soap and lotions. The leaves are used as an insect repellant. When bruised, both leaves and twigs emit an onion-like odor. The tree is often used as a shade tree because it is pest free and widely adapted.

19) ***Cedrela odorata*** L.

STINKING CEDAR

A large deciduous tree 12–30 m tall, slightly buttressed with a trunk diameter of 1–2 m. Crown rounded and large; bark gray, nearly smooth when young, but becoming fissured with age. Leaves alternate, pinnate, 30–50 cm long, 12–20 cm wide, 12–20 pairs of leaflets; leaflets opposite to subopposite, 5–10 cm long, 2–5 cm wide, ovate-lanceolate, acuminate, entire, and stalked. Flowers many, clustered in panicles, 15–40 cm long. Calyx 4–5 lobed, cupped, irregularly toothed, and glabrous; corolla yellow-green with 5 oblong petals. Fruit a small woody capsule, 4 cm long; seeds small and winged.

This species is indigenous to the West Indies and tropical South America. It produces a light, durable, aromatic timber suitable for the tropics because of its inherent insect repellent properties. Both bark and leaves emit a fetid odor when freshly cut, hence the name. In Guam, this tree grows better on the coral or limestone soils than on those derived from volcanic material. Large specimens (15m and over) were found in Agana, Mangilao and at the Naval hospital. Flowering occurs in December and January; fruits mature in July and August.

20) ***Swietenia macrophylla*** King

BIG LEAF MAHOGANY, HONDURAN MAHOGANY

A large semi-deciduous tree to 27 m tall with a straight, erect, and slightly buttressed trunk; crown dense with dark green foliage. Bark ridged, fissured, and dark gray in color. Leaves alternate, paripinnate, 15–35 cm long, glabrous, shiny; leaflets opposite, 4–6 pairs on short stalks, lanceolate, 10–18 cm long, 4–8 cm wide, entire, and oblique at the base. Inflorescence an axillary panicle, 10–15 cm long; flowers urceolate, greenish-yellow, 1 cm across; calyx 5–10 lobed; petals 5, oblong, 7 mm long; stamens 10. Fruit an

upright oblong woody capsule 13 cm long on a stout 8 cm long stalk. Capsule cleaves into five longitudinal sections at maturity releasing numerous winged seeds. Seeds flat, 8–10 cm long (including the wing), and reddish-brown in color.

This timber species is native to Central America, but is now planted throughout the tropics for both lumber and shade. A three acre planting was established by the Department of Agriculture in 1917 on a hill behind Piti Village; the species has become naturalized. It has grown well on both basic and acidic soils, provided internal drainage is not impeded. Flowering begins in April with green fruits in August; mature seeds were collected in November. Seeds were again available in March/April. It is one of the major species used in reforestation on the island and throughout the warm latitudes.

21) ***Toona australis*** Harms
T. ciliata var. *australis* (F. Muell.) C. DC.
Cedrela toona var. *australis* (Roxb.) C. DC.

TUN, TOON

A semi-deciduous tree to 20 m tall with ascending branches; bark silverish-gray, scaly plates; twigs stout, mostly glabrous, olive green with lenticels and prominent leaf scars. Leaves alternate, paripinnate, 35–50 cm long, 20–30 cm wide, with 12–26 leaflets; leaflets opposite on 1 cm stalks, lanceolate to oblong-lanceolate, 7–14 cm long; 3–7 cm wide, long acuminate apex, cuneate to rounded base, asymmetric, entire to slightly crenuate margins, dark green above, paler beneath, midrib curved and prominent beneath. Inflorescence a terminal or axillary panicle, much branched, 30 cm long; flowers white, fragrant, on short pedicels, calyx 5 lobed; petals 5, oblong, 5 mm long; stamens 5. Seed capsule dark brown, 2–3 cm long, splitting into five parts; seeds flat, brown, thin, and winged at both ends.

This species is native to the frost-free areas of the Himalaya region, and has succeeded as a tropical timber because it is resistant to dry wood termites. Toon seed was introduced to Guam from Hawaii in 1972. Specimens were established at the Dept. of Agriculture, Mangilao. Plant growth and development has been poor on the island's acid soils but favorable on the argillaceous limestone soils.

EUPHORBIACEAE

22) ***Aleurites trisperma*** Blanco

SOFT LUMBANG

A tall evergreen tree to 18 m in height with a dense rounded crown and dark green foliage. Bark dark gray to brown, slightly fissured, with lenticels. Leaves alternate, spirally arranged, simple, entire with margins somewhat sinuate, broadly ovate to cordate, 12–20 cm long, 8–15 cm wide, palmately veined; petioles 25–35 cm long with two distal glands. Flowers in terminal panicled cymes; petals 5, yellowish-white to pink and longer than the sepals. Fruit drupaceous and dry, 5–8 cm in diameter, globose, with 3 longitudinal grooves, green maturing to medium brown, densely velutinous-pubescent, 3 seeded. Seeds brown, 2 cm in diameter, with woody testa.

One of five economically important species of *Aleurites*. It is indigenous to eastern Asia and the western Pacific area where oil is extracted from the seeds and used for lighting lamps. This species flowers in March and April with fruits ripening in September and October; some fruit remain on the tree while most drop.

This tree is rare in Guam but grew well wherever observed. Stone (1970) reported that Rodin made collections from a single specimen on Northwest Field in 1945. In 1968 a seedling was transferred from Northwest Field to the Department of Agriculture, Mangilao, and is now 15 m tall. The parent tree, however, could not be found. Other specimens are located in the Piti Forest. It is mildly damaged by the Chinese Rose Beetle (*Adoretus sinicus*).

ANACARDIACEAE

23) ***Spondias dulcis*** Forst.
S. cytherea Sonn.

WI TREE, OTAHEITE APPLE

A deciduous tree to 20 m tall with a spreading crown and slightly ascending branches; bark grayish-brown, smooth, with lenticels and longitudinal fissures. Leaves alternate, imparipinnate, 30–50 cm long, up to 25 cm wide, crowded at the branch ends, glabrous; leaflets 11–23 opposite to subopposite, stalked, 8–11 cm long, 4–5 cm wide, elliptic to oblong, acuminate, slightly asymmetric, oblique at the base, entire to slightly crenulate; veins mostly unbranched. Inflorescences 15–20 cm long, terminal paniculate; flowers small, whitish, perfect; calyx 4–5 toothed, petals 4–5; stamens 8–10, styles 4–5 and erect. Fruit an ovoid to obovoid drupe with tough yellowish glabrous skin, 5–8 cm in diameter, flesh firm, pale yellow, juicy, acidic. Seeds 1–5, and imbedded in a woody pyrene.

This species was reportedly introduced during the early 1960's from the Society Islands where it occurs naturally. It is commonly cultivated in the village of Barrigada for its fresh fruit. The tree is deciduous during the dry season, but flowers in February with fruit ripening in August and September. It is sometimes called "lychee" by the local people, but should not be confused with *Litchi chinensis* which is commonly known as lychee in other places. The tree seems to be well suited to the calcareous soils in Guam, and propagates easily from cuttings taken just before flowering.

24) ***Spondias mombin*** L.
S. axillaris Roxb.
S. lutea L.

YELLOW MOMBIN

A deciduous tree 15 m tall with an open, light green crown; bark gray brown, with light brown corky knobs, becoming furrowed with irregular narrow uneven ridges. Leaves alternate, imparpinnate, 35–50 cm long, up to 30 cm wide, crowded at branch ends, with rachises thickened at their bases; leaflets 9–19, opposite to subopposite, 10–15 cm long, 3–5 cm wide, elliptic, accuminate, slightly asymmetric, base oblique, margins with sharp

closely spaced, gash serrulations; veins distinct beneath, and branching toward the margins. Inflorescence large, loose terminal panicles, 18–25 cm long; flowers perfect, yellowish-white, small, solitary or sub-solitary; calyx 4–5 cleft, petals 4–5, stamens 8–10, styles 4–5. Fruit ovoid, 5 cm long, 4 cm wide, yellow, thin skinned, with a yellow soft juicy flesh; stone 5 celled.

This species is of neotropical origin, and cultivated for its fruit which has a mawkish or turpentine taste to some people. It was probably introduced about 1970 by Palauans who call it "meseiedel". The best specimens occur in the area around Mt. Santa Rosa. Like *S. dulcis,* the yellow mombin loses its leaves in the dry season. Flowering has occurred in April/May and fruit matured in the late summer.

25) ***Spondias pinnata*** (L.f.) Kurz
S. mangifera Willd.

HOG PLUM

A deciduous tree 15–20 m tall (5–6 m on Guam) with an open crown and wide spreading branches; bark smooth, whitish-gray, with occasional knobs; twigs thick and lenticellate with prominent leaf scars. Leaves alternate, imparipinnate, 30–45 cm long, 20–25 cm wide, crowded at branch ends, glabrous; new leaves and rachises pinkish in color; rachises thickened at base; leaflets 5–15, opposite, shortly stalked, 10–12 cm long, 4–5 cm wide, oblong to elliptic, abruptly acuminnate, with an oblique base, entire, dull green and thinly leathery; veins 10–40, nearly perpendicular to the midrib. Inflorescence a long slightly branched terminal panicle, glabrous; flowers scattered, very small, perfect or imperfect; calyx glabrous, 5-toothed; petals 5, very short, oblong, greenish-white. Fruit yellowish-orange, smooth, drupaceous, ovoid, 3–4 cm long, with a thin layer of flesh surrounding a 1–3 seeded fiberous pyrene.

This species is native to tropical America and commonly cultivated in the West Caroline Islands. It was assumed to have been introduced around 1970 by Palauans who call it "titimel". Several well established trees were found on Palauan holdings in the Mt. Santa Rosa area. The ripened fruit is freshly eaten while the leaves, which have a noticeable turpintine odor, are sometimes used to flavor Palauan food. The tree loses its leaves during the dry season, and flowering begins in April/May. It normally has mature fruit by mid to late summer.

26) ***Spondias purpurea*** L.

SINIGUELAS, SPANISH PLUM

A deciduous tree 10 m tall with a somewhat open or spreading growth habit. crown thin, irregular. Bark light gray, smooth, becoming fissured. Leaves alternate, imparipinnate, 10–25 cm long; leaflets 7–23, opposite to subopposite, oblong, 2–5 cm long, acute, entire or slightly toothed, glabrous. Inflorescence large, terminal and axillary panicles; flowers small, purplish to greenish, perfect, on short pedicels; calyx 4–5 cleft; petals 4–5, imbricate; stamens 10, shorter than the petals; styles 5, erect. Fruit a red or purple, obovoid to globose drupe, 2–4 cm long with a spicy, juicy, subacid flesh, and a somewhat tough rind. The single seed is brown and ridged.

Siniguelas is also native to the American tropics and is the most commonly cultivated species of the genus in Guam. Many specimens were seen in the villages of Dededo and Yigo, but the time of introduction was not determined. The trees lose their leaves early in the dry season, and flowering commences in February or March, followed shortly thereafter by the new foliage. The fruit is often eaten while still green; however, ripe fruit is usually obtained in July or August. This species is easily propagated by cuttings made prior to bud burst, and it bears consistently.

SAPINDACEAE

27) ***Litchi chinensis*** Sonn.

LYCHEE, LEECHEE

A medium sized evergreen tree, to 15 m with a dense, dark green, rounded crown, and glossy foliage. Bark brown with fine scales, dimpled. Leaves alternate, paripinnate, 25 cm long; leaflets 2–6 pairs, 8–12 cm long, 3–5 cm wide, oblong-elliptic and lanceolate, apex acute, base cuneate, leathery, drooping, shiny above, glabrous beneath. Flowers polygamous, many, borne on terminal panicles to 30 cm in length, greenish-white to yellowish-green; calyx with five-lobed sepals; petals absent; stamens 6–10, exserted. Fruit an edible drupe with a white juicy and acid flesh, globose, 3–5 cm in diameter; rind tubercled, red to crimson. The single seed is brown.

Lychee is native to southern China where it is extensively cultivated for fruit production. In 1977 several hundred seedlings were imported from Taiwan and distributed around the island. This species thrives in deep, well drained loamy soils where moisture is not limiting. Neither flowers nor fruit were observed. The wi tree (*Spondias dulcis*) is often called lychee by the Chamorro speaking islanders.

RHAMNACEAE

28) ***Colubrina arborescens*** (Mill.) Sarg.
C. ferruginosa (Brongn.)

WILD COFFEE

A small tree to 6 m, evergreen with an open crown. Bark thin, moderately smooth, light gray. Twigs with a reddish-brown pubescence. Leaves alternate, simple, elliptical to ovate-lanceolate, 5–15 cm long, 2–8 cm wide, entire, apex acute, base obtuse to cordate; upper surfaces dark green, slightly shiny; lower surfaces paler than above; veins present and prolonged near the margins; petioles 1 cm long. Inflorescence racemose and axillary; flowers small, white with reddish pubescence; sepals 4–5, cuplike, spreading, pointed; petals 5, smaller than the sepals, yellow, folded around 5 opposite stamens. Fruit a capsule, globose to slightly 3-lobed, 9 mm diameter, with a cuplike base. Seeds black, shiny, flattened, 2–3 mm long.

This tree is native to Asia and the Pacific where it is used for forestry and ornamental purposes. Its hard and heavy wood is ideal for posts and pilings, and the bark is used to make a drink in the West Indies. Plantings were established on Nimitz Hill and near Fena

Lake in 1973. It is better adapted to limestone-derived soils. Flowering occurred in March and the capsules matured in July/August.

VITACEAE

29) ***Vitis vinifera*** L.

UBAS, GRAPE

A more or less climbing, strong, woody, deciduous vine with brown, shredding bark; when young the bark is glabrous to somewhat floccose, and rust colored. Tendrils forked, intermittent (every third joint vacant) on tendriliforous shoots, coiled, 10–20 cm long, slender tipped, and leaf-opposed. Leaves simple, thin, cordate-ovate to suborbicular, 10–20 cm wide, margin coarsely toothed or jagged, with 3–5 overlapping lobes, glabrous above, tomentose beneath, palmately veined; petioles 2–6 cm long. Inflorescence a thyrsus, leaf-opposed, replacing tendrils; flowers often imperfect, petals 5, united at the apex; calyx minute. Fruit a berry, variable in both size and color, and in large clusters; berries oval to oblong with skin adhering to the pulp.

In Guam this variety produces clusters 5–20 cm long. The berries are 1 cm long, glabrous, green, and ripen to deep purple or black, with one or two seeds. The vines usually flower from April through May with fruit ripening in either September or October. Leaf fall usually begins in December, but the leaf rust disease (*Phakospora vitis*) has caused premature leaf drop.

This species was reported by Safford (1905), who noted that the islanders used the name "parra" in its description. There was no evidence of this name currently being used. Plants are occasionally grown as dooryard specimens, and are popular where cultivated.

BOMBACACEAE

30) ***Pachira aquatica*** Aubl.
P. macrocarpa (Schlect.) Walp.

PALAU NUT, GUYANA CHESTNUT

A medium sized pyramidal shaped tree, 7–13 m tall with an open growth habit. Branches horizontal, sparse, in tiers of 4 or 5. Bark smooth, green to grey with some lenticels. Leaves alternate, palmately compound; leaflets 5–9, oblong to elliptic, leathery, 8–20 cm long; petioles 10–15 cm long, swollen at the base. Flowers axillary, very large, solitary, pedunculate, calyx short, unlobed, campanulate to tubular, 2 cm long, narrow; stamens 200–500, white at base, united into a long tube, anthers yellow. Fruit a brown, woody capsule 15–30 cm long, to 13 cm wide with seeds embedded in a flossy pulp.

This species is native to the West Indies and is grown mostly for its edible filbert-like nut. It is relatively rare in Guam; specimens were found at the Naval Hospital, the Dept. of Agriculture and in Yigo. There was no record concerning its introduction to the island but the Palauans, who make a candy from the seeds, were probably responsible. It is propagated by either seed or cuttings, and is reputed to bear fruit in 3 or 4 years. Flowering is heaviest from June to August, and the capsules mature in December and January.

STERCULIACEAE

31) ***Kleinhovia hospita*** L.

KLEINHOVIA

A small to medium-sized tree (to 15 m in Guam) with an open and spreading crown, and trunk diameter to 45 cm. Bark smooth and gray brown. Leaves alternate, simple, 10–20 cm long, 8–15 cm wide, cordate, apex acute to acuminate, margin entire; petioles 5–10 cm long. Inflorescence terminal, paniculate, pubescent; flowers small; sepals deciduous; petals 5, unequal, the upper with longer claws; staminal column 5-fid, each division with 3 extrose anthers. Fruit capsular, loculicidal, 5-celled membranaceous, inflated, obconical to pyriform, 2–3 cm wide. Seeds small, rounded, tubercled, 1 or 2 in each cell.

This species is a native of the old world tropics. A small grove of 12 to 18 mature trees was found in a lowland forest on the south bank of the Togcha River about 500 m upstream from the highway bridge. This habitat is a low moist acid soil, subject to periodic inundation. *Kleinhovia* is considered an introduction to Guam because most of the plants were similar in size and thus age, and few seedlings were found in the vicinity. It is not known how or why these trees became established at this isolated site. Mature fruits were collected in late August, and flowering was estimated to begin at the onset of the rainy season.

GUTTIFERAE

32) ***Clusia rosea*** Jacq.

CUPEY, BALSAM APPLE

An evergreen tree 5–15 m tall with light brown to gray bark of moderately smooth texture; branches somewhat ascending. Leaves opposite, shortly petiolate, thick, leathery, bluntly obovate, cuneate, 8–20 cm long, nearly as wide. Flowers axillary and terminal, stalked, solitary, perfect or imperfect, 5 cm in diameter; petals 6, white to pink, with 4–6 persistent sepals; stamens many. Fruit a greenish capsule, globose, 8 cm in diameter, with 8–12 valves having yellow interiors, dehiscent, revealing equal number of cells. Seeds bright red to scarlet or purple in color, and sticky.

This neotropical species is commonly cultivated for ornamental purposes, and specimens were found in Toto and along Tumon Bay. It begins its life cycle as an epiphyte but eventually becomes self-supporting. It appeared to be relatively pest free in Guam. Mature capsules were observed in June and July, but flowering was not observed. No record of its introduction was found.

33) ***Garcinia livingstonei*** T. Anders.

GARCINIA

A tree up to 12 m tall with hard and heavy wood. Bark light gray to ash in color, rough, slightly fissured. Branches somewhat ascending and arching, bearing whorls of branchlets in tiers of three. Leaves whorled, simple, coriaceous, entire to crenulate,

oblong, 8–12 cm long, 3–4 cm wide, veins visable above, obscure beneath, midrib prominent below, apex obtuse, base rounded; petioles 1 cm long. Flowers axillary and creamy yellow. Fruit yellowish-orange to red, globose, 5 cm in diameter, pedicel 3 cm long; seeds 1 or 2, light brown and surrounded by a fleshy orange aril.

This species is indigenous to tropical Africa where the fruit is eaten occasionally. The plant was introduced to Guam in 1950, and is cultivated in Barrigada. Its sweet fruit, which usually matures by June or July, has not been very popular among the islanders. Some people have mistakenly called it the nutmeg tree.

PASSIFLORACEAE

34) ***Passiflora edulis*** f. ***flavicarpa*** Dent.

YELLOW PASSIONFRUIT

A woody, perennial, evergreen climbing vine; stems obtusely angled, glabrous, and of suffused reddish-purple color; tendrils axillary, simple, 10–25 cm long. Leaves alternate, 5–10 cm long, usually 3-lobed, serrate to dentate, glabrous, glossy above, stipulate; petioles 1–10 cm long, with two distal glands. Bracts glabrous, green, 1 cm long. Flowers axillary, solitary, perfect, 5–8 cm wide; calyx tubular, sepals 5, white; corona consisting of two circular rows of threadlike filaments, purple at the base and white at the apex; stamens 5; style tripartite, ovary superior, one celled. Fruit an ellipsoid berry, bright yellow, firm skinned, many seeded, 6–8 cm long. Seeds dark brown, flattened, pitted, and surrounded by a yellowish pulp.

This taxon is cultivated extensively throughout the Pacific basin for fresh fruit, and juice production. It is native to Brazil and was reportedly introduced to Guam from Hawaii in the mid-1970's. It is occasionally cultivated on the island and specimens are found at the Dept. of Agriculture, Mangilao. The plants are propagated by seed and grow well despite their susceptibility to attack by the Chinese Rose Beetle (*Adoretus sinicus*). The yellow passionfruit is better adapted to the warmer tropical climates than the purple form (*Passiflora edulis*). Both taxa are easily distinguished by either the fruit color or by the suffusion of red and purple colors present in the stems and tendrils of the yellow passionfruit. This plant flowers and fruits throughout much of the year. Upon maturation, fruits fall from the vine.

PUNICEAE

35) ***Punica granatum*** var. ***nana*** (L.) Pers.

DWARF POMEGRANATE, GRANADA

A deciduous compact shrub to 2 m tall, armed with a few short spines; bark grayish-brown; twigs brown and with lenticels. Leaves mostly opposite, ovate-oblong to lanceolate, 2–4 cm long, 5–10 mm wide, glabrous, glossy, apex obtuse to mucronate, base cuneate, margins sinuate, petioles very short and reddish. Inflorescence terminal, flowers solitary or 2 to 3 clustered, perfect, reddish-orange, 2–3 cm wide; calyx campanulate to tubular, orange, thick leathery with 5–8 persistant sepals; petals broadly obovate, orange to red, mostly 5, wrinkled; stamens many, inserted on flower tube with slender filaments and

yellow anthers; ovary inferior; style and stigma one. Fruit sub-globose, to 5 cm wide, reddish-orange, smooth, coriaceous, 3–7 celled, with many seeds; seeds very small, each surrounded by a clear, reddish, juicy, acid pulp.

This dwarf variety of the pomegranate (*P. granatum*) is native to southwestern Asia, and thrives in deep heavy loam soils where there is a pronounced dry season. Flowering and fruit production commonly begin within the first year. This plant was introduced to Guam in the late 1970's and is occasionally cultivated on the island.

MYRTACEAE

36) ***Eucalyptus alba*** Reinw. ex Blume

TIMOR WHITE GUM

A medium sized tree to 18 m in height and 60 cm in diameter with an open, sparsely branched crown. Bark smooth, pale pink to greenish-white, mottled or blotched, exfoliatious. Timber reddish-brown, somewhat soft but durable. Juvenile leaves sub-opposite, ovate-lanceolate to broadly eliptical and petiolate. Mature leaves mostly alternate, broadly lanceolate to deltoid, 10–13 cm long, 3–4 cm wide, acute and petiolate; petioles subterete and 2–3 cm long. Inflorescence umbellate, axillary, 3–7 flowered; peduncles somewhat terete or compressed, 1–2 cm long. Buds pedicellate, clavate to ovoid, 9–10 mm wide. Operculum hemispherical, apiculate, shorter than the calyx tube with pedicels 5 to 8 mm long; anthers versatile, obovate, opening in parallel slits; glands globular. Fruit pedicellate, hemispherical to campanulate, 8 mm in diameter; disc rather thin, somewhat truncate; valves usually 4 or 5, rather broad, and slightly exserted.

This tree is indigenous to Northern Australia and Eastern Indonesia. It thrives in monsoonal climates with a minimum annual rainfall of 800 mm, and at elevations up to 425 m. Seeds were obtained from Australia, and seedlings were first planted in the Cotal Conservation Reserve in 1978. They grew moderately fast (3 m) in the first year but slowed in subsequent years. Because of its growth habit, this species is commonly used in Guam for soil conservation and landscape purposes, rather than for timber.

37) ***Eucalyptus brassiana*** Blake

CAPE YORK RED GUM

A medium to large tree to 20 m in height with a crooked crown and pedulous branchlets. Bark rough, gray, persistent on trunk; smooth and dull white on branches. Juvenile leaves opposite to subopposite, petiolate. Mature leaves alternate, petiolate, lanceolate, 12–16 cm long, 4–8 cm wide.

This taxon is closely related and morphologically similar to both *E. camaldulensis* and *E. tereticornus* which are described below. One noticeable difference is a swelling of the root crowns in Guam plantings. The trees came from Australian seed, and were planted in 1978 at the Cotal Conservation Reserve. They did not grow as fast as their two close relatives mentioned above, and neither flowering nor fruiting has been observed.

38) ***Eucalyptus camaldulensis*** Dehn.
E. rostrata Schlect.

RIVER RED GUM, MURRAY RED GUM

A medium to large tree to 30 m tall, with diameters to 2 m and an open crown; bark smooth, commonly dull white or ashen; twigs reddish. Juvenile leaves opposite to subopposite, petiolate, slightly glaucous, slightly falcate, lanceolate, 6–9 cm long, 3–5 cm wide. Mature leaves alternate, petiolate, lanceolate, acuminate, 12–22 cm long, 1–3 cm wide, venulose, and pale green on both sides. Inflorescence axillary umbels, with 5–10 flowers; peduncles terete, 10–15 mm long. Buds ovoid to hornshaped, pedicellate, 6–10 mm long, 4–5 mm wide. Operculum conical to rostrate, twice as long as the goblet shaped calyx tube; anthers versatile, obovate, opening in parallel slits; dorsal gland small, globular. Fruit capsulate, hemispherical to broadly turbinate, 7–8 mm by 5–6 mm; disc sharp and domed; valves exsert, acutely deltoid, incurved.

This species is widely distributed throughout Australia, and is usually found near a water-course or an alluvial flats. Ecologically, it is adapted to a wide range of soil types, and is widely planted around the world.

It was imported from Australia and planted at the Cotal Conservation Reserve in 1978. Its form, rate of growth and typhoon resistance are considered superior to the other eucalypts found in Guam. However, two species of leaf roller have caused minor damage to the foliage. Because of its broad adaptation, this species is used for forestry and conservation purposes on the island's volcanic derived soils.

39) ***Eucalyptus citriodora*** Hook

LEMON SCENTED GUM

A moderately tall (12–25 m) slender tree with an open crown; bark smooth, white, powdery and exfoliating throughout; timber durable and pale colored. Juvenile leaves opposite for 4–5 pairs, petiolate, oblong to oblong-lanceolate, rough, setose, 7–15 cm long, 3–6 cm wide. Mature leaves alternate, petiolate, lanceolate to linear, lemon scented, 10–16 cm long, 1–2 cm wide. Inflorescence terminal umbels, 3 to 5 flowered on terete peduncles, 5 mm long. Buds ovoid and pedicellate. Operculum hemispherical, shorter than the calyx tube; anthers obovate. Fruit urceolate, 1 × 1 cm, pedicellate and contracted to a short thick neck. Disc thin, oblique; valves enclosed.

This species is native to subtropical regions of Queensland, Australia where it thrives in heavy clay soils. It was imported from Australia and two plantings were established at the Cotal Conservation Reserve in 1978. Because of its open crown and slow growth, the tree failed to shade out the competing vegetation, and is more often used as an aromatic ornamental. Flowering has not been observed, but capsules mature in September and October.

40) ***Eucalyptus deglupta*** Blume.
E. naudiniana F. Muell.

MINDANAO GUM, KAMARERE

A medium to very large tree from 15–60 m tall, and up to 2 m in diameter. Bark smooth, green to reddish-orange, glaucous, exfoliatious; branchlets angular; timber moderately durable and reddish in color. Juvenile leaves opposite on one to three year old

trees, petiolate, ovate to oblong-lanceolate, 5 cm long, 4 cm wide, acuminate, thin. Mature leaves alternate, petiolate, pale green, ovate-lanceolate, acuminate, 5–14 cm long, 2–7 cm wide. Inflorescence paniculate, terminal, rather large, 3–7 flowered. Buds clavate to cylindroid, acute, pedicellate, 5 × 4 mm; flower operculum acutely conical, as long as the calyx tube; anthers reniform with a small terminal gland. Fruit pedicellate, ovoid-clavate or globose, 5 × 5 mm. Disc thin, valves as long as the calycine portion, protruding.

This species is naturally distributed from Mindanao in the north to New Guinea in the south, including the Celebes and the Moluccas. Kamarere is adapted to moderately fertile, sandy loams of riverflats where rainfall averages 2500 to 3000 mm per year. It is a fast growing species and is used for both timber and pulp.

Seeds were obtained in Hawaii and plantings were established in the Cotal Conservation Reserve in 1978. The growth rate was moderately fast with good form on protected sites. Over half of these trees flowered within the first year of field planting during November, but failed to set fruit until 1981. Capsules commonly matured 2 to 4 months after flowering.

41) ***Eucalyptus grandis*** Hill ex Maiden

TOOLER, ROSE GUM, FLOODED GUM

A large spreading tree to 46 m tall with a diameter of 2 m and a moderately dense crown; bark smooth, white or sub-glaucous, exfoliatious; timber red and durable. Juvenile leaves subopposite, shortly petiolate, oblong-lanceolate, thin, undulate, 3–6 cm long, 1–3 cm wide. Mature leaves alternate, petiolate, lanceolate, acuminate, undulate, 13–20 cm long, 2–4 cm wide, dark green, faintly veined. Inflorescence umbellate, axillary, 3–10 or more flowers; peduncles compressed, 10–12 mm long. Buds pyriform, usually constricted in the middle, pedicellate, glaucous, 10 mm long by 5 mm wide. Operculum conical to shortly rostrate, shorter than the calyx tube; anthers versatile, cells long, gland globular, rather large. Fruit pedicellate, glaucous, pyriform, rather thin, slightly contracted at the orifice, 7 mm long, 6–8 mm wide. valves 4–6, thin and usually incurved.

This tree is native to regions bordering the rainforests of eastern Australia. Best growth is obtained on loam soils derived from a basaltic parent material. Kelly (1978) reported that the heights of 8 m were attained during the first years growth under intensive management. The tree is used for subtropical coastal forestry where it produces excellent quality all-purpose lumber.

Seeds of this species were obtained from Australia in 1977 and two plantings were established in 1978 within the Cotal Conservation Reserve. The growth rate is slower than other eucalypts imported to Guam, but the trees do have good form. Typhoons and insects have caused only minor damage to this species.

42) ***Eucalyptus jensenii*** Maiden

WANDI IRONBARK

A medium size tree to 19 m in height and 1 m in diameter, crown spreading; bark light gray, corky, rough, vertical furrows, persistent on trunk and branches; twigs reddish-

orange and smooth. Juvenile leaves opposite, oblong to broadly ovate, 6–8 cm long, 2–6 cm wide, slightly glaucous, petiolate. Mature leaves alternate, oblong to lanceolate, 10–16 cm long, 3–5 cm wide, apex obtuse to rounded, base asymmetric, subglaucous, petioles 1 –2 cm long. Inflorescence umbellate, axillary, 3–7 flowers; peduncles terete, 5 mm long. Buds ovoid, 5 mm × 3 mm, glaucous, nearly sessile. Operculum hemispherical to turbinate, 4 mm × 3 mm, very glaucous.

This tree is native to Australia's Northern Territory. It was introduced to Guam from Australia in 1979 and planted at the Cotal Conservation Reserve. Three years after field planting, specimens averaged over 4 m in height. Because of its thick corky bark it is fire hardy and considered a useful conservation species for the island's savannas. Flowering in Guam has occurred in October, and matured capsules were available in January. This tree is tolerant of insect pests but susceptable to lodging during typhoons.

43) ***Eucalyptus pellita*** F. V. Muell.
E. spectabilis F. V. Muell.

RED MAHOGANY

A medium to large tree attaining 30 m in height and 2 m in diameter, with a heavily branched crown. Bark rough, fibrous, becoming fissured, persistent throughout; twigs smooth, brownish-orange; timber durable and red in color. Juvenile leaves subopposite for 3–4 pairs, oblong to lanceolate; 3–9 cm long, 3–5 cm wide, rather thick, petiolate. Mature leaves alternate, ovate to broadly lanceolate, 10–16 cm long, 5–8 cm wide, coriaceous, smooth and shining, finely veined, petiolate. Inflorescence umbellate, axillary, 3–8 flowers; peduncles compressed to being strap-shaped, 10–25 mm long, 4–6 mm wide. Buds pedicellate, cylindroid-urceolate to broadly turbinate, 15–22 mm long, 10–15 mm wide. Operculum conical to subglobose, much inflated, broader and longer than the bicostate calyx tube; anthers versatile, obovate opening in parallel slits, dorsal gland ovate, rather small. Fruit shortly pedicellate, subglobose to turbinate, bicostate, 15–18 mm long, 16–20 mm wide; discs large, domed, up to 5 mm in diameter; valves usually exserted.

This species is discontinuously distributed along the coasts of Queensland and New South Wales where annual rainfall ranges from 900–2300 mm. It is used for conservation purposes on coastal sandy soils, rough construction, and for honey production as it has an extended flowering period of up to nine months.

Several plantings of red mahogany were established in 1978 at the Cotal Conservation Reserve with seed received from Australia. Because of its good form and wind resistance, it is useful for exposed sites. Flowering first occurred during the sixth year (1983) in early September, and these fruits matured toward the end of November.

44) ***Eucalyptus tereticornis*** Sm.
E. umbellata (Gaertn.) Domin

RED FOREST GUM

A tall tree to 40 m with a thick trunk and somewhat open crown. Bark smooth and irregularly blotched throughout, but sometimes with rough flaky plates, persistent at the base; timber durable and red colored. Juvenile leaves subopposite for 2–3 pairs, elliptical

to lanceolate, 6–16 cm long, 5–6 cm wide, petiolate. Mature leaves alternate, linear-lanceolate, 10–21 cm long, 2–3 cm wide, slightly falcate, petiolate. Inflorescence umbellate, axillary, 5–12 flowers; peduncles almost terete, 5–12 mm long. Buds hornshaped to conical, pedicellate, 12–16 mm long. Operculum conical, usually 2–3 times longer than the cupular calyx tube; anthers versatile, opening in long narrow cells; dorsal gland rather small and globular. Fruit hemispherical to turbinate capsules, pedicellate, 6–9 mm long, 8–10 mm wide; the calycine rim is often sharp; discs broad, domed and fused to rather thick, broad, strongly exserted valves.

This tree occurs naturally along the east coast of Australia from Victoria north to southern New Guinea, where it tolerates heavy soil and waterlogged conditions. The forest red gum was introduced from Australia and planted at the Cotal Conservation Reserve in 1977. It has tolerated strong winds, drought, and insect damage. Some two year old specimens developed longitudinal fissures on the trunk which exposed cambium tissue. These fissures callousèd within a few weeks causing no apparent damage. Flowering normally begins in July and lasts for about one month; mature capsules have been available in October. This species is used in Guam for forestry, soil conservation, and landscaping.

45) ***Eucalyptus urophylla*** S. T. Blake

TIMOR MOUNTAIN GUM, AMPUPU

A very large, apically dominant, tree to 55 m tall with diameters to 2 m. Bark shows much variation within species but is persistent to branches and trunk, reddish-brown to brown in color; twigs smooth and generally red; timber pinkish-brown to reddish-brown. Juvenile leaves subopposite, petiolate, broadly lanceolate, 10–15 cm long, 5–8 cm wide. Mature leaves subopposite to alternate, acuminate, lanceolate to linear, 12–20 cm long, 2–5 cm wide, moderately thin, petiolate. Umbels axillary with 7–11 flowers; peduncles somewhat flattened, 1–2 cm long; pedicels angular. Buds globose to ovoid; operculum rounded, conical, slightly apiculate, length equal to width. Fruit obconical to cupular; discs moderately wide, almost flat, obliquely depressed; valves 3–5.

Ampupu is native to Timor and the surrounding islands. It is usually sympatric with *E. alba* and *Casuarina* spp. in monsoonal climates. Growth is best on deep, well-drained soils derived from igneous and metamorphic rock, but poor on calcareous soils. The species was introduced from Australia and planted in 1978 in the Cotal Conservation Reserve. It is susceptable to lodging and has a slower growth rate when compared to other eucalypts on the island. Flowering occurred in July and fruits matured in October.

46) ***Eugenia aquae*** Burm. f.
Syzygium aquaeum (Burm. f.) Merr. and Perry

WATER ROSE APPLE

A small evergreen glabrous tree to 8 m tall with a somewhat compact rounded crown and crooked growth habit; bark smooth, thin, grayish-brown, slightly mottled. Leaves opposite, oblong to elliptic, entire, firm, glossy, glabrous, leathery, 12–20 cm long, 4–6 cm wide, pinnately nerved, nearly sessile; apex acute to acuminate; base cordate. Inflorescence axillary, racemose, 4–7 cm long with 3–7 flower clusters; flowers 2–3 cm wide on short pedicels with four white and reddish petals; calyx with four lobes; ovary inferior;

stamens many, exserted, white and reddish. Fruit berry-like, white becoming rose pink, pyriform, smooth and thin skinned, crisp, juicy and sweet, 2–3 cm wide, 1–3 seeded; seed round, hard, 4–6 mm wide, embedded in the flesh.

This species is indigenous to the Malay Peninsula and Borneo where it is cultivated primarily for its edible fruit. It is occasionally cultivated by Palauans living in Guam who call it "edebsachel". It is probable that they introduced it in the late 1960's or early 1970's.

Flowering in Guam begins in June and continues through November, with heavier flowering following extended periods of rainfall. Four to eight weeks are needed for fruit maturation. A specimen located in Dededo reportedly bore fruit in its third year. Plants are easily propagated by cuttings or seed.

47) ***Melaleuca leucadendron*** L.
M. cajaputi Roxb.

RIVER TEA TREE, PAPERBARK

A small to medium-sized evergreen tree with a bushy growth habit. Bark thick, spongy, papery, multilayered, and whitish to light gray in color. Leaves alternate, linear to oblong, curved or straight, thinly leathery, 5–10 cm long, one cm wide, with 3–7 longitudinally oriented parallel veins. Inflorescence terminal, cylindrical spikes, 10–20 cm long, intercalary; flowers 20–60, petals five and white; stamens in five bundles, 1 cm long. The inflorescence of this species may appear to be axillary because vegetative growth proceeds from its tip. The fruit is a spherical or hemispherical capsule, 2 mm wide.

Paperbark is native to Australia, New Guinea, and New Caledonia where it is found in habitats ranging from swamps to dry savannas. It was first planted on Navy lands in 1970. Subsequent plantings were established at the Cotal Conservation Reserve in 1978. This tree has grown slowly on Guam, but it is virtually fireproof. Flowering occurs intermittently and mature capsules remain on the tree continuously.

Because of the variation in taxonomic characteristics, there are questions regarding the authority of this name; some botanists have classified it as *M. quinquenervia* (Cav.) S. T. Blake.

48) ***Psidium littorale*** f. ***littorale*** Raddi
P. littorale f. ***lucidium*** (Degener) Fosb.

ABAS, YELLOW CHERRY GUAVA

An evergreen tree to 7 m tall with an open branching habit; branches cylindrical; bark smooth, grayish-brown, peeling. Leaves opposite, simple, entire, pinnately veined, glabrous, glossy, deep green, elliptic to obovate, 6–8 cm long, 2–4 cm wide; apex acute; petioles short and stout. Flowers axillary, solitary, white, 2.5 cm wide, pedunculate; corolla with 4–5 orbicular petals; stamens many, clustered at base of calyx lobes; calyx prolonged above the ovary, obscurely lobed. Fruit round to obovate, 2–4 cm diameter, many seeded, sulphur-yellow in color with white flesh, acid when ripe. Seeds small, hard, and yellow-brown in color.

This species is native to Brazil but is now cultivated pantropically. In Guam, trees usually flower most heavily in November and December with ripened fruits available from

April through August. The fruit is commonly eaten fresh or made into either juices or jellies. The trees are adapted to most soil types, but prefer well drained sandy loams. It is not known when the guava was introduced to Guam, but it is common throughout the island.

This guava is easily distinguished from *P. guajava* by the bark and branches; *P. littorale* f. *littorale* has smooth bark and terete branches, while *P. guajava* has scaly bark and quadrangular shaped branches.

SAPOTACEAE

49) ***Chrysophyllum cainito*** L.

CAINITO, STAR APPLE

An evergreen tree to 12 m and diameters to 60 cm; crowns of dense dark glossy green foliage. Bark brown, rough, scaly, fissured. Leaves alternate, acute, oblanceolate-elliptic, 8–13 cm long, 3–8 cm wide, entire, drooping with upcurled sides; upper surfaces deep green, smooth, shiny; lower surfaces velvety, copper colored, veinated; petioles 1–2 cm long, reddish-brown, pubescent. Flowers purplish-white, small, clustered on axillary pubescent stalks one cm long; sepals six, rounded, brownish-green, imbricate; corolla tubular, stamens opposite the lobes. Fruit a berry, 5–8 cm diameter, glabrous, smooth, hard, green when young, and dark reddish-gray to purple when ripe. Seeds 3–8, flattened, brown, imbedded in a tasty white juicy pulp.

The star apple is native to Central America and the West Indies. It is cultivated in Guam as a dooryard specimen for both ornamental and fresh fruit purposes. Specimens were collected in Barrigada, and numerous plants were seen in Agana, Santa Rita and Sinajana. it is adapted to a wide variety of soils, and can be easily distinguished by the bronze satin color of the lower leaf surfaces. Fruit bearing is variable among specimens, so asexual propagation is advised. Flowers occurred sporadically in July and mature fruits were seen the following January/February. The time of introduction was not determined.

50) ***Pouteria campechiana*** (HBK.) Baehni
P. rivicoa (Gaertn. f.) Ducke

EGGFRUIT, CANISTEL

An evergreen tree 9–15 m tall with an erect habit; bark gray brown, rough; twigs stout with prominent leaf scars. Leaves alternate, entire, somewhat crowded toward branch ends, bright green, glabrous, elliptic to narrowly obovate, 10–25 cm long, 5–10 cm wide, 12–20 pairs of veins; apex rounded to acuminate; base cuneate; petioles 1–2 cm long. Flowers axillary, pedunculate, solitary or fascicled in clusters of three; sepals ovate 4–6, imbricate, tomentose; corolla five lobed, greenish-white; stamens five, united to corolla base, inserted; ovary superior. Fruit globose to ovoid, apiculate, 10–15 cm long, greenish-brown to yellow skin, 1–3 seeded; pulp smooth, sweet, orange to yellow in color. Seeds ovoid, 3 cm long, dark brown, shiny, smooth on one side and rough on the other.

This native of tropical America is not commonly cultivated on the island. Specimens

were found in the villages of Barrigada and Agana Heights. While it tolerates poor soil conditions, growth is best on clay loam soils. Most trees have grown from seed, but superior lines are propagated vegetatively. Flowering occurred in October, and fruits were available in February and March. The time of introduction was not determined.

51) ***Pouteria*** sp.

CHESA, EGGFRUIT

An evergreen tree to 5 m tall with an open growth habit; bark gray-brown, rough; twigs stout, rough, gray-brown, with leaf scars. Leaves alternate, entire, crowded at branch ends, glabrous, narrowly obovate, 10–25 cm long, 2–4 cm wide, 8–12 pairs of veins; apex rounded acuminate; base cuneate; petioles 1–2 cm long. Flowers axillary, solitary or fascicled in clusters of three on 1 cm peduncles; sepals ovate, 4–6 in number, imbricate, tomentose, corolla greenish-white, 1 cm long, with six oblong lobes; stamens six, united to the corolla base, inserted, ovary superior. Fruit ellipsoid, apiculate, 8–10 cm long, 4–5 cm wide, green to yellow skin, 1–3 seeded; pulp yellow, smooth, sweet. Seeds ellipsoid, distinctly three-sided, pointed at each end, 5 cm long, 1–4 cm wide, brown, smooth throughout.

This form of *Pouteria* has been reported as both a variety of *P. campechiana* and as a distinct species under the unpublished name of *P. salisfolia* HBK. (Fosberg, 1980; pers. comm.). Because of the different foliar morphology and the dissimilarity of seeds, it is likely that both taxa of *Pouteria* found in Guam, are distinct species.

The best specimen was found in Toto where it reportedly was planted in 1975, and bore fruit in 1980. This tree flowers most heavily in October and November with fruit ripening in December and January. It was reportedly introduced from the Philippines as a seed.

VERBENACEAE

52) ***Gmelina arborea*** Roxb.

MELYNA, ABANG

A semi-deciduous tree, 13–20 m tall, sparsely branched; bark sandy gray, speckled, smooth. Leaves opposite, simple, entire, broadly ovate, 15–30 cm long, 10–20 cm wide, smooth above, pubescent beneath; apex acuminate; base somewhat cordate; petioles 5–15 cm long with two distal glands. Inflorescence cymose, both terminal and axillary, in drooping panicle-like cymes, 30 cm long. Flowers brownish-yellow, 2–3 cm across, on short pedicels; calyx 4–5 toothed or entire; corolla tubular, five-lobed, bell shaped; stamens four. Fruit drupaceous, round to ovoid, 2–3 cm diameter, yellow, juicy, 1–4 seeded, pyrine hard.

This species is native to India, and is planted throughout the topics. It has recently gained notoriety as a fast growing forest/ornamental tree. The timber is glossy white, resistant to warping and similar to teak. It is primarily used for small carpentry and carving. This species was first introduced from Hawaii in 1971, and again in 1977 from the South

Pacific. Plantings were established in the Cotal Conservation Reserve, Naval magazine, and Santa Rita; the tree seems better adapted to Guam's limestone soils. Flowering occurs in May/June, and the seeds mature by late July.

BIGNONIACEAE

53) ***Crescentia cujete*** L.

CALABASH

A medium-sized tree to 12 m tall with a short trunk and thin gray bark; branches outspread and arching. Leaves alternate, spirally arranged, clustered at nodes, nearly sessile, oblanceolate, simple, entire, 5–15 cm long, smooth to downy beneath; apex obtuse; base cuneate. Flowers cauliferous, solitary or clustered on main branches or trunk, 5 cm long; corolla campanulate with five irregular lobes, somewhat lacerated, yellowish with red or purple veins. Fruits globose, 15–30 cm long, green to yellow, hard shelled, smooth; pulp white, juicy, with many seeds. Seeds dark brown, flat, 8 mm long.

This species is native to tropical America where the hollowed-out fruit is used to store water. The flesh of the fruit may be toxic, but seeds are edible and also oil bearing. Specimens were found on O'Brien Drive in Agana, and as landscape trees throughout the island. Flowering and fruit set is light, but continuous throughout most of the year. The time of introduction was estimated at about 1970.

54) ***Jacaranda mimosaefolia*** D. Don
J. acutifolia R. Br.

JACARANDA, GREEN EBONY

A semi-deciduous, spreading tree with a thin open, light green crown, attaining heights of 15 m; bark smooth, pale gray, flaky; twigs stiff, brittle. Leaves opposite, bipinnate, 27–35 cm long, 12–16 cm wide; pinnae imparipinnate, 20–30 pairs, to 10 cm long, and 2 cm wide, with 19–51 pinnules; leaflets oblong-rhomboid, sessile, 6–7 mm long, shortly acuminate, lighter beneath. Flowers many, in terminal panicles, 20 cm long. Corolla mauve to bluish, funnelform to campanulate, 5 cm long, five-lobed, two-lipped; calyx five-toothed, truncate; stamens four. Fruit capsular, 5 cm in diameter, flattened, with somewhat wavy edges, rounded apex, two seeded. Seeds flat, winged.

This species is native to northwest Argentina, and is presently planted throughout the tropics and sub-tropics. Because of its colored flowers, the tree is commonly used in urban landscape. It was introduced to the island from Hawaii in 1976. Specimens were distributed in several villages and two plantings were established at the Cotal Conservation Reserve. Flowering and fruiting were not observed.

RUBIACEAE

55) ***Anthocephalus cadamba*** (Roxb.) Miq.
A. morindifolia Korth.

KADAM

A deciduous, monopodial, symmetrical tree with a slightly buttressed trunk, to 24 m tall; branches sparse, horizontal and drooping slightly at the ends; bark gray, smooth, somewhat fissured and sometimes with coarse flakes. Leaves opposite, petiolate, ovate to oblong, 15–22 cm long, 8–12 cm wide drooping, prominently veined, upper surface glabrous and coriaceous, lower surface tomentose along the veins; stipules lanceolate, caudacious. Flowers yellow to orange, solitary heads, 5 cm in diameter; corolla tubular, lobes five; stamens five, borne in the throat, filaments short. Fruits confluent into a fleshy globose mass, 5 cm in diameter, edible. Seeds minute.

Kadam is a fast growing species native to the Indo-Malesian region extending from India to New Guinea. Seeds were introduced from Hawaii in 1972 and later from the Philippines. Plantings were established at both the Cotal and Ypiga Conservation Reserves. This species is better adapted to the limestone soils where growth rates of 2–3 m per year are reported. Flowering and fruiting were not observed.

56) ***Coffea canephora*** Pierre ex Forehner
C. robusta Linden

ROBUSTA COFFEE

A small evergreen tree to 4 m tall, branches somewhat drooping; bark glabrous, brown, slightly fissured. Leaves opposite, oblong-elliptic, 20–28 cm long, 7–12 cm wide, entire to crenulate, midrib prominent below, veins paired, apex acuminate, base cuneate; petioles 2–3 cm long; stipules pointed, broadly triangular, Inflorescence axillary, flowers in clusters, white, fragrant; corolla salverform to funnelform with 5–7 petals which are longer than the corolla tube; calyx short, cup shaped, toothed; stamens exserted, united at the base. Fruit drupaceous, globose, 1–2 cm long, two-seeded, red at maturity then turning brown, adhering to tree; seeds grooved, ellipsoidal.

Robusta coffee is used in the production of instant coffee, and is the only commercial species resistant to coffee leaf rust (*Hemileia vastatrix*). This plant is a native of tropical Africa and not commonly seen in Guam, but the trees found in Barrigada are well adapted. They were introduced and planted in 1975. Flowering and fruit set occurred after four or five years. Flowers tended to flush after periods (3–7 days) of rainfall.

Conclusion

This work clearly supports the hypothesis that man remains the primary agent in the dispersal of higher plants throughout the Insular Pacific. Several factors including commodity trade, immigration, research and tourism effect and accelerate this process. In a pluralistic society such as Guam, it is inevitable that more plants will become established on the island as long as the present socioeconomic trends continue. It is further probable that this increased rate of plant introduction will ultimately influence the floristic patterns of the more isolated islands in the region.

Although the importation of plant species to Guam cannot be halted, greater vigilance could prevent the introduction of deleterious diseases and pests which often accompany incoming plant material. Adherence to a protocol for the introduction of desired eco-

nomic species is essential to protect the island's unique and indigenous flora as well as its agricultural crops. All imported plant material should be closely monitored, and only those species falling within the protocol should be allowed.

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