Proc. Fla. State Hort. Soc. 97:314-317. 1984.

THE CURRYLEAF TREE (MURRAYA KOENIGII SPRENG.) IS ATTRACTING ATTENTION IN FLORIDA

JULIA F. MORTON
Morton Collectanea,
University of Miami,
Coral Gables, FL 33124

Abstract. **A small, tropical tree belonging to the orange subfamily of the Rutaceae, the curryleaf is native to India, Ceylon (Sri Lanka), and former Indochina, and is commonly cultivated in home gardens in these areas and in Malaya for its muskily aromatic leaves, locally prized for flavoring curries and chutneys, though not utilized in commercial curry powder mixtures. Plants were introduced by Dr. David Fairchild in 1926 and thereafter the tree was frequently seen as an ornamental in southern Florida but came into disfavor because of the proliferation of shoots from its spreading roots. In recent years, professors and students from India have been eagerly seeking the leaves and these are now being supplied on a small scale to dealers in East Indian foods. The tree has withstood many brief frosts in Dade County.**

The curryleaf tree, *Murraya koenigii* Spreng. (syns. *M. foetidissima* Teyem. et Binn.; *Chalcas koenigii* Kurz; *Bergera koenigii* L.), is a member of the orange subfamily of the Rutaceae, and closely related to our popular hedge plant, orange jasmine (*M. paniculata* Jack) (5). The most common local name for the curryleaf tree in India is mitha nim, or mitha neem (24) (meaning "sweet nim" (12) or "sweet neem"), to distinguish it from the botanically unrelated but somewhat similar neem tree (*Azadirachta indica* A. Juss.). The latter has non-aromatic leaves eaten as a vegetable and is being widely exploited today for the insect-repellent and insecticidal action of the leaves and extracts of the seeds.

There are numerous other dialectical names for the curryleaf in India including kathmin, kurry patta, kariaphulli (3), karayapan (13), barsanga (6), and glandla (3). The Ceylonese call it karivempu, karapincha (1, 23), or katu vempu (30). In Malaya, it is known as curry bush, garupillai, kerupulai, or karwa pale (11). In Vietnam it is xan troc, chum hoi trang, or sao nhon; in Laos, dok ki be, or dok khi be (32).

Description

The tree is erect, reaching 15 to 20 ft in height with a clear trunk to 4-10 ft having a maximum circumference of 18 inches. It is nearly evergreen, but in India and Florida is leafless for a short period in late winter. The alternate, imparipinnate, usually hairy-petioled leaves range from 4 to 15 inches or more in length and are composed of 9 to 25 (3) alternate, short-stemmed, light-green leaflets, asymmetrical, elliptic (11), ovate, lanceolate (22), or somewhat rhomboid (3), blunt-pointed and minutely toothed; 1 to 2 inches long, 3/8 to 1 inch wide; finely hairy on the underside (11), and strongly, muskily aromatic (3); of distinctive bitter-acid flavor.

Flowers, borne in broad, hairy-stalked, erect, corymbose panicles, are sweetly fragrant, white, small, bell-shaped, 5-parted (33). The clustered fruits, to 3/8 inch long, are ovoid or nearly round, with a small point at the apex; thin-skinned; turn from green to red and finally black when ripe (33), and contain mucilaginous pulp around 1 or 2 small, white seeds (38) (Fig. 1). The juice of the fruit is said to stain the skin as does the sap of green walnuts (14).

Fig. 1. The curryleaf tree (*Murraya koenigii* Spreng.) has attractive, muskily aromatic, pinnate leaves, and bears nearly-round fruits which turn from green to red and finally black. (Photo by Julia Morton).

Origin and Distribution

The tree grows naturally in forests nearly throughout India and the Andaman Islands; also in Thailand, Kampuchea, Laos and Vietnam. It is rather scarce in the wild in Ceylon (translated as "Sri Lanka" in Ceylonese), but is much cultivated there and in India (24), and, mainly by Indian people, in Malaya (11), Pakistan, Bangladesh, Burma, Java, Madagascar (34), Zanzibar and Pemba (39).

The world in general is little aware of the curryleaf tree, for it has received scant attention in botanical and horticultural literature. It is apparently unknown in Hawaii; not mentioned by Marie Neal (*In gardens of Hawaii*; Spec. Pub. 50, Bishop Mus. Press, Honolulu; 1965) nor by Howard St. John (*List and survey of the flowering plants in the Hawaiian Islands*; Mem. No. 1, Pacific Trop. Bot. Gard., Lawaii, Kauai; 1973). It has been grown in Florida for more than 50 yr (17, 38). The celebrated plant explorer, Dr. David Fairchild, introduced plants

from Peradeniya, Ceylon, in 1926 (P. I. #68351) (29). Seeds from trees growing in the Jaffna Peninsula, northern Ceylon were sent by A. A. Ward of the American Ceylon Mission, in Tellippalal, to the U. S. Department of Agriculture in mid-1927 (P. I. #73098) (30), and further seeds from the same area were received in mid-1931 (P. I. #93880) (31).

In his book, *Exploring for plants*, Dr. Fairchild told of his first encounter with the species: "Among the ingredients deemed essential to all the curries of Ceylon is also the curry leaf (*Murraya koenigii*). This curry leaf is a peculiar ingredient for, like our bay leaf, it only gives a flavor. It is boiled with the curry but thrown out of it before serving. I had never before seen it and was struck by the piles of it everywhere. It is always used fresh. I could not find out what particular flavor this leaf imparted to the Ceylon curry; to me it was indistinguishable among the wealth of flavors, and I can find no reference to its use in Java or Sumatra; I found it only in Ceylon" (17).

Dr. Fairchild planted a seedling at his home, The Kampong, in Coconut Grove, Miami, and he refers to this plant in another book. *The world grows round my door:* ". . . we nursed and cared for this tree, wondering for some time how we could propagate it, since for several years it bore no fruits; finally Ralph Robinson (a *Citrus* authority) made the discovery that root cuttings could be taken. With the passing of time certain signs of suckering appeared around the tree (Fig. 2). These increased and finally became alarming, as the little plants invaded my Natal pineapple plantation near by, threatened to smother my *Annona* trees, and finally made a veritable lawn of suckers for yards around, to the disgust of Sands, who finds them hard to cut with his lawnmower. 'Don't plant them things; they's a pest,' he advises those who come and get little plants of it.

Fig. 2. A tree-like clump of curryleaf suckers surrounded by suckers of all sizes arising from the spreading roots, is one of 3 specimens at the USDA Subtropical Horticulture Research Unit, Old Cutler Road, Miami. (Photo by Julia Morton).

"The oriental fragrance of the Curry leaves has come to be liked and praised by those who have tasted Ernest's (the cook's) rice dishes. And to get around the bother of its suckering I have worked it on the orange jasmine, using that as a stock because it does not sucker. No word of the suckering habit of the tree appears in Swingle's book" (18).

Swingle stated that Dr. Fairchild "regularly uses the fresh leaves in making curry", and added, "According to Mrs. Marian Bell Fairchild, a few leaflets of this plant left to soak in French dressing, but removed before the dressing is poured on the salad, give an agreeable flavor to the salad that almost everyone likes, and one which I found very pleasant." (38).

A. A. Ward, in his remarks accompanying the 1927 introduction, wrote, "In Ceylon, the dried leaves are used in curries, soups, etc." (6, 30). And it is true that the leaves are sold both fresh and dried in India (33). At the present time, plastic bags of dried leaves are exported from Bombay to Indian food dealers in Washington, D. C., and doubtless other cities in North America. Unfortunately, the name imprinted on the bag of dry leaves sent to me by Dr. Govind Kapadia of Howard University is simply "NEEM", but the contents are definitely the aromatic leaves of *Murraya koenigii*. In addition to the culinary uses already mentioned, the leaves are employed in flavoring mulligatawny soup (9, 23), chutneys and pickles, and are pounded together with dried coconut, chili pepper and salt to make a popular preserve (33).

Culture in Southern Asia

The tree is hardy and flourishes up to an elevation of 2,000 ft in Ceylon (23); up to 5,000 ft in the Himalayas (10). It does well in almost any type of soil if there is good drainage. Propagation may be by root suckers or air-layers (19), but is usually by seeds which are best germinated in partial shade in nurseries and the seedlings are transplanted when 1 yr old (33). They are set in the field at a tree-to-tree spacing of 15 or 20 ft, and require little or no care. The curryleaf has few natural enemies apart from the fungus *Rhizoctonia solani*, which may cause collar rot of seedlings, and *Fomes pectinatus*, inducing white sap rot (33). In India, harvesting of leaves begins 15 months after planting out and is repeated every 2 to 3 months (33).

Processing

Various methods of drying the leaves have been tested—cross-flow, through-flow, sun, and vacuum-shelf. Vacuum-shelf drying results in the best green color in the product (34). The loose leaflets are usually marketed whole. To prepare a powder, the fresh leaves are blanched in a hot solution of 0.2% potassium metabisulphite, 0.1% sodium bicarbonate, and 0.1% magnesium oxide for 3 min. Then they are oven-dried at 140 to 149°F for 3 to 3-1/2 hr to achieve a moisture content of about 3 to 4% (2). The curryleaf powder is not an ingredient of the commercial curry powders in world trade, which are mixtures of 16 to 32 other spices (20, 21, 26).

Present Status in Florida

Since 1945, I have seen curryleaf trees growing in the dooryards of private homes in southern Florida. Some have been eliminated because of the nuisance of the suckers, but there are still 2 trees at the Kampong, one of which has suckered so prolifically that Larry Schokman, Superintendent of the estate, decided 4 yr ago to start trimming the suckers as a hedge (Fig. 3). There are now solid walls of curryleaf about 4 ft high along both sides of a footpath, continuing on from the point where a hedge of orange jasmine terminates. The other tree, about 17 ft high and gracefully ornamental, is situated on the open lawn where weekly mowings keep the suckers as short as the grass

and inconspicuous. Other specimens may be seen at Smith's Tropical Fruit Grove in Bonita Springs, the Fairchild Tropical Garden and the U. S. Department of Agriculture's Subtropical Horticulture Research Unit, in Miami, the Preston B. Bird and Mary Heinlein Fruit and Spice Park in the Redlands, and on the campus of the University of Miami, Coral Gables. Obviously, the curryleaf tree has survived many brief frosts in southern Florida.

Fig. 3. Larry Schokman, Superintendent of the Sweeney estate in Coconut Grove (the former home of Dr. David Fairchild and still known as "The Kampong") manages irrepressible curryleaf tree suckers by trimming them as a hedge on both sides of a footpath. (Photo by Julia Morton).

Word of these trees has spread among Indian students and professors in universities around this country and, when any of these people arrive in this area, they eagerly come to request a few leaves or a small plant to take home. As a result of the apparent demand, the curryleaf tree has, at long last, become a small cash crop for southern Florida. A few local people are now supplying the leaves to restaurants and Asiatic grocery dealers who phone their customers to come and pick them up because they remain fresh only 2-3 days. Mr. Sudhrrkumar, proprietor of Patel Shippers, advertises curry leaves in the newspaper INDIA ABROAD and has been purchasing the leaves to ship by air fresh to customers in Alabama, Arkansas, Illinois, Michigan, Missouri, New Mexico, New York, Ohio and Texas together with tropical fruits and other produce. He also shade-dries leaves to fill the demand during the late-winter/early-spring off-season (when the tree is changing its leaves). He "rations" the curry leaves, sending only 4 or 5 lb. to each customer. He says he could easily distribute 1,000 lb. at any time if he had that much. He is growing 200 small trees (transplanted root suckers) to establish a grove of his own.

William Lessard, owner of W. O. Lessard Nursery in the Redlands, has 50 young trees mostly root suckers, but also a few seedlings which grow more slowly, and he intends to increase his planting to 100. The tropical plantsman, Laymond Hardy, has helped to popularize the curryleaf tree by recommending it in his talks at Rare Fruit Council meetings in Broward County and West Palm Beach and he has given away hundreds of root suckers for planting. A family at Canal Point is setting out a grove.

The suckering habit has now become an advantage to those who are harvesting leaves from the suckers as well as the parent trees, and suckering can be enhanced by deliberately injuring the spreading roots. The suckers leaf out quickly after plucking and high-nitrogen fertilizer and irrigation expedite the recovery of over-plucked trees.

In harvesting, some pluck the leaves individually; others clip off the terminal cluster of foliage complete with the silky, purplish new shoots. One should not take so many leaves from a curryleaf tree as to expose the branches and trunk to sunburn. It is best to spread out the plucking and to limit the harvest to 5 lb. per tree per week. Medium-sized trees are climbed and leaves taken from the inner branches only. As trees grow larger, it will be necessary to use ladders and perhaps pruning poles.

The manual labor might be viewed as uneconomic. However, Lessard says that a worker can harvest 20 lb of individually-picked leaves in a morning and pack them in the afternoon for fresh shipment. The wholesale price is $4/lb. Selling directly to a grocer or restaurant, one may receive as much as $11/lb. This does not seem exorbitant when compared with the price of the dried leaflets as sold retail in Washington—$1.39 per oz ($22.24/lb.). I counted 1,100 leaflets in addition to some fragments in the plastic bag. Assuming 1,200 and an average of 18 leaflets per leaf, one would have to pick 67 leaves to yield an ounce of dried leaflets, and this could be done rather quickly on such a lushly-foliaged tree. At present, this small industry is profitable and there are good prospects for much wider sales as the supply increases.

Grafting Experiments

With a view to making the tree more desirable as a dual-purpose ornamental, I have taken an interest in Dr. Fairchild's attempt to overcome the suckering by grafting the curryleaf tree onto the orange jasmine. The latter was introduced from Hongkong in 1915 (P. I. #40392) and Dr. Walter Swingle noted that, because of its vigorous root growth, "lemons can be budded on it and make a rapid growth" (28). Apparently Dr. Fairchild's effort did not succeed inasmuch as both Kampong trees sucker and neither shows any sign of having been grafted.

I took to Horticulturist Paul Soderholm, at the U. S. Department of Agriculture's Subtropical Horticulture Research Unit, Miami, 6 orange jasmine plants about 3 yr old that were donated by Shaw Nursery and Landscape Company. He added 2 plants and, in midsummer of this year, tried 3 methods of joining scions from the curryleaf onto the total of 8 rootstocks: 3 were cleft grafted, 3 side-grafted, and 2 inverted-T budded. None was successful. Further trials will be made at a different season.

Chemical Composition of Leaves

Analyses of dried mature leaves at the Central Food Technological Research Institute, Mysore, India, show the following constituents: moisture, 63.20-66.3%; total nitrogen, 1.15%; crude protein (N X 6.25), 6.1-6.92%; fat (ether extract), 1.0-6.15%; total sugars, 18.92%; starch, 14.60%; crude fiber, 6.4-6.80%; ash, 13.06%; acid insoluble ash, 1.35% (33, 34). Also reported are the following values: mineral matter, 4.2%; calcium, 0.81%; phosphorus, 0.6%; iron, 0.0031%; carotene (as vitamin A) 12,600 I. U.; nicotinic acid; ascorbic acid, 0.004%; free amino acids: asparagine, glycine, serine, aspartic acid, gluatmic acid, threonine, alanine, proline, tyrosine, tryptophan, γ-aminobutyric acid, phenylalanine, leucine, isoleucine, traces of ornithine, lysine,

arginine, and histidine (3). Though the calcium content is high, the level of total oxalates, 1.35% (soluble oxalates, 1.15%) interferes with the assimilation of the calcium (33). Also present in the leaves are 6 carbazole alkaloids: mahanimbine, mahanine, koenine, koenigine, koenidine, koenimbine (27), and a crystalline glucoside, koenigin (33).

Other Products

Fruits. While not generally recognized as edible, in India the firm-ripe fruits are harvested in the summer, steamed, washed, cooked, passed through a pulper to remove seeds, and canned with or without the addition of sugar (2). The fruit yields 0.76% of a yellow, volatile oil with a peppery taste, and also contains the glucoside, koenigin (3).

Leaf oil. Fresh leaves are steam distilled under a pressure of 90 lb./sq inch to obtain a yield of 2.6% of volatile oil, deep-yellow, of strong, spicy odor and clove-like flavor, suitable for use as a fixative in heavily aromatic soaps. It contains 4.6% *dl-a*-phellandrene, 9.2% *d*-sabinene, 5.5% *d-a*-pinene, 6.8% dipentene, 3.2% *d-a*-terpineol, 26.3% caryophyllene, 4.4% isosafrol, 18.2% cadinene, 12.8% cadinol, 2.7% lauric acid, and 3.4% palmitic acid (3).

Seed oil. The seeds yield limblee, limbolee, or simbolee, oil which is yellow, clear and transparent and has medicinal uses (14, 25, 36).

Wood. The wood, grayish-white, close-grained, hard and durable, is used in India for agricultural implements. It is medium-heavy, weighing 43-50 lb./cu ft.

Bark. The bark contains several alkaloids: curryangine, currayanine, girinimbine, koenimbine, mahanimbine, mukonine, murrayacine, murrayacinine, and murryanine (4, 7, 8, 15, 16, 35).

Nectar. The flowers are a minor source of nectar for honeybees (37).

Medicinal and Superstitious Uses

Raw fruits and young leaves are astringent and eaten to halt diarrhea and dysentery (32). A tea of the toasted leaves is taken as an antiemetic; a leaf decoction with added bitters is administered in fever. Crushed leaves are applied on bruises and skin eruptions (10). After boiling in milk, leaves are pounded and plastered on bruises and bites of venomous creatures. Crushed bark and roots are used similarly. Both bark and roots are used as stimulating tonics. The roots are laxative (9, 13, 14, 32). The root juice is taken to relieve pain in the area of the kidneys (3). In central Vietnam, the leaves are put into water for bathing infants afflicted with mange (32). The Swahilis in east Africa burn the leaves as incense in the belief that the smoke will protect their sick children from evil spirits (39).

Literature Cited

1. Alston, A. H. G. 1938. The Kandy flora. Ceylon Gov't Printer, Colombo.
2. Anonymous. 1963. Curry leaf oil and powder. Canning of berry pulp. Food Sci. 12:295.
3. Anonymous. 1962. Wealth of India: Raw Materials. Vol. VI. Coun. Sci. & Indus. Res., Delhi.
4. Anwer, F., A. S. Masaldan, R. S. Kapil, and S. P. Popli. 1973. Synthesis of Murrayacine; oxidation with DDQ of the activated aromatic methyl group of the alkaloids of *Murraya koenigii* Spreng. Indian J. Chem. 11:1314-1315.
5. Bailey, L. H. 1947. The standard cyclopedia of horticulture. Vol. I. The Macmillan Co., New York.
6. Benthall, A. P. 1946. Trees of Calcutta and its neighborhood. Thacker Spink & Co. (1933) Ltd., Calcutta.
7. Chakraborty, D. P. et al. 1974. Chemical taxonomy XXXV. Structure of murrayacinine, a new carbazole alkaloid from *Murraya koenigii*. Chem. Ind. (London) 4:165-166. (CA 81:4103f).
8. Chakraborty, D. P., P. Bhattacharyya, S. Roy, S. P. Bhattacharyya and A. K. Biswas. 1978. Structure and synthesis of Mukonine, a new carbazole alkaloid from *Murraya koenigii*. Phytochem. 17: 834-835.
9. Chittenden, F. J. 1951. The Royal Horticultural Society dictionary of gardening. Vol. III. Oxford, at the Clarendon Press.
10. Chopra, R. N., S. L. Nayar, and I. C. Chopra. 1956. Glossary of Indian medicinal plants. Coun. Sci. & Indus. Res., New Delhi.
11. Corner, E. J. H. 1952. Wayside trees of Malaya. Vol. 1 & 2. Gov't Printing Office, Singapore.
12. Cowen, D. V. 1965. Flowering trees and shrubs in India. 4th ed. Thacker & Co., Ltd., Bombay.
13. Dastur, J. F. 1952. Medicinal plants of India and Pakistan. D. B. Taraporevala Sons & Co., Ltd., Bombay.
14. Drury, H. 1873. The useful plants of India. William H. Allen & Co., London.
15. Dutta, N. L., C. Quasim, and M. S. Wadia. 1969. Constituents of *Murraya koenigii*: structure of curryangin. Indian J. Chem. 7: 1061-1062.
16. Dutta, N. L., C. Quasim, and M. S. Wadia. 1969. Synthesis of Mahanimbin and Curryangin. Indian J. Chem. 7:1168-1169.
17. Fairchild, D. 1931. Exploring for plants. The Macmillan Co., New York.
18. Fairchild, D. 1947. The world grows round my door. Chas. Scribner's Sons, New York.
19. Fenzi, E. O. 1915. Frutti tropicali e semitropicali (Esclusi gli agrumi). Inst. Agr. Coloniale Italiano, Firenze.
20. Heath, H. B. 1978. Flavor technology: profiles, products, applications, The AVI Publ. Co., Westport, Conn.
21. Lakshmanachar, M. S. 1967. Indian spices and their export trade. Agricultural Situation in India. January. p. 849.
22. Liberty Hyde Bailey Hortorium. 1976. Hortus Third, a concise dictionary of plants cultivated in the U. S. and Canada. Macmillan Publ. Co., Inc., New York.
23. Macmillan, H. G. 1952. Tropical planting and gardening. 5th ed. Macmillan & Co., Ltd., London.
24. Maheshwari, J. K. 1963. The flora of Delhi. Coun. Sci. & Indus. Res., New Delhi.
25. Masters, M. T. 1876. The treasury of botany. Vol. I. Longmans, Green & Co., London.
26. Merory, J. 1968. Food flavorings, composition, manufacture and use. 2nd ed. The AVI Publ. Co., Inc., Westport, Conn.
27. Narasimhan, N. S., M. V. Paradkar and S. L. Kelkar. 1970. Alkaloids of *Murraya koenigii*: structure of mahanine, koenine, koenigine and koenidine. Indian J. Chem. 8:473-474.
28. Office of Foreign Seed and Plant Introduction. 1915. Plant Immigrants. No. 108. Bur. Plant Indus., U. S. Dept. Agr., Washington, D. C.
29. Office of Foreign Plant Introduction. 1926. Inventory No. 88. Bur. Plant Indus., U. S. Dept. Agr., Washington, D. C.
30. Office of Foreign Plant Introduction. 1929. Inventory No. 91. Bur. Plant Indus., U. S. Dept. Agr., Washington, D. C.
31. Office of Foreign Plant Introduction. 1933. Inventory No. 108. Bur. of Plant Indus., U. S. Dept. Agr., Washington, D. C.
32. Petelot, A. 1952. Plantes Medicinales du Cambodge, du Laos et du Vietnam. Vol. I. No. 14. Centre de Rech. Sci. et Tech., Arch. des Rech. Agron. au Camb., au Laos, et au Vietnam, Saigon.
33. Philip, J. 1981. Curry leaf—and its uses. World Crops, Nov./Dec. 125-127.
34. Prakash, V. and C. P. Natarajan. 1974. Studies on curry leaf (*Murraya koenigii* L.). J. Food Sci. & Tech. 11:184-286.
35. Roy, S. and D. P. Chakraborty. 1974. Mahanimbine from *Murraya koenigii* Spreng. Phytochem. 13:2893.
36. Smith, J. 1882. A dictionary of popular names of the plants which furnish the natural and acquired wants of man, in all matters of domestic and general economy. Their history, products and uses. Macmillan and Co., London.
37. Sundararaj, D. and G. Balasubramanyam. 1969. Guide to the economic plants of South India. Amudha Nilayam Private Ltd., Madras.
38. Swingle, W. T. 1943. The botany of *Citrus* and its wild relatives of the orange subfamily (Family Rutaceae, Subfamily Aurantioideae), p. 129-474 In: H. J. Webber & L. D. Batchelor (ed.). The Citrus Industry, Vol. I. Univ. Calif. Press, Berkeley, 1943 (3rd ptg. 1948).
39. Williams, R. O. 1949. Useful and ornamental plants in Zanzibar and Pemba. Zanzibar Protectorate (Gov't Printer, Zanzibar).