

## THE GENERA OF MYRTACEAE IN THE SOUTHEASTERN UNITED STATES<sup>1</sup>

KENNETH A. WILSON

### MYRTACEAE Jussieu (MYRTLE FAMILY)

Shrubs or trees with simple, opposite or alternate, coriaceous, glandular-punctate, exstipulate leaves, often with a continuous intramarginal vein. Inflorescence cymose, racemose, or paniculate or the flowers solitary. Flowers complete, regular, 4- or 5-merous. Calyx 4- or 5-lobed, distinct, or undivided in the bud and splitting irregularly in anthesis, or falling off as a calyptra. Petals 4 or 5 (attached at the apex of the hypanthium) or wanting. Stamens numerous, free or united into 5 bundles, the versatile anthers with gland-tipped connectives. Style and stigma 1, the ovary inferior, (1)2-5-locular, each locule with 2-many ovules. Fruit a 1-many-seeded berry or a many-seeded capsule. Embryo variously shaped.

A family of about 80 genera and 3000 species, primarily of the tropics of both hemispheres. The glandular-punctate leaves, inferior ovary, and numerous stamens usually are distinctive. Two subfamilies based primarily on the nature of the fruit generally are recognized: the Leptospermoideae, centered in Australia, are characterized by dry, dehiscent fruits; the Myrtoideae (with the single tribe, Myrteae) have fleshy, indehiscent fruits and occur in the tropics of both Old and New Worlds. The latter is divided into three subtribes based on the structure of the embryo. Subtribe Myrciinae Berg (cotyledons foliaceous, twisted and folded; the radicle elongate) is represented in our area by *Calypttranthes*. Subtribe Eugeniinae Berg (cotyledons fleshy, distinct, partly or completely fused, or conferruminate (closely adherent); the radicle very short) includes *Eugenia* and *Myrcianthes*, as well as the large Old World genus *Syzygium*. Subtribe Pimentinae Berg (cotyledons very short; embryo spiral or curved; radicle elongate) is represented in our flora by *Myrtus*, *Psidium*, and *Rhodomyrtus*.

<sup>1</sup>Prepared for a biologically oriented generic flora of the southeastern United States, a joint project of the Arnold Arboretum and the Gray Herbarium made possible through the support of George R. Cooley and the National Science Foundation, and under the direction of Reed C. Rollins and Carroll E. Wood, Jr. The scheme follows that outlined at the beginning of the series (Jour. Arnold Arb. 39: 296-346. 1958). Other published portions of these studies will be found in Jour. Arnold Arb. 40, 41. 1959, 1960. I am grateful to Rogers McVaugh who generously offered many comments and suggestions in connection with this family. I am also indebted to Leonard J. Brass, George R. Cooley, and Richard A. Howard for their aid in obtaining specimens and their help in various other ways.



Generic distinctions are difficult in the family, and, as a result, many different classifications have been proposed. Great emphasis has recently been placed on the structure of the embryo in determining various taxonomic groupings. Evidence from anatomy and pollen morphology has been used in connection with generic problems.

The inflorescence of the Myrtaceae is very variable and has been interpreted as resulting from various modifications of a potentially floriferous branch which develops in the axil of a leaf. The majority of the Myrtaceae which have been studied have a diploid chromosome number of 22.

Representatives of at least *Eucalyptus* L'Her., *Callistemon* R. Br., *Syzygium* Gaertn., *Feijoa* Berg, and *Myrciaria* Berg are cultivated in Florida as ornamentals or for their fruits.

#### REFERENCES:

- ANDREWS, E. C. The development of the natural order Myrtaceae. Proc. Linn. Soc. New S. Wales 38: 529-568. 1913. [On the origin and distribution of the Myrtaceae.]
- ATCHISON, E. Chromosome numbers in the Myrtaceae. Am. Jour. Bot. 34: 159-164. 1947. [Includes all previously recorded chromosome numbers.]
- BARANOV, P. A. Coleorrhiza in Myrtaceae. Phytomorphology 7: 237-243. 1957 [1958].
- BERRY, E. W. The origin and distribution of the family Myrtaceae. Bot. Gaz. 59: 484-490. 1915.
- BROGLI, B. Beiträge zur Anatomie der Myrtaceen Rinden. Thesis, Basel, 84 pp. 1926.\*
- BUSWELL, W. N. Florida myrtles. Am. Bot. 35: 138-143. 1929. [General descriptions and notes on the cultivated and native species, with some comments on their economic value.]
- INGLE, H. D., and H. E. DADSWELL. The anatomy of the timbers of the south-west Pacific area. III. Myrtaceae. Austral. Jour. Bot. 1: 353-401. 1953. [Includes some American species.]
- KAUSEL, E. Beitrag zur Systematik der Myrtaceen. Ark. Bot. II. 3: 491-516. 1956. [Proposes a classification of the Myrtaceae on the basis of characters of the seed and embryo, and describes 5 new genera.]
- . Myrtaceae. Inst. Paran. Catal. Gên. 28: 1-4. 1957. [List of genera and synonyms of the Myrtaceae, excluding the "Leptospermaceae."]
- McVAUGH, R. Nomenclatural notes on Myrtaceae and related families. Taxon 5: 133-135, 162-167. 1956.
- . Tropical American Myrtaceae. Notes on generic concepts and descriptions of previously unrecognized species. Fieldiana Bot. 29: 145-228. 1956. [Includes a study of the inflorescence.]
- . Myrtaceae. In Flora of Peru. Field Mus. Nat. Hist. Bot. 13(4<sup>2</sup>): 569-818. 1958. [The most recent revisionary study.]
- MAURITZON, J. Contributions to the embryology of the orders Rosales and Myrtales. Lunds Univ. Årsskr. II. Sect. 2. 35(2): 1-120. 1939.\*
- MENNINGER, E. A. The cultivated eugenias in American gardens. Natl. Hort. Mag. 38: 92-104, 145-164. 1959. [Species of *Syzygium*, *Acmena*, *Eugenia*, *Myrceugenia*, *Myrciaria*, *Pimenta*, *Myrcianthes*, and *Myrtus*, both native and introduced; includes excellent photographs.]



- MOWRY, H., L. R. TOY, and H. S. WOLFE. Miscellaneous tropical and subtropical Florida fruits. Revised by G. D. Ruehle. Fla. Agr. Ext. Serv. Bull. 156A: 1-116. 1958. [Includes species of *Eugenia*, *Feijoa*, *Myrciaria*, *Psidium*, *Rhodomyrtus*, and *Syzygium*.]
- NIEDENZU, F. Myrtaceae. Nat. Pflanzenfam. III. 7: 57-105. 1893.
- PIKE, K. M. Pollen morphology of Myrtaceae from the south-west Pacific area. Austral. Jour. Bot. 4: 13-53. 1956. [Includes some American species.]
- SMITH-WHITE, S. Cytological studies in the Myrtaceae. II. Chromosome numbers in the Leptospermoideae and Myrtoideae. Proc. Linn. Soc. New S. Wales 73: 16-36. 1948.
- SOUBIHE SOBRINHO, J., and J. T. A. GURGEL. Characteristics of the seeds of fruit-producing Myrtaceae. Revista Agr. Piracicaba 27: 83-90. 1952.\* [In Portuguese.]
- . Polyembryony and adventitious embryony in citrus, *Mangifera* and fruit-bearing Myrtaceae. II. Dusenja 4: 421-428. 1953.\* [In Portuguese.]
- STURROCK, D. Tropical fruits for southern Florida and Cuba and their uses. Publ. Atkins Inst. Arnold Arb. 1: 1-131. 1940. [Myrtaceae, 81-92.]
- WEBERLING, F. Untersuchungen über rudimentäre Stippen bei den Myrtales. Flora 143: 201-218. 1956.

#### KEY TO THE GENERA OF MYRTACEAE

- A. Leaves alternate; inflorescence spicate; stamens united into 5 bundles; fruit capsular; bark white, spongy, peeling off in sheets. . . . . 1. *Melaleuca*.
- A. Leaves opposite, inflorescence paniculate, cymose, racemose or flowers glomerate or solitary; stamens free; fruit a fleshy 1-many-seeded berry.
  - B. Inflorescence a panicle; calyx undivided in bud, circumscissile, the lid usually remaining attached at one side; petals absent; embryo with foliaceous, twisted and folded cotyledons and an elongate radicle. . . . . 2. *Calypttranthes*.
  - B. Inflorescence a raceme or dichasium or the flowers solitary or glomerate; calyx-lobes, if developed, 4 or 5; petals white or rarely rose colored.
    - C. Inflorescence racemose or the flowers glomerate or fascicled; calyx-lobes 4; fruit 1(rarely 2)-seeded; embryo with fleshy, fused cotyledons. . . . . 3. *Eugenia*.
    - C. Inflorescence a dichasium or the flowers solitary.
      - D. Calyx-lobes 4, distinct in the bud, petals 4, white, leaves pinnately veined.
        - E. Flowers in dichasia, embryo with 2 distinct, fleshy cotyledons, radicle short; fruit 1(rarely 2)-seeded. . . . . 4. *Myrcianthes*.
        - E. Flowers solitary, embryo curved, the cotyledons short, radicle elongate; fruit many-seeded. . . . . 5. *Myrtus*.
      - D. Calyx-lobes 5, distinct in the bud, or the calyx closed in the bud and splitting irregularly in anthesis, usually into 5 segments; petals 5.
        - F. Petals white; leaves pinnately veined, calyx closed in the bud, splitting irregularly in anthesis. . . . . 6. *Psidium*.
        - F. Petals rose colored; leaves 3-veined; calyx-lobes distinct in the bud. . . . . 7. *Rhodomyrtus*.



## Subfam. LEPTOSPERMOIDEAE Niedenzu

## Tribe LEPTOSPERMEAE DC.

1. *Melaleuca* Linnaeus, Mant. Pl. Gen. 1: 14. 1767, nom. cons.

Tree with alternate, 1-many-veined leaves. Flowers sessile in the axils of bracts, in dense or elongate spikes or occasionally solitary, the axis of the spike growing into a leafy shoot during or after flowering. Calyx-lobes 5, deciduous. Petals 5, white, orbicular, spreading in anthesis. Stamens numerous, united in 5 bundles opposite the petals. Ovary 3-locular, each locule with numerous ovules; hypanthium extending beyond the ovary. Fruit a loculicidal capsule dehiscing at the top, crowned by the hypanthium. (*Cajuputi* Adans., 1763, nom. rejic.) TYPE SPECIES: *M. Leucadendron* (L.) L. (Name from Greek, *melas*, black, and *leukos*, white, alluding to the black trunk and white branches of one of the species.) — BOTTLE-BRUSH.

The subfamily Leptospermoideae, which is characterized primarily by the capsular fruits, has its center of distribution in Australia, and is represented in our area by a single naturalized species, *Melaleuca Leucadendron* (L.) L. The bottle-brush occurs in southern Florida where it is both cultivated and naturalized. This tree is conspicuous because of its white, spongy bark which peels off in large sections. The chromosome number of three other Old World species has been determined as  $2n = 22$ .

The closely related genus *Callistemon* R. Br. is frequently cultivated in Florida and may be distinguished by its free stamens which are bright red in color.

Various species of *Eucalyptus* L'Her. in the same subfamily are cultivated in the warmer parts of our area. Although some of the species have become naturalized in California, apparently none has become established in Florida.

## REFERENCES:

- SCHORY, E. A. The cajaput tree in Florida. Carib. Forest. 19: 50-55. 1958. [*M. Leucadendron*, culture and uses.]  
SHARMA, V. N., and P. SINGH. Preliminary chemical examination of the liquid exudate from abnormal growths in *Melaleuca leucadendron* Linn. Jour. Sci. Indus. Res. 15C(11): 256. 1956.\*

## Subfam. MYRTOIDEAE Niedenzu

## Tribe MYRTEAE DC.

## Subtribe Myrciinae Berg

2. *Calyptranthes* Swartz, Prodr. Veg. Ind. Occ. 79. 1788, nom. cons.

Trees or shrubs with opposite leaves. Inflorescence a myrcioid panicle (e.g., with the principal branches opposite, elongate, and terminating in



single flowers or simple dichasia), the inflorescence axis usually abortive above the first node and the panicles appearing to be paired. Calyx undivided in bud, circumscissile in anthesis but usually remaining attached at one side. Petals wanting. Stamens numerous, inserted on the margin of the hypanthium which is prolonged above the summit of the ovary; anthers versatile, splitting longitudinally. Ovary 2 (seldom 3)-locular, each locule with 2 ovules. Fruit a 1- or 2 (seldom 3)-seeded berry crowned by the hypanthium. Embryo with twisted and folded foliaceous cotyledons, and an elongate radicle. (*Chytraculia* P. Br., 1756, nom. rejic.; *Chytralia* Adans., 1763, nom. rejic.) TYPE SPECIES: *C. Chytraculia* (L.) Sw. (Name from Greek, *kalyptra*, veil, and *anthos*, flower, alluding to the lidlike dehiscence of the calyx.) — SPICEWOOD, MYRTLE-OF-THE-RIVER.

About 100 species native to tropical America and the West Indies; represented in our area by two species, *Calyptranthes Zuzygium* (L.) Sw. and *C. pallens* (Poir.) Griseb., both of which occur in southern Florida, as well as Cuba and other islands of the West Indies. Because of the hood-like dehiscence of the calyx, *Calyptranthes* is one of the easiest genera of the American Myrtaceae to recognize. However, many of the species are so variable in size and shape of leaves and in the characters of the flowers that they are by no means well marked. This genus, as well as all others in the family, is in need of a thorough revision which should be accompanied by extensive field study.

#### Subtribe Eugeniinae Berg

#### 3. *Eugenia* Linnaeus, Sp. Pl. 1: 470. 1753; Gen. Pl. ed. 5. 211. 1754.

Trees or shrubs with opposite leaves. Inflorescence racemose, the terminal flower of the axis usually wanting; axis sometimes extremely shortened, the inflorescences then resembling axillary fascicles, umbels, or glomerules [or flowers rarely solitary in the lowermost axils of otherwise leafy branchlets]. Petals 4, orbicular, ovate or obovate, white, spreading in anthesis. Stamens numerous, free, the anthers versatile, splitting longitudinally. Ovary 2-locular, each locule with numerous ovules, the hypanthium extending slightly beyond the ovary or not at all. Fruit a 1 (rarely 2)-seeded berry crowned by the persistent lobes of the calyx. Embryo apparently undivided, with thick, fleshy, fused cotyledons. TYPE SPECIES: *E. uniflora* L.,  $2n = 22$ . (Named in honor of Prince Eugene of Savoy, 1663–1736, a patron of botany and horticulture.) — STOPPER.

A tropical genus of about 500 species represented in southern Florida by five indigenous species: *Eugenia anthera* Small, endemic, and *E. myrtoides* Poir. (*E. buxifolia* (Sw.) Willd.), *E. axillaris* (Sw.) Willd., *E. rhombea* (Berg) Krug & Urban, and *E. confusa* DC., which occur also in the West Indies. Although some of the species of *Eugenia* are clear cut and easily recognizable, the great majority are ill defined and difficult to determine, being based on leaf or floral characters which are very variable.



*Eugenia* has at various times included almost all species of the Eugeniinae, and the inclusive genus has been variously divided into smaller groups on the basis of the structure of the inflorescence and of the embryo. However, authors are by no means in agreement. Evidence from pollen morphology, wood anatomy, and anatomy of the bark supports the conclusion that the New World *Eugenias* are distinct from those of the Old World which are treated by the majority of recent authors as *Syzygium* Gaertn. *Eugenia* is said to differ from *Syzygium* in the pseudomonocotyledonous, apparently undivided embryo, and in the smooth seed coat which is free from the pericarp; the cotyledons of *Syzygium* are separate and the seed coat roughish, loosely or closely adhering to the pericarp.

Among the Old World species which are cultivated in Florida are *Syzygium Jambos* (L.) Alston, the rose apple ( $2n = 28$ , c. 42, 46, c. 54); *S. Cumini* (L.) Skeels, the Java plum or jambolan ( $2n = 44, 46$ ); and *S. malaccensis* (L.) Merr. & Perry, the Malay apple ( $2n = 22$ ). *Eugenia Dombeyi* Skeels, *E. Luschnathiana* Klotzsch ex Berg, *E. uniflora* L., Surinam cherry, and other species are known also in cultivation in Florida; the first two, however, are only sparingly grown, while *E. uniflora* is very popular both as an ornamental and for its edible fruits.

#### REFERENCES:

- See family references, McVAUGH (1956, Tropical American Myrtaceae, pp. 166-169).
- CHATTAWAY, M. M. The anatomy of bark. VII. Species of *Eugenia* (sens. lat.). Trop. Woods 111: 1-14. figs. 1-10 [2 pls.]. [Supports the separation of the Old World eugenias from those of the New World.]
- DADSWELL, H. E., and H. D. INGLE. The wood anatomy of the Myrtaceae, I. A note on the genera *Eugenia*, *Syzygium*, *Acmena*, and *Cleistocalyx*. Trop. Woods 90: 1-7. pls. 1, 2. 1947.
- GAGNEPAIN, F. Classification des *Eugenia*. Bull. Soc. Bot. Fr. 64: 94-103. 1917.
- HENDERSON, M. R. The genus *Eugenia* (Myrtaceae) in Malaya. Gard. Bull. Singapore 12: 1-293. 1949. [Rejects the removal of *Syzygium* from *Eugenia*.]
- JAYAWEERA, D. M. A. Variation in the flower of *Eugenia malaccensis* Linn. Jour. Linn. Soc. Bot. 55: 721-728. 1957. [A study based on teratologies.]
- MERRILL, E. D., and L. M. PERRY. The Myrtaceous genus *Syzygium* Gaertner in Borneo. Mem. Am. Acad. Arts Sci. 18: 135-202. 1939. [Includes notes on American species of *Eugenia*.]
- PIJL, L. VAN DER. Über die Polyembryonie bei *Eugenia*. Rec. Trav. Bot. Néerl. 31: 113-187. 1934.
- TIWARY, N. K. On the occurrence of polyembryony in the genus *Eugenia*. Jour. Indian Bot. Soc. 5: 124-136. 1926.

#### 4. *Myrcianthes* Berg, Linnaea 27: 315. 1854 [1856].

Trees or shrubs with opposite leaves. Inflorescence an axillary dichasium, the terminal (central) flowers usually sessile in the fork. Calyx 4-lobed [rarely 5-lobed], the lobes distinct, persistent. Petals 4, white, spreading in anthesis. Stamens numerous. Ovary 2-locular, each locule with numer-



ous ovules; hypanthium not extending beyond the summit of the ovary. Fruit a 1 (seldom 2)-seeded berry crowned by the persistent lobes of the calyx. Embryo with distinct, fleshy cotyledons, the plumule shorter than the radicle. (Including *Anamomis* Griseb.) TYPE SPECIES: *M. apiculata* Berg (see McVaugh, Taxon 5: 143. 1956.) (Name from *Myrcia*, and Greek, *anthos*, flower, in reference to the resemblance of the flowers to those of the genus *Myrcia*.) — NAKEDWOOD.

A genus of perhaps 50 or more species ranging from southern peninsular Florida to the West Indies, southward to Bolivia and Argentina, chiefly along the Andes, and southern Brazil. The genus is characterized by having solitary flowers or flowers in simple or compound dichasia, the hypanthium not extending beyond the ovary, the multiovulate ovary, and the embryo, as far as known, with two distinct cotyledons. *Myrcianthes dicrana*<sup>2</sup> occurs in hammocks along both coasts of southern peninsular Florida and on Key West and *M. Simpsonii*<sup>3</sup> in hammocks along the lower east coast of Florida and the Florida Keys. The latter differs in its larger flowers, many-flowered cymes, and the greater number of stamens.

*Myrcianthes* has been said to differ from *Anamomis* in the 5-parted flowers and in the presence of a plumule in the embryo. In a study of the Peruvian Myrtaceae, McVaugh found no support for separating the two genera, and he reported that 4-merous species occasionally have 5-merous flowers, and that a plumule is present in all mature seeds of species of *Anamomis* which were examined. In other morphological details the two genera are very much alike.

#### REFERENCES:

- See also family references, McVAUGH (1956, Tropical American Myrtaceae, pp. 169, 170; 1958, pp. 745–757.)  
SMALL, J. K. The genus *Anamomis* in Florida. *Torreyana* 17: 221–224. 1917 [1918].

#### Subtribe Pimentinae Berg

5. **Myrtus** Linnaeus, Sp. Pl. 1: 471. 1753; Gen. Pl. ed. 5. 212. 1754.

Shrubs or small trees with opposite leaves. Flowers solitary, peduncled, in the axils of leaves or of bracts or reduced leaves at the lowermost nodes of an otherwise leafy branch. Calyx 4[or 5]-lobed, the lobes distinct, persistent. Petals 4, white, spreading in anthesis. Stamens numerous. Ovary 2- or 3-locular, each locule with numerous ovules; hypanthium not extending beyond the summit of the ovary. Fruit a many-seeded berry crowned by the persistent lobes of the calyx. Seed coat bony; embryo

<sup>2</sup> *Myrcianthes dicrana* (Berg) K. A. Wilson, comb. nov. *Eugenia dicrana* Berg, *Linnaea* 27: 259. 1854 [1856], *Anamomis dicrana* (Berg) Britton, N. Am. Trees 728. 1908.

<sup>3</sup> *Myrcianthes Simpsonii* (Small) K. A. Wilson, comb. nov. *Anamomis Simpsonii* Small, *Torreyana* 17: 222. 1917 [1918].



uncinate-curved, the cotyledons short and inconspicuous. (*Mosiera* Small.)  
TYPE SPECIES: *M. communis* L. ( $2n = 22$ ). (*Myrtus*, the Latin name, from the Greek name, *myrtos*.) — STOPPER (cf. Small).

A genus of about 16 species, according to the most recent interpretation (Burret), with one species in Europe, one in Africa, and about 14 in Florida and the West Indies; in our area represented by one or perhaps two species. *Myrtus verrucosa* Berg (*Mosiera longipes* (Berg) Small) and *M. bahamensis* (Kiaersk.) Urban (*Mosiera bahamensis* (Kiaersk.) Small) occur in southern peninsular Florida and on the Florida Keys in pinelands and in hammocks. It is questionable that the two, which differ in size of flowers and to some extent in the habit of the plants, are distinct; if united, the correct name is *M. verrucosa*.

The genus has been variously interpreted and has been considered to include as many as 50 species, most of which are now regarded as belonging to other genera. A study of *Myrtus* is badly needed and should take into account the American groups which have been allied with it. Such a study should establish the limits of the genus, and indicate whether our species rightfully belong to it. The nature of the inflorescence, fruit, seed, and embryo, clearly indicate that our species are not allied with *Eugenia*, and, in fact, belong in a different subtribe.

#### REFERENCES:

- See also family references, McVAUGH (1956, Tropical American Myrtaceae, pp. 173, 174.)  
BURRET, M. Myrtaceen-Studien. Notizbl. Bot. Gart. Berlin 15: 479-550. 1941. [Retains 2 Florida species in *Myrtus*.]  
SOUÈGES, R. Embryogénie des myrtacées. Développement de l'embryon chez le *Myrtus communis* L. Compt. Rend. Acad. Sci. Paris 210: 548-550. 1940.

#### 6. *Psidium* Linnaeus, Sp. Pl. 1: 470. 1753; Gen. Pl. ed. 5. 211. 1754.

Trees or shrubs with opposite, pinnately veined leaves. Flowers axillary and solitary or in 3-flowered dichasia. Calyx undivided in bud, splitting irregularly in anthesis, remaining attached to hypanthium. Petals 4 or 5, white, spreading. Stamens numerous, free, inserted on the hypanthium. Ovary inferior, usually 4- or 5-locular, each locule with numerous ovules. Fruit a many-seeded berry, crowned by the persistent segments of the calyx. Embryo curved, cotyledons short, radicle elongate. TYPE SPECIES: *P. Guajava* L. (Name from Greek, *psidion*, pomegranate [*Punica Granatum*].) — GUAVA.

A genus of about 150 species of tropical and subtropical America. *Psidium Guajava* L.,  $2n = 22$ , originally introduced and cultivated for its edible fruits, has become naturalized in southern Florida as well as in many other warm parts of the world. The round or pear-shaped, yellow fruit is highly prized and is eaten raw or used to make jellies, preserves, or beverages. Many varieties have arisen in cultivation, but little taxonomic





Wilson, K A. 1960. "The genera of Myrtaceae in the southeastern United States." *Journal of the Arnold Arboretum* 41(3), 270–278.

<https://doi.org/10.5962/bhl.part.15232>.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/33617>

**DOI:** <https://doi.org/10.5962/bhl.part.15232>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/15232>

#### **Holding Institution**

Missouri Botanical Garden, Peter H. Raven Library

#### **Sponsored by**

Missouri Botanical Garden

#### **Copyright & Reuse**

Copyright Status: In copyright. Digitized with the permission of the rights holder.

Rights Holder: Arnold Arboretum of Harvard University

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.