PRINCIPES

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Contents for October

Cover Picture

Sugar palm with bamboo ladder for tapping. Photo by R. H. Miller.

*For readers unfamiliar with the metric system used in this article, a meter (m.) is slightly more than a yard, a centimeter (cm.) is about 3/8 of an inch, a liter is slightly more than a quart.

THE VERSATILE SUGAR PALM[1]

ROBERT H. MILLER[2]

Introduction

Linnaeus once described the palms as the "princes of the vegetable kingdom." The Indo-Malaysian sugar palm might well be designated as the "prince of princes," although some may prefer to reserve this honor for the pantropical coconut palm. The benefits of the coconut palm as a source of nourishment, protection, and economic wealth in tropicana are well established. Commercially, the coconut is probably the most important of all palms.

It is not so widely recognized, however, that the sugar palm, while considerably more restricted in its distribution than the coconut palm, and of little or no importance in foreign commerce today, nevertheless may well be considered even more utilitarian in its adaptability to the necessities of people inhabiting its immediate geographical range. Historically, it appears to be one of the economic palms utilized longest by civilized man. During World War II the sugar palm was of considerable value to the Indonesians under Japanese occupation. Today, it still holds significant utilitarian values for the teeming populations of Indo-Malaysia and Southeast Asia.

The author has had ample opportunity to observe the varied uses to which this palm is put in Malaysia. The purpose is to discuss its ethnobotany as well as to describe its great versatility, particularly in Indonesia.

1/The writer gratefully acknowledges the Dutch translations rendered by Dr. A. J. G. H. Kostermans, Forest Research Institute, Bogor, Java, Indonesia.

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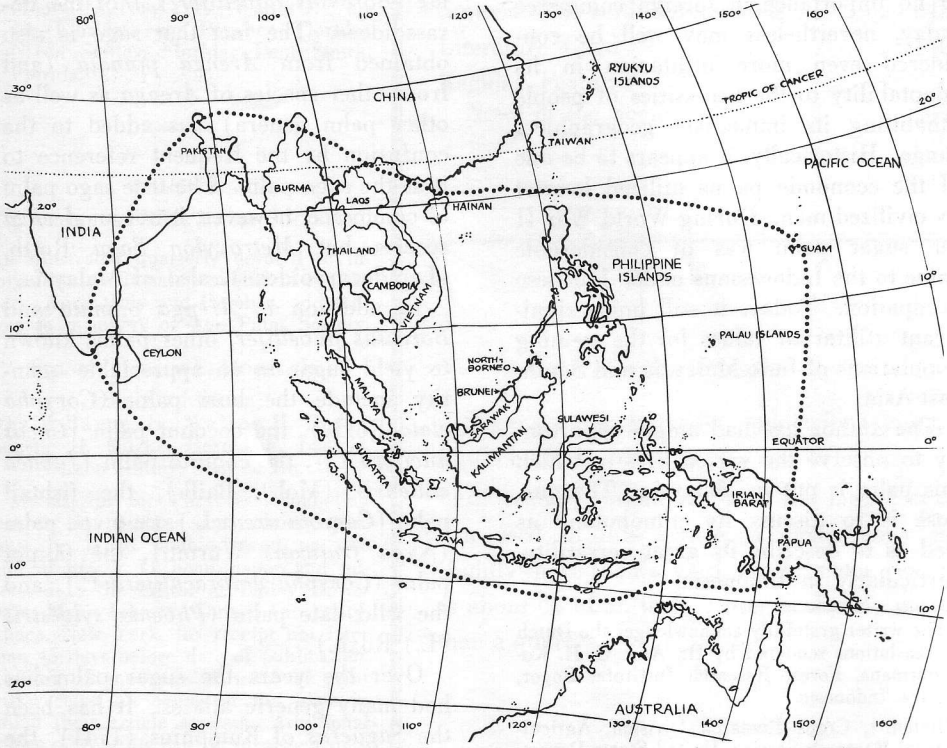
While the genus *Arenga* Labill. (Caryotoideae) contains about 12 species endemic to Southeast Asia and the Malayan tropics, *Arenga pinnata* (Wurmb) Merr. (*A. saccharifera* Labill.) appears to be the one most often exploited. The generic name, probably derived from the Malay word aren, has specific reference to the sugar palm. Among the English vernaculars it is variously called black sugar palm, feather palm, gomuta or gomuti palm, saguero palm, toddy palm, and wine palm. It is sometimes confused with another economically important palm (also sugar-producing), and also often referred to as the sugar palm, namely the palmyra palm or lontar (*Borassus flabellifer* L.) of the Borassoideae. The fact that sago is also obtained from *Arenga pinnata* (and from other species of *Arenga* as well as other palm genera) has added to the confusion by the frequent reference to it as the sago palm. The true sago palm of commerce, however, it not an *Arenga* species but *Metroxylon Sagu* Rottb. (Lepidocaryoideae), also of Malaysia.

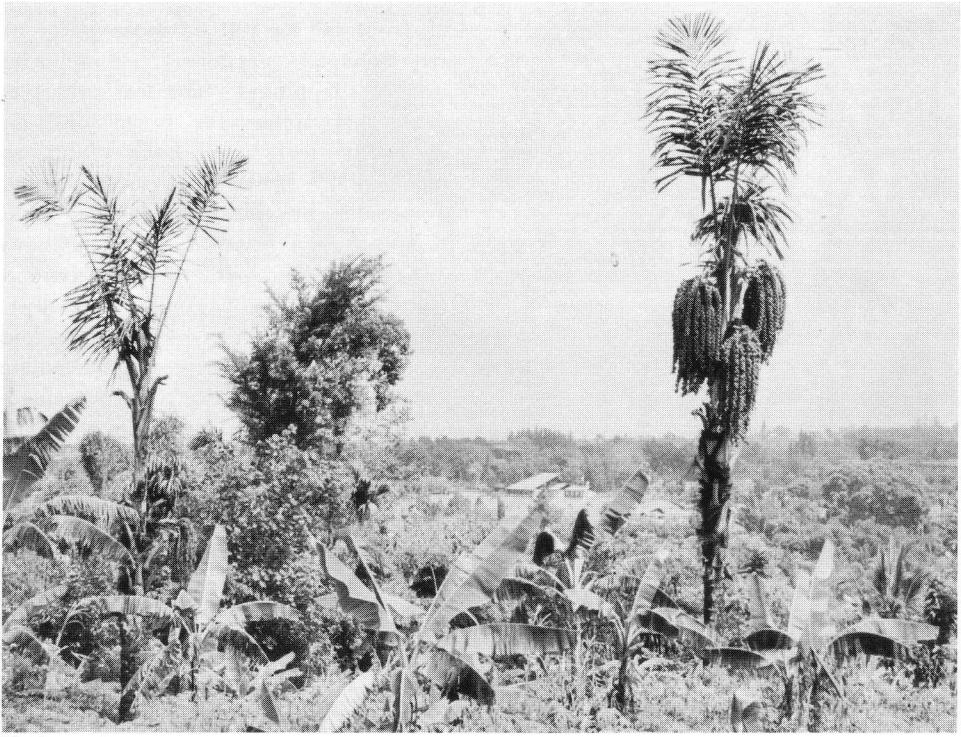
In addition to *Arenga pinnata* and *Borassus flabellifer*, other palms known to yield sugar in an appreciable quantity include the buri palm (*Corypha elata* Roxb.), the coconut palm (*Cocos nucifera* L.), the coquito palm (*Jubaea chilensis* (Mol.) Baill.), the fishtail palm (*Caryota urens* L.), the nypa palm (*Nypa fruticans* Wurmb), the talipot palm (*Corypha umbraculifera* L.), and the wild date palm (*Phoenix sylvestris* (L.) Roxb.).

Over the years the sugar palm has had many generic aliases. It has been the *Saguerus* of Rumphius (1741), the *Borassus* of Loureiro (1790), the *Gomu-*

tus of Correa (1807), the *Sagus* of Perottet (1824), and the *Caryota* of Blanco (1837).

The sugar palm has also acquired a vast number of local native names too numerous to include here. Among the 150 some Indonesian vernaculars alone (see Heyne, 12, for a large listing), probably the most common is *kawung* or *pohon aren*. The Dutch referred to it as *arenpalm* and *suikerpalm* or *sagoeer*, among various appelations. In former Dutch New Guinea (now renamed by the Indonesians as Irian Barat) it is known among the natives as *semaki* or *waké*. In Sarawak, Brunei, and North Borneo it is referred to locally as *ejok* or *apin*. The Bataks of Sumatra call it *bagot*. In the Philippines there are also many local names for this palm, including the Spanish *cabo negro*, and among the Tagalog epithets, *káong* and *káuing* (see Brown and Merrill, 6, for provincial names). In Hainan it is called *shan-ye-tsz* or "mountain coconut." In former French Indochina (Cambodia, Laos, Cochin-China, Annam, Tonkin), the natives refer to the sugar palm by a great variety of local names, among them being *cay doat* or *cay goat*, *cay do ac*, *cay da*, *cay bung bang*, *chhouk*, *chre*, *thout nhi*, and *cho col*. To the Malayans the name *enau* refers to the wild sugar palm, while its cultivated form is called *kabong* or *kobong*. In the Malaccas (Malaya; not Indonesian Moluccas), in addition to the latter names, it is also known as the *gumuti tree*. The Thai people (Siamese) know it as *ka chok*, *lang khai*, and *nao* or *tao*. The Burmese refer to it as *taung-ong* or *toung-ong*. In Assam it is





62. Young (right) and old (left) sugar palms at Bandung, Java, Indonesia. Elevation 700 meters. The bulk of the leaves had been removed for use as woven fencing.

called *gamati* palm, while in various other regions of eastern India it is known as the *gomuti* or *gomuta* palm; and in the Tamil language of southern India it is *kichiippanai.*

Thus, while the history of the sugar palm is lost in antiquity, the innumerable epithets, when translated, are indicative of its age-old popularity (it is also referred to in Sanskrit writings), its probable center of origin, and geographical distribution. They attest to its great versatility as well.

Geographical Distribution

The introductory discussion indicates to some degree the natural range of the sugar palm. While it appears to be indigenous primarily to the Indo-Malaysian archipelago, with its apparent center of distribution in Indonesia, it is to be found sporadically throughout the Malay Peninsula, Thailand, Burma, Cambodia, Laos, and Vietnam (Fig. 61). It also appears on the island of Hainan off the south coast of China, probably as an introduction. It is reported as far north as Assam, in the Kabu valley of Mánipur of northeast India. Its western extent appears to be in the state of Rissa on the east coast of India, with introduction into Ceylon only as a cultivated plant. In its extreme southerly range it is confined to the moister regions of the Sunda Islands; and has been introduced into tropical northern Australia. It extends eastward to the former Dutch New Guinea, but there are no records of its occurrence in Papua. Merrill (16) reports it as generally planted and naturalized in most of the islands and provinces of the Philippines. It has also been introduced on

63. Close-up of the young sugar palm at right in Fig. 62, bearing four fruit clusters in various stages of development.

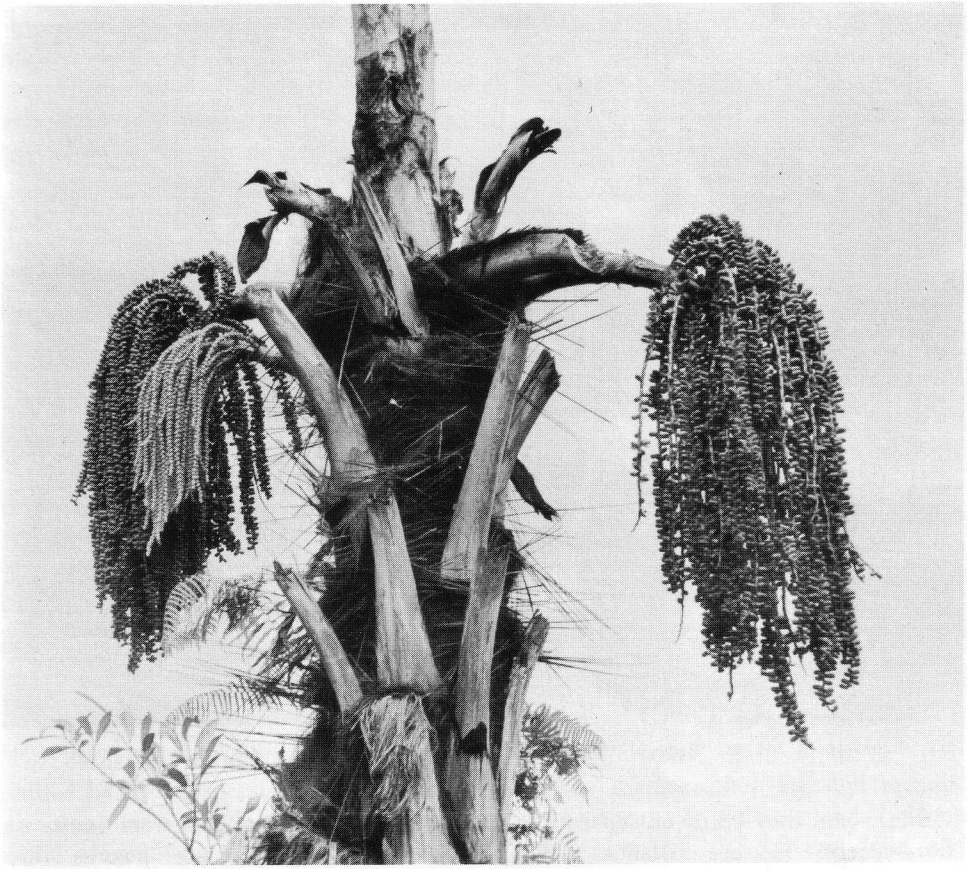
Guam, the Palaus, and other Pacific islands. While Burkill (7) states that it extends northeastward to the Liu-Kiu Islands (Rykukyu Islands), there is no evidence of this; nor has it been reported on Formosa (Taiwan).

General Morphology

The bole is solitary, straight, columnar and unarmed, 7-10 m. in height, exclusive of leaves, and approximately 40-50 cm. in diameter when fully grown. Occasional trees have been reported to reach up to 16 m. (leaves excluded) in height and 65 cm. in diameter. These tall stout palms are easily recognized by their distinctively large and very long (5-9 m.) feather-like, dark green leaves (sometimes appearing almost blackish-green) which ascend stiffly to form a diffuse, dense crown (Fig. 62). Each unevenly pinnate (imparipinnate) leaf, spirally arranged on the bole, consists of from 60 to 100 or more pairs of sword-shaped (ensiform), sub-opposite or opposite pinnae. The leaf rachis is devoid of pinnae for some 1.5-2 m. above the leaf base. Each pinna, as much as 1.5 m. in length and 6-8 cm. (or more) in width, has parallel venation, and is a glossy dark green above (adaxially) and somewhat scurfy and whitish or light green below (abaxially). The induplicate pinnae have a single fold at their more or less sessile, auriculate bases, are flatly V-shaped in transection, and possess enlarged midribs. The upper portion of each pinna is dentately serrate, with a more or less oblique and toothed (praemorse) apex. The pinna base usually consists of 1-2 distinctly unequal blunt auricles.

The rachis of each leaf is woody and smooth, light green and slightly concave above. Below, it is somewhat quadrangular or rounded, light-colored and slightly scurfy, flaring out into a very broad base. The sheath margins become shredded into very long stiff, coarse fibers (bristle-like) that protrude in various directions and become interspersed among a mass of other less coarse horsehair-like fibers, collectively presenting a reticulated and mat-like shaggy profusion. The abaxial portion of the leaf base is usually copiously ensheathed with a soft, felt-like tomentum which may be white, ash-colored, light brown, or blackish, depending in part upon the age of the leaf (Fig. 66).

The trees reach maturity (flowering stage) in 6-12 years, and their flowering habit is quite irregular (see discussion under Sugar Tapping). As they approach senescence the boles invariably assume a distinctive shaggy appearance. The older leaves break off near their bases and the leaf-bole axes of the remnants provide ecological niches for a host of life forms (see Ecology).



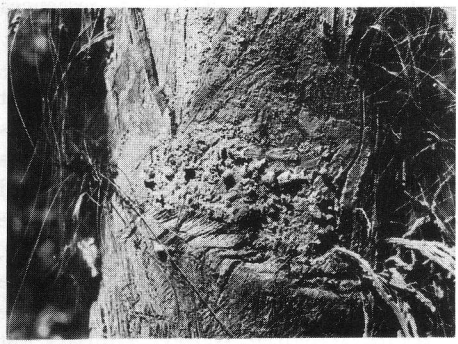
64. Close-up of the old palm at left in Fig. 62, with three male inflorescences in various stages of development. Note the matted, black horse-hair-like fibers within the leaf base remnants. The longer, coarser and splint-like fibers protrude at various angles. Ferns are growing out from the fibrous material and its accumulated debris.

Inflorescence

The sugar palm is a monoecious plant bearing very large pendulous (tail-like), interfoliar inflorescences arising from the leaf axils (Figs. 63, 64). With the initiation of flowering, after 6-12 years of growth, it usually flowers continuously for 2-5 years. The inflorescences arise initially from the apex of the bole, with successive ones becoming initiated and developing in a descending order from the apex (basipetally), the female inflorescences usually preceding the male. The male and female inflorescences, which eventually become 1-2 m. in length, are at first ensheathed in the bud by 5-7 lanceolate-oblong, imbricated, caducous bracts. The inflorescences emerge from the spathes in 6-9 weeks. Each is composed of a large, stout, ascendent peduncle recurving downward at the apex and branching into numerous long pendulous, spike-like axes. Flowers open first at the base of each branch and successively toward the apex. The numerous flowers (florets) are sessile, and either male or female. The female flowers are generally solitary, the male solitary or paired (rarely in three's but with the central flower female and

65. Close-up of the profusion of horse-hair-like fibers, interspersed with the longer, coarser and splint-like fibers, from the leaf base axils.

sterile); and they occur on separate inflorescences. In rare instances of bisexual flowers the stamens are usually abortive. The flowers of *Arenga pinnata* are presumably wind-pollinated (anemophilous), since the writer has never observed pollinating insects visiting the flowers.



66. Felt-like tomentum, *lunglum* or *baruk*, on the outer surface of the leaf base.

The scentless male flowers (more numerous than the female) possess three green imbricated persistent sepals about one-fourth the length of the petals, with broadly acute, thin-margined apices (Fig. 67). The three (rarely four) navicular, valvate, caducous petals (2.5 cm. long) are red-brown or red-purple externally, smooth and somewhat fleshy, with a concave, yellow interior. The numerous yellow stamens consist of elongated, aristulate or apiculate anthers borne on very short or vestigial filaments, the anthers dehiscing by lateral slits. There is no rudimentary ovary.

The female flowers are also scentless and consist of three unequal green imbricated orbicular sepals about one-third the length of the petals, and persistent. The three petals are 1.5-2.5 cm. long, coriaceous, light green, ovate to some-

67. Male flowers of the sugar palm.

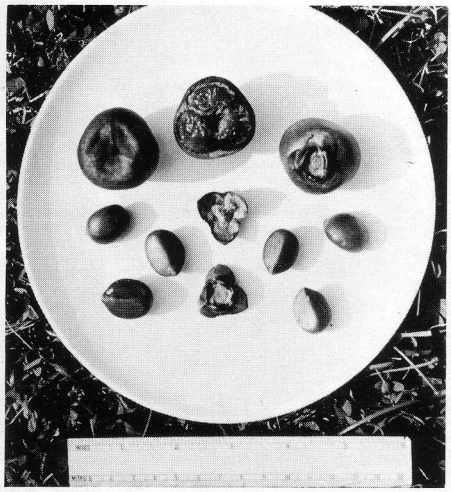
what cordate or triangular, valvate above united bases, and persistent, along with the sepals, as a cupule at the base of the fruit (Fig. 68). Staminodes may be lacking; when present they are minute, and sometimes produce nectar. The ovary is superior, three-lobed, subglobose and smooth; it has three sessile, conical, trigonous and persistent stigmas and is trilocular, each locule containing a single erect ovule, two or three of which may be fertile.

The mature fruit is an obovoid to sub-globose or oblong-turbinate smooth berry, 5-6 cm. in width and length, with a depressed trigonous upper surface. The exocarp, or outer surface, is yellow to yellow-brown (blue-green or green when immature) and coriaceous; the mesocarp is whitish, gelatinous, fleshy and very acrid due to the presence of many needle-like stinging crystals (raphides); the endocarp is black, smooth, relatively thin and stony. Two or three seeds usually mature; they are dull metallic gray-brown, trigonous and oblong (plano-convex), 2.5-3.5 cm. long and 2.0-2.5 cm. wide; the endosperm is copious and homogeneous (of glacial translucency and cartilaginous when immature, becoming gray-white and horny); the embryo is minute and more or less centrally located within the endosperm (Figs. 68, 88).

The sugar palm is reported to possess 32 somatic chromosomes (Darlington and Wylie, 8).

Ecology

Arenga pinnata, a more or less sylvan species, is not restricted entirely to the jungles (Indo-Malaysian rain forest) of the humid tropics. It grows from sea level to an elevation of some 1,200 meters; thus, it can be grown at relatively higher elevations than the coconut



68. Fruit and seed of the sugar palm. The cupule, comprised of the sepals and petals, may be seen at the base of the fruit and also separated therefrom.

(see Sugar Tapping for a discussion on the effects of elevation). It appears to be hardy, self-sustaining. and disease-resistant. It grows readily in well-drained soils of dark cool valleys as well as on the banks of mountain streams and rivulets, along forest margins, and on partially open hillsides. It appears to develop slowly in flat, exposed and sunny habitats, whereas growth is much more rapid and luxuriant in moist, less open, partly wooded valleys. The natives seem to have little difficulty cultivating it on moist rocky hillsides and waste land in general. In fact, it appears to be found much more abundantly near kampongs or villages than in the wild state.

In the "ladang" type of agriculture practiced by primitive people, the land is cleared and utilized until exhausted, when a new site is chosen. This very questionable type of agriculture is sometimes "improved upon" by the planting of sugar palm seeds in order that, within 10 or 15 years, it may develop into a profitable sugar grove. Bartlett (3) states that this palm is purposely planted around kampongs of the Toba region of Sumatra, and that ". . . it has a definite place in the simple crop rotation of Batak agriculture."

In the forests of Indo-Malaysia the ripe fruit is usually disseminated by various fruit bats, wild swine (*Sus* spp.), and the civet cat (*Paradoxurus* sp.).

While many members of the palm family are definitely considered to be stately and graceful in appearance, the sugar palm could hardly be described as such in any state of its development. With the approach of maturity, and particularly in its senescence, the sugar palm acquires a shaggy, dreary appearance in general, owing in part to the accumulation of humus-forming detritus from deteriorating leaf bases, along with their massive fibrous reticulum, and the accretion of numerous other forms of plant life, including lichens, and especially ferns and mosses (Figs. 64, 65). The resultant unkempt appearance undoubtedly prompted Rumphius (20) to remark that ". . . it is the ugliest in shape of all trees." Old senescent boles are usually hollow inside.

As is true for a number of palms, the decaying fibrous leaf base of the sugar palm provides an excellent habitat for a large variety of fauna and flora. For example, the abundance of plant forms finding an ecological niche within the decaying leaf bases, enabled Backer and Posthumus (1) to culture the following ferns alone from the accumulated debris: *Asplenium adiantoides* C. Chr.; *Davalia corniculata* Moore, *D. denticulata* Mett., *D. divaricata* Desv., and *D. solida* Sw.; *Humata heterophylla* Desv.; *Nephrolepis acuminata* Kuhn, *N. biserrata* Schott, and *N. radicans* Kuhn; *Nidus* spp.; *Ophioglossum pendulum* L.; *Photinopteris speciosa* Bl.; *Polypodium persicifolium* Desv., *P. punctatum* Sw., *P. scolopendria*

Burm., *P. subauriculatum* Bl., and *P. verrucosum* Wall.; *Vittaria elongata* Sw., *V. ensiformis* Sw., and *V. lineata* Sw.

While the sugar palm does not appear to be particularly ravaged by insect life — in fact it seems to sustain little damage from insects pests in general — its leaves are occasionally damaged by the rhinoceros beetle (*Orcytes rhinoceros* L.). Dead and decaying sugar palms are reported to harbor this dreaded beetle, which also causes considerable harm to the coconut palms that often grow near it. In the Moluccas, a long-legged beetle member of the Scarabaeidae, *Euchirus longimanus* L., is often found wallowing in the sap containers of the tappers.

Economic Uses

Food

To the native the uses to which the sugar palm may be put are legion. The products are inexpensive. Almost all parts of the plant are useful in one form or another. It is most unfortunate that the sugar palm, of all tropical crops, should not have been given greater consideration, for it is easily managed and certainly inexpensive to cultivate. Barrett (2) comments, perhaps with some overemphasis, that "... in the byways of tropical agriculture there is no more interesting case of neglected possibilities among the major crops than that of the sugar palm." Certainly it could play a much more important role in the local agriculture of many underdeveloped countries of the humid tropics. Its many potentialities have been only partially exploited by the natives within its natural geographic range. It could very well be cultivated on a pantropical scale as an additional crop potential to be added to the minor economy of many tropical areas. With proper management and modern methods it might very well prove to be a highly profitable plant. Although its products are of apparently diminishing importance to the more sophisticated people, it is true that to the teeming millions of kampong natives of Southeast Asia, and of Malaysia in general, the sugar palm is still of considerable basic importance.

In the following discussion it should be noted that the native names are given where possible, without regard to differences in provincial or ethnic group vernaculars, but rather as names quite common to the country or state as a whole. Because the bulk of information being presented is primarily concerned with the usage of the sugar palm in Indonesia, the names, terms, and the processes given are the ones most frequently encountered in Bahas Indonesia (the official language). The possible interchange of such names in the dialects of the Balinese, Javanese, Sundanese, and others, are purposely not considered. To include all of the international native vernaculars here would be impossible (for additional local names see Blanco, 4; Blatter, 5; Burkill, 7; Heyne, 12; Merrill, 16; Rumphius, 20; and the Handbook, 11).

Palms in general have been utilized in multiple ways. They have long received recognition as an excellent natural source of nourishment and drink. To many natives of the Indo-Malaysian region, the sugar palm is of primary importance as a food supply source, dessert, sweetening agent, medicine, and beverage. The primitive native looks upon this palm with considerable respect (and reverence: see Superstitions and Ceremonials) as an important adjunct to his daily existence. To the more sophisticated, it perhaps provides little more than additional variety to the daily fare. An interesting list of recipes, utilized by Indonesians in the nineteenth century

in concocting various dishes and refreshments from the sugar palm, is given by Teijsmann (24).

As is true of many palms, the terminal bud or "cabbage" (*tunas* or *ubud* in the Philippines) of the sugar palm is edible, and highly prized for salads, whether raw or cooked. However, removal of the bud may terminate the life of the palm; and, usually, natives will not destroy a means of income for this source of food except in emergencies or in times of famine. The very young etiolated leaves and petioles (*humut*), and the pith of young stems, are occasionally eaten in soup or fried in Indonesia. They are said to be relished as a pickled preserve by the Manipuris of northeast India.

69. The glistening, slippery and cartilaginous seeds of the sugar palm with their seed coats removed. The *tjeng-kaling* of Indonesia.

In Malaya the ordinarily inedible fruit of the sugar palm is called *buah batu;* in Bali it is referred to as *bilulu;* and in Java as *tjaruluk*. The Indonesians commonly prepare a favorite (although somewhat indigestible) confiture called *tjeng-kaling*, from the white, more or less cartilaginous, slippery immature endosperm (*kolang-kaling*) of the sugar palm (Fig. 69). The half-ripened fruit is first burned to facilitate removal of the innumerable and exceedingly irritating crystals from the pericarp. After the seeds are thoroughly washed, and the seed coat removed, the endosperm is soaked in lime water for several days. Finally it is boiled or steeped in various sugary and — or both — spicy solutions that impart a flavor to its natural insipidness. It is then eaten as a type of sweetmeat; however, the "meat" may be chopped, mixed with colored water or coconut milk and drunk (often with crushed ice) as a kind of refreshment called *kolak*. The immature endosperm is used in fruit salad, *rudjak gulang kaling*.

Also considered a delicacy in Indonesia is a dessert-like preparation called *klopon*, made from cooked glutinous rice, and sprinkled with grated coconut meat and the brown sugar of the aren palm.

In Java and elsewhere the trees, when no longer considered productive for sugar tapping, are felled and cut into short sections; or the bole may be split lengthwise, without sectioning first, and the pith scooped out with an adz, axe, or mallet to obtain the starchy sago (*atji kawung*) (Figs. 70, 71). The pith contains a mass of woody fibrous material which has to be removed as a contaminant. The sago can actually be obtained when the first inflorescences appear, or even earlier. However, the destruction of the palm for this purpose alone would usually prove to be unprofitable for the native. Once the pith is removed from the bole, the fibrous mash is further pulverized, usually with a wooden pestle in a stone or wooden mortar. Then it is washed in a trough of running water to remove the fibrous material and other impurities. The starch particles in suspension are drawn off into a wooden or earthen settling tank. After several changes of water, and further settling and separation from extraneous debris,

70. Removing the fibrous pith from a sugar palm trunk in order to obtain the sago starch is a common *kampong* venture in West Java.

the sago starch is removed and allowed to dry in the sun. The starch should be a light gray-white, resembling the true sago starch (*Metroxylon Sagu*) (Figs. 72, 73).

Local variations in processing the sago have more or less the same basic method. For example, in the Philippines, one variation is simply to pulverize the fibrous pith, then wash out the starch by allowing water to run over further pulverizations until all starch is removed. The starch in suspension is washed in several settling tanks of water, then dried. According to reports, it takes two men two or three days to remove the pith and process the mash for *Arenga pinnata* starch.

While it is not uncommon for an old sugar palm in Indonesia to yield from 125 to 135 or more pounds of starch (estimated at 50 to 75 kilograms in the Philippines, Barrett, 2), this yield is considered to be actually about one-fifth of

71. A halved sugar palm trunk from which the coarse fibrous pith containing sago starch is being removed. Note the relative thickness of the trunk "wood."

72. Cookies made from the sago flour of the sugar palm (left); cleaned, powder-like sago (center); raw, uncleaned sago (right).

that obtained from the true sago palm. Blatter (5) reports that more than 150 pounds per tree is obtained from the sugar palms in India. Thus, the yield per tree is obviously quite variable. After consistent tapping of a sugar palm for sugar, it may yield little or no sago, if it has reached the stage where inflorescences are no longer produced. Tammes (23) states that tappers in the Celebes maintain that after tapping, a tree no longer yields sago. However, this did not prove the case in west Java, where trees are commonly felled for the sago after tapping operations have ceased. In the Philippines, if a sugar palm is to be used for sago only, the inflorescences are removed for a period of about one year as quickly as they are formed. The tree is tested periodically for the proper condition ("ripeness") of the starch by notching the base of the bole from time to time and by removing a fragment for further determination.

The use of *Arenga* sago as a general food source is relatively important in certain regions. In Indonesia as a whole, this source of food is considered to be generally unimportant except in times of rice crop failures or famine. However, the Javanese peasants of the kampongs put it to constant use whenever available. The natives have found that a constant diet of this sago results in nutritional deficiences, and contributes to various intestinal diseases and disorders. The processing of starch from the sugar palm is of widespread occurrence in Malaysia; however, it appears to be more an industry of a local kampong nature and importance.

Although recognized as inferior to

73. Various products obtained from the sugar palm. Coarse, unprocessed, fibrous sago (upper left) in comparison with the cleansed product (upper right). A bottle of vinegar or *tjuka* (upper center). Two common forms of cigarette "paper" obtained from young leaflets (lower left and right). The felt-like tomentum, *lunglum* or *baruk*, obtained from the outer surface of the leaf base and used as tinder and caulking, is shown in lower center. See Fig. 66.

that of the true sago in both quality and flavor, the rather coarse sugar palm sago is considerably utilized by the poorer classes for its starch content in baking and other cookery, and as a general purpose paste and for starching clothing. An inferior bread (*roti kawung*), musty in odor and quite flavorless, is sometimes prepared from the meal. The markets or pasars quite frequently have various pastries (*atji kwé-kwé*) made from aren sago flour (Fig. 72). In Java a type of noodle or vermicelli (*mi* or *bami*) is sometimes prepared by the Sundanese from this flour and is eaten as such in soup or cooked with vegetables.

The starch obtained from the sugar palm is highly prized by the Filipino natives also. Burkill (7) reports that the pagan Mangyans of Mindoro supposedly subsisted in part on a regular diet of this meal. Occasionally, a form of tapioca is prepared in the Philippines by dropping wet pellets of the prepared starch on hot plates (Brown and Merrill, 6). According to Rumphius (20), in Borneo the *Arenga* sago meal is made into pellets (tapioca-like) and sold as *sagu Borneo;* it is also used there for making porridge. In Indonesia, the sago when mixed with a sweetened, often artificially colored syrup or coconut milk yields a starchy tapioca-like popular drink or refreshment called *tjendol.*

In the Philippines, after the starch has been removed the remaining fiber and finely chopped particles are sometimes boiled down into a gruel as feed for swine (Brown and Merrill, 6).

Beverage

While one of the most important economic products of *Arenga pinnata* is the brown aren sugar obtained from the sap (see Sugar Tapping and Sugar Processing), the latter is also used in various other ways. It may be drunk in its fresh state (called *legén* or *nira*) while fairly sweet, or allowed to ferment into a relatively mild wine or toddy (called variously *saguer, tuak manis,* or *lahang*), a kind of national drink in Indonesia. In the Philippines it is a highly prized beverage in either the fresh or alcoholic state (one form of a drink called *tuba*). In Java, the fresh sap is sometimes placed in tightly stoppered bottles and buried in the mud of fish ponds while undergoing fermentation for an alcoholic drink.

As an alcoholic beverage it may be mixed with various bitters as a type of wine, or it may be distilled into a type of brandy or gin called *arak,* much relished by the Chinese of Malaysia (a drink apparently forbidden to the Malayans at one time). Rumphius (20) reports that when the wine is properly prepared with bitters, it has been preferred by some of the Amboinese to Spanish wine. The various "bitters" impart a bitter taste to the wine, and putatively improve the alcoholic content while slowing down acetic acid formation. The preparation of bitters in Indonesia is in part derived from, among other plants, the green twigs of *Bauhinia lingua* DC. (*daun lidah-lidah*), and the crushed bark or stems of various plants such as *Cymbopogon nardus* Rendle (*seré* — not actually bitter), *Anthocephalus macrophyllus* Havil. (*samama*), *Breynia pubescens* Merr. (*aal*), *Citrus medica* L. (*djeruk katés*), and *Commersonia bartramia* Merr. (*kaju totara* or *blentjong*). (See Medicinal Uses.)

In some regions of Indonesia a refreshing beer-like drink is sometimes concocted from the sugar palm sap with a mixture of nutmeg (*Myristica fragrans* Houtt.) or *pala* and the stems of citronella grass (*Cymbopogon nardus* Rendle) or *seré.*

The fresh sap, when maintained at low alcoholic content, is also often used by some local Indonesian bakeries in the preparation of yeast (*induk roti*) from the presence of *Saccharomyces tuac* Vorderman. The alcohol obtained from fermented sap was formerly used by the Javanese in some of their dyeing processes. Calculations by Hines (2), in some Philippine experiments, indicate that with proper oxidation and no loss, each liter of fresh sugar palm sap containing 14 per cent sucrose should yield approximately 80 cc. of 90 per cent alcohol.

In Indonesia when the sap is allowed to ferment beyond the drinkable stage (often by placing it in a warm place or in direct sunlight for a week) a three to four per cent acetic acid or vinegar (*asam tjuka* or *tjuka djawa*) is formed which is used for cooking and in sauces to impart a sour or tart flavor. While the vinegar is being processed, dried fruit of a species of *Globba* is sometimes added; the Amboinese may include seed cakes of *Hornstedtia rumphii* Val. In Java, 10-20 tiny red peppers of *Capsicum frutescens* L. (*tjabe*) per liter of fermenting sap are often added in the process of making the *tjuka.* This additive supposedly inhibits other forms of bacteria, and allows the acetic acid bacteria to multiply and thus hasten vinegar formation. By using a similar additive, the Filipinos retard the fermentation process in making various potions from the sugar palm sap.

One liter of palm sugar sap under proper oxidation may yield as much as

1.8 liters of a four per cent vinegar, accoring to Hines. Thus, on account of the relative ease with which this type of vinegar is made, as well as the relatively high yield (although it is of poorer keeping quality and taste than cider or grape vinegar), considerable amounts are produced throughout Malaysia. Hines states that a large part of the *kaon* sap in the Cavite province of Luzon is converted into vinegar of this type.

Sugar Tapping

Mention has been made regarding the rather distinct developmental sequence of inflorescences in the sugar palm, namely, their development in a basipetal fashion, first from the top of the bole and then progressively downward. After the inception of flowering, the older the palm the lower the development of successive inflorescences in the axils of the leaf armor, until finally an inflorescence may be developed only three or four feet above the base of the bole. The experience of the native dictates whether or not it is worth tapping any further, or whether the tree is to be felled for its starch content.

The sugar palm is monoecious, with irregular flowering habits. The natives do not always know whether the developing buds will produce male or female inflorescences (*majang*). Observations indicate that considerable variation also exists in the number of male versus female inflorescences produced, as well as in the time and position of development. Initiation of flowering almost invariably begins with the development of female inflorescences, followed by the males. Records indicate that some sugar palms develop as many as six female inflorescences before a single male is produced. Once flowering has begun it is continuous for the life of the palm, with new inflorescences appearing before older ones are exhausted. Two to four or more inflorescences may be evident at any one time on young palms, whereas older ones may bear but one at a time.

Throughout Malaya and Indonesia the male inflorescences are called *majang bunga*. For some superstitious reason the natives refer to the sap-producing peduncles of the male inflorescences as "female" and vice versa. The Amboinese distinguish between the topmost, the longest, and the earliest males (which they regard as producing the best *saguér*) *as tema*, referring to successive males as *talae* (Rumphius, 20).

Inasmuch as considerable variability exists between the relative ages of the sugar palms upon reaching maturity, this is reflected in their flowering habit and concomittantly affects the age at which an individual tree may be tapped. Some trees may be tapped when five to six years of age, but the average appears to be around 10 to 12 years. There is also much variability in the yield from individual male inflorescences. The literature frequently and erroneously reports palm sugar as having been obtained from the sap of the fruit stalk and spathe. Actually, the female inflorescences contain comparatively little sap for tapping purposes.

As the inflorescences develop, the bracts usually shed, leaving the male or female flowers visible with their elongating peduncles. Throughout Malaysia the true female inflorescences are usually entirely disregarded for tapping purposes. When the male flowers begin to shed their pollen, the peduncle has usually reached its greatest stage of elongation, and in Java this is one of the criteria used to commence preparations for tapping. At Serdang, Malaya, the approximate period between the

74. A sugar palm tapping site approximately eight meters above the ground. Note the bamboo "ladder" and the sap collecting tube.

opening of the male bract and the start of the tapping operation is about 70 days (Milsum and Dennett, 17).

The process of collecting the sugar palm sap in Java is called *njadap;* the tappers are referred to as *panjadap* or *pengnjadap*. The Amboinese call their tappers *teifferars,* and to the early Portuguese in Indonesia they were known as *tiffadores*. In west Java the container for collecting the sap is known as a *lodong*. It usually consists of a piece of bamboo culm (*Gigantochloa* sp.) one to two meters long, with an inside diameter of about eight cm., and with all but the lowermost nodal diaphragm removed (Figs. 76, 77). This receptacle is capable of holding from three to six or more liters of sap. While the use of bamboo receptacles for this purpose is common throughout Indo-Malaysia, a variety of collecting vessels is used, ranging from simple assorted tins to rather ingenious traditional contrivances. For example, collecting-vessels were formerly made in Malaysia by utilizing the inner part of scraped sago palm leaf-sheaths. These were three-sided (concavo-convex in outline) and approximately 25 cm. in diameter by 45 cm. in length; the sheath edges wedged lengthwise into narrow bamboo culm sections which served as corners of the vessel (K. J. C., 13).

It is a common practice in Indonesia to use various types of bamboo ladders or *tangga sigai* in order to reach the tapping sites, which may be as much as eight meters or more in height from the base of the sugar palm bole (Fig. 74). Interestingly enough, these ladders may be of typical fashion with cross bars, or they may be more primitive in nature. They may consist of no more than a stout bamboo culm with only single toe holes notched out directly above each node, and thus seemingly require a very agile, strong-big-toed climber to make the rather hazardous ascents and descents. At any rate, the tapping preparations, like the subsequent twice-daily collections, are gymnastic performances requiring limberness and dexterity. In time, as the heavy inflorescences develop closer to the ground level, they may be tapped without need for a climbing device.

Considerable variation exists, among the tappers, as to the best way to extract the sap. This depends upon individual ingenuity, traditional methods, and local superstitions. Often, throughout Malaysia, the very heavy male inflorescence is tied to a higher leaf for support, then the entire peduncle is pounded lightly all around with a stick, small wooden mallet, or pestle, for several minutes each day for two to three weeks (in some instances as much as six weeks). This act results, presumably, in a loosening and partial rupturing of the internal tissues, and tends to produce wound tissue and stimulate the flow of sap to the injured regions. Often the tapper will resort to pricking the ped-

uncle at intervals, until he can ascertain this flow to his satisfaction. The inflorescence will then be severed only at its immediate base, without disturbing the remaining peduncle, before tapping the peduncle itself. At this stage of development the peduncle varies in length from some 45 to 65 cm. (Barrett, 2, 40-60 cm.). No effort is made to salvage any part of the removed inflorescence portion; it is usually left to dry, and sometimes used as a type of fuel.

Instead of pounding the peduncle, the Filipinos of the Cavite province of Luzon may tie a cord or strip of bamboo on the inflorescence, and wrench it gently up and down and sideways several times a day in order to obtain a similar effect. At the time of tapping, the inflorescence is removed as usual. Also, in the Philippines it is sometimes the practice to rub the end of the cut peduncle with the crushed fruits of the wild chili pepper, *siling labuyo* (*Capsicum frutescens* L.), and then to wrap the end in a banana leaf or other covering, for several days until the sap flows freely. Barrett (2) reports a greatly increased flow shortly after this treatment occurs, ". . . presumably influenced by the effect of the exceedingly penetrating principle of the peppers." Probably it is the result of stimulation created by the "rubbing" act rather than by the peppers themselves. In some regions the palm of the hand or the sole of the foot is rubbed over the cut to "stimulate" the flow.

In the Batak lands of Sumatra the sap-flowing end of the peduncle is called *mata ni bagot* or "eye of the sugar palm." It is interesting to note the various traditional and superstitious procedures used in order to maintain the flow of sap. Bartlett (3) observed that when flow did not occur a "medicine"

75. This male inflorescence on an old sugar palm was only two meters above the ground when tapped. See the following photograph.

76. Tapping of the male inflorescence shown in photograph 7. Note the short bamboo collecting tube.

(*obat*) had to be applied. If the peduncle end was merely dry and not running freely, treatment called for a vigorous rubbing with the sole of the foot (*tapak ni pat*), or rubbing with the fruit of a vine, of unknown genus, called *goppang batu*. If yellow in appearance, the end would be rubbed with the leaves of *torop* (*Artocarpus elastica* Reinw.); if black-spotted, it would be rubbed with an undetermined medicinal herb called *attaladen*. If entirely black, the surface of the end is rubbed over with kettle-bottom soot.

Once the inflorescence is removed, the sap tends to drip profusely. The peduncle is partially inserted into the open end of the collecting vessel, often with a banana leaf-segment tied to the opening in order to protect the contents from impurities. Collections are usually made twice daily, once in the morning and again in the late afternoon. Prior to each tapping, after the initial removal of the inflorescence, a thin slice (3-5 mm.) is removed from the end of the peduncle in order to hasten the sap flow. Without this procedure the cut surface in time tends to dry out and become plugged with gums and other residues, so that the flow is slowed considerably and eventually stops entirely. Often during the tapping period the base of the sugar palm becomes littered with these cuttings. The Filipinos often rub the aforementioned crushed fruit of the wild chili pepper over the end of the peduncle after each fresh cut.

At one time it was customary for the Malacca tappers to wait a few days after removing the inflorescence before they began the actual tapping. The peduncle end would be encased in a moist mass of rice and the tuber pulp of *Dioscorea cylindrica* Burm. (*D. hispida* Dennst.). It is of interest to note that according to Burkill (7), the great abundance of the latter species in parts of Malacca ". . . is a result of cultivation by tappers for this purpose."

The Balinese tappers cover the ends of the peduncles with leaves of a form of *Colocasia esculenta* Schott. (syn. *C. aquatile* of Rumphius) or *Leea aequata* L. (syn. *Frutex aquosus* of Rumphius) for a day. They make their daily slices prior to tapping; the slice, not completely removed, serves as a cover over the mouth of the collecting vessel. Rumphius (20) reported that the Amboinese made a cut or hole on the lower side of the peduncle before removing the inflorescence, and hung a container there until the male flowers had dropped off. Then they severed the inflorescence's remains and tapped by removing a thin slice each time.

In the Minahassa region of the Celebes the natives sometimes build fires at the base of the sugar palm, to "force" the sap flow. Or they may fell the palm with the crown lower than the base. The crown is then removed and the base is pounded to enhance the flow of sap toward the lower end. In the Batak area of Sumatra tapping is often accomplished by driving a knife into the bole; the knife is then pounded in order to create sap flow (Heyne, 12).

Barrett (2) questions the practical value of some of the foregoing manipulations to the native tapper, inasmuch as he is ". . . usually inclined to follow local superstitions and traditions in the matter of routine details in managing the tapping and gathering processes." However, investigations by others reveal that the preliminary pounding or wrenching of the peduncle and the subsequent removal of thin slices indeed does stimulate and enhance the flow of sap.

It is a general practice in the Philippines to use a new bamboo collecting

vessel (called a *panahod*) each day when tapping (Brown and Merrill, 6). Sometimes the Filipinos will place a small quantity of crushed ginger or wild chili pepper in the collecting vessels. The sap dripping down upon these additives apparently absorbs enough of the semi-antiseptic principles to inhibit the action of yeasts and bacteria for several hours. However, when the sap is to be processed for vinegar, no effort is made to deter fermentation in the receptacle. In Indonesia caution is used to sterilize the collecting vessels partially by smoking and/or rinsing them with lime water before reuse. Sometimes the bamboo tubes are merely rinsed with boiling water.

Considerable variation in yield from individual peduncles is recorded. While the volume of sap flow shows considerable fluctuation, the concentration of the sap remains fairly constant (Tammes, 23). Apparently the yield, according to the length of time that an individual peduncle may be tapped, is dependent to a certain extent upon such factors as age of the palm, developmental stage of the peduncle prior to tapping, length of the peduncle, time lapse between tappings, and undoubtedly such other factors as ecological conditions and geographical location. According to Tammes, the Minahassa (Celebes) tappers "... did not perceive any influence of the weather." However, it is claimed that in the Philippines the sap flow is usually greater during the rainy than the dry season; furthermore, it is greater during the night than during the day (Hines, 2). There also appears to be some appreciable difference in sap-flow of trees grown in low, wet soils where moisture is abundant and always available.

Lautier (15) states that at an altitude of 3,000 feet the sugar palm flowers at the age of 16 years, and at 1,800 feet at 12-13 years. At lower altitudes it has supposedly the highest sap yield, whereas at the higher elevations it produces for the longest period of time. Moreover, at the higher elevations the sugar palm may be tapped for a period of four to five years, and at lower elevations for only three years.

It is believed that the maximum flow per individual peduncle is reached within the first three weeks of tapping. Some tappings may stop rather abruptly, while others may flow for eight to ten weeks or more. In west Java sap has been known to run for an average of about five months, the poorest for about two months, and the best for approximately nine months. One 20-year-old sugar palm was reported to have yielded as much as 10 to 15 liters per eight-hour period. An exceptional farmer in western Java, working about 24 trees, reported that the first tappings yielded approximately seven liters per day, with successive peduncles yielding five to six liters per day, and finally diminishing to two or three liters daily on the lowermost peduncles.

While the average yield appears to range between three and six liters per day from a single peduncle, Hines (2) reports that in the Philippines the sap flow diminishes from 10 to 12 liters to two liters per day after about two and one-half months. According to investigations by Gibbs (10), also in the Philippines, a maximum of only two liters per day was obtained from two trees tapped under his direction. Tammes (23), working in the Celebes, recorded 7.4 liters of sap in 24 hours; his average was about five liters. It is of interest to add Blatter's (5) observation that the quantity of sap obtained

from a single sugar palm peduncle is comparable to that obtained from 10 coconut palm peduncles.

Tapping continues until it is no longer profitable in time and effort. Then a new inflorescence is tapped. Actually, three to ten peduncles may be tapped at any one time, depending upon the behavior and reaction of the palm; however, the average appears to be two. Apparently, where more than one peduncle is tapped from the same palm, the amount of sap as well as the sugar content is often proportionally less than that from the first inflorescence tapped. In Java this held true for inflorescences that were initially tapped, simultaneously, on the same palm, as well as for individual peduncles tapped at successively lower levels after the first inflorescence had been finally tapped out.

The "bleeding" of the sugar palm is strictly local in character, as compared with that of sugar maple (*Acer saccharum* Marsh.). If an attempt to obtain sap from the bole is made (similar to tapping for maple sugar sap) no sap flow occurs (Heyne, 12, notwithstanding; see pertinent remarks on page 25 of this paper). The flow comes solely from the severed or punctured male inflorescence peduncle. These observations are further corroborated by the work of Tammes (23). Furthermore, the sap flow is polar, and only the acropetal or distal end of the peduncle exhibits this phenomenon. Tammes placed the distal end in water and found that there was no indication of "bleeding" from the proximal or basipetal end. A rate of phloem exudate was calculated at seven meters per hour (11.5 cm./min.). The transport of sugar was calculated at 4.7 gm. sucrose/min./cm.^{2} in transection. Tammes also reports that 34 liters of sap were obtained in five days from one peduncle, with a computed sugar content of 16 per cent; which yielded 5¼ kilograms of sugar and 29 liters of water.

Sugar Processing

The freshly collected sap of the sugar palm is of an aqueous, almost clear consistency and of a light straw color; its flavor is slightly sweet. Upon exposure to the air it soon assumes a whitish turbidity and acquires a somewhat tart taste. The fresh sap consists principally of water and sucrose, with an admixture of traces of gums (0.25 percent), mannitol (0.17 per cent), proteins (0.04 per cent), and inorganic salts, all in the aggregate totaling about one per cent (Tammes, 23). Various reports indicate the sugar content varying from 14 to 16.5 per cent (Barrett and Hines, 2; Gibbs, 10; Milsum and Dennett, 17; Tammes, 23). For a comparison of the number of pounds of sugar obtained from one gallon of *Arenga pinnata* peduncle sap with that of other saccharíferous plants, see Table I.

Little or no reducing sugars occur in the fresh sap. The ratio of invert sugar to saccharose is very low, being approximately 0.13 per cent according to Milsum and Dennett (17); and with a nitrogen content of 0.005 per cent. In comparison with that of other saccharíferous plants, the sap is extremely low in acidity (see Table II); samples indicate only a trace of acid (Hines, 2). The untreated sap, however, ferments rapidly, with a tendency to increase in acidity.

The procedure followed in processing palm sugar in general is as varied as the ethnic groups involved. There is some evidence that the people of Southeast Asia invented the art of sugar-making, and it is conceivable that man's first source of sugar may well have been obtained from *Arenga pinnata.*

In Java, if the sap is to be converted

Table I

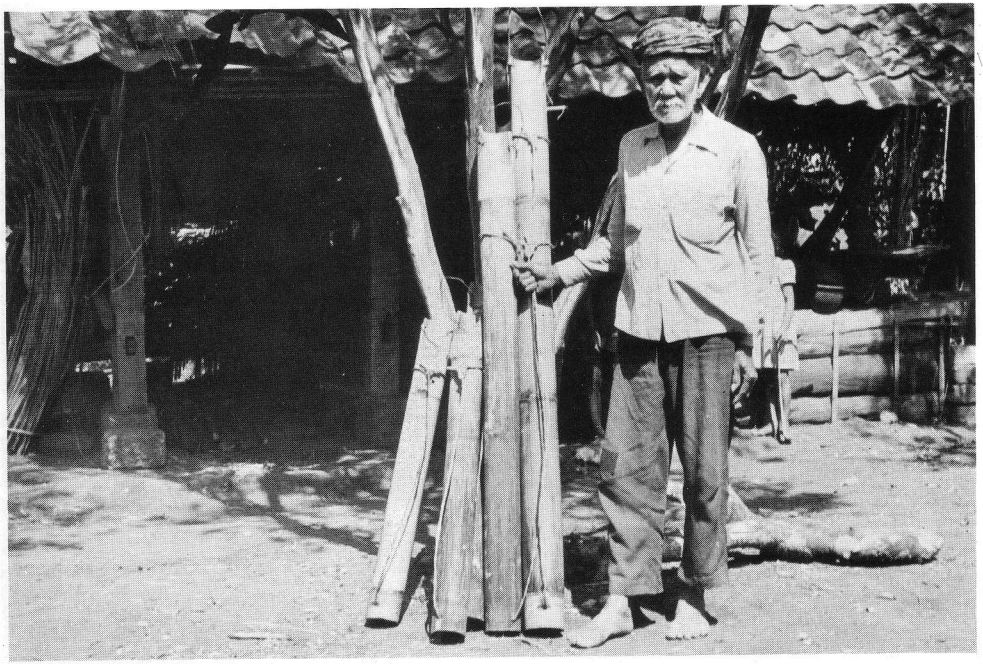
Approximate number of pounds of sugar obtained from one gallon of fresh sap

Sugar cane *Saccharum officinarum*	1.00 lbs.
Sugar beet *Beta vulgaris*	1.50 lbs.
Sugar maple *Acer saccharum*	0.16 lbs.
Sugar palm *Arenga pinnata*	0.50 lbs.

Table II

Partial analysis of the fresh sap of some sacchariferous plants

Plant	Sugar source	Invert sugar	Sucrose	Non-sugars (organic)	Non-sugars (inorganic)	Acidity (pH)	Water	Nitrogen
Sugar cane *Saccharum officinarum*	woody culm	−1.00%	±14%	7%	3.5-4%	5.5-6.6	69-75%	0.14%
Sugar beet *Beta vulgaris*	fleshy root	−0.125%	±17%	2%	0.7%	6.2-6.8	77%	0.83%
Sugar maple *Acer saccharum*	sapwood	−0.10%	± 2%	1.8%	0.33%	6.5-7.0	95%	0.93%
Sugar palm *Arenga pinnata*	male peduncle	−0.13%	±15%	0.30%	0.02%	trace	80-85%	0.005%



77. A Sundanese sugar palm tapper from West Java with his bamboo collecting vessels. The palm sugar is processed in the hut behind.

into sugar, it is taken to a small processing hut provided with an open-topped oven-like hive-shaped firebox or clay furnace in which a hot wood fire is maintained. The content of the bamboo collecting vessels is emptied into a metal container of three to six liter capacity. This container is in turn set into a somewhat larger metal receptacle containing boiling water. The entire apparatus resembles a large open-type double boiler (Fig. 78). The fire is maintained for three to four hours while the evaporating process takes place (called *ngawedang* in west Java). As the sap becomes condensed into a brown molasses, various plant materials may be added to prevent the liquid from boiling over. Pieces of hard coconut (*kelapa*) endosperm, the seeds of *Ricinus communis* L. (*dulang-dulang*), the hard seeds of *Aleurites moluccana* Willd. (*kemiri* or *muntjang*), or even the mature bony seeds of sugar palm itself may be utilized for this purpose. Burkill (7) also mentions the use of a resinous matter (*laru*). In addition, drops of coconut oil or pieces of beeswax may be added (this process is called *mepes*) as a supposed preventative measure against the excessive adherence of the sugar to the molds, and to facilitate the removal of the crystallized sugar afterward.

78. Sugar palm sap being boiled in an oil drum section. Note the hive-shaped firebox.

After the sugary condensate is boiled

down further, so that drops of it form a soft ball in cold water, the container with the now much-thickened syrup, or jaggery, of considerably heavier-than-molasses consistency is quickly removed from the heat and poured into a heavy iron basin installed in a scooped-out depression in the earth floor of the hut. It is whipped continuously with a wooden paddle until it further thickens (a process called *guis*); any foreign matter is removed. A bamboo mat is spread out, its surface slightly moistened with water, and the molds (*ganduan*), first dipped in water, are placed on the matting. The molds may have been partially sterilized in boiling water beforehand, but more often they have not — usually they are merely washed in water and allowed to sun-dry. The partly crystallized sugar is then quickly removed from the basin with a small iron dipper and poured into the molds (a process called *ngagandu*). The molds are simple rings, cut from the internodes of a bamboo (*Gigantochloa* sp.), and they are usually about one-quarter of an inch thick, three-quarters to one inch in height, and two to two and one-half inches in outside diameter (Fig. 80).

Approximately five minutes after the pouring (the act is termed *antjret*), the sugar has crystallized further and hardened sufficiently to be removed from the ring by gentle finger pressure. This product of the sugar palm, the so-called *gula kawung* (*gula Malacca*), is light brown at first, but darkens somewhat upon aging. Sugar of an inferior grade is often of a dirty blackish-brown hue and may contain many impurities. Color variation depends in part upon the natural contents, amount of additives, and cleanliness in processing. The proteins, gums, and pectins apparently impart the brownish color. The sugar also contains albuminous matter which can be eradi-

79. Bamboo drying mat and utensils utilized in the processing of palm sugar in West Java.

80. Bamboo rings used in molding palm sugar.

81. Freshly made "cakes" of a good quality palm sugar.

82. Packages of sugar palm "cakes" wrapped in dry banana leaves and ready for marketing.

cated by thorough boiling, but this tends to make it soft and hygroscopic, and to induce fermentation, according to Brown and Merrill (6).

The little round sugar cakes are about three-quarters to one inch in thickness and about two inches in diameter (Fig. 81). Approximately six to seven cakes are usually obtained per liter of sap. About one-half hour after the cakes have been processed and allowed to cool, they are wrapped and tied in packets of ten, in dried banana leaves of *Musa brachycarpa* Backer, *pisang batu* (Fig. 82), or in woven leaflets of the sugar palm. The cakes remain solid as long as they are kept completely dry; as soon as moisture is absorbed they deliquesce easily.

Gula kawung possesses somewhat the color and taste of brown sugar obtained from processing sugar beets and sugar cane, but it obviously lacks the refinement. As far as can be determined, the production of *Arenga* palm sugar has never reached a commercial scale. Apparently, even during colonial administrations, no systematic attempts were made to utilize the tree in agricultural practice. It is principally a kampong venture, with the cakes finding their way only into the local *pasars* or markets for domestic consumption. However, some investigators are optimistic and enthusiastic in their reports regarding the commercial possibilities (Barrett, 2; de Vry in Watt, 26; Hines, 2; Roxburgh, 19), while others consider it commercially unprofitable.

Fibers

The black and tough, horsehair-like fibers obtained from the broad leaf bases of the sugar palm (Figs. 83, 84), provide an abundance of material of both domestic and commercial importance (called in Indonesia - *indjuk*, Malay - *eju*, Malacca - *gumuti*, Guam - *cabo negro*, and in the Philippines - *cabo negro* or *yunot*). The Filipinos consider the fiber as the most important industrial product of the palm (Fealy, 9). Although of great durability, the fibers are fairly coarse, sharp, and rather stiff (less pliable than hemp fibers and thus not used for fine cordage). At one time they were used in Europe for industrial purposes. Heyne (12) reports that the Dutch exported some 31 tons of the fiber from Java in 1912.

Since the fiber is very durable, possesses great strength, and is extremely resistant to the action of sea water (probably more so than any other known natural plant fiber), it has served as excellent material for covering submarine cables and subterranean parts of telephone and telegraph poles. It is believed that the fibers in the form of a wrapping should afford considerable protection against the teredo or shipworm to pilings in salt or brackish waters. The Sumatrans often wrap the end of a post with the fiber prior to setting it in the ground as a supposed precaution against termites. Sometimes the fibers are also mixed with lime or mortar as an added measure. In Indonesia, dams have been constructed with layers of the *indjuk* inserted between the

83. A profusion of horse-hair-like fibers within the leaf base of a sugar palm. The longer and coarser splint-like fibers have already been removed. See Fig. 65.

stones, on the premise that as the mud settles the dam becomes more watertight.

To the native fisherman of Malaysia the fiber serves as excellent material for fish netting and fishing lines, seines, and other fishing gear, and for sundry other purposes aboard their fishing boats or *perahu* (*proa*). The fiber is apparently not affected by heat or moisture, although its tensile strength does not approach that of coir (coconut fiber) or hemp. However, this is somewhat debatable, according to the literature. Cordage (*tali indjuk kawung*), anchor ropes, and hawsers are commonly plaited from the sugar palm fibers, although the natural stiffness of the fibers and their prickliness caused them to be in disfavor for use aboard old sailing vessels, where considerable rope (*tali temali*) had to pass through the rigging. The fiber also lends itself as a durable material for caulking boats.

In India the black fibers, known as *gomuta* or *gomuti*, at one time served as an important source of mechanical filter material. The fibers have also been considered as a possible substitute for horsehair in upholstery and in the manufacture of wigs. Formerly the fibers were even put to use in the form of false beards by the Nias warriors on an island off the northwest coast of Sumatra (Burkill, 7).

Although the fibers of the sugar palm have perhaps been put to their greatest use as rough cordage (Fig. 85), they also serve many other utilitarian purposes. The natives find that the fibers and the cordage made from them are often even more adaptable than the ubiquitous scandent rattans, or *rotan* (*Calamus* and *Daemonorops* spp.),

84. The black horse-hair-like fibers of the sugar palm being transported to market. Each bundle may weigh more than 50 kilograms. This *tukang* had conveyed his load over seven kilometers.

found in the forests. In many kampongs the fibers are put to considerable use in weaving and sewing, and for stitching thatch. A type of cloth is woven by the natives of Brunei and Sarawak, and belts from coils of the black fibers are fashioned by the Sakai women of northern Perak, Malaya. In Indonesian Borneo, now known as Kalimantan, the natives often adorn themselves with various ornaments woven from the black fibers. The Sea Dyaks of Sarawak weave bracelets and anklets from the fibers; while in Sumatra the fibers are made into a heavy thread for various purposes — including use as strings for the two-stringed lute or *kasapi* of the Bataks. In the Toba region the black fibers of the sugar palm are called *riman*. In Vietnam and adjoining countries the hatmakers select certain of the fibers to serve as threads for stitching together palm-leaf hats (Burkill, 7). The Javanese manufacture a large variety of items for domestic use from the fibers, including doormats of a blackish hue (Fig. 85). They also sometimes burn the fibers as a mosquito repellant. The Indonesians may wrap these fibers around various types of fruit in order to enhance their coloration prior to marketing them. For example, Ochse (18) mentions the use of *indjuk* as a wrapper around the fruit of the palm, *salak* (*Salacca edulis* Reinw.), ". . . so that they may get a fine dark brown colour."

That these fibers were apparently highly valued by the early Spaniards also is indicated by Rumphius' report (20) that they were paid as tribute by the natives of some of the Philippine islands.

The durable, almost imperishable nature of the sugar palm fibers is indicated in a report by Rumphius. He states that an article of treasure, wrapped in the "black gomuto" and buried for more than one hundred years, was recovered and the fibrous material found to be practically intact. Burkill (7) mentions a 209-year-old anchor, exhibited in the Sandakan museum of North Borneo, with some of the cable plaited from these fibers still intact. Blanco (4) states that if the fiber is utilized as thatching material, it should last up to 30 years. However, other "well-informed Filipinos" have claimed that it will last for a century (Fealy, 9).

Interspersed among the horsehair-like fibers at the base of the sugar-palm-leaf petiole are stiffer and thicker (3-5 mm.), splint-like fibers (*pansuri*), which throughout Malaysia are used for making a great variety of brushes and brooms (Fig. 85). These heavier fibers (actually ". . . the fibrous remains of the larger vascular bundles" — Tomlinson, 25) are used extensively as broom "straws." When bundled to-

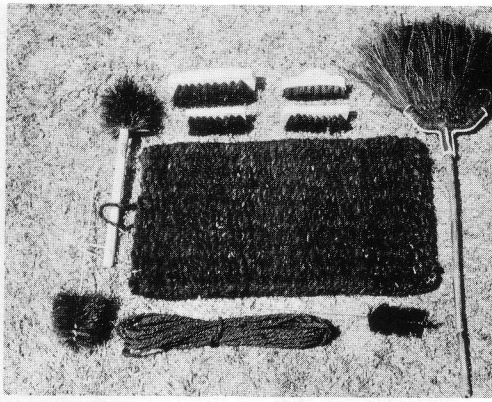
gether they become what looks like a "witch's broom" — and in fact serve as a broom (a *sapu lidi* or *sapunjer*). The same straws or splints are often woven by the Javanese into various types of basketry (*rigen*). Incidentally, splints for basketry may also be obtained from portions of the leaf rachis other than from the base. These occur in various permanent colors ranging from greenish-white to gray-green, through shades of a rich dark red to brown or nearly black, depending upon the age of the leaf and whether or not the epidermis is first removed. By working these colors, a variety of interesting patterns is accomplished by the Filipinos on screens, stands, matting, boxes, tables, and other lightweight articles of furniture.

The petiole bases often assume the appearance of mat-like "sheets" of reticulate fibers. When a number of these sheets are overlaid and secured they are sometimes used as sieves. The same material may be cut into different sizes and utilized as very durable, though somewhat flammable, roofing material. In the Philippines, thatch-like raincoats are sometimes woven from these fibrous sheets, as well as from the sugar-palm leaflets themselves.

Synthetic fibers of today have somewhat supplanted the natural product. Nevertheless, to millions of natives throughout Southeast Asia and Malaysia, the fibers of the sugar palm will probably continue to play an important part in their daily life.

Miscellaneous Uses

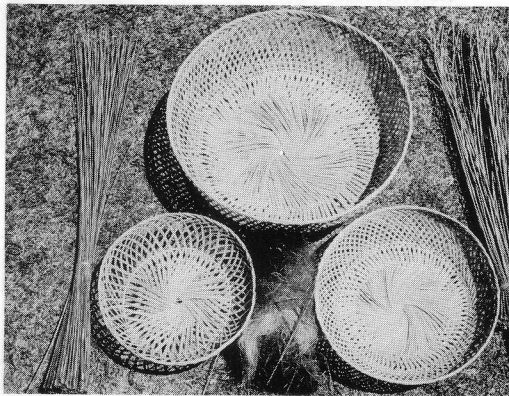
In addition to using the petiole base fibers for cordage and thread, the Indonesians often utilize the leaflets themselves for the purpose. The leaflet midribs (*njehreh* or *lidi*) may also serve for a hundred-and-one uses, such as material for brooms, basketry, fishing



85. Rope, broom, doormat, and various brushes made from the black horse-hair-like fibers of the sugar palm.

implements, and the like (Fig. 86). Fine cigar boxes were once fashioned out of the scraped and split midribs. The Balinese sometimes make a sort of jew's harp (*genggong*) from a dried slit leaflet of the sugar palm; for a handle or holder they use the leaflet midrib of the lontar or palmyra palm (*Borassus flabellifer*). In Java, the very young, etiolated leaflets are cut and used as cigarette wrappers (*duan kawung* or *duan rokok*) for the native cigarettes (Fig. 73). Formerly, throughout Malaysia, writing pens (*harupat* or *kalam kobong*) were

86. Basketry and brooms made from the leaf midribs of the sugar palm. A small bundle of the horse-hair-like fibers from the leaf base is shown in lower center.



87. The two smaller drums, *dog-dog*, on the right are made from a single sugar palm trunk. Those on the left are made from the trunks of the *nangka* or jackfruit (*Artocarpus integra* Merr.).

made from the leaflet midribs, as well as from the thicker, petiole base fibers — the *pansuri*. Also, school children once etched Arabic characters on clay-filled boards with these styli (Burkill, 7; Teijsmann, 24). From the same thick fibers the natives of Macassar used to make darts for their blowpipes. This type of dart apparently splinters when it penetrates, and causes wounds subject to infection (Rumphius, 20).

Entire leaves are often utilized as a durable, but somewhat flammable, decay-resistant roofing material (*atap*). The leaflets are used for thatching and the rachis as rafters; or, for the latter, a particular variety of bamboo may be substituted. In northern Sumatra the split leaf rachis is sometimes used as a lathing material. In Malacca the entire leaves are used for constructing the roofs of mosques. The Filipinos also highly prize the leaves as a natural roofing material. Elsewhere the leaf rachis is sometimes fashioned into fine walking sticks and canes. The relatively broad leaflets are commonly used as a wrapping material and for packing in the kampongs. Sandals are fashioned from the broad leaf bases themselves, as well as from the fiber reticulum alone.

The Javanese often plait flower baskets (*pas bunga*) from the young long branches or rachillae of the inflorescences.

The fibers of the roots are also used for a variety of purposes. In the Celebes the root fibers have been woven into capes (Heyne, 12), while the Bataks of Sumatra use them in basketry. The central portion of the roots provides excellent and much preferred buggy whip material, and it is also sometimes used for fishing twine. In Java the water-macerated roots are utilized as a durable matting (*sekung*). At one time hats were also made from this root fiber. In the Philippines the roots are sometimes burned as a mosquito repellant.

The abundant and very hard fibers of the bole yield a beautiful "grain" which will take a fairly high polish. This relatively thin (2-3 cm.) ligneous portion of the sugar-palm trunk is often used for making various articles of furniture and utensils, canes, swagger sticks, axe handles, and occasionally very durable canoes or *perahu lesung*. This "woody" material is of such hardness that an axe readily rebounds from it.

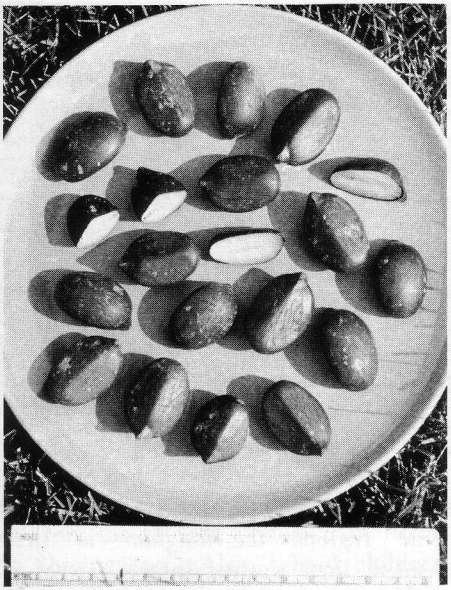
The "outer bark" of the trunk was used by the early Amboinese soldiers to sheath their swords and knives. According to Skeat and Glagden (21), the early pagan tribes, the Jakuns of Malaysia, used the "wood" to make butts for their blowpipe darts. In view of the inherent hardness, durability, and decay resistance of the boles, the natives are provided with material for drain pipes, gutters, troughs, and underground water conduits. In the Celebes the natives use it frequently for flooring. In Indonesia, entire bole sections are occasionally hollowed out, smoothed, and made into various bongo-type drums (*dog-dog*) by stretching and tying scraped carabao (water buffalo) or some other skin over one or both ends (Fig. 87).

As mentioned previously, the lower or abaxial surface of the leaf petiole is covered with an abundance of soft, felt-like or moss-like hairs (Fig. 66). In the Philippines it is known as *barok*; among Indonesians it is *lunglum* or *baruk* (the *zwam* of the Dutch). This material serves as a fine caulking or oakum for boats and as a filler for pillows. The aboriginal Malayans used this substance as a wadding to prevent windage in shooting with their blowpipes (Skeat and Blagden, 21). Its greatest use is as a tinder for starting fires, primarily with the primitive flintstone and steel. According to Heyne (12), the former Dutch East Indies exported 60 to 75 tons per year to Singapore.

It is of further interest to note the various rituals, and the variety of additives mixed with this dried tomentum apparently to enhance its combustibility. In the Philippines the tinder is often prepared by soaking the *barok* in the juice of the banana stalk or that of *Kolowratia elegans* Presl (*talbák*), or in a lye made from the ashes of *Vitex negundo* L. (*lagundi*) and then dried. In Java it is collected, dried, and used *per se*; or it may be mixed with the ashes of rice husks and a little water, allowed to dry thoroughly, and stored in a tinder box for future use. Among other plants that the Indonesians use as admixtures are leaf fragments and ashed leaves of *Citrus medica* L. (*djeruk katés*); *Homalonema* sp. (*tjariang*); *Hibiscus similis* Bl. (*waru gombong*); *Vitex trifolia* L. (*lagundi*); *Mallotus moluccana* Muell.-Arg. (tétér); *Ipomoea peltata* Chois. (*areuj tjarajun*), and the ashed pericarp of *Durio zibethinus* Murr. (*durén*). In some regions the *lunglum* is first cleaned, then washed in the sap of a *Globba* sp., and finally sun-dried to yield a fine spongy tinder.

The pericarp of the sugar-palm fruit contains an abundance of calcium oxalate acicular crystals that must be carefully removed before the immature endosperm within the seeds or kernels can be consumed. Otherwise these raphides will cause an intense and very painful swelling and burning sensation to the mouth and mucous membranes, as well as to other tender regions of the body. However, wild pigs do not seem to be affected in their fondness for the rotting fruit. In fact, the natives on Bangka formerly entrapped swine by building a palisade with a heavy trap door around a fruit-bearing *Arenga pinnata* palm.

Since the juice of the crushed pericarp is extremely irritating when taken orally (it is also reported to be dyspneic), it has figured in the history of various criminal poisoning ceremonies by the natives. This juice has also been used in fish ponds to render the fish so helpless as to make them float on the



88. Seeds of the sugar palm.

surface for an easier catch. The innumerable raphides apparently partially paralyze the gills.

According to Burkill (7), the Javanese town of Surabaja was captured in 1545 after the local water supply was poisoned with the carcasses and pulped fruit of the sugar palm. Blanco (4) relates how the macerated fruit pulp and water was used, in former times, to pour over the attacking Mohammedan pirates in the Philippines. In early wars, when fortifications in the Moluccas were beleagured, the defenders put to practical use a similar "hell water" (20). This means of defense, Rumphius states, ". . . causes such a burning and pain, that one could become a lunatic."

Brown and Merrill (6) mention how crushed fruits were strewn, designedly, around fish ponds in the Philippines, to prevent thievery at night. The raphides are extremely irritating to the bare feet of the poachers.

Formerly in Indonesia, when the seeds (*bidji; chit-luk* in Thailand) of the sugar palm were allowed to mature, the dull metallic gray-brown, hard kernels (Fig. 88) were often cleaned and polished to serve as touchstones (*batu bidji*), to test the purity of silver and gold. The kernels are still used as toys and in games (*main ukik*) by Malaysian children in the kampongs.

Medicinal Uses

The common practice of native medicine is almost always purely empirical, and often based upon tradition and superstition. The sugar palm sap is used for medicinal and therapeutic purposes in the native villages throughout Malaysia, and particularly in Indonesia. Dutch investigators have ascribed possible lactigenous potentialities to the sap itself.

In Java, concoctions prepared from the roots of the sugar palm are often used as a medicine for kidney stones. Supposedly, they hasten the dissolution of the stones. Both in the Philippines and Indonesia the fermented sap is popularly utilized for its putative curative properties against tuberculosis. In Java, the fermented sap is often consumed, in certain prescribed dosages, as a preventative against dysentery or Indian sprue, as well for chronic constipation and hemorrhoids. It has also been used as a diaphoretic and uriniparous agent. The fresh sap (*legen* or *nira*), if drunk on an empty stomach or taken in too large quantities, acts as a purgative. Conversely, the Moluccans will not drink the fresh sap, considering it to be unsanitary and causing diarrhoea.

Throughout Malaysia the fresh sap is often allowed to ferment into a palatable light wine, called *saguér, lahang,* or *tuak manis* (see discussion under Food and Beverage). In Indonesia, various bitters, e. g., the bark of the *niri* or *njiri* tree (*Xylocarpus moluccensis* M. Roem.), the roots of the *sesoot* tree

(*Garcinia picrorrhiza* Miq.), or the crushed bark, leaves and fruit of the tree *slatri* or *sulatri* (*Calophyllum soulattri* Burm.) are compounded into a medicinal stomachic and apertif known as *obat saguér*. Many other herbs may be added in lieu of the "bitters" for such concoctions of putative medicinal value.

The felt-like tomentum (*lunglum* or *baruk*) that covers the leaf base is often used as a styptic and cicatrizant, and for other purposes (see Miscellaneous Uses).

Superstitions and Ceremonials

In certain regions of Java superstition forbids the planting of the sugar palm seed in gardens or along rice fields. It is believed that only civet cats plant the seeds and that for man to do so would offend the gods. Elsewhere in Indonesia — for example in the Toba lands of the Bataks of Sumatra — this belief is not held, and the seeds are planted without fear. Curiously enough, the planting of sugar palm seeds is performed primarily by the women of Asahan (northeast Sumatra), in order that the trees may become more "fruitful" and yield more sap — an example of "sympathetic magic" according to Bartlett (3). This is also a common practice among the Nias islanders off the coast of northeast Sumatra.

Throughout Indonesia there are many bizarre kampong legends relative to the embodiment, and female personification, of the sugar palm. The Asahan natives hold the palm in reverential and superstitious esteem, to the extent that altars are often constructed specifically from the leaves, upon which offerings (*búlunk ni bagot*) are tendered to propitate evil spirits. Bartlett reports that various magical *apparati* often adorn the notches cut into the leaf rachis, in addition to the offerings themselves. In the Moluccas the sugar palm is known as *sého;* there too, it is held in high and reverential esteem, because it is their god Kiriwaerong who presides over the tree.

The following legend among the Tobanese of Sumatra illustrates the importance and reverence still attached to the sugar palm. The daughter of a chief was to be married against her will. To escape from the hated bridegroom she leaped from her window and disappeared into the ground, and from that very spot the sugar palm sprang up. The natives visualize the wine (sap) from the tree as her tears, the black fiber as her hair, and the leaves as her ribs. As the tree is tapped the natives often chant: "Princess, have pity upon us and increase your tears" (Kruijt, 14). In their traditional custom Indonesian tappers may chant an enjoinder to the tree "to be generous." To the Toradjas of central Sulawesi (Celebes), the sugar palm is first personified as a maiden, to be wooed and won prior to tapping, and then as a full-breasted mother who will be bounteous with her milk (sap) during the actual tapping operations.

Another legend tells how the dying sister of a man who was heavily in debt prayed to the gods to be transformed into a tree that would provide him with the means of paying off his debts. After her burial, the sugar palm sprang from her navel; out of her forehead grew the opium plant, from her feet arose the banana plant, while palm wine is the milk from her breasts (Kruijt, 14).

Among the Bataks the term for the sugar palm is *bagot*. These natives of north-central Sumatra use the same euphemistic word for the female breasts. In the Toba region the carved representations of a woman's breasts, adorning the fronts of certain houses, are called *bagot ni rumah* or "breasts of the house." Bartlett (3) states that

". . . only the closest association with this most useful palm would have led to its personification and to the invention of the Batak counterpart of the Daphne myth."

One of the many Balinese birth ceremonies involves an elaborate mixture of various bulbs, rhizomes, roots, leaves, and fruit of herbaceous and woody species along with salt, *Arenga* palm sugar, and the human placental tissue of the afterbirth.

Skeat (21) relates the anecdote of a Malay birth ceremony in which the midwife (*bidan* or *dukun beranak*) chews a betel quid containing, among a variety of substances, twigs (*segar kabong*) of the sugar palm and then proceeds to expectorate on the navel of the infant. The act is supposedly protective in nature. Skeat and Blagden (21) report that the aboriginal Malayans or Jakuns used a large bunch of sugar palm fibers as a signal to passersby not to approach a place where a woman was in labor. Traditionally, bundles of these fibers "as big as a child's head" were kept in constant readiness.

In various parts of Malaya charms are made from the *ejok* or *eju* fibers, as well as from wild boar bristles, to ward off evil spirits. Malay boatmen sometimes fasten sections of a sugar palm leaf (*segar kabong*) to the top of their masts as a "protective," to prevent the much-feared Water Spirit (*Hantu Ayer*) — a form of St. Elmo's fire or light — from settling upon their vessel (Skeat, 21). According to Teijsmann (24), it was believed in some regions of the old Dutch East Indies that if birds or fish were impaled on the splint-like, thick *pansuri* fibers and then cooked, those who ate them would suffer intense headaches and vertigo.

Barrett (2) relates an instance of superstition in the Philippines. The natives attributed the cessation of sap-flow, in a certain sugar palm that they were tapping for record flow, to the resentment of the tree towards tapping by those "not the owner of the palm."

Literature Cited

1. Backer, C. A., and O. Posthumus. 1939. Varenflora voor Java. Uitg. van's Lands Plant. Buitenzorg, Java.
2. Barrett, O. W., and C. W. Hines. 1914. The sugar palm. Philippine Agric. Rev. 7 (5):209; 216-228.
3. Bartlett, H. H. 1919. The manufacture of sugar from *Arenga saccharifera* in Asahan, on the east coast of Sumatra. 21st Annual Rept. Mich. Acad. Sci.; 155-165.
4. Blanco, M. 1845. Flora de Filipinas. ed. 2.
5. Blatter, E. 1926. Palms of British India and Ceylon. Oxford Univ. Press. London.
6. Brown, W. H., and E. D. Merrill. 1920. Philippine palms. Minor products of Philippine forests. Bur. Forest. Bull. 22: 150-158.
7. Burkill, I. H. 1935. A dictionary of the economic products of the Malay peninsula 1: 230-236. Crown Agents for the Colonies. London.
8. Darlington, C. D., and A. P. Wylie. 1955. Chromosome atlas of the flowering plants. George Allen and Unwin Ltd. London.
9. Fealy, Nellie E. 1923. Sugar-producing palms. Facts about sugar. 17(3): 58-61.
10. Gibbs, H. D. 1911. The alcohol industry of the Philippine islands. Part I. Philippine Jour. Sci. 6(3): 147-206.
11. Handbook of industrial plants in common use. 1915. Bull. 54. Bureau of Education. Manila.
12. Heyne, K. 1950. De Nuttige Planten van Indonesie. ed. 3, 1: 383-389. s'-Gravenhage. Bandung.
13. K. J. C. 1911. The sugar palm of the East Indies. Jour. Royal Society Arts. 59 (3,048): 568.
14. Kruijt, A. C. 1906. Het animisme in den Indeschen Archipel. p. 153. s'-Gravenhage
15. Lautier, O. A. B. 1890. De arenboom. Tijds. Nijv. Landb. Nederlandsch-Indie 41: 95-97.
16. Merrill, E. D. 1922. An enumeration of Philippine flowering plants. 1(2): 160-161.
17. Milsum, J. N., and J. H. Dennett. 1930. A preliminary note on the sugar palm. Malayan Agric. Jour. 17: 449-453.
18. Ochse, J. J. 1927. Indische Vruchten. Weltevreden. pp. 180-182.
19. Roxburgh, W. 1874. Flora Indica: 669-670.
20. Rumphius, G. E. 1750. Herbarium Amboinense. Vol. 1.
21. Skeat, W. W. 1900. Malay Magic. Macmillan Co. New York.

22. ————————, and C. O. Blagden. 1960. Pagan races of the Malay peninsula 2: 22.
23. Tammes, P. M. L. 1952. On the rate of translocation of bleeding-sap in the fruit stalk of *Arenga*. Proc. Konink. Nederl. Akad. Wetenschappen, Ser. C. 55(2); 141-143.
24. Teijsmann, J. E. 1844. De Arenboom. Indisch Magazijn 1(4-6): 1-20.
25. Tomlinson, P. B. 1962. The leaf base in palms; its morphology and mechanical biology. Jour. Arnold Abroretum 43:23-50.
26. Watt, G. 1899. A dictionary of the economic products of India 1: 302-304.

Prof. Dr. Max Burret, 1883-1964

Dr. Eva Potztal of the Botanischer Garten und Museum at Berlin-Dahlem, Germany, has written of the death of Prof. Dr. Max Burret on September 19, 1964, after a long illness. Dr. Burret was the foremost student of palms for many years and was awarded the Founder's Medal by the Fairchild Tropical Garden in 1958. A biographical account by his associate, Dr. Potztal, and a list of his publications on palms appear in *Principes* 2: 87-91. 1958.

NEWS OF THE SOCIETY

Since the biennial meeting, held in California in April, the activities of the Society have been more or less quiescent. Members have been doing quite a bit of traveling. The immediate past president, David Barry, Jr., and his wife Emilie, have been on a leisurely trip around the world, during which they visited a number of our members abroad, including M. J. Marnier-Lapostolle, owner of the outstanding botanical garden "Les Cedres", at Saint-Jean-Cap Ferrat, on the French Riviera, and M. Marcel Lecoufle, noted authority on bromeliads, at Boissy-Saint-Leger, (S. & O.), France. Monsieur Lecoufle won 25 prizes at the famous exhibition "Les Floralies de Paris" last April, including the *premier grand prix d'honneur*, thus becoming the grand sweepstakes winner. His reproduction of a primitve village with thatched huts, waterfall, stream and many trees holding orchids, bromeliads and other choice plants, was truly outstanding. Congratulations, M. Lecoufle!

Several members, including the editor of *Principes*, Dr. H. E. Moore, Jr., (fortunately recovered from a severe bout of malaria contracted on his around-the-world trip last winter), attended the International Botanical Congress at Edinburgh, Scotland, where botanists from the world over gathered to give and hear reports of their recent research work.

The Society's Vice-president, Otto Martens, and his wife took a leisurely trip up the West Coast to Vancouver, then by train across Canada, thence by car through the glories of the New England fall to New York, where they visited the Fair.

Your secretary spent two thrilling weeks in Colombia, seeing many fascinating plants and birds, motoring through the scenic Andes, and meeting several outstanding botanists, including Dr. H. Pérez Arbeláez, Dr. J. Idrobo and Dr. Alvaro Fernandez P., who showed us many interesting things which otherwise we might have missed. She brought back seeds of two small palms new to her, and so far unidentified.

James H. Specht, a San Diego member, spent a few days in southern Florida, where he was specially struck with the great number of coconut trees, including the large groves on Key Biscayne. He also became enamored of key lime pie! Another recent visitor to Miami was Mr. Oroth Choulamountry, of the Department of Agriculture, Vientiane, Laos. Much impressed by the palms he saw at Fairchild Tropical Garden and at the USDA Plant Introduction Station, he joined the Society and asked to have seeds sent to him after his return to Laos. It is hoped that we

can obtain through him seeds of some of the Laotian palms.

The Society's founder, Dent Smith, suffered a severe injury to his leg in a boating accident late in September. He has been confined to his bed, suffering great pain, for several weeks, but by the time this appears in print he very probably will be fully recovered.

Stanley Kiem, Superintendent of Fairchild Tropical Garden, is at this writing on a 'round the world trip, looking for some fine new material for the Garden's collections, including some new cycads. Dr. John Popenoe, the Garden's director, and Gerard Pitt, volunteer worker at the Garden, have made several trips to the Bahamas, collecting plants not before introduced into the United States. The Garden expects to establish a large collection of Bahamian plants suitable for growing in Florida.

The California branch of the Society met on September 6th at "Cycad Hill", home of the out-going chairman, Loran Whitelock and his wife Eva. Attendance was excellent, and a lively plant auction helped to replenish the branch's treasury. James H. Specht, of San Diego, was elected chairman for the coming year.

The South Florida branch, under the able direction of chairman Alix Muldavin, has held a number of meetings and field trips. Billings McArthur, of Winter Park, Fla., was kind enough to drive down, bringing the slides he took during the biennial meeting in California, for the delectation of those who were unable to attend.

LUCITA H. WAIT

". . . . I call attention to one of the commonest yet one of the strangest attitudes in the observation of palms by fanciers of them, — the habit of picking out dissimilarities between individual trees as if the differences were marks of species. This practice appears to be general among palm lovers and perhaps even among students of these plants if they happen to have opportunity to see the trees growing. If two trees differ a little in hang of leaf, in minor items in the flower stalks, in tints of green in the foliage, in direction of the segments, and particularly in size of fruits, the trees must perforce be different species! This fallacy is difficult to overcome or to explain. Persons who would never think of applying such tests to oak trees or oranges, to pine trees or tomatoes, may nevertheless maintain them with the utmost conviction in all kinds of palms, so much so that it is almost impossible to convince them that palms are as variable as are many other kinds of palms or to instruct them in real specific differences."

L. H. Bailey
(*Gentes Herbarum* 4:54. 1936)

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