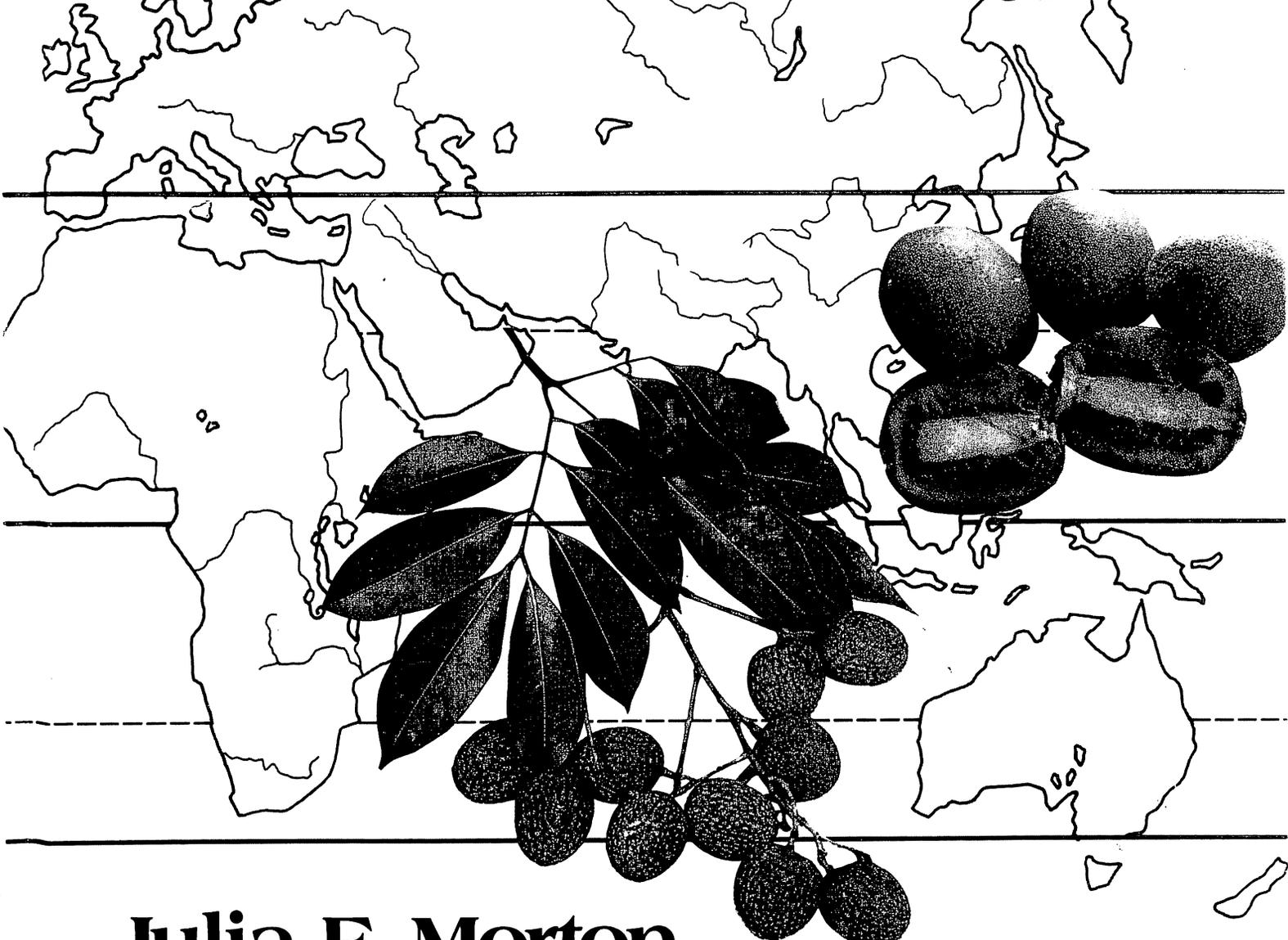


FRUITS OF WARM CLIMATES



Julia F. Morton

Durian (Plate XXXVIII)

The family Bombacaceae is best known for showy flowers and woody or thin-shelled pods filled with small seeds and silky or cottonlike fiber. The durian, *Durio zibethinus* L., is one member that differs radically in having large seeds surrounded by fleshy arils. Apart from variants of the word "durian" in native dialects, there are few other vernacular names, though the notorious odor has given rise to the unflattering terms, "civet cat tree", and "civet fruit" in India and "*stinkvrucht*" in Dutch. Nevertheless the durian is the most important native fruit of southeastern Asia and neighboring islands.

Description

The durian tree, reaching 90 to 130 ft (27-40 m) in height in tropical forests, is usually erect with short, straight, rough, peeling trunk to 4 ft (1.2 m) in diameter, and irregular dense or open crown of rough branches, and thin branchlets coated with coppery or gray scales when young. The evergreen, alternate leaves are oblong-lanceolate, or elliptic-obovate, rounded at the base, abruptly pointed at the apex; leathery, dark-green and glossy above, silvery or pale-yellow, and densely covered with gray or reddish-brown, hairy scales on the underside; 2½ to 10 in (6.25-25 cm) long, 1 to 3½ in (2.5-9 cm) wide. Malodorous, whitish to golden-brown, 3-petaled flowers, 2 to 3 in (5-7.5 cm) wide, with 5-lobed, bell-shaped calyx, are borne in pendant clusters of 3 to 30 directly from the old, thick branches or trunk.

The fruits are ovoid or ovoid-oblong to nearly round, 6 to 12 in (15-30 cm) long, 5 to 6 in (12.5-15 cm) wide, and up to 18 lbs (8 kg) in weight. The yellow or yellowish-green rind is thick, tough, semi-woody, and densely set with stout, sharply pointed spines, 3- to 7-sided at the base. Handling without gloves can be painful. Inside there are 5 compartments containing the creamy-white, yellowish, pinkish or orange-colored flesh and 1 to 7 chestnut-like seeds, ¾ to 2¼ in (2-6 cm) long with glossy, red-brown seedcoat. In the best fruits, most seeds are abortive. There are some odorless cultivars but the flesh of the common durian has a powerful odor which reminded the plant explorer, Otis W. Barrett, of combined cheese, decayed onion and turpentine, or "garlic, Limburger cheese and some spicy sort of resin" but he said that after eating a bit of the pulp "the odor is scarcely noticed." The nature of the flesh is more complex—in

the words of Alfred Russel Wallace (much-quoted), it is "a rich custard highly flavored with almonds . . . but there are occasional wafts of flavour that call to mind cream cheese, onion-sauce, sherry wine and other incongruous dishes. Then there is a rich glutinous smoothness in the pulp which nothing else possesses, but which adds to its delicacy. It is neither acid, nor sweet, nor juicy; yet it wants none of these qualities, for it is in itself perfect. It produces no nausea or other bad effect, and the more you eat of it the less you feel inclined to stop." (*The Treasury of Botany*, Vol. I, p. 435). Barrett described the flavor as "triplex in effect, first a strong aromatic taste, followed by a delicious sweet flavor, then a strange resinous or balsam-like taste of exquisite but persistent savor." An American chemist working at the U.S. Rubber Plantations in Sumatra in modern times, was at first reluctant to try eating durian, was finally persuaded and became enthusiastic, declaring it to be "absolutely delicious", something like "a concoction of ice cream, onions, spices, and bananas, all mixed together."

Some fruits split into 5 segments, others do not split, but all fall to the ground when mature.

Origin and Distribution

The durian is believed to be native to Borneo and Sumatra. It is found wild or semi-wild in South Tenasserim, Lower Burma, and around villages in peninsular Malaya, and is commonly cultivated along roads or in orchards from southeastern India and Ceylon to New Guinea. Four hundred years ago, there was a lively trade in durians between Lower Burma to Upper Burma where they were prized in the Royal Palace. Thailand and South Vietnam are important producers of durians. The Association of Durian Growers and Sellers was formed in 1959 to standardize quality and marketing practices. The durian is grown to a limited extent in the southern Philippines, particularly in the Provinces of Mindanao and Sulu. The tree grows splendidly but generally produces few fruits in the Visayas Islands and on the island of Luzon. There are many bearing trees in Zanzibar, a few in Pemba and Hawaii. The durian is not included in the latest *Flora of Guam* (1970) which covers both indigenous and exotic species. It has been introduced into New Guinea, Tahiti, and Ponape.

The durian is rare in the New World. Seeds from Java were planted at the Federal Experiment Station in Mayaguez, Puerto Rico in 1920. The single resulting tree bloomed heavily in February and March in 1944 but only one fruit matured in July and it had but 3 normal carpels. Nevertheless, there were 6 fully developed seeds which germinated and were planted. The tree has fruited in Dominica and Jamaica. There have been specimens in the Royal Botanic Gardens, Port-au-Spain, Trinidad, for many years though they are not very much at home there. Young trees and seeds were introduced into Honduras from Java in 1926 and 1927, and the trees have grown well at the Lancetilla Experimental Garden at Tela, but they bear poorly to moderately. Seedlings have lived only briefly in southern Florida.

Varieties

Much variation occurs in seedlings. There are over 300 named varieties of durian in Thailand. Only a few of these are in commercial cultivation. In Malaysia, 100 types are graded for size and quality. In peninsular Malaya, there are 44 clones with small differences in time and extent of flowering, floral and fruit morphology, productivity and edible quality.

Pollination

There is no evidence that the durian is wind-pollinated and it is believed that bats (mainly *Eonycteris spelea*) transfer pollen when they visit the flowers for nectar. Honeybees are seen on the flowers too early in the afternoon to serve as pollinators. Natural pollination is possible only at night, the heavily fragrant flowers opening in late afternoon and being receptive from 5 P.M. until 6 A.M., but pollen begins to shed at 7 P.M. and other floral parts gradually fall, only the pistil remaining at 11 P.M.

The durian has a high rate of self-incompatibility. In peninsular Malaya, the norm is 20% to 25% fruit-set, and it is realized that cross-pollination is essential to obtaining good crops. Hand-pollination performed during the day on buds that would open in 24 to 36 hours gives a much higher percentage of fruit-set than pollination of opened flowers. In unopened flowers the style is $\frac{1}{3}$ as long as in fully opened flowers and the pollen reaches the ovules more quickly.

Climate

The durian is ultra-tropical and cannot be grown above an altitude of 2,000 ft (600 m) in Ceylon; 2,300 ft (700 m) in the Philippines, 2,600 ft (800 m) in Malaysia. The tree needs abundant rainfall. In India, it flourishes on the banks of streams, where the roots can reach water.

Soil

Best growth is achieved on deep alluvial or loamy soil.

Propagation

Durian seeds lose viability quickly, especially if exposed even briefly to sunlight. Even in cool storage they can be kept only 7 days. Viability can be maintained for as long as

32 days if the seeds are surface-sterilized and placed in air-tight containers and held at 68°F (20°C).

They have been successfully shipped to tropical America packed in a barely moist mixture of coconut husk fiber and charcoal. Ideally, they should be planted fresh, flat side down, and they will then germinate in 3 to 8 days. Seeds washed, dried for 1 or 2 days and planted have shown 77-80% germination. It is reported that, in some countries, seedling durian trees have borne fruit a few years of age. In India, generally, they come into bearing 9 to 12 years after planting, but in South India they do not produce fruit until they are 13 to 21 years old. In Malaya, seedlings will bloom in 7 years; grafted trees in 3 years or earlier.

Neither air-layers nor cuttings will root satisfactorily. Inarching can be accomplished with 50% success but is not a popular method because the grafts must be left on the trees for many months. Selected cultivars are propagated by patch-budding (a modified Forkert method) on rootstocks 2 months old and pencil-thick, and the union should be permanent within 25 to 30 days. The plants can be set out in the field within 14 to 16 months. Grafted trees never grow as tall as seedlings; they are usually between 26 to 32 ft (8-10 m) tall; rarely 40 ft (12 m).

Culture

Generally, durian trees receive little or no horticultural attention in the Far East. Young grafted plants, however, need good care. They should be staked, irrigated daily during the dry season, given monthly feedings of about $\frac{1}{8}$ oz (5 g) of a 6-6-6 fertilizer formula, and the rootstock should be pruned gradually as leaves develop on the scion. When set out in the field, the trees should be 30 to 40 ft (9 to 12 m) apart each way.

Studies in Malaya have shown that a harvest of 6,000 lbs of fruits from an acre (6,720 kg from a hectare) removes the following nutrients from the soil: N, 16 lbs/acre (roughly equal kg/ha); P, 2.72 lbs/acre (roughly equal kg/ha); K, 27.9 lbs/acre (roughly equal kg/ha); Ca, 1.99 lbs/acre (roughly equal kg/ha); Mg, 3.26 lbs/acre (roughly equal kg/ha).

Season

In Ceylon, the durian generally blooms in March and April and the fruits mature in July and August, but the periods may shift considerably with the weather. Malaya has two fruiting seasons: early, in March and April; late, in September and October. Nearly all cultivars mature within the very short season during which the fruits are present in great numbers in local markets.

Harvesting

In rural areas, villagers clear the ground beneath the durian tree. They build grass huts nearby at harvest time and camp there for 6 or 8 weeks in order to be ready to collect each fruit as soon as it falls. Caution is necessary when approaching a durian tree during the ripening season, for the falling fruits can cause serious injury. Hunters place traps in the surrounding area because the falling fruits attract game animals and all kinds of birds. The fruit is also placed as bait for game in the forests.



Fig. 81: The heavy, spiny durian (*Durio zibethinus*) is prized in Southeast Asia and Malaysia for its custard-like, odorous flesh.

Yield

Durians mature in 3½ to 4½ months from the time of fruit-set. Seedling trees in India may bear 40 to 50 fruits annually. Well-grown, high-yielding cultivars should bear 6,000 lbs of fruit per acre (6,720 kg/ha).

Keeping Quality

Durians are highly perishable. They are fully ripe 2 to 4 days after falling and lose eating quality in 5 or 6 days.

Pests and Diseases

Minor pests in the Philippines are the white mealybug (*Pseudococcus tilacinus*) and the giant mealybug (*Drosicha townsendi*) which infest young and developing fruits.

Very few diseases have been reported. In West Malaysia, patch canker caused by *Phytophthora palmivora* was first noted in 1934. It is becoming increasingly common on roots and stems of durian seedlings. Infection in the field begins at the collar with oozing of brownish-red gum and extends up the trunk and down to the roots. Sometimes a tree is completely girdled at the base and dies. Testing of 13 clones showed that all but 2 were susceptible. The 2 resistant clones succumbed after the stems were wounded and inoculated. It is evident that pruning injuries have provided access for the organism. The disease is encouraged by close-planting which shades the soil and promotes

dampness. Weeds, grass and mulch around the collar are also contributing factors. Budded trees are particularly susceptible because of their habit of putting forth low branches and the occurrence of cracks where these join the main stem. When these low branches are pruned, the wound must be immediately treated with a fungicide.

Food Uses

Durians are sold whole, or cut open and divided into segments, which are wrapped in clear plastic. The flesh is mostly eaten fresh, often out-of-hand. It is best after being well chilled in a refrigerator. Sometimes it is simply boiled with sugar or cooked in coconut water, and it is a popular flavoring for ice cream. Javanese prepare the flesh as a sauce to be served with rice; they also combine the minced flesh with minced onion, salt and diluted vinegar as a kind of relish; and they add half-ripe arils to certain dishes. Arabian residents prefer to mix the flesh with ice and sirup. In Palembang, the flesh is fermented in earthen pots, sometimes smoked, and eaten as a special sidedish.

Durian flesh is canned in sirup for export. It is also dried for local use and export. Blocks of durian paste are sold in the markets. In Bangkok much of the paste is adulterated with pumpkin. Malays preserve the flesh in

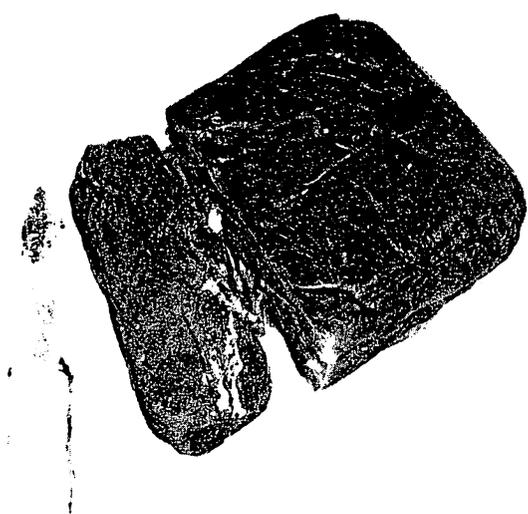


Fig. 82: Blocks of preserved durian paste are sold in the Bangkok market.

salt in order to keep it on hand the year around to eat with rice, even though it acquires a very strong and, to outsiders, most disagreeable odor. The unripe fruit is boiled whole and eaten as a vegetable.

The seeds are eaten after boiling, drying, and frying or roasting. In Java, the seeds may be sliced thin and cooked with sugar as a confection; or dried and fried in coconut oil with spices for serving as a side-dish.

Young leaves and shoots are occasionally cooked as greens. Sometimes the ash of the burned rind is added to special cakes.

Toxicity

The seeds are believed to possess a toxic property that causes shortness of breath.

Other Uses

Rind: The dried or half-dried rinds are burned as fuel and fish may be hung in the smoke to acquire a strong flavor. The ash is used to bleach silk.

Wood: The sapwood is white, the heartwood light red-brown, soft, coarse, not durable nor termite-resistant. It is used for masts and interiors of huts in Malaya.

Food Value Per 100 g of Edible Portion*

	<i>Fresh Arils</i>	<i>Dried Arils</i>
Calories	144	
Moisture	58.0-62.9 g	18.0 g
Protein	2.5-2.8 g	
Fat	3.1-3.9 g	3.0-6.0 g
Sugars	(approx.) 12.0 g	37.0-43.0 g
Starch	(approx.) 12.0 g	8.0-13.0 g
Total Carbohydrates	30.4-34.1 g	
Fiber	1.7 g	
Ash	1.1-1.2 g	3.0 g
Calcium	7.6-9.0 mg	
Phosphorus	37.8-44.0 mg	
Iron	0.73-1.0 mg	
Carotene (as Vitamin A)	0.018 mg 20-30 I.U.	
Thiamine	0.24-0.352 mg	
Riboflavin	0.20 mg	
Niacin	0.683-0.70 mg	
Ascorbic Acid	23.9-25.0 mg	
Vitamin E	"high"	

*Analyses made in Malaya, Honduras and elsewhere.

Medicinal Uses: The flesh is said to serve as a vermifuge. In Malaya, a decoction of the leaves and roots is prescribed as a febrifuge. The leaf juice is applied on the head of a fever patient. The leaves are employed in medicinal baths for people with jaundice. Decoctions of the leaves and fruits are applied to swellings and skin diseases. The ash of the burned rind is taken after childbirth. The leaves probably contain hydroxy-tryptamines and mustard oils.

The odor of the flesh is believed to be linked to indole compounds which are bacteriostatic. Eating durian is alleged to restore the health of ailing humans and animals. The flesh is widely believed to act as an aphrodisiac. In the late 1920's, Durian Fruit Products, Inc., of New York City, launched a product called "Dur-India" as a "health-food accessory" in tablet form, selling at \$9 for a dozen bottles, each containing 63 tablets—a 3-months' supply. The tablets reputedly contained durian and a species of *Allium* from India, as well as a considerable amount of vitamin E. They were claimed to provide "more concentrated healthful energy in food form than any other product the world affords"—to keep the body vigorous and tireless; the mind alert with faculties undimmed; the spirit youthful.

A toothpaste flavored with durian is currently marketed for durian fanciers.

Related Species

There are estimated to be 28 species in the genus *Durio* in Malaysia. Only 5 species in addition to the durian bear edible fruits. These are *D. dulcis* Becc., in Sabah and Indonesian Borneo; *D. grandiflorus* Kost., in Sabah, Sarawak, and Indonesian Borneo; *D. graveolens* Becc., in peninsular Malaya and all of Borneo and Sumatra; *D. kutejensis* Becc., all over Borneo, and ranked second to the durian in edibility; and *D. oxleyanus* Griff., in peninsular Malaya and all of Borneo and Sumatra. All five are cultivated in Brunei and a few to some extent in Malaysian Borneo.

It is believed that some of the other species, especially

D. malaccensis Planch. and *D. Wyatt-Smithii* Kost., which are very closely allied to *D. zibethinus*, may be useful in breeding for pest- and disease-resistance and other characters.

There is evidence that natural interspecific cross-pollination is going on because a hybrid of *D. zibethinus* and *D. graveolens* has been found in northeastern Indonesian Borneo, and some trees of normally white-flowered *D. malaccensis* have been discovered in Johore State with reddish flowers, perhaps from cross-pollination by the pink or red-flowered *D. lowianus* King and *D. pinangianus*.