

LIBRARY

MAR 4 1980

NEW YORK
BOTANICAL GARDEN

**Magnoliaceae
through
Ceratophyllaceae
of
New York State**

RICHARD S. MITCHELL
New York State Museum

ERNEST O. BEAL
Western Kentucky University

Contributions to a Flora of New York State II
Richard S. Mitchell, Editor

1979

Bulletin No. 435

New York State Museum

The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Albany, New York 12230

Digitized by the Internet Archive
in 2017 with funding from
IMLS LG-70-15-0138-15

<https://archive.org/details/bulletinnewyorks4351newy>

**Magnoliaceae
through
Ceratophyllaceae
of
New York State**

**RICHARD S. MITCHELL
New York State Museum**

**ERNEST O. BEAL
Western Kentucky University**

**Contributions to a Flora of New York State II
Richard S. Mitchell, Editor**

1979

Bulletin No. 435

New York State Museum

**The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Albany, New York 12230**

THE UNIVERSITY OF THE STATE OF NEW YORK

Regents of The University (*with years when terms expire*)

1981	THEODORE M. BLACK, A.B., Litt.D., LL.D., Pd.D., D.C.L., L.H.D. <i>Chancellor</i> -----	Sands Point
1988	WILLARD A. GENRICH, LL.B., L.H.D., LL.D. <i>Vice Chancellor</i> -----	Buffalo
1986	KENNETH B. CLARK, A.B., M.S., Ph.D., LL.D., L.H.D., D.Sc. -----	Hastings on Hudson
1983	HAROLD E. NEWCOMB, B.A. -----	Owego
1982	EMLYN I. GRIFFITH, A.B., J.D. -----	Rome
1983	MARY ALICE KENDALL, B.S. -----	Rochester
1984	JORGE L. BATISTA, B.A., J.D., LL.D. -----	Bronx
1982	LOUIS E. YAVNER, LL.B. -----	New York
1986	LAURA BRADLEY CHODOS, B.A., M.A. -----	Vischer Ferry
1980	MARTIN C. BARELL, B.A., I.A., LL.B. -----	Kings Point
1981	JOSEPH R. BONGIORNO, B.S., M.D. -----	Brooklyn
1984	LOUISE P. MATTEONI, B.A., M.A., Ph.D. -----	Bayside
1981	J. EDWARD MEYER, B.A., LL.B. -----	Chappaqua
1985	ARLENE B. REED-DELANEY, B.A., M.D. -----	Albany
1987	R. CARLOS CARBALLADA, B.S. -----	Arcade

President of The University and Commissioner of Education
GORDON M. AMBACH

Executive Deputy Commissioner of Education
JOSEPH J. BLANEY

Deputy Commissioner for Cultural Education
ROBERT J. MAURER

Assistant Commissioner, State Museum
NOEL C. FRITZINGER

Director, State Science Service
HUGO JAMNBACK

Chief, Biology Survey
RICHARD H. MONHEIMER

State Botanist
RICHARD S. MITCHELL

PREFACE

OUR GOAL in producing this series is to present a useful and authoritative account of the plants of New York State. This series of contributions is intended to reflect the knowledge and taxonomic opinions of specialists who prepare the manuscripts, while following a generalized format for consistency. Inclusion of ecological, distributional, medical and economic information on each species is also one of our major aims. Habitat references, flowering times, pertinent synonymy, etc., apply specifically to New York plants rather than to the entire ranges. Complete illustration should facilitate identification of specimens for those who are not formally trained in botany. Descriptions are original, ordered and as complete as possible to provide sequential cross-referencing.

Distribution maps accompany species of seed plants, ferns, mosses, lichens and some groups of fungi. These are plotted by counties to eliminate pinpointing endangered habitats, while offering an accurate visual picture of past collecting. Maps are based on the master file at the New York State Museum, Albany, and supplemented by available data (specimens examined by the authors) from herbaria housing significant New York collections. Specific data or literature citations for any map may be obtained, on approval, from the Museum.

We hope that these bulletins will serve individuals with interest in the flora, as well as to provide information for State and Federal agencies, conservation organizations, industry and the scientific community. With these works go our hopes for the preservation and wise use of a precious and lifegiving resource . . . our State's plantlife.

Richard S. Mitchell, Editor

The New York State Flora Committee

The steering council of the New York State Flora Committee met for the first time on January 19, 1976, and established as its goals the promotion of study of the State's plant resources and the publication of this series of Museum Bulletins. These contributions will be continually updated after publication for possible incorporation into larger volumes at a later date.

Members of the council at the time of this publication are:

Richard S. Mitchell, Chairman, State Botanist, N.Y. State Museum, Albany (Vascular Plants)

Charles J. Sheviak, Curator of Botany, N.Y. State Museum, Albany (Vascular Plants)

Robert T. Clausen, Cornell University, Ithaca (Vascular Plants)

Edwin H. Ketchledge, College of Environmental Science and Forestry, Syracuse (Bryophytes)

Clark T. Rogerson, New York Botanical Garden, New York (Fungi)

George J. Schumacher, Biology Department, SUNY, Binghamton (Algae)

CONTENTS

	Page
Preface.....	iii
The New York State Flora Committee	iii
Acknowledgments.....	v
Important Note	v
Legend	vi
Magnoliaceae.....	1
<i>Magnolia</i>	1
<i>Liriodendron</i>	4
Annonaceae.....	6
<i>Asimina</i>	6
Calycanthaceae	8
<i>Calycanthus</i>	8
Lauraceae	10
<i>Lindera</i>	10
<i>Sassafras</i>	12
<i>Persea</i>	13
Saururaceae.....	14
<i>Saururus</i>	14
Aristolochiaceae	16
<i>Asarum</i>	16
<i>Aristolochia</i>	18
Nymphaeaceae	23
<i>Nymphaea</i>	23
<i>Nuphar</i>	25
Nelumbonaceae.....	29
<i>Nelumbo</i>	30
Cabombaceae	31
<i>Cabomba</i>	31
<i>Brasenia</i>	33
Ceratophyllaceae	34
<i>Ceratophyllum</i>	34
Appendix I. (Associated Fungi).....	37
Appendix II. (Associated Insects)	46
Bibliography.....	53
Index	62

ACKNOWLEDGMENTS

The illustrations in this treatment are originals by Deborah Morrison. The appendices on insects and fungi are the work of J. Kenneth Dean, with reviews by Timothy McCabe, Clark Rogerson and John Haines, to whom we offer our thanks. Our special appreciation goes to Arthur Cronquist for his comments on the manuscript. Thanks also to the members of the Steering Council of the Flora Committee for review, and to Howard Pfeifer for special attention to the chapter on Aristolochiaceae. We wish to express our sincere thanks to the staffs and curators of the following institutions for their complete cooperation and hospitality when we visited or borrowed their collections: the U.S. National Herbarium (US), the New York Botanical Gardens (NY), Cornell University (CU,BH), Environmental Science and Forestry, Syracuse (SYRF), Harvard University (GH,NEBC), Brooklyn Botanical Gardens (BKL) and the Buffalo Academy of Sciences (BUF). Data from the above collections were added to the master file at the New York State Museum, Albany (NYS). This file was started by Homer D. House over 40 years ago and was largely produced and maintained by Stanley J. Smith. Funding for illustration services: Albany County Department of Employment and Training.

The classification system employed in this flora is that of Arthur Cronquist (1968), with modifications agreed upon through personal communication.

IMPORTANT NOTE

All economic uses, folklore, medical and pharmaceutical notes, uses as foodstuffs, etc., are compiled from the literature and do not represent an endorsement by the authors or the New York State Museum. Some of the uses may, indeed, be dangerous if incorrectly employed. Some are not effective and are presented for historical interest only.

LEGEND

FOR ALL MAPS IN THIS PUBLICATION THE FOLLOWING
SYMBOLS APPLY:

- Solid dot—specimen seen by author; data on file at the State Herbarium (NYS)
Circle—Field observation with location data and observers name on file (NYS)
Hollow triangle—Literature citation on file (NYS)

FOR ALL ILLUSTRATIONS IN THIS PUBLICATION THE
FOLLOWING LETTER-DESIGNATIONS APPLY:

- | | |
|---------------------------|------------------|
| A. Habit sketch | G. Inflorescence |
| B. Silhouette | H. Fruit section |
| C. Fruit or fruit cluster | J. Seed |
| D. Twig or winter branch | K. Rhizome |
| E. Bark/trunk | M. Leaf whorl |
| F. Flower | |

Magnoliaceae (Magnolia Family)

The Magnoliaceae is a family of ancient lineage, comprising 12 genera and some 200 species. These are primarily native to temperate and subtropical Asia and North America, but some range southward to Java and Brazil. Members of Magnoliaceae are absent in Europe, Africa and Australia. Two species of *Magnolia* and one *Liriodendron* are native to New York State. Asiatic Magnolias and their artificial hybrids are quite popular horticulturally, especially section Yulania, known for precocious and spectacular flowers which appear in spring, when plants are virtually devoid of leaves. Tulip-tree (*Liriodendron*) and several species of North American evergreen and deciduous *Magnolia* are grown as ornamental shade trees within and outside their natural ranges. The family is also of some importance in North America in terms of wood production.

FAMILY DESCRIPTION

Deciduous or evergreen shrubs and trees. Trunks of some species reach a height of over 40 meters. Bark is ridged with age or scaling and flaking, often aromatic. Stipules are free or adnate to the petiole, and leave conspicuous scars on the twigs. Leaves are simple, pinnately veined; alternate, and sometimes lobed, possessing etherial oil cells. Flowers are solitary, axillary or terminal, nearly always bisexual. Flower buds are enclosed in 1–3 tough bracts which are deciduous as the flower expands. The perianth is of 5–30 (33) free parts (tepals), spiral or arranged in two or more whorls. The perianth is relatively undifferentiated except in *Liriodendron*, where sepals and petals are distinguishable. Stamens are numerous, often fleshy or appendaged; anthers 2-locular and longitudinally dehiscent (extrorse or introrse). The stamens spiral on the elongate central axis of the flower, leaving a zone of scars beneath the fruit (either contiguous or not). Ovaries are also spirally arranged on the central axis, each ovary consisting of a free or basally fused conduplicate carpel. Each carpel has 2–6 anatropous, bitegmic, crassinucellar ovules. Fruits are in cone-like aggregates of woody follicles or samaras. Seeds are one to several per fruit with tiny embryos imbedded in copious, oily endosperm.

KEY TO GENERA

1. Leaves acute to obtuse, uncut; flowers not marked with orange; anthers introrse; fruit remaining in a cone-like aggregate of dehiscent follicles, unwinged1. *Magnolia* (p. 1)
1. Leaves truncate, notched and lobed; flowers bicolored, yellow-green with orange marks; anthers extrorse; fruit dry, indehiscent, winged, falling separately2. *Liriodendron* (p. 4)

1. MAGNOLIA

Common Names: Magnolia, Cucumber-tree, Sweet-bay

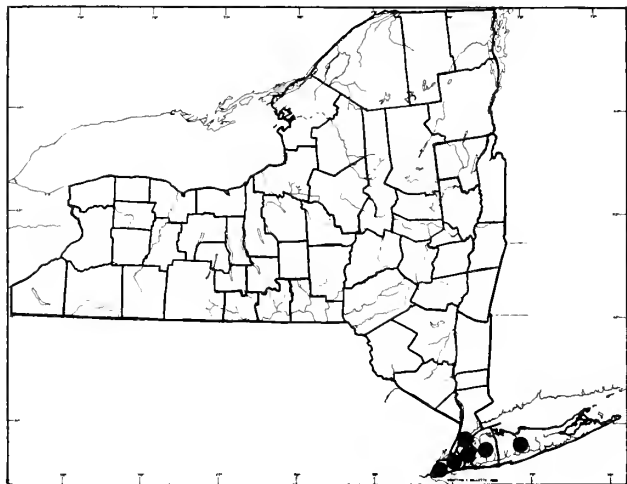
Authority: Linnaeus, Species Pl. I, pp. 535–536, 1753

A genus of approximately 80 trees and shrubs, represented in New York State by two native species.

Description: Flowers, bisexual; **stigmas** 1 per carpel, papillate; **styles** 1 per carpel, recurved or hooked at tips; **carpels** numerous, spiraling on the floral axis, each carpel sessile or short-stipitate, cylindric, bearing two **ovules**, becoming a coriaceous to woody **follicle** which dehisces along a longitudinal suture; **fruits** in a cone-like aggregate; **seeds** 1–2 per follicle (or aborted), remaining temporarily attached to the fruit by vascular threads, drupe-like, with a reddish, leathery to fleshy outer coat and a hard inner layer; **stamens** spiraling on the axis, numerous, caducous, fleshy, without differentiated filaments, often appendaged at tips; **anther sacs** introrsely or laterally dehiscent; **perianth** of undifferentiated **tepals**; tepals (5) 6–15 (33), broadly oval to linear, greenish-yellow, white, pink, or purplish, similar to one another in size and shape (rarely the outer whorl reduced); **flowers** solitary, often fragrant, appearing with the leaves or before; flower **buds** enclosed in spathe-like, glabrous to densely pubescent **bracts** which drop early, leaving scars on the **peduncle**; **leaves** simple, alternate or falsely whorled, evergreen or deciduous, blades coriaceous to fleshy, sometimes basally lobed or emarginate at the apex; **petioles** thick; **stipules** caducous, free or attached to the petiole, leaving scars; **twigs** with mixed **winter buds**, both vegetative and floral; **bark** variously ridged or peeling; **trunks** to 40 m in height; perennial shrubs or trees.

KEY TO MAGNOLIA SPECIES

1. Leaves conspicuously silver-gray beneath; tepals or mature fruiting axes less than 5 cm long.....1. *Magnolia virginiana* (p. 2)
1. Leaves pale green beneath; tepals or mature fruiting axes 5–12 cm in length.....2. *Magnolia acuminata* (p. 3)



1. *Magnolia virginiana* L.

Common Names: Sweet-bay, Swamp-bay, Magnolia-bay, Bay, Magnolia-laurel, Beaver-tree

Type Description: Linnaeus, Species Pl. I, p. 535, 1753

Synonyms: *M. australis* Ashe, *M. glauca* L.

Origin: Eastern North America

Habitats: Swampland, poorly drained coastal plain forests

Habit: Lax shrub or slender tree, late-deciduous to evergreen

Flowering: June–July (September)

Fruiting: July–November

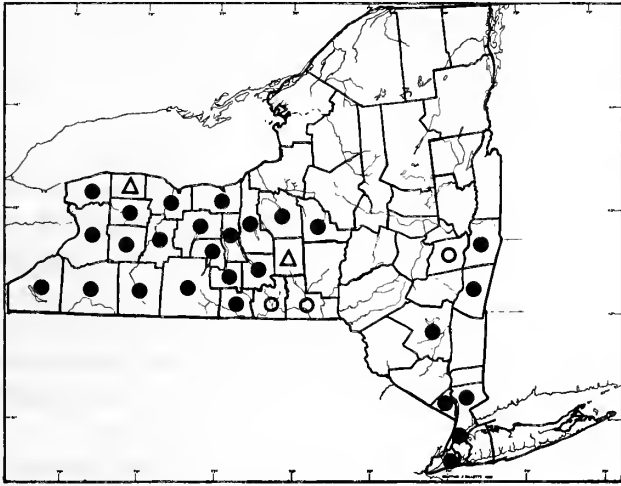
General Distribution: Long Island and Massachusetts coast south to Florida, west to Texas



Description: Flowers bisexual; stigmatic surfaces punctate on reflexed styles, 1 per carpel; ovaries numerous, each a conduplicate carpel, greenish, glabrous, spirally arranged, ca. 1 cm long, cylindric, each becoming a short-beaked, ellipsoid follicle; follicle 1–2 cm long, reddish to purple-brown at maturity; fruiting-cone ellipsoid, 3–5 cm long; seeds 0–2 per follicle, ovoid, 0.8–1.1 cm long, red; stamens few, 8–9 mm long, with acute appendages; tepals spatulate to orbicular, 3–5 (9) cm long, white to cream colored, appearing with leaves, 6–15 (18) in number, the outer 3 usually reflexed, the inner ones forming a subglobose flower; flower 3–5 cm long, white to cream colored, fragrant, opening with the leaves; bud scales sericeous; peduncle stout, 1–2 cm long, glabrous to sericeous; leaves alternate, late-deciduous (evergreen further south), narrowly oblong to oblong-elliptic or lanceolate, 4–11 (17) cm long, 2–5 (6.5) cm broad, acute tipped, cuneate to acute at bases, upper surfaces bright green, glabrous or finely pubescent, copiously sericeous on lower surfaces with a silver-gray sheen (rarely greenish); petioles yellow-green, 1.5–2 (3) cm long; stipule scars extending nearly to the lamina base; twigs glabrous to densely sericeous, greenish becoming purple-brown with age; pith strongly septate; winter buds sericeous; bark of trunk and older limbs gray-brown, flaking and forming furrowed plates; branching system open, lax; trunks up to 1 m (d.b.h.), 30 m in height. (2n = 38).

Intraspecific Variation and Hybridization: Differences in deciduousness and persistence of pubescence on leaves, petioles and twigs have been used to separate southern var. *australis* Sarg. from ours. These characters are quite variable and seem to represent a rough longitudinal cline. Multiple trunked, shrub-like habit prevails in some locations, and may either be genetically fixed or environmentally induced. Hybrids are recorded between this species and: *M. hypoleuca* Sieb & Zucc., *M. macrophylla* Michx., *M. tripetala* L., *M. grandiflora* L. and *M. guatemalensis* J. D. Smith.

Importance: The wood is used in furniture manufacture for both structural components and face-veneer. The plant is sometimes cultivated as a moisture and shade-tolerant tree.



2. *Magnolia acuminata* (L.) L.

Common Names: Cucumber-tree, Mountain Magnolia, Cucumber Magnolia

Type Description: Linnaeus, Syst. Nat. ed. 10, vol. 2, p. 1082, 1759

Synonyms: *M. virginiana* var. *acuminata* L., *M. acuminata* var. *ludoviciana* Sarg., *Tulipastrum americanum* Spach, *Tulipastrum acuminatum* (L.) Small

Origin: Eastern North America

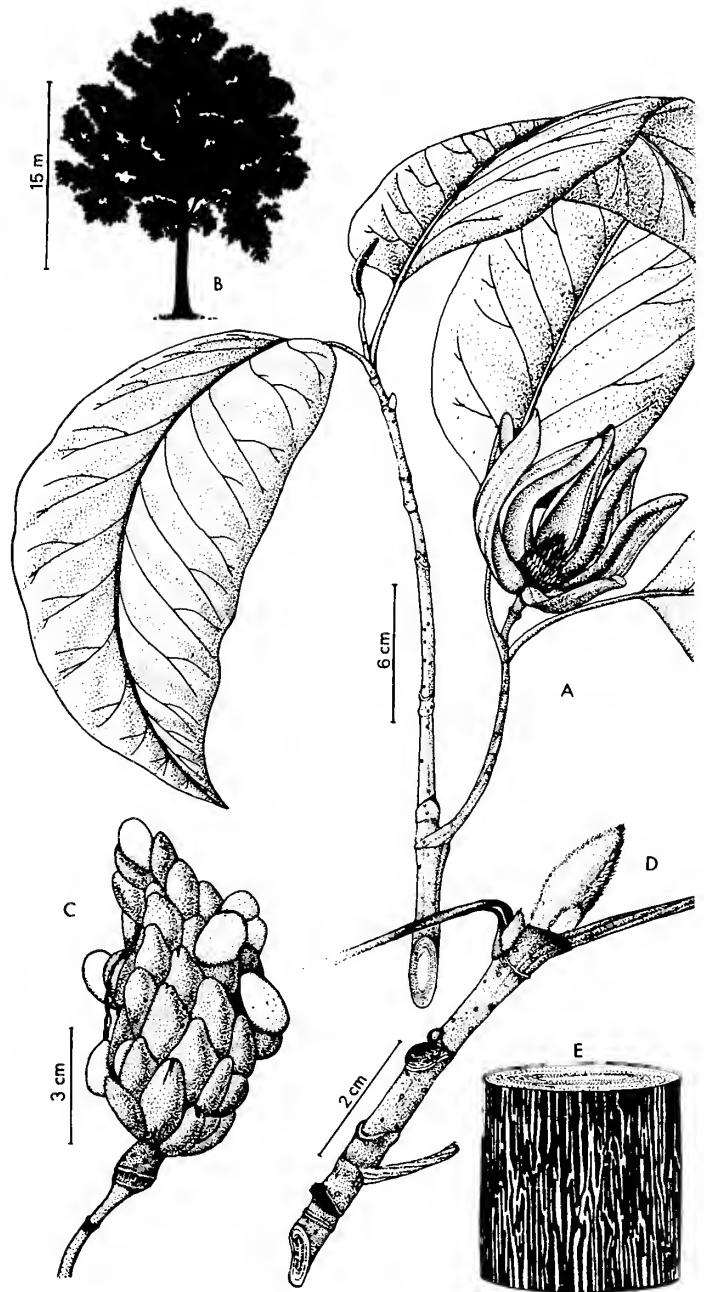
Habitats: Rich, moist soils of loose texture, primarily in uplands; commonly associated with Red and White Oaks, Hickory, Ash, Beech and Tulip-tree

Habit: Straight, slightly buttressed trunk, pyramidal crown, and spreading root system; scattered trees, rarely forming stands

Flowering: May–June

Fruiting: July–September

General Distribution: New York and southern Ontario south in the highlands to Alabama (Louisiana) and west to Oklahoma



Description: Flowers bisexual; **stigmatic surfaces** punctate on the early-deciduous, recurved **styles**, 1 per carpel; **ovaries** numerous, free, spirally arranged, each of a single conduplicate **carpel** about 2.5 cm long; each carpel becoming an unbeaked, rounded-obtuse **follicle**, dehiscent along a longitudinal **suture**, pinkish, becoming red-brown at maturity; **fruit** aggregate oblong to cylindric (or assymetrical due to abortion), up to 8 cm long; **seeds** 0–2 per follicle, 0.9–1.1 cm long, glossy, red-orange at maturity; **stamens** numerous, spirally arranged on the floral axis, about 1 cm long; **filaments** distinct; **tepals** oblanceolate to obspatulate, 2 cm (outer) to 12 cm (inner in length, the outer 3 sepaloid, reflexed, the inner 6 petaloid, forming a slenderly campanulate flower; **flower** 5–10 cm long, glaucous green, tinged with yellow and occasionally purple (sometimes bright yellow further south), appearing with the leaves, borne on stout, **peduncles** which are copiously villous and 1.5–3.2 cm long; **leaves** alternate, deciduous, thin, often membranous, 8–25 (40) cm long, 4–10 (20) cm broad, elliptic to oblong with acuminate (rarely obtuse) tips and truncate to cuneate bases, upper surfaces dark green, glabrous to puberulent, lower surfaces pale, glabrous to finely pubescent, slightly glaucous or sericeous near the veins; **fall coloring** yellow; **petioles** about 3 cm (1.5–5.0) long, silvery-sericeous to almost glabrous, with basal **stipular scars**; **leaf scars** horseshoe-shaped; **twigs** reddish-brown to tan, glabrous except at **nodes**, **lenticellate**; **pith** not conspicuously diaphragmed; **winter buds** silky-sericeous, silvery, oblong, the terminal ones cylindric reaching 2 cm in length; **bark** of the **trunk** and older limbs gray-brown to dark brown, fissured into narrow, flaky ridges; branching pattern forming a broadly to narrowly pyramidal **crown**; **trunks** up to 1.5 (2) m (d.b.h.), 35 (40) m in height. (2n = 76).

Intraspecific Variability and Hybridization: Most of the variability of this species occurs in the southern part of its range. Plants with clear, golden, inner tepals are designated forma *aurea* (Ashe) Hardin. Plants called var. *subcordata* (Spach) Dandy may also have yellow flowers, but these are distinguished by more pubescent twigs and leaf undersurfaces (see Hardin, 1954). Hybrids with *M. quinquepetala* (Buc'hoz) Dandy have been given the binominal *M. brooklynensis* Kalmbacher.

Importance: This species is the hardiest of our native Magnolias. It is commonly cultivated and used as rootstock for less hardy species. Grafting allows these to be grown far north of their natural ranges. The wood (often mixed with that of Tulip-tree) is used in furniture manufacture and in making fixtures, blinds, crates and boxes, doors and pulpwood.

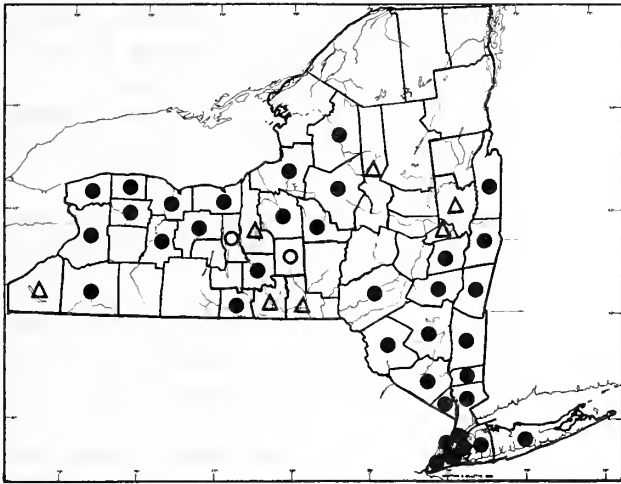
Introduced Species: *Magnolia tripetala* L., Umbrella-tree, is native further south, and has been introduced northward, where it is hardy to Massachusetts. We have one specimen from Southold, Long Island for which there are insufficient data to determine its origin. *M. fraseri* Walt. is reported as an adventive in a Sullivan County nursery, where it was introduced with a shipment of *Rhododendron* from North Carolina.

2. LIRIODENDRON

Common Names: Tulip-tree, Yellow Poplar, Tulip Poplar

Authority: Linnaeus, Species Pl. I, p. 535, 1753

A genus of two closely related species of eastern North America and southern Asia. Fossil records indicate widespread past distribution of the genus over North America and Eurasia. Our native *Liriodendron* is a tall, distinctive tree, valuable for its timber and as an ornamental.



1. *Liriodendron tulipifera* L.

Common Names: Tulip-tree, Yellow Poplar, Tulip Poplar, White-wood

Type Description: Linnaeus, Species Pl. I, p. 535, 1753

Synonyms: *Tulipifera liriodendron* Mill. (also misspelled *Liriodendrum*) *L. procerum* Salisb.

Origin: Circumboreal Arctotertiary Forest

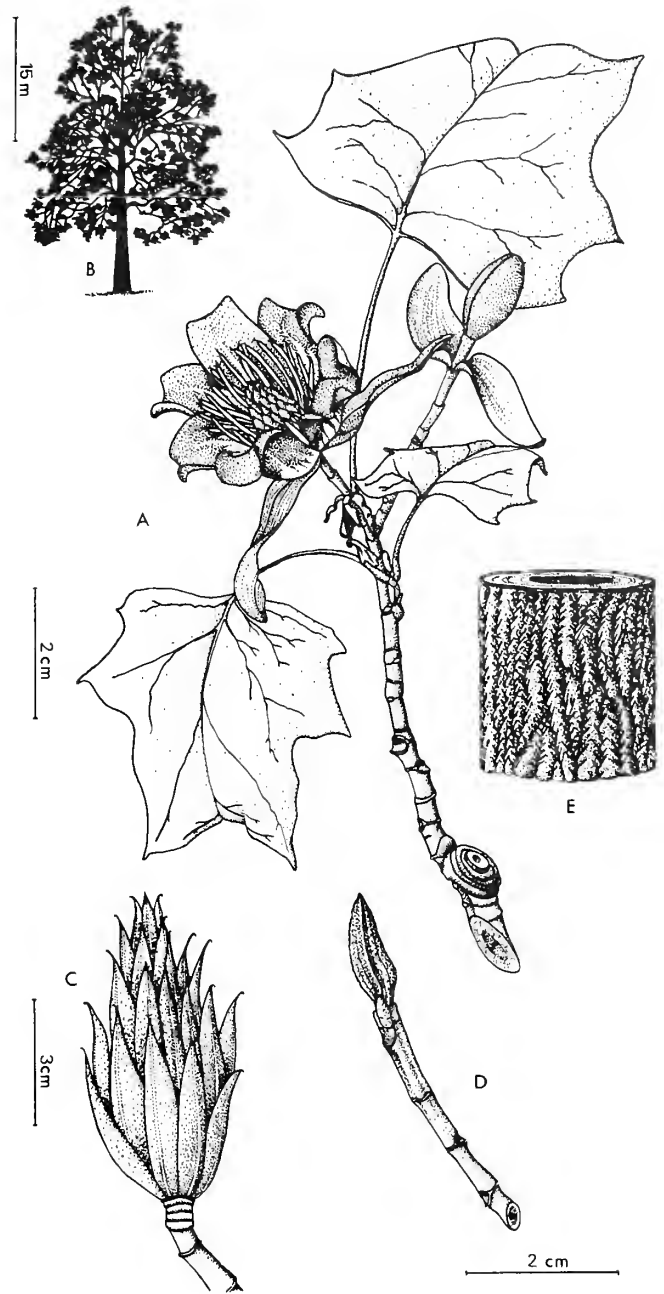
Habitats: Moist, but well drained, loose-textured soils of medium depth; a successful secondary invader of forest habitats, lime tolerant and more moisture tolerant southward; found in a broad spectrum of forest types, from Oak-Hickory to coniferous mixtures.

Habit: Tall, straight trunk, terminating above the open, oblong, deciduous crown; root system deep, wide-spreading.

Flowering: May–June

Fruiting: July–October

General Distribution: Vermont to northern Florida, west to Michigan, Missouri and Louisiana (cultivated elsewhere)



Description: Flowers bisexual; stigmas 1 per carpel, often reflexed at the style tip; styles 1 per carpel, flattened, tapering; ovaries numerous, imbricated, spiraling on the central floral axis; each ovary of a single conduplicate carpel, greenish-yellow, squamelliform, becoming an elongate samara in fruit; samara 4–5 cm long, 4–5 mm wide, acute tipped; seeds 1–2 per indehiscent fruit; fruit aggregate deciduous as a unit, fusiform, 5–7.5 cm long, pale tan to brownish, the lowermost fruits often persistent on the axis; stamens numerous, spiraling on the axis, up to 4 cm long, the filaments distinct, shorter than the anther sacs and stout; perianth differentiated into calyx and corolla; sepals 3, greenish, reflexed, about 6 cm long, cucullate, blunt-tipped; petals 6, in two whorls, strongly upcurved, often reflexed in the terminal cm, 4–6 cm long, 1.5–3.1 cm broad, pale green to bright yellow, each petal banded with a distinctive orange mark near the base; flowers borne singly, broadly campanulate, 6–10 cm wide, on short shoots; peduncles stout, greenish; leaves alternate, deciduous, usually saddle-shaped, with two acute to acuminate tipped upper lobes and two lower lobes with one or two such tips; lobing variable, especially in juvenile leaves which may be deeply cleft or barely lobed at all; leaf bases truncate, tips truncate to emarginate,

blades bright green above to glaucescent below, 10–15 cm in diameter; **fall coloring** lemon-yellow; **petioles** slender, 5–15 cm long; **stipules** elongate (up to 3.5 cm), deciduous, encircling the twig and leaving distinct scars; **twigs** stout, glabrous, lenticelled, red-brown to gray with exfoliation; **pith** strongly **diaphragmed**; **terminal buds** up to 1.5 cm long, with a “duck-billed” appearance; **outer 2 bud scales** enclosing the bud entirely, valvate; **leaf scars** circular to oval; **bark** of young trunk and older limbs with characteristic, whitish split-depressions in the grayish surfaces; **older bark** gray-brown, deeply furrowed; **trunks** straight, becoming massive with age, terminating above the oblong **crown**, up to 4.5 m (d.b.h.), to 55 m (record 198 ft) in height. (2n = 38).

Infraspecific Variation: Other than natural hetrophyly exhibited in native populations, most variation in this species has been exhibited only in cultivation. This involves leaf variegation, flower color variants, leaf and crown shape.

Importance: This is one of the most beautiful cultivated trees native to North America. Its unusually graceful habit, showy flowers and fall coloring far outweigh the “dirty” aspect of shedding fruit aggregates. Although it is not an outstanding shade producer, the tree is fast-growing and mixes well with other species for landscaping effects. The wood is pale (called Whitewood and Poplar in the trade) and is an important commodity with many uses. It is well suited for rotary-cut veneering, used in furniture, plywood production, piano cases and produce boxes; it is also a source of pulp (soda process). The wood is used structurally for furniture manufacture, for doors, blinds, crates, caskets, musical instruments, wooden utensils and toys.

Annonaceae (Custard-apple Family)

A large pantropical family of woody plants with over 800 described species and 60–80 genera. *Annona* (including *Uvaria*) is the largest genus with nearly 200 species. One Custard Apple, (*Annona glabra* L.) is native to southern Florida, and others are cultivated for their fruit and as ornamentals. *Asimina* (Pawpaw) has two native species, one of which reaches western New York State. The Pawpaw fruit is both picked for food and planted as a novelty in the eastern United States.

FAMILY DESCRIPTION

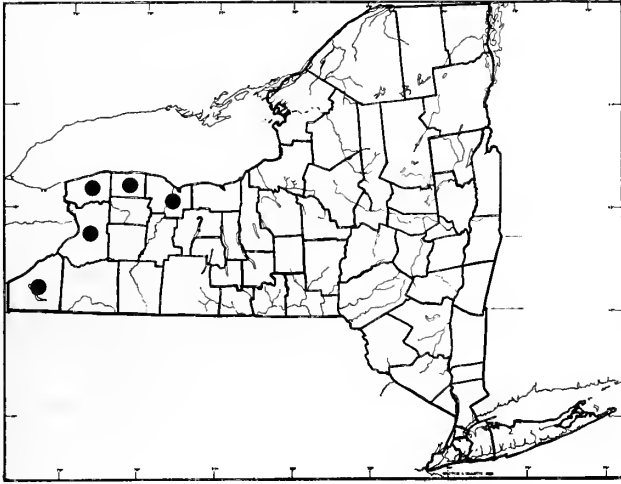
Trees or shrubs. The alternate leaves are persistent or deciduous, without stipules and with naked buds in the axils; flowers are usually bisexual, and are radially symmetrical, differentiated into calyx and corolla and valvate in bud. Sepals are 3; petals 6, in 2 whorls. The central floral axis is elongate with numerous adnate, extrorse stamens spiraling on it. Anther sacs are 4-celled, longer than the filaments. Ovaries are superior, terminating the axis, 1–many, usually 1-carpelled, 1-loculed, becoming berries, cohering to form a fleshy aggregate fruit (or solitary). Ovules are 1 to many per ovary, anatropous, maturing to seeds which have a minute embryo and copious ruminant (mottled) endosperm.

1. ASIMINA

Common Name: North American Pawpaw

Authority: Adams, Fam. Pl. II, p. 365, 1763

A genus of some 8–10 species of subtropical and boreal eastern North America, with one species extending northward onto the Erie-Ontario Lowlands in western New York.



1. *Asimina triloba* (L.) Dunal

Common Name: Pawpaw

Type Description: Dunal, Mon. Anon., p. 83, 1817

Synonyms: *Annona triloba* L., *Orchidocarpum arietinum* Michx., *Porcelia triloba* Pers., *Uvaria triloba* Torr. & Gray

Origin: Eastern North America

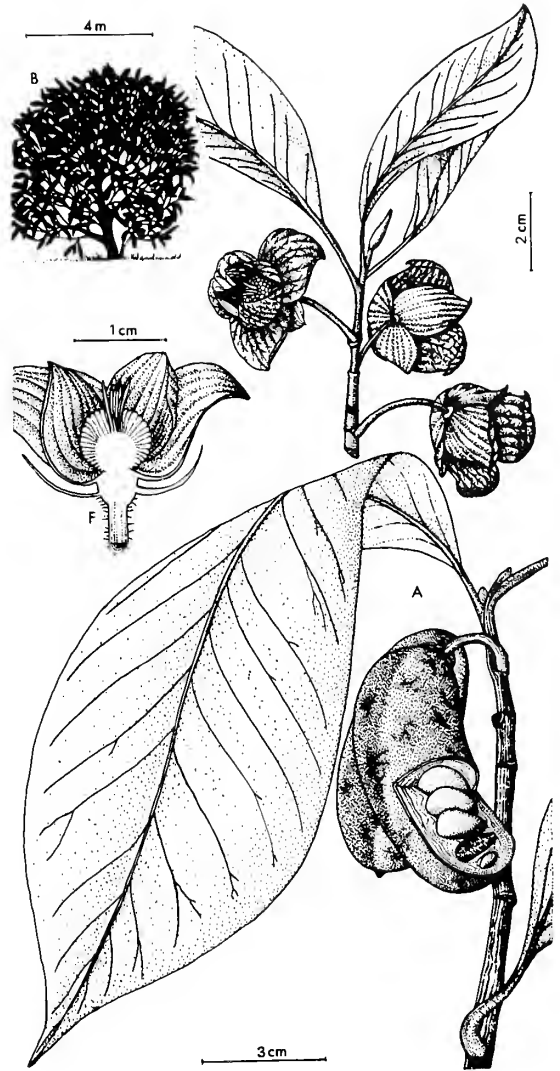
Habitats: Rich alluvial soils, woodlands, openings

Habit: Shrub or small tree

Flowering: April–May

Fruiting: August–September

General Distribution: Western New York and southern Ontario to eastern Nebraska, south to eastern Texas and central Georgia, with outliers in north Florida and southern Louisiana



Description: Flowers bisexual; stigma and style 1 per carpel; ovaries 3–15, fusiform, on the elongate floral axis, only 1–3 (4) developing into fruit; fruit 6–15 cm long, 3–4.5 cm thick, yellowish to purple-brown, fleshy, edible; ovules parietal, becoming (4) 6–10 disc-shaped seeds, 1–2 cm in diameter; endosperm mottled and chambered; embryo small; stamens numerous, on the column, in a globose, adhering mass, 6–11 mm in diameter; anther sacs adnate until anthesis, extrorse; filaments very short; perianth differentiated into three whorls; inner petals valvate in bud, velutinous, narrowly oblong to strap-shaped, 1.5–2.3 cm long, 5–10 mm wide, dark reddish-purple; outer petals 3, imbricate in bud, velutinous, as broad or broader than long, 1.5–2.1 cm, lurid purple, occasionally blushed with yellow-green; calyx of 3 sepals, deciduous, red-brown adaxially woolly, ca. 1 cm long; peduncles 6–8 mm long, arising from wood of the previous year's growth, covered with reddish-brown wool; flowers solitary, cauliflorous, alternate on the stem; leaves alternate, simple, entire, deciduous, densely woolly when very young; leaf blades 10–32 cm long, 6–13 cm wide, appearing with the flowers and almost fully expanded by anthesis, glabrous to velutinous, especially below, paler beneath, obtuse to cuneate at bases, obtuse (rounded), acute apiculate to strongly cuspidate at tips (caudate); midrib grooved above, woolly within the groove; petiole with a strong, woolly groove adaxially, 0.5–3.0 cm long; stipules absent; buds small, reddish-woolly; twigs densely woolly, red-brown to gray-brown, less pubescent with age, sometimes fluted and ridged; older bark grayish, mottled, smooth to warty and flaking; trunks 5–30 cm (d.b.h.), usually shrubby; trees with closed, oval crowns occasionally to 11 m in height, from spreading root systems.

Importance: This species is planted for its fleshy, edible fruits. The pulp is whitish to yellow and has a sweet, fruity taste at maturity. The bark of young twigs is sometimes used by fishermen as a stringer for their catch. Seminole Indians reportedly make a tea from the flowers to help kidney discomfort.

Calycanthaceae (Calycanthus Family)

This group of evergreen or deciduous shrubs has two genera and about 6–7 species, all found in warm-temperate regions. *Chimonanthus* is native to Asia while *Calycanthus* is represented in California and in the southeastern United States. Members of the family in New York State are found as escapes from cultivation only, being native further south. Their economic importance is limited to minor use as ornamental shrubs. This primitive family has a curious mixture of characters which places it in the order Magnoliales, but shows clear affinities for the Rosales as well.

FAMILY DESCRIPTION

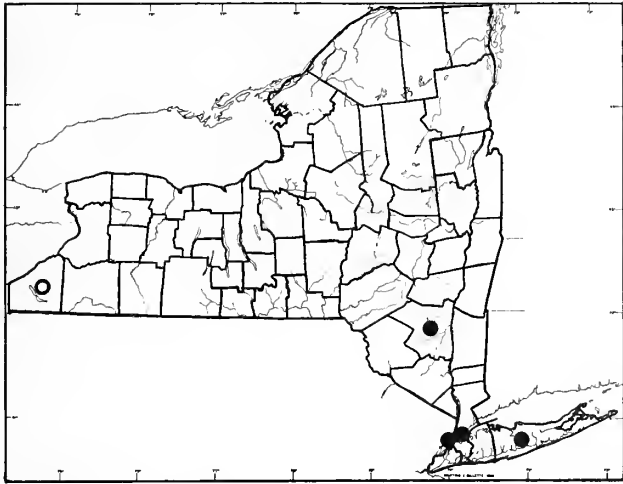
Plants are shrubby, with evergreen or deciduous, opposite, simple leaves. Petioles are short and lack stipules. The fragrant flowers are borne (solitary) in the leaf axils; they are bisexual, the perianth undifferentiated, or grading into sepal-like bracts below. Tepals are free, showy, spiraling on a cup-like perigynous receptacle. Stamens are 5–30 or more, inserted on the inner surface of the receptacular cup; anthers are adnate, extrorse, 2-celled; filaments are distinct but short, the inner ones sometimes devoid of fertile anther sacs. Ovaries are 1-loculed, each of a single carpel, numbering 8–22, “superior” to the receptacular cup, which surrounds and virtually encloses them. Styles are filiform, with a single minute stigma each. Placentation is parietal; ovules are 1 or 2 (with one aborting). The fruit is an achene, enclosed with others in the fleshy, mature receptacle. The embryo is large with convolute cotyledons, and endosperm is lacking.

1. CALYCANTHUS

Common Names: Sweet-shrub, Carolina Allspice, Strawberry-shrub, Bubby-shrub

Authority: Linnaeus, Syst. Nat., p. 1066, 1759

A genus of aromatic shrubs native to eastern and western North America. *Calycanthus occidentalis* Hook & Arn. is the native California “Spice-bush,” while up to three species have been recognized as native from the Appalachian Plateau southward. The following species is cultivated and escapes New York State.



1. *Calycanthus floridus* L.

Common Names: Sweet-shrub, Strawberry-bush, Bubby-bush

Type Description: Linnaeus, Syst. Nat., p. 1066, 1759

Synonyms: *Calycanthus fertilis* Walt., *C. laevigatus* Willd., *C. oblongifolius* Nutt., *C. nanus* (Loisel.) Small, *C. glaucus* Willd., *C. mohrii* Small, *Butneria florida* (L.) Kearney, *B. fertilis* (Walt.) Kearney

Origin: Eastern North America

Habitats: Rich woodlands, floodplains and uplands

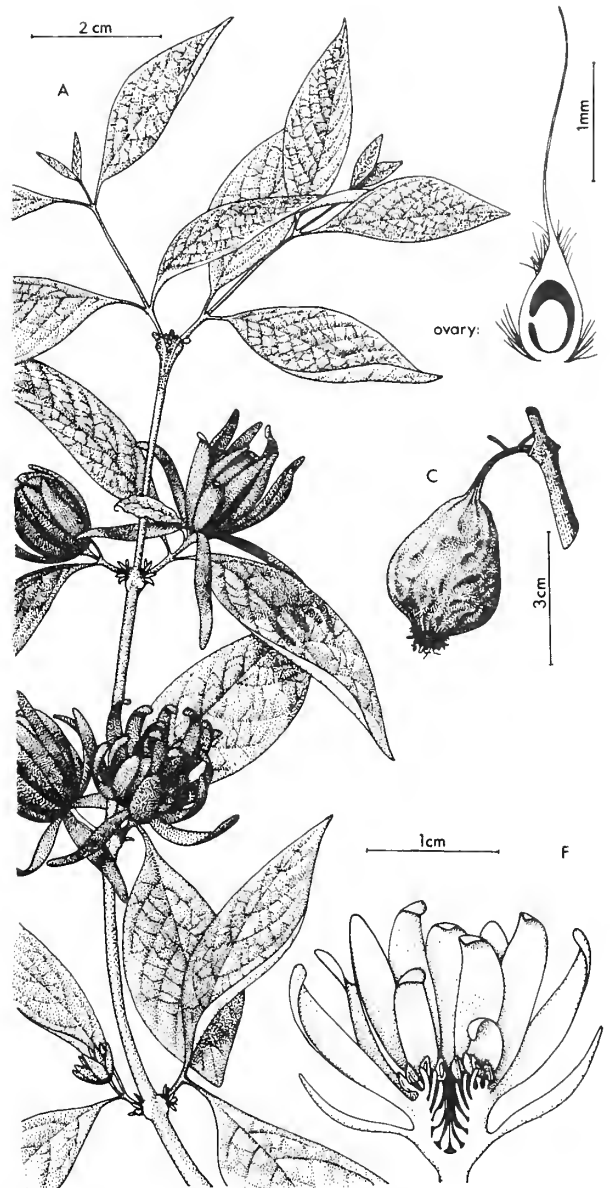
Habit: Round-crowned, somewhat stiffly branched shrub

Flowering: April—July

Fruiting: July—September

General Distribution: Pennsylvania south to peninsular Florida, west to Mississippi, cultivated elsewhere (escaping in New York)

Description: Flowers bisexual; stigma 1, style 1, ca 2 mm long, transparent, filiform, with a ring of acicular hairs at the base; ovaries 10–15 (20), free, each of a single carpel ca. 1 mm long; carpels inserted on the inner surface of a cup-like receptacle which is lined with transparent, acicular hairs; each carpel with 1 (2) ovules, becoming a single-seeded achene in fruit, enclosed with the others in the accrescent, fruit-like receptacle; stamens numerous, spiraling on the rim of the floral cup, just inside the perianth, forming a crown-like cluster above the ovaries; anther sacs extrorse; filaments stout, arching over the gynoecium, the connective extending beyond the anther sacs; staminodes present in the inner ring of stamens; perianth parts free and numerous, spiraling on the rim of the receptacular cup; when young they are greenish, pubescent, leaf-like, enlarging as the flower matures to become glabrous, strap-shaped to lanceolate tepals, 1–2.5 cm long, 5–10 mm wide, rose-carmen to maroon and brownish with age, the outer few smaller, greenish; flower sometimes subtended by one or two bracts (transitional to tepals); flowers with a fragrance like strawberries (typical variety) or nearly odorless; peduncles 4–10 mm long, puberulent; flowers borne singly between leaves on short, lateral shoots; leaves opposite, simple, entire, aromatic; leaf blades glossy green, scabrous to glabrescent above, pilose or sericeous below, to glabrous, ovate with obtuse to acuminate tips, 2–10 cm long, 1–7 cm broad; petioles 1–2 cm long, pubescent at least when young; stipules absent; twigs reddish-brown with pale, oval lenticels; leaf scars V-shaped; buds very small, pubescent; bark of older trunks dark, red-brown to blackish, stripping; stems erect to spreading, stiffly opposite-branched with a rounded crown, up to 3 m high, from a shallow root system.



Importance: This species is widely cultivated in the eastern United States, showing tolerance for more severe climates than its natural range would suggest; shade tolerant. The bark of the typical variety has been used as a spice, however, var. *laevigatus* has been reported to contain substances which cause regurgitation in humans and poison animals. Indians used a mild extract as a deterrent to the return of disease symptoms such as fevers. Fruit and leaves of the fragrant variety have been used as a perfume.

KEY TO VARIETIES

1. Leaves covered with soft hairs on the undersurfaces; flowers strongly fragrant1. *C. floridus* var. *floridus*
1. Leaves with glabrous, sparsely strigulose or glaucous undersurfaces; flowers without a strong odor.....2. *C. floridus* var. *laevigatus* (Willd.) T. & G.

Note: The name *laevigatus* is apparently preceded by a Nuttall epithet which would replace it, but we have not seen the type or a formal recombination, and feel it would be inappropriate here.

Lauraceae (Laurel Family)

This is a large, mostly tropical, family of trees and shrubs, with 35–40 genera. At least ten of these have species which are native or escaping in the United States. New York has *Lindera*, Spice-bush, and *Sassafras* as natives, and *Persea*, Red Bay, as an introduction. On the west coast *Umbellularia*, California Laurel, is native, and four tropical genera are indigenous to southern Florida. *Laurus nobilis* L., Grecian Laurel, and *Persea americana* Mill., Avocado, as well as *Cinnamomum camphora* (L.) Nees & Eberm., the Camphor-tree, are widely escaped from cultivation in subtropical and mediterranean climates. Many Lauraceous trees are known for their aromatic bark and foliage (e.g., commercial cinnamon). They are commonly used in spices, teas and folk remedies. The bark of *Sassafras* is used to make a tea and as a flavoring in gumbo.

FAMILY DESCRIPTION

Woody trees or shrubs with deciduous or evergreen leaves. Leaves, bark and wood usually contain aromatic oils. Stipules are absent. Leaves are usually alternate, simple, sometimes lobed, with pinnate venation or three main, arching veins from near the leaf base. Flowers are bisexual or more commonly unisexual on dioecious or polygamous plants; flowers are in clusters, spikes racemes or umbels, which are usually axillary. The perianth is undifferentiated, with (4) 6 tepals in 2 similar whorls, usually small, greenish to yellow (or white), fused into a short tubular base. Stamens are 12, in 4 whorls, often reduced to staminodia in inner whorls. Outer stamens associated with stalked glands in many species. Anthers are 2- or 4-celled, dehiscing by flaps. The ovary is solitary, superior or fused slightly to the perianth tube, and of a single carpel, which becomes a single-seeded drupe or berry. The fruit base is often ringed by the enlarged remains of the perianth tube. The single ovule is anatropous, becoming a seed which lacks endosperm.

KEY TO GENERA

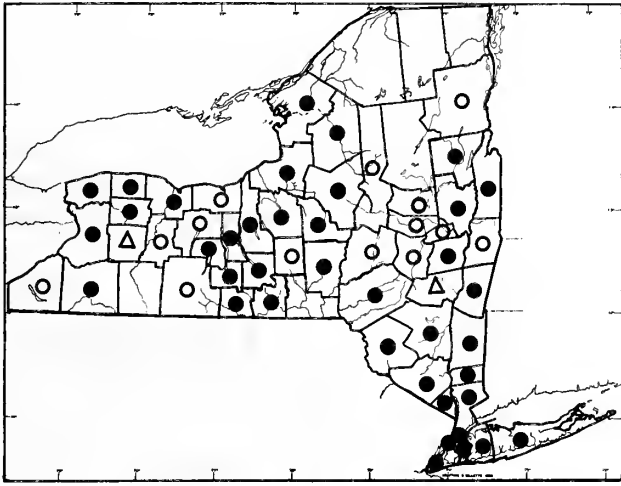
1. Plants evergreen; flower clusters appearing in the leaf axils of young growth.....3. *Persea* (p. 13)
1. Plants deciduous; flower clusters appearing before or with the leaves.....(2)
 2. Flowers in small, subsessile clusters, less than 1 cm in diameter; leaves not lobed; fruit red.....1. *Lindera* (p. 10)
 2. Flowers in racemes 3–5 cm long; leaves often mitten-shaped or bilobed; fruit dark purple.....2. *Sassafras* (p. 12)

1. LINDERA

Common Names: Spice-bush, Wild Allspice, Feverbush

Authority: Thunberg, Nov. Gen. Pl., p. 64, 1783 (nom. cons.)

A large genus of shrubs and trees with over 100 temperate and subtropical species. Although the group is primarily Asiatic, there is one widespread, eastern North American species which reaches New York State. Another native species is extremely rare with a more southerly range.



1. *Lindera benzoin* (L.) Blume

Common Names: Spice-bush, Benjamin-bush, Fever-bush

Type Description: Blume, Mus. Bot. Lugd.—Bat. I, p. 324, 1851

Synonyms: *Laurus benzoin* L., *Benzoin aestivale* Nees, *Benzoin benzoin* (L.) Coult.

Origin: Ancient Arctotertiary Forest of North America

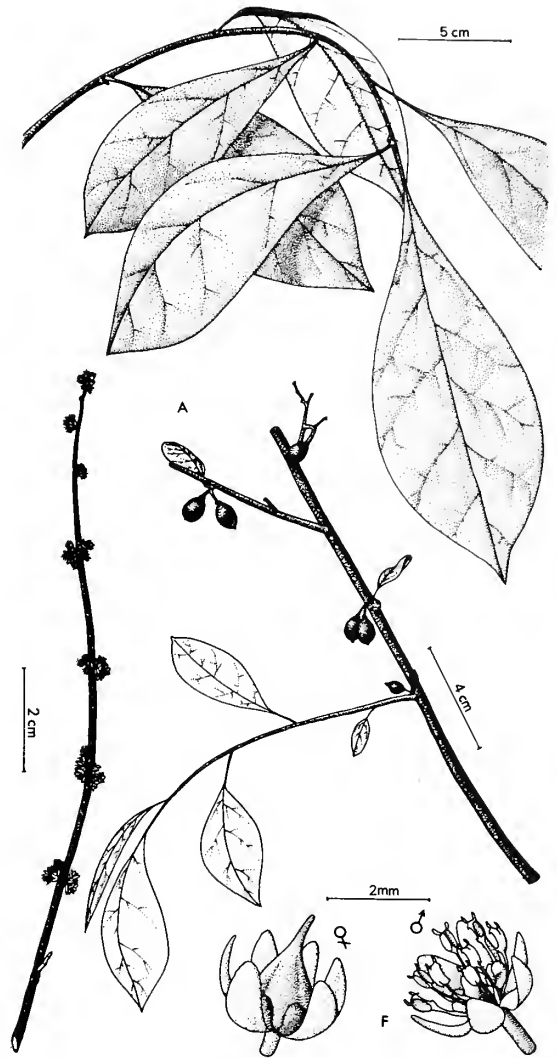
Habitats: Moist woodlands in rich soils and litter

Habit: An erect to sprawling understory shrub or small tree

Flowering: March–May

Fruiting: June–July

General Distribution: Maine to Florida, west to Kansas and Texas



Description: Plants polygamodioecious or dioecious; **stigma** 1, on a short style; **ovary** 1, globose, becoming an elliptic-oblong **drupe**; **fruit** scarlet (rarely yellow), 8–10 mm long, 5–7 mm wide; **seeds** without endosperm; **stamens** (male flowers) 9, in 3 whorls, the inner filaments glandular at the bases and 1–2 lobed, variously reduced to **staminodia** in carpellate flowers, **anther sacs** 2-locular, 2-valved; **perianth** undifferentiated, with 6 separate **tepals** in 2 whorls, yellow to greenish or brown-tinged without, 1–2 mm long; **peduncles** obscure in flower, attaching the subsessile perianths, becoming stout, 2–6 mm long in fruit; **inflorescences** of dense, umbellate clusters of 4–6 flowers, each subtended by 4 red-brown deciduous bracts; **staminate clusters** 5–6 mm in diameter, occurring alternately near the tips of new growth; **pistillate clusters** solitary or often paired just above the former year's leaf scars; **leaves** alternate, ovate-oblong to obovate, 6–18 cm long, 2–7 cm wide, glabrous, rich green above, paler beneath, margins entire, bases acute to cuneate, tips (obtus) acute to abruptly acuminate; **fall coloring** pale yellow; **petioles** 3–11 mm long, glabrous; **stipules** absent; **twigs** brownish-gray to black, smooth with a few ovate, pale **lenticels**; **leaf scars** broadly deltoid; **vegetative buds** minute, 0.5–0.8 mm, smooth, brown; **flower buds** subglobose, 1–2 mm long; **branching** profuse near branch tips; **bark** brownish, aromatic; a broad-crowned shrub, up to 4.5 m tall, from a shallow, spreading **root system**. ($2n = 24$).

Infraspecific Variation: Plants in the southeastern United States with pubescent twigs and underleaves have been given varietal status, but intergrade with nonpubescent populations. Forma *xanthocarpa* (G. S. Torrey) Rehder, with yellow fruits, is a mutant native to Massachusetts.

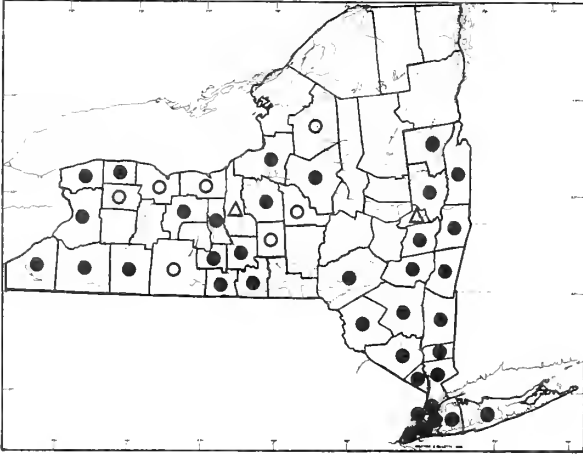
Importance: The aromatic bark has been used in medicinal teas like Sassafras, and the bitter component is said to reduce fevers and sinus congestion. It is listed as a stimulant, diaphoretic and vermifuge. During revolutionary times, berries were powdered and substituted for allspice in cooking. The plants are occasionally cultivated in shady yards, including the yellow-fruited form.

2. SASSAFRAS

Common Names: White or Red Sassafras

Authority: Nees & Ebermaier, Handb. Med. Pharm. Bot. II, p. 418, 1831

A genus of three species, two Asian and one in eastern North America. The asiatic species are not known in cultivation, but the American species is grown within and outside its natural range. It is valued for its aromatic bark and roots, but becomes weedy in the southeast.



1. *Sassafras albidum* (Nutt.) Nees

Common Names: Sassafras, White-sassafras

Type Description: C. G. Nees, Syst. Laurin., p. 490, 1836

Synonyms: *Laurus sassafras* L., *Sassafras officinale* Nees & Eberm., *S. variifolium* (Salisb.) Kuntze

Origin: Ancient Arctotertiary Forest

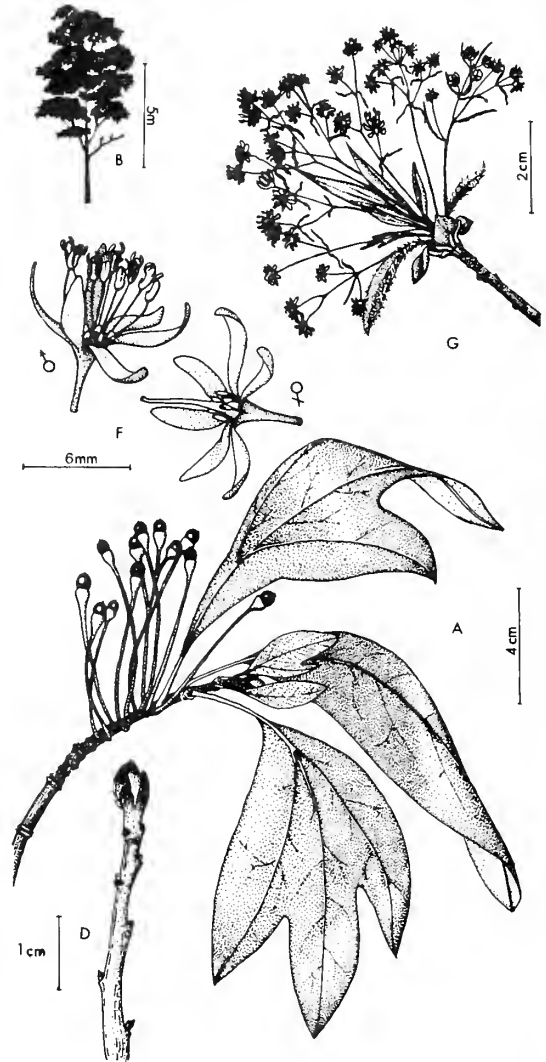
Habitats: Mesic to dry, open woodlands, thickets, borders, openings and fencerows

Habit: An open-crowned, usually slender tree or shrub, propagating by root sprouts

Flowering: April–June

Fruiting: June–August

General Distribution: Southwest Maine to eastern Iowa, south to eastern Texas and central Florida



Description: Plants dioecious; **female flowers:** stigma 1, slightly expanded from the single, slender style; **ovary** 1, becoming an ovoid, blue to purple-black **drupe**, 0.8–1.2 cm in diameter; a single, pendulous, anatropous **ovule** becomes the stony pit or seed; rudimentary **staminodia** 6–12 in whorls of 3; **male flowers:** **ovary** tissue rudimentary, sterile; **stamens** 9, in 3 whorls; both **anther** sacs 2-loculed, 2-pored; **filaments** inserted at the perianth base, the inner 3 with pairs of stalked **glands**; **perianth** (both sexes) undifferentiated, with 6 lobes, free to near their bases, greenish-yellow, 5–8 mm long; **pedicels** 5–25 mm long, silky pubescent to glabrous, becoming stout and reddish in fruit, swollen just below the fruit base; each pedicel usually subtended by a linear, pubescent **bract** in flower; **inflorescence** a compound raceme (often corymbose) of 2–several axes, each 3–7 cm long, the cluster subtended by a leathery **involucre** of bracts and bud scales; **basal bracts** oval to strap-shaped with rounded tips, rose-tinged, glabrous to finely sericeous; plants **heterophyllous**; **leaves** alternate, deciduous, aromatic; **leaf blades** oval to elliptic, unlobed, mitten-shaped or 2-lobed (rarely more), 7–15 (20) cm long, 5–15 cm broad, shallowly to abruptly cuneate at the bases, the lobes and tips acute to obtuse, bright green above, glaucous, paler beneath, essentially glabrous to puberulent (silky); **fall color** yellow to orange-rose blushed or spotted; **petioles** 1–5 cm long, often pu-

berulent; **stipules absent**; **twigs** red-brown, the younger ones fluted, becoming shiny, mucilaginous; **lenticels** punctate, dark; **leaf scars** kidney-shaped with a linear bundle scar; **buds** minute, with imbricated scales, shiny-glabrous; **bark** of the trunk deeply furrowed with age, brown to grayish, aromatic; **trunks** usually small but up to 1 m (d.b.h.), 1–20 (40) m tall, from a prolific **rootstock** capable of root-bud propagation. ($2n = 48$).

Intraspecific Variability: Pubescence of leaves and twigs is variable, the more silky plants having been designated var. *molle* Fern. Twig color also may vary from greenish to red-brown or bright red-purple in forma *moldenkii* Oswald.

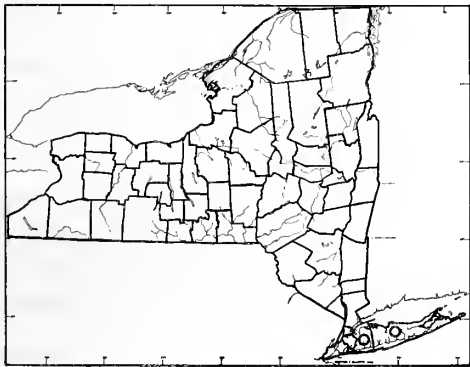
Importance: Sassafras extract has been reported as a potential carcinogen in experimental rats (Kapadia, *et al.*, 1978). The oily, aromatic foliage, bark and roots have been variously used to make teas and tonics. The extract is one of the ingredients in root beer. The oil is used in aromatic soaps. Sassafras teas are popular, especially in rural areas. Filé gumbo is a delightful southern dish prepared from young shoots pith and bark of the Sassafras in combination with rice and chicken or shrimp. The wood is of minor importance, sometimes mixed with Black Ash (*Fraxinus nigra* Marsh.) or sold under its name. Used locally, it is employed in small-boat construction, children's furniture and troughs and pales for rails and fenceposts. The plant is an invader of old fields and abandoned lots where land once was cultivated, or it is commonly spread by birds, appearing first along fencerows and under telephone lines. The plants are cultivated, but are more often pests in the southeastern United States, where root suckering is common and dense, shrubby stands abound.

3. PERSEA

Common Names: Red Bay, Sweet-bay

Authority: Miller, Gard. Dict. Abr. ed. 4, 1754 (nom. cons.)

A genus of over 100 tropical and subtropical shrubs and small trees, naturally ranging south to Chile and northward to the eastern seaboard of the United States. Red Bay (*P. borbonia*) has been reported to escape cultivation in New York State. Avocado (*P. americana*) can produce summer shoots from seed, but these do not persist.



1. *Persea borbonia* (L.) Spreng.

Common Name: Red Bay

Type Description: Sprengel, Syst. II, p. 268, 1825

Synonyms: *P. littoralis* Small (also combinations under *Borbonia* Mill. and *Tamala* Raf.)

Origin: Eastern North America

Habitats: Wooded swamps and marsh borders of the southeast, rarely escaping northward

Habit: Evergreen shrub or small tree

Flowering: June–July

Fruiting: July–September

General Distribution: Delaware south to Florida and the Bahamas, west to Texas in the coastal zone and piedmont (escaping here)



Description: Flowers bisexual; **stigma** 1, **style** 1, **ovary** single, ovoid, becoming a subglobose, fleshy, purple-blue to black **drupe**, 8–12 mm in diameter; **ovule** 1, becoming a single, stony pit in **seed**; **stamens** 12, the innermost of 4 whorls reduced to sterile, glandular **staminodia**; **anther** sacs 4 per stamen, each 2-locular, opening by valvate **pores**, the outer whorl extrorse, the inner two fertile whorls introrse; **filaments** with basal glands; **perianth** of 6 separate **tepals** in 2 whorls, 2.8–3.5 mm long, greenish to white; bell-shaped **calyx** pubescent without, flaring as it dries and becoming persistent in fruit; **pedicels** slender, 0.2–1.6 cm long, becoming thicker and densely reddish-pubescent in fruit; **inflorescences** borne in the leaf axils, cymose with several flowers borne from the common **peduncle** which is 1–6 cm long and villous to woolly-sericeous; **leaves** evergreen, alternate, coriaceous, leaf blades bright green above, paler beneath, finely to densely pubescent or almost glabrous above, 4–10 (15) cm long, 1–6 cm wide, elliptic to lanceolate or obovate, with obtuse to cuneate bases and obtuse to acuminate tips; **petioles** 1–3 cm long, villous to appressed-woolly; **stipules** absent; **twigs** usually densely woolly-sericeous with appressed red-brown hairs, their **bark** brown with oval, scale-like **lenticels**; **leaf scars** irregular; **buds** densely pubescent; **bark** of older limbs and trunks deeply furrowed, dark brown, aromatic; **trunks** up to 18 cm (d.b.h.) and a height of 12 m, usually shrubby, from a shallow **rootstock**. ($2n = 24$).

Infraspecific Variation: The plants vary mostly in density of hairs on the twigs and leaves, the commoner type being forma *pubescens* Fern.

Importance: The shrub is cultivated north and west of its range, but not extensively. The aromatic leaves have been used as a substitute for bay leaf in cooking. The wood is hard, red-brown and brittle, sometimes used in cabinetmaking and boat trim.

Saururaceae (Lizard's-tail Family)

A distinctive group of five genera of primitive, herbaceous perennials, native to Asia and North America. This family is distributed in the remnants of the once-circumboreal Arctotertiary Forest, where it probably originated. Of the two native genera, *Anemopsis* is restricted to west coast, while *Saururus* has one species in Asia and one in eastern North America. Members of this family are found in a variety of moist habitats, especially *Saururus*, which often occurs as an emergent aquatic.

FAMILY DESCRIPTION

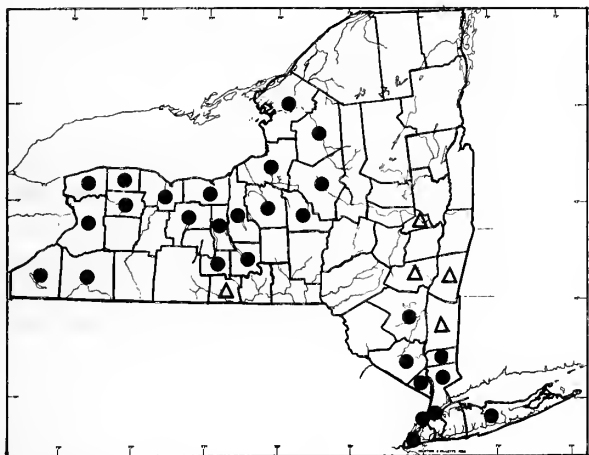
Plants are perennial, stoloniferous and/or rhizomatous, with alternate, simple leaves. They have ethereal oil glands in the stems and leaves. Stems are jointed, with \pm sheathing petioles. Flowers are bisexual; stigmas and styles are 1 per carpel; carpels are conduplicate, 3–4 (5) per flower, free to near the base to almost totally syncarpous. Fruits are dry to fleshy, indehiscent. Ovules usually 2 per carpel, orthotropous. Seeds have a well-developed perisperm, but little endosperm surrounding the tiny embryo. Stamens are 3 or 6 (8), inserted below or on the carpels. A perianth is lacking, but the racemes or spikes may have petaloid to foliaceous bracts. Inflorescences are terminal or opposite the leaves.

1. SAURURUS

Common Name: Lizards-tail

Authority: Linnaeus, Species Pl. I, p. 341, 1753

A genus of two species aquatic herbs with one representative in the eastern United States.



1. *Saururus cernuus* L.

Common Names: Lizard's-tail, Water-dragon, Swamp-lily

Type Description: Linnaeus, Species Pl. I, p. 341, 1753

Synonyms: *Spathium* Lour., *Sauruopsis* Turcz., *Mat-tuschkia* Gmel., *Neobiondia* Pamp.

Origin: Obscure, possibly Arctotertiary lowlands

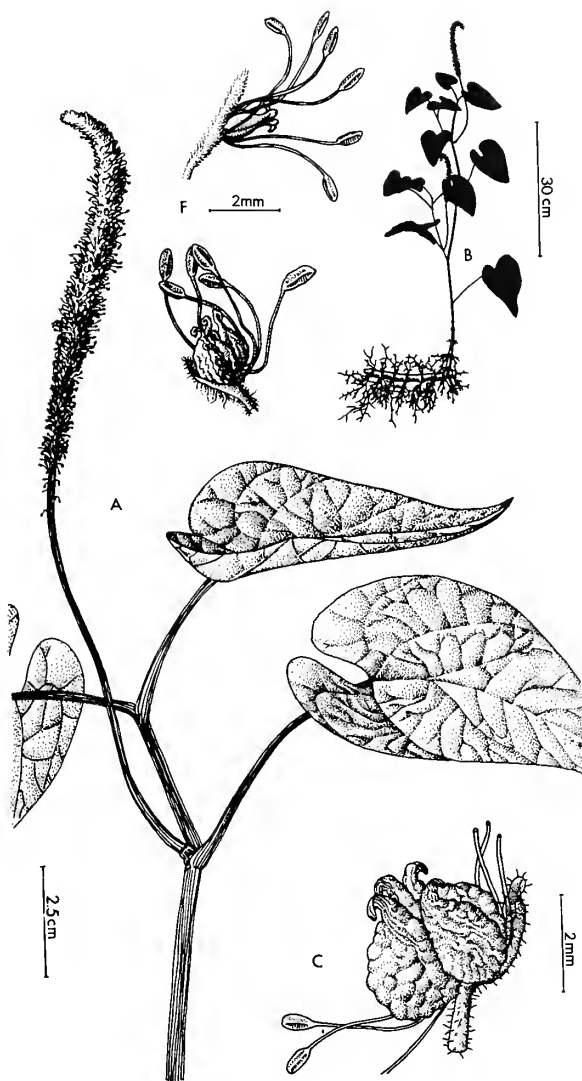
Habitats: Shallow water or muck of swamps, lake margins, river backwaters

Habit: Erect perennial, rhizomatous herb, often aquatic-emergent

Flowering: June–September

Fruiting: July–November

General Distribution: Southern New England to Michigan, south to eastern Kansas, Texas and Florida, mostly in lowlands



Description: Flowers bisexual; stigma 1 per carpel, 2-crested, linear with an open groove between crests, covering the inner surface of the style and reflexed with it at the tip; style 1 per carpel, fleshy, reflexed outward; each ovary a conduplicate carpel; carpels usually 4 per flower (3–5), spirally arranged, fused only at their bases, becoming convoluted, warty and brownish in fruit; fruit 2–3 mm long, each an indehiscent nutlet; ovules 2, crassinucleate, orthotropous, with two integuments, one ovule transverse, not developing, one ascending, becoming a solitary seed; seed with a filmy outer coat and brownish inner one, developing a massive perisperm beneath a small endosperm and embryo at the micropylar end; stamens usually 6 (4–8), 3 abaxial and 3 adaxial to the carpel cluster on the foliar bract; filaments 3–4 mm long, capillary, giving the flower its whitish color, much exceeding the ovaries; anther sacs elliptic, basifixed, yellowish, opening by longitudinal slits; perianth absent, the floral parts being inserted on a laterally divergent bract; floral bract pubescent, cucullate, about 2 mm long; inflorescences of terminal or lateral, racemose spikes, 8–35 cm long, with 150–350 fragrant flowers spiraling on each axis; spikes drooping at the tips in flower, becoming erect in fruit; peduncles glabrous, 2–5 cm long; leaves alternate, simple and aromatic, blades cordate with obtuse to acute tips and entire margins, \pm palmately veined, 5–15 cm long, 3–8 cm broad, glabrous, glossy green above, paler, below; petioles about half as long as the leaves, sheathing at the bases by adnate (stipular) tissue; nodes jointed; internodes sulcate with 7–9 ribs; stem 40–100 cm in height from a pale, branching rhizome system; roots adventitious at the nodes. ($2n = 22$).

Importance: The plants are freely cloning and highly competitive in aquatic ecosystems, possibly crowding out some other species entirely under certain conditions. They are infrequently cultivated on wet ground. Mashed and boiled roots were applied as a poultice by Choctaw Indians; the extract is listed as a sedative, antispasmodic and astringent.

Aristolochiaceae (Birthwort Family)

Primarily a tropical and subtropical group of lianas, subshrubs and herbs, this family has few members scattered in boreal regions. Two genera, *Aristolochia* and *Asarum* reach North America. One *Asarum* species and one of *Aristolochia* are native to New York State, while three more *Aristolochias* escape cultivation here. The plants are known for various uses in conventional and folk medicine, mostly in the past. Dutchman's-pipe, Birthwort and Wild Ginger are valued as ornamentals. The bell or trumpet-shaped flowers are noted for their purple to lurid greenish-yellow color combinations, and some produce a fetid odor. *Aristolochia* flowers trap insects overnight and shed pollen on them the following day as they seek their escape.

FAMILY DESCRIPTION

Our native genera have bisexual flowers which are regular or bilaterally symmetrical. They are solitary, or borne in clusters or in loose racemes in the leaf axils. Stigmas equal the number of locules (6 in ours) of the single ovary which is wholly or partially inferior. Styles are united to form a column, with the 6–12 stamens, free (*Asarum*) or adnate to it (*Aristolochia*). Petals are absent. The calyx is conspicuous, petaloid, campanulate or tubular-contorted, 3-lobed. The fruit is a septicidal, 6-lobed or angled capsule or an indehiscent berry. The anatropous ovules may become compressed seeds which may bear caruncles. Endosperm is copious and embryos are minute. Leaves are cordate to triangulate-sagittate, rarely broadly linear; they are alternate and distichous. The stems are prostrate, twining or erect, the herbaceous members copiously rooting.

KEY TO GENERA

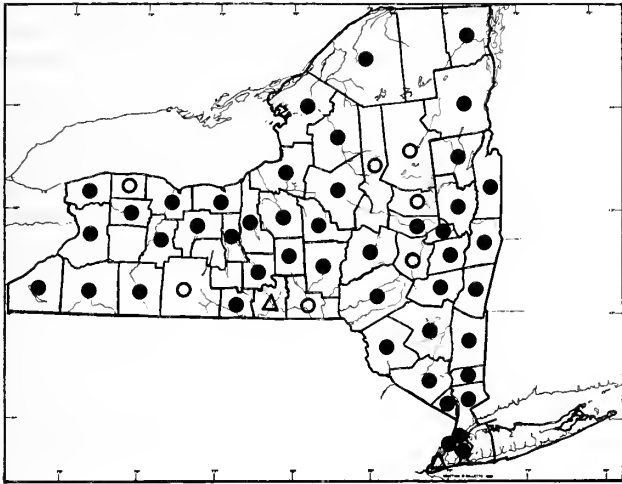
1. Flowers campanulate, radially symmetrical; stamens 12; stems prostrate, producing two leaves annually per node1. *Asarum* (p. 16)
1. Flowers tubular-contorted, bilaterally symmetrical; stamens 6; erect herbs or twining vines with leafy stems.....2. *Aristolochia* (p. 17)

I. ASARUM

Common Names: Wild Ginger, Asarabacca, Asarette (Quebec), Wild Nard

Authority: Linnaeus, *Species Pl.*, p. 442, 1753

A genus of herbs, distributed circumboreally, primarily in the southern remnants of the Arctotertiary Forest of Eurasia and North America. Over 60 species have been described, mostly from eastern Asia. A single species is widespread in the rich woodlands of New York State, where it exhibits a wide polymorphism. A group called Heartleaves is closely related, but of more southerly distribution (sometimes segregated as *Hexastylis*). The genus *Asarum* is known throughout the North Temperate area for its uses in folk medicine, and it is cultivated occasionally as a curiosity or ground cover.



1. *Asarum canadense* L.

Common Names: Wild Ginger, Asarabacca, Canadian Ginger, Indian Ginger, Canada Snakeroot

Type Description: Linnaeus, Species Pl. I, p. 442, 1753

Synonyms: *A. acuminatum* (Ashe) Bickn., *A. ambiguum* (Bickn.) Daniels, *A. reflexum* Bickn.

Origin: Eastern North America

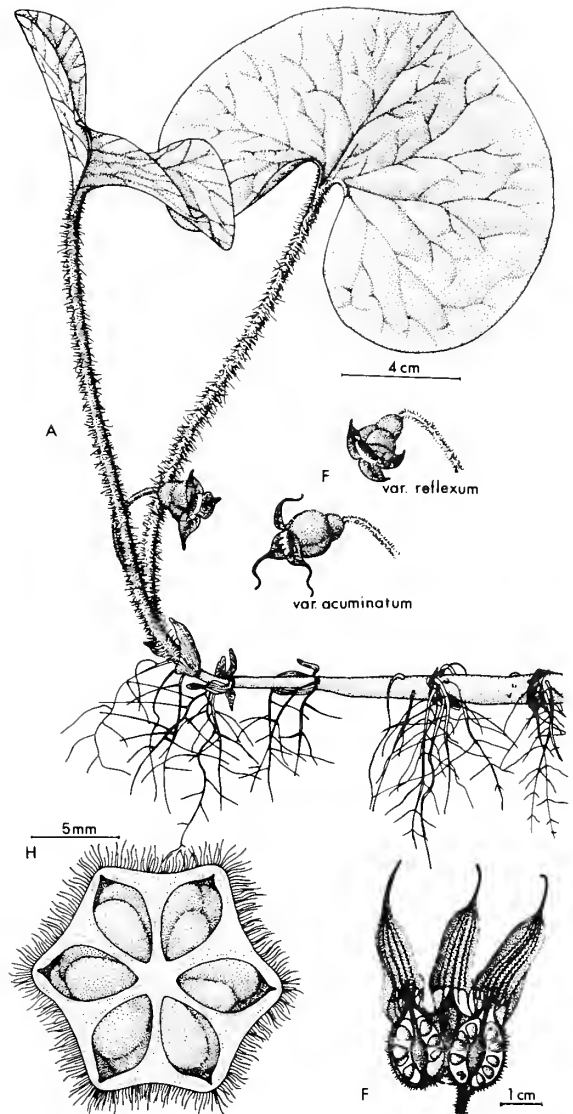
Habitats: Humus-rich, moist soils and leaf litter of forest floors and slopes

Habit: Sprawling, perennial, rhizomatous herb, forming clonal colonies

Flowering: April–June

Fruiting: June–August

General Distribution: Gaspé Peninsula to Minnesota, south to Arkansas and North Carolina



Description: Flowers bisexual; **stigmas** 6; **styles** 6, cohering to form a furrowed column; **ovary** 1, fusiform, 6-chambered, with many anatropous **ovules**, its ventral walls fused to the calyx, becoming a 6-locular **berry** with strongly caruncled **seeds**; **berry** 0.6–1.8 cm in diameter, enclosed in the persistent calyx and opening irregularly with age; **stamens** 12, free, their bases inserted on the ovary; **connectives** projecting beyond the anther sacs as subulate tips; minute, subulate, **rudimentary stamens** inserted alternate to the lobes within the calyx; **petals** absent; **calyx** regular, 2–5 cm long, fused with the ovary below, campanulate, strongly 3-lobed and cleft above, dark to dusky red-purple, yellowish- to greenish-tinged within, densely villous with septate trichomes which are sparser within the flower; **calyx tips** ascending to spreading (or reflexed), deltoid to acuminate, caudate tipped or merely apiculate; **peduncle** densely villous, 1–5 cm long; **flower solitary**, borne between two leaves; leaves cordate, reniform to orbicular, 3–8 (12) cm long (from the sinus), 5–15 (21) cm wide, with rounded to obtuse apex, surfaces minutely hispid to pilose along major veins, dark to pale green, sometimes brown- or purple-mottled; **petioles** 5–20 (28) cm long, weakly to strongly villous; **stem** prostrate, annually bearing 2–3 scarious scales and 2 leaves, fragrant, freely rooting.

Infraspecific Variation: A number of varieties have been named on the basis of calyx characters. Those with calyx lobes gradually tapering to caudate tips have been called var. *acuminatum* Ashe. The more distinctive var. *reflexum* (Bickn.) Robins. is linked with the typical variety by intermediates designated var. *ambiguum* (Bickn.) Farw. In its typical form, var. *reflexum* has deltoid calyx lobes which are strongly reflexed. Forma *phelpsiiae* of St. Lawrence County, New York is a population in which leaf sinuses are fused.

Importance: Roots, rhizomes and leaves have an agreeable odor, suggestive of ginger, and have been used in small quantities in seasoning; roots have been boiled in a thick sugar-syrup as a delicacy. In any quantity, Wild Ginger has medicinal effects, however. Powder and tonics have been used as emetics, mange cure, and a source of brown dye in Europe; in North America, medicinal uses have included heart stimulation, treatment of arrhythmia and chest pains, promotion of menstruation, relief of bowel spasms and treatment of throat ailments; it is listed as a stimulant, carminative, diuretic and diaphoretic; extracted principles include a volatile oil used in perfume, camphor-like azorone, asarin, a bitter component, resin, mucilage, alkaloids and aristolochic acid, known to have antimicrobial properties and retard certain kinds of cancer in mice. Root tinctures were used by American Indians to treat ear infection, and early European settlers in the New World learned to mix the powder with bark scraps as a deterrent to tooth decay.

2. ARISTOLOCHIA

Common Names: Birthwort, Dutchman's-pipe, Pine-vine, Serpentary, Virginia Snakeroot

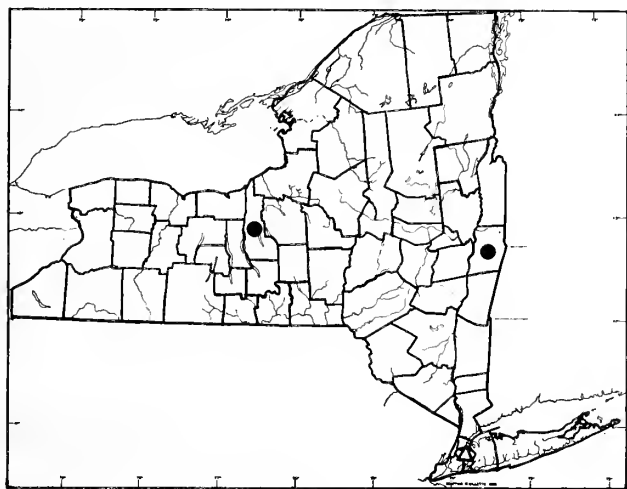
Authority: Linnaeus, Species Pl., p. 960, 1753

A large genus of vines, herbs or subshrubs, distributed pantropically, with some species reaching temperate regions. Of the four species reported in New York, only one is native to the State, where it is a rarity, as well. Two of the three naturalized species are native to the southeastern United States. Pipe-vine and Dutchman's-pipe are cultivated as trellis plants. The genus *Aristolochia* derives its name (which translates, "best delivery" from Greek) from medicinal powers which allegedly give aid in childbirth.

Description: Flowers bisexual; **stigmas** 3 or 6, forming lobes or crown-like projections on a single, thick styler column or **gynostemium**; **ovary** wholly inferior, 6-loculed, elongate, externally similar to the peduncle, becoming a septicidal capsule; **placentation** axile; **seeds** numerous, compressed, with copious endosperm; **corolla** absent; **calyx** conspicuous, purple to lurid, yellow-green or mottled, tubular to pipe-shaped, bilaterally symmetrical by virtue of irregular twisting and lobing, with a basal chamber or **utricle**, and a tube which flares at its distal end into an unevenly lobed limb; the **throat** of the limb may bear an **annulus**, and the junction between utricle and tube of some species is elaborated into a **syrix** (absent in ours); **inflorescences** pseudofascicular by crowding, or flowers borne singly in leaf or bract axil, often on short, lateral, fertile shoots; **pedicels** often associated with bracts or reduced leaves; **leaves** alternate, simple, linear-sagittate to cordate-ovate, long-petioled, estipulate; **stems** woody, twining, or erect to lax herbs, somewhat woody at base, from perennial **rootstocks**. Vines twine clockwise (left to right).

KEY TO SPECIES OF ARISTOLOCHIA

1. Flower tube nearly straight; flowers clustered in the leaf axils1. *Aristolochia clematitis*(p. 19)
1. Flower tube strongly curved, often pipe-like; flowers not clustered(2)
 2. Plants herbaceous, never twining; flowers in scaly-bracted cymes from the plant base2. *Aristolochia serpentaria* (p. 20)
 2. Plants climbing, twining; flowers solitary in the leaf axils(3)
3. Peduncles and flowers densely tomentose; peduncular bract absent3. *Aristolochia tomentosa* (p. 21)
3. Peduncles and flowers glabrous or weakly pubescent; peduncular bract conspicuous, leaf-like4. *Aristolochia macrophylla* (p. 22)



1. *Aristolochia clematitis* L.

Common Name: Birthwort

Type Description: Linnaeus, Species Pl. II, p. 962, 1753

Origin: Southern Europe

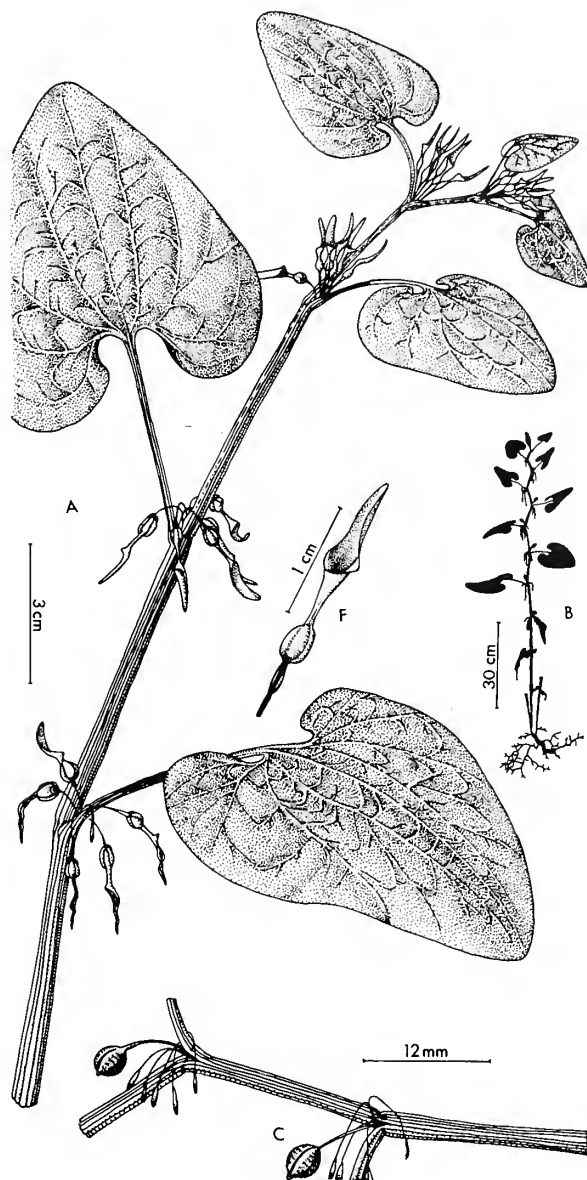
Habitats: Waste places, old lots, roadsides as an escape

Habit: Erect herbs

Flowering: June–August

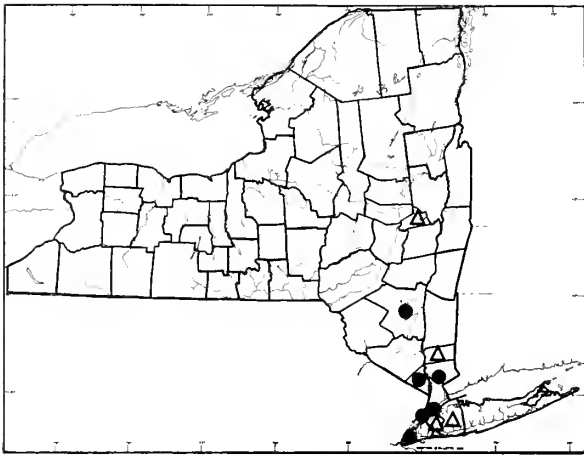
Fruiting: August–October

General Distribution: European (introduced locally in North America)



Description: Flowers bisexual; stigma of 6 pointed lobes; stylar column thick, short; ovary 6-celled, inferior, becoming a subglobose to cylindric capsule, 2.5–3.1 cm long, dehiscent basipetally along 6 longitudinal sutures; seeds numerous, flattened, 10 mm long, 12 mm wide; stamens 6, sessile on the column, equidistant; petals absent; calyx tube straight or only slightly curved; utricle flared near its attachment to the ovary, yellow-green to purplish-tinged; tube narrowing, weakly reflexed to form a narrowly deltoid to trullate, purplish limb; limb 0.8–1.4 cm long, calyx 1.3–2.1 cm total length, glabrous except for a few small hairs on the utricle base; peduncles about 5 mm long, persistent; inflorescence of axillary fascicles of (1) 2–8 flowers; leaves broadly cordate to reniform, 4–11 cm broad, auriculate with large, incurved and occasionally blunt lobes, tips obtuse to rounded, (leaves) 2–8 cm long, from the sinus, palmately veined with a strongly reticulated venation system between, essentially glabrous; petioles glabrous, ridged, 2–6 cm long; pseudostipules absent; nodes estipulate, but often with persistent peduncles in the axils; internodes sulcate and sharply ridged; stems up to 1.5 m tall, erect to spreading from a tough, perennial rhizome.

Importance: Extracted aristolochic acid has been used as a bacterial and fungal retardant; in Europe the highly diluted crude extract has been used for colds, chills, fevers and asthma. Concentrated extracts of any *Aristolochia* may be harmful to the digestive tract and lethally poisonous if administered indiscriminately.



2. *Aristolochia serpentaria* L.

Common Names: Virginia Snakeroot, Serpentry

Synonyms: *A. hastata* Nutt., *A. sagittata* Muhl., *A. polyrrhizos* Spreng. *A. dodecandra* Raf., *A. convolvulacea* Small, *A. serpentaria* var. *hastata* (Nutt.) Duchartre, *A. officinalis* Nees, *A. nashii* Kearney, (also combinations under *Endodeca*, *Pistolochia* and *Psophiza*)

Type Description: Linnaeus, Species Pl. II, p. 961, 1753

Origin: Eastern North America

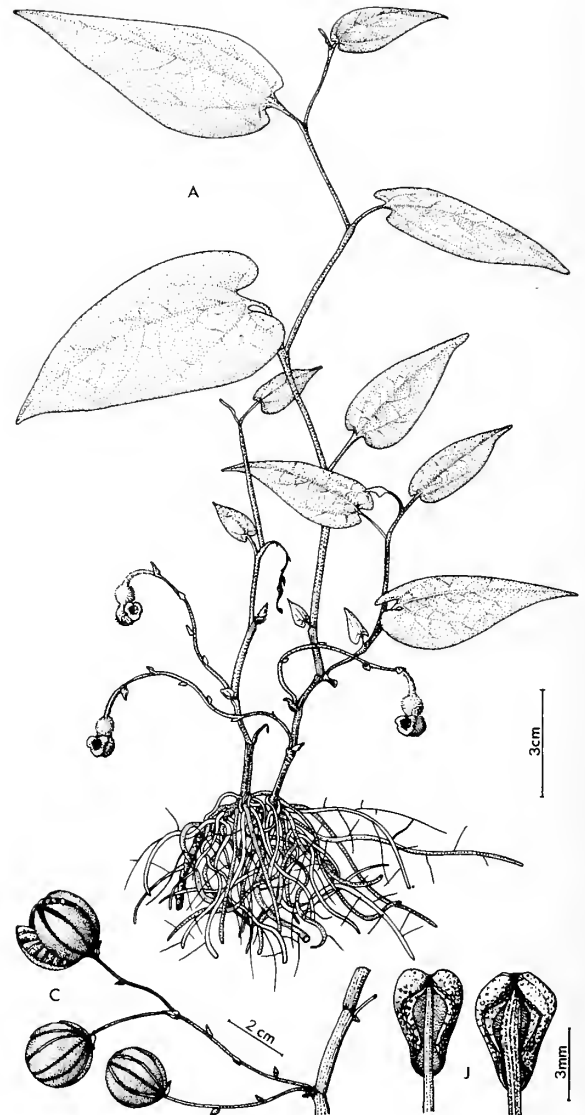
Habitats: Rich, often calcareous soils, woodlands and floodplains

Habit: Erect or ascending herb, often bearing its flowers among leaf litter

Flowering: Late May–July

Fruiting: July–October

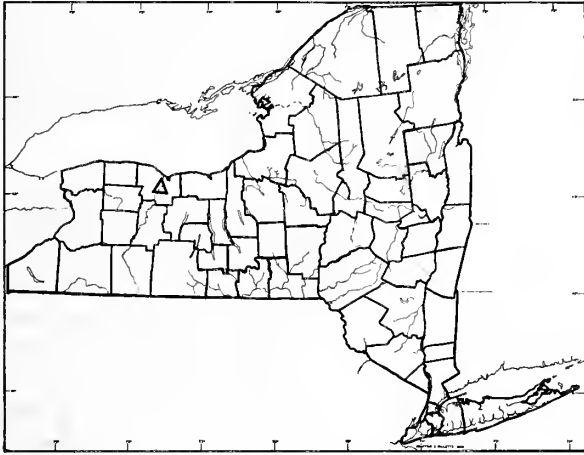
General Distribution: Connecticut and southern New York to Florida, Texas and Missouri



Description: Flowers bisexual; stigma 6-lobed; stylar column fleshy, ca. 1.5 mm high; ovary 1, inferior, becoming a spheroid capsule, 0.8–1.5 cm in diameter, dehiscing basipetally along 6 longitudinal sutures; seeds relatively few, 4–5 mm long, ellipsoid with acute tips, each borne on a prominent funicular stalk which attaches within a sinus; seed surfaces are yellowish, pebbly, giving the superficial appearance of grape pits; stamens 6, connivent, roughly paired; petals absent; calyx irregularly curved to form an S-configuration, 0.8–1.4 cm total length; utricle subglobose; tube variously swollen, flared at the distal end into an unevenly lobed limb; outer calyx sparsely to densely matted-pilose, especially toward the utricle; syrx slightly developed, inequilateral; limb madder-purple, 3-lobed with a smooth, ring-like annulus; fertile branches ("peduncles") 2–9 cm long, scaly, wiry, arising alternately from near the plant base, bearing 1- (2–several) flowers each; peduncle scales alternate, 2–several per stalk, sessile-hastate, pubescent, 1–4 mm long; leaves membranous, heteromorphic; upper leaves alternate, distichous, ovate-lanceolate to linear-hastate or cordate at bases, 4–15 cm long, 2–8 cm broad, sparsely puberulent; lower leaves abruptly reduced, grading into scales below; petioles longest on middle to upper leaves, 0.4–2.5 cm long; pseudostipules absent; internodes minutely pubescent; stems 8–50 cm tall, branching at the bases, erect or ascending, arising from a short rhizome with a dense fibrous root system.

Intraspecific Variation: The shape and lobing of leaves may vary from one population to another or even on individuals. Plants with strongly divergent basal lobes on narrowly attenuate leaves have been given both species and varietal ranks (see synonymy). Cleistogamous flowers have been described, in which the calyx tube does not develop normally, but remains as a small cap.

Importance: Like other *Aristolochia* species, it is suspect in livestock and human poisoning, but the plants are rare and cases are rarely reported. Aristolochic acid (yellow bitter-principle), resinous aristinic acid and a volatile oil have been extracted from this species; moderate doses of extract are said to act as a gastric stimulant, and may aid in dyspepsia; however, large doses are known to overstimulate, causing upset and dysentery. The principle was commonly mixed with barks of various trees and made into a medicinal tea; Indian lore recommends a root extract to check vomiting; folk uses and claims are numerous, but not well documented, including treatment for bilious, typhus and typhoid fevers, small-pox, pneumonia, amenorrhoea and septicemic fevers; its use after snakebite is apparently as a fever retardant. Its reputation as a panacea is highly suspect, not recommended in modern medicinal practice.



3. *Aristolochia tomentosa* Sims

Common Name: Woolly Pipe-vine

Type Description: Sims, Bot. Mag., pl. 1369, 1811

Synonyms: *A. hirsuta* Muhl., *A. tripteris* Raf., *A. coriacea* Raf., *A. hitchcockii* Gandoger (also combinations under *Siphisia*, *Isiphia*, *Hoquartia*, *Isotrema* and *Dasyphonion*)

Origin: Eastern North America

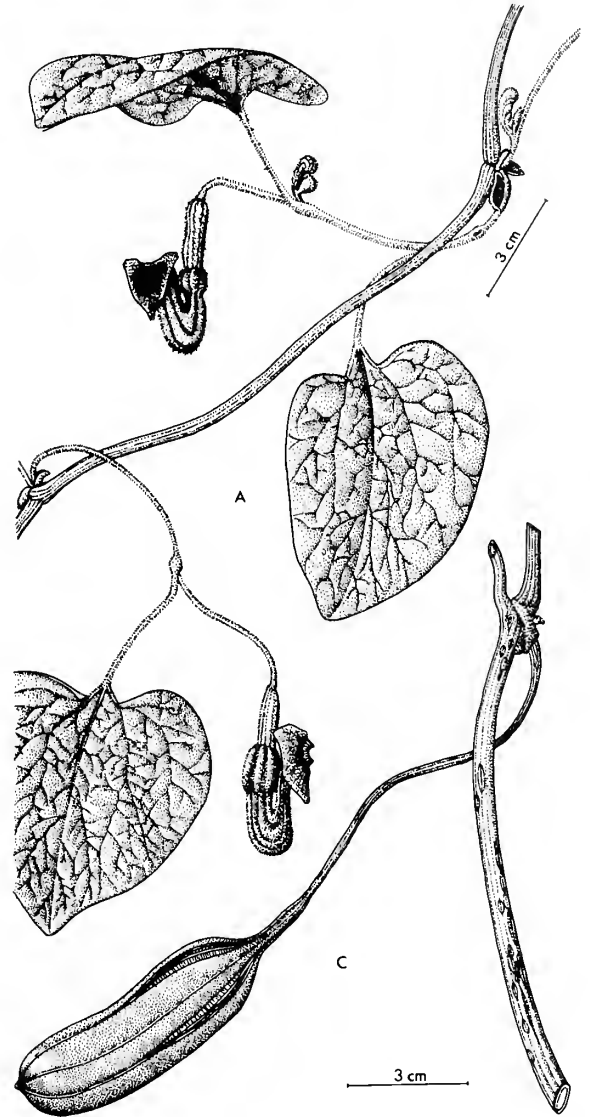
Habitats: Moist, alluvial woods and calcareous bottom-lands

Habit: Twining, woody, perennial vine, becoming a high-climbing liana

Flowering: June–July

Fruiting: August–November

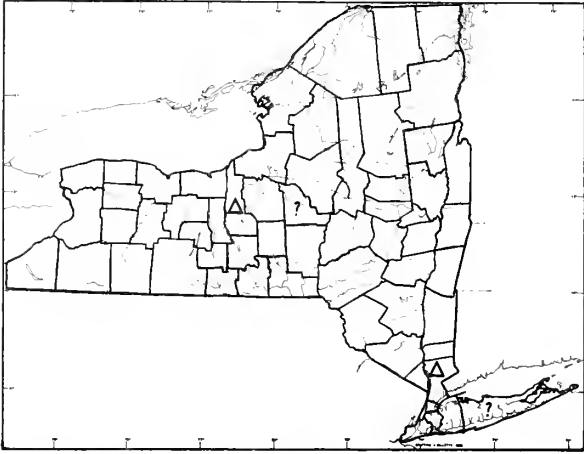
General Distribution: Illinois to Florida, west to Texas (escaping cultivation in New York State)



Description: Flowers bisexual; stigma 6-lobed; stylar column fleshy, ca. 3 mm high; ovary 2–2.5 cm long, inferior, well-developed in flower and distinguishable from the pedicel, densely tomentose without, becoming a large, woody capsule (4.5–8 cm long, 1.5–2.5 cm wide) which dehisces along 6 longitudinal sutures; seeds numerous, flattened, caruncled, 0.8–1.0 mm long and broad; stamens 6, adnate to the stylar column in pairs; petals absent; calyx cylindric, somewhat inflated at the utricle; tube strongly curved upward, yellowish, tomentose, with an abruptly flared limb; limb purple, 1.3–1.7 cm across, 3-lobed, the lower lobe slightly larger; annulus prominent, rugose, nearly closed at the throat; pedicels 1.5–3.1 cm long (or short, bearing an undeveloped flower) on densely tomentose, short, lateral shoots, 1–4 cm long; the joint usually bears a tomentose reduced leaf which is less than 1 cm in length; bud scales at the shoot base tomentose beneath, minute; inflorescences are of 1–2 flowers per shoot, borne singly; leaves are broadly cordate to reniform, with obtuse to rounded tips, 3–10 (20) cm long, 2–8

(15) cm broad, densely tomentose below, less pubescent above; **petioles** tomentose, 1–4.5 cm long; **pseudostipules** absent; **nodes** somewhat enlarged with a tuft of hairs at the base of each short shoot; **internodes** slightly fluted, glaucous to puberulent, reddish beneath; **stems** woody, twining, up to 25 m from a perennial **rootstock**.

Importance: Cultivated outside its range in the United States, Canada and Europe as an arbor or trellis plant.



4. *Aristolochia macrophylla* Lamarck

Common Names: Dutchman's-pipe, Pipe-vine

Type Description: Lamarck, Encycl. Meth. Bot. 1, p. 255, 1783

Synonyms: *A. durior* Hill, *A. siphon* L'Her., *A. frutescens*, Marsh, *A. grandifolia* Salisb., *A. arkansaw* Lodd., (also combinations under *Hoquartia*, *Siphisia*, *Isiphia* and *Isotrema*)

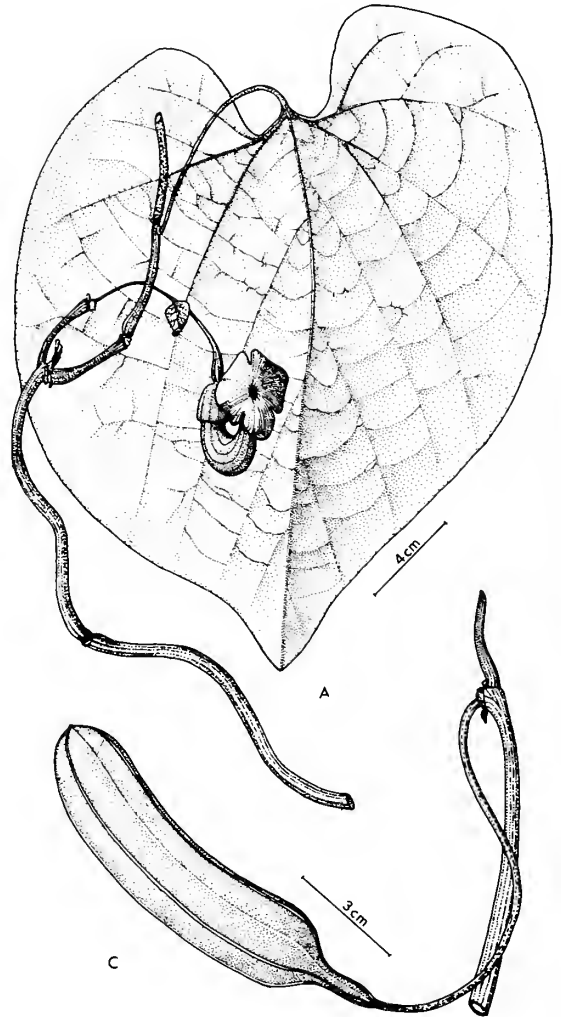
Habitats: Rich woodlands and streambanks in upland environments

Habit: Twining, high-climbing, woody liana

Flowering: June (New York)

Fruiting: August–November

General Distribution: Pennsylvania (Connecticut) to northern Alabama in the Appalachian uplands, cultivated and naturalizing northward to New York



Description: Flowers bisexual; **stigma** 6-lobed, **stylar column** fleshy, about 4 mm high; **ovary** 1, inferior, not conspicuous in flower, slightly furrowed, glabrous, developing into a large cylindric **capsule**, 5.5–10 cm long, 1.5–5.8 cm wide, valvate-dehiscent along 6 longitudinal **sutures**; **seeds** numerous, cordate-flattened, **caruncled**, 0.6–1.0 cm long; **stamens** 6, adnate to column, paired; **petals** absent; **calyx** with a flared utricle, the tube curved abruptly upward, 2–2.5 cm long, narrowing toward the apex, yellowish, often mottled, essentially glabrous, expanded abruptly into a **limb**; limb 3-lobed, madder-purple, the upper two lobes acute, the lower blunt-obtuse, 2–2.5 cm broad; **pedicels** 2–4 cm long, glabrous, on slender, **lateral shoots** 1–3 cm long; **bract** at their joint foliaceous, sessile, puberulent, 1–3 cm long and wide, cordate-clasping; **leaves** cordate, ovate to reniform with acuminate tips, 10–45 cm long and broad, minutely pubescent beneath, especially on the veins; **petioles** puberulent to glabrous, 3–8 cm long; **pseudostipules** absent; **nodes** somewhat enlarged, **internodes** reddish, variously ribbed and thickened, glabrous; **stem** climbing up to 20 m from a perennial **rootstock**.

Importance: This is a popular cultivated plant in the United States and especially in Europe where it is not an uncommon sight covering columns, trellises and lamp posts. It is grown primarily for its climbing properties and lush foliage; propagated from cuttings.

Note: According to Pfeifer (1962, 1966) the commonly used binomial, *A. durior*, is based on an illustration of poor quality which more closely resembles *Bignonia capreolata*.

Nymphaeaceae (Waterlily Family)

As treated herein, the Nymphaeaceae consists of the genera *Nymphaea*, *Nuphar*, and *Ondinea*, the latter being described in 1970 from northwestern Australia. Three genera native to New York State, which have been ascribed to Nymphaeaceae in the past, are treated as separate families: *Nelumbo* (Nelumbonaceae), *Brasenia* and *Cabomba* (Cabombaceae). Still other genera, not native to New York State, are also considered to belong to separate families; thus *Victoria* and *Euryale* (Euryalaceae) and *Barclaya* (Barclayaceae) are not included in the family description. Since *Ondinea* has unusual characteristics (3–5 carpels, epigynous stamens, no petals), and is also not native to this continent, its characters are omitted as exceptions. Depending on the author involved, *Nymphaea* can be considered to have about 40 species and *Nuphar* as many as 25. However, only one polymorphic species of *Nymphaea* occurs in our area, and the most recent treatment of *Nuphar* (Beal, 1956) reduced the number of species in North America and Europe to one, with several subspecies and intergrading clinal series. Of these, three subspecies and their intermediates occur in New York State. Members of the Nymphaeaceae and their hybrids are popular in cultivation. They are also important as wildlife food and in the light and shelter dynamics of aquatic ecosystems.

FAMILY DESCRIPTION

Members of Nymphaeaceae are aquatic, colony-forming perennials. Rhizomes range from slender to massive (sometimes tuberous) with thick, adventitious roots throughout, and petioles and peduncles are arranged spirally, appearing tightly clustered near their tips with the decay of dead tissue. Leaves are submerged, floating or emergent, passing through a series of submerged forms in early development. Mature leaves are orbicular to oval with a sinus (rarely slightly peltate) to sagittate, glossy green above, paler green to red-purple, much-veined below. Petioles are elongate, fleshy. Flowers are perfect, radially symmetrical, floating or emergent. They are solitary on long, stiff peduncles (which recoil after fertilization in *Nymphaea*). Flowers of *Nymphaea* are persistent at the water surface for several days during which time they grow in size, opening and closing daily. Perianth parts (excluding staminodia) 4–40 free, white or yellow (blue, pink) to greenish or maroon, not strongly differentiated into calyx and corolla in *Nymphaea*. Stamens are numerous, spirally arranged, attached to the carpellary wall or hypogynous, introrse; anther sacs are two in number. Stamens grade into petal-like staminodia in *Nymphaea*. Carpels are numerous, partially or wholly fused. Each conduplicate carpel contains numerous anatropous ovules which vary in lateral union and attachment to the carpel wall. Stigmatic areas are exposed on a radiate disc. The margins fuse early in *Nuphar* but late in *Nymphaea* (not at all in some *Nuphar* mutants) emphasizing their conduplicate origin. Seeds are numerous within each carpellary unit of the fruit; they are operculate, with or without an aril. Fruits are leathery berries, dehiscent into pips near the water surface (*Nuphar*) or submerged on the recoiled peduncles (*Nymphaea*). Each seed has a straight embryo and starchy to albuminous endosperm.

KEY TO GENERA

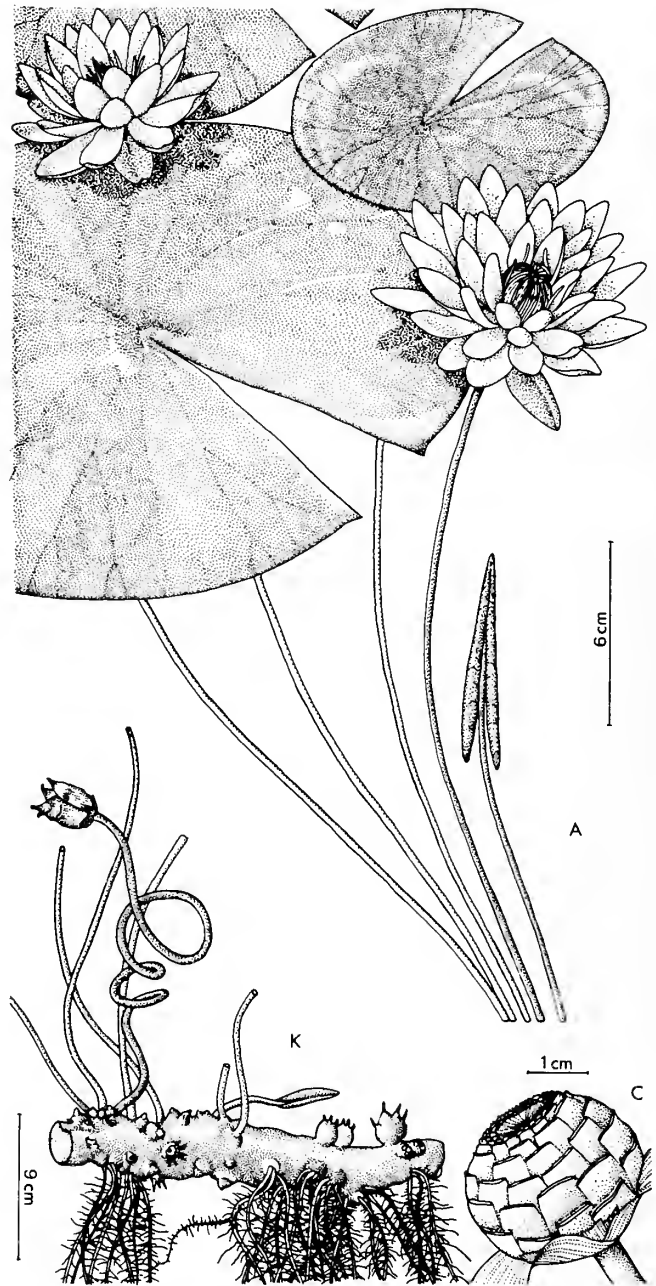
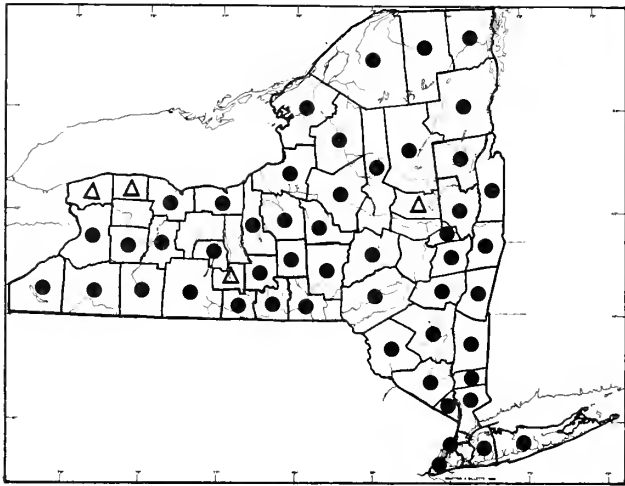
1. Perianth parts (tepals) snowy white (to pinkish), the outer 4–5, \pm sepaloid; carpels partially fused, the stigmatic areas individually curved inward; stamens perigynous on the carpellary wall; seed arillate; leaves mostly orbicular, lobes pointed at the tips.....1. *Nymphaea* (p. 23)
1. Perianth parts yellow to green (often maroon), clearly differentiated into outer and inner series; carpels completely fused, the stigmatic areas on a lobed or entire disc; stamens hypogynous; seeds not arillate; leaves orbicular to hastate, the lobes rounded2. *Nuphar* (p. 25)

1. NYMPHAEA

Common Names: Water-lily, Pond-lily, *Nymphaea*, Fragrant Water-lily, White Water-lily, Bonnet

Authority: Linnaeus, *Species Pl.*, p. 510, 1753

A genus of perhaps 40 species distributed primarily in the Northern Hemisphere. Many species are highly prized as ornamentals, and variability is extensive, even among our "native varieties." The timing of opening and closing of flowers is apparently dependent on the specific clone involved. Fruits and seeds are sought out by diving birds, where they lie near the bottom, entangled in the recoiled peduncles.



1. *Nymphaea odorata* Ait.

Common Names: White Water-lily, Fragrant Water-lily, Pond-lily, Nymphaea, Sweet-scented Water-lily, Rose-colored Water-lily, Bonnet

Type Description: Aiton, Hort. Kew. 2, p. 227, 1789

Synonyms: *N. tuberosa* Paine, *N. odorata* f. *rubra* Guillon, *N. spiralis* Raf., *N. lekophylla* (Small) Cory, *Castalia odorata* (Dryand.) Woodv. & Wood, *Castalia lekophylla* Small, *Castalia tuberosa* (Paine) Greene

Origin: Eastern North America

Habitats: Ponds, slow streams, quiet lakes and sloughs

Habit: Rhizomatous, sometimes tuberous, aquatic, herbaceous perennial with mostly floating leaves and flowers; forming extensive colonies

Flowering: June–September

Fruiting: Late June–November

General Distribution: Newfoundland to Manitoba, northern Minnesota and Michigan to Florida, Texas, Mexico and El Salvador

Description: Plants with bisexual flowers; stigmas 10–25 per flower, forming a radiate disc, with sterile tissue extending upward as a crown of slender, incurved appendages; ovary 1, consisting of 10–25 partially fused carpels, becoming a leathery berry, 2.5–3.5 cm in diameter in fruit; ovules numerous, anatropous, variously fused to the carpel wall; seeds arillate and operculate, ellipsoid, 1.5–4.4 mm long; embryo in a pocket near the hilum; cotyledons large, enfolding the plumule; endosperm albuminous to thick, starchy, enclosed in copious perisperm; stamens 60 or more, introrse; anther sacs elongate, upcurved; filaments attached basally to the hypanthium surrounding the ovary; petaloid staminodia, 1–4 cm long, intergrading with the tepals of the perianth; perianth radially symmetrical, consisting of numerous, inner, white to pinkish tepals, 2–9 cm long, 1.5–3.5 cm wide, elliptic-lanceolate to spatulate with acute to rounded tips, grading into a few (usually 4) greenish to purple sepal-like lobes; flowers solitary, floating or emergent, often fragrant, 7–25 cm broad, open from morning to early afternoon; peduncles smooth, fleshy, up to 3 m long, greenish to purple; leaves mostly orbicular to oval in outline, 4–50 (60)

cm in diameter, with a sinus to the petiole and pointed, basal lobes, pale to dark green, waxy above, often purple to pale red beneath, essentially net-veined with a few major laterals arising from the midrib; **petioles** arising with the peduncles on the rhizome, greenish to purple or with longitudinal, brown stripes; **rhizomes** slender to thick, fleshy and starchy, sometimes **tuberous** and serving to propagate certain clones; **roots** fleshy, adventitious. ($2n = 56$ or 84 in large, southern forms).

Infraspecific Variation: Of the many other described taxa in this genus, we have *N. odorata* f. *rubra* Guillon and “*N. tuberosa*” in New York State. The former is an escape from cultivation which has naturalized in a few areas. The concept of *N. tuberosa* has received considerable acceptance and attention, due to the large number of obvious characters ascribed to it. It has been characterized as tuberous, with large leaves, greenish beneath, brown striped petioles, large, odorless flowers which stay open longer, green sepals, numerous, broader, spatulate-rounded petals, narrower anther sacs on inner filaments, few carpels and seeds and short arils. Numerous field observations as well as population and transplant studies have confirmed the erratic distribution and clustering of these traits (Monson) 1957–58; Williams, 1970). Although clones are known which concentrate certain character-combinations, the array of such combinations is extensive. Most northern populations appear to be tuberous to an extent, relying on this means of propagation more than on seeds. Further study of this group is called for, especially comparing northern and southern representatives of the species-complex.

Importance: *Nymphaea odorata* has long been cultivated and encouraged where it naturally occurs in North America. Its horticultural introduction into England in 1786 is said to have aroused much interest in Water-lily cultivation throughout Europe (Sculthorpe, 1967). It is the traditional lily pad of literature and folk songs of the North American continent. It is still prized as an aquatic ornamental, though many more exotic cultivars have been bred. It is considered a weed in situations where it clogs waterways or adds to silts in ponds. It is a valuable shelter and attachment for small animals and algae, and the seeds are eaten by waterfowl. Rhizomes and tubers are extremely starchy, and may be utilized as human food. Indians of the north central states used the pulp in bread-making. The tubers are sought out as food by wild hogs and deer.

2. NUPHAR

Common Names: Yellow Pond-lily, Spatter-dock, Yellow Water-lily, Cow-lily

Authority: J. E. Smith in Fl. Graec. Prodr. I, p. 361, 1808–09 (nom. cons.)

A genus of highly variable plants, limited to the Northern Hemisphere. Some authors recognize as many as 25 species (and literally hundreds of infraspecific taxa) with up to 18 of these occurring in the United States and Canada. The most recent treatment (Beal, 1956), supported by subsequent experimental evidence (Beal & Southall, 1977), recognizes one species throughout North America and Europe with 9 subspecies. It is that treatment which will be followed here.

1. *Nuphar luteum* (L.). Sibth. & Smith

Common Names: Yellow Pond-lily, Spatter-dock, Yellow Water-lily, Cow-lily

Type Description: Linnaeus, Species, Pl., p. 510, 1753 (in part)

Synonyms: *Nymphaea lutea* L., *Nymphaea umbilicaulis* Salisb. in König & Sims, *Nymphozanthus vulgaris* Rich., *Nenuphar lutea* Hayne, *Clarivillea lutea* (L.) Hegets., *Nenufar luteum* Hayne, *Nufar systylum* Wallr., *Nymphaea lutea* (L.) Bub., *Nymphozanthus sericeus* (Lang) Fern., *Nymphozanthus luteus* (L.) Fern.

Origin: Eurasia (but long native to North America)

Habitats: Ponds, lakes, sloughs, streams, bogs and occasionally on wet mud

Habit: Strictly rhizomatous perennial herb, forming clonal colonies

Flowering: May–October

Fruiting: June–November

General Distribution: Temperate to subtropical and subarctic areas of the Northern Hemisphere

Description: Flowers bisexual; **stigmatic areas** borne on a radiate, deeply crenate to entire **stigmatic disc**, 0.5–5 cm in diameter, the 5–36 **stigmatic rays** extending to within 4 mm of the disc margin and often to the margin; **style** 1, very constricted to about the same diameter as the stigmatic disc, green, yellowish and/or variously tinged with maroon; **ovary** 1, the **carpels** completely fused, 5–36 chambered, with numerous **ovules** per chamber, up to 8 cm

long in fruit; seeds operculate, not arillate, 2.5–5 mm wide and up to 5 mm long; stamens numerous hypogenous, with ventral anthers 1–10 mm long, usually with sterile tissue extending (up to 4 mm) beyond the anthers; corolla represented by small (up to 10 mm long) yellowish to maroon petals in a spiral arrangement immediately external to the stamens; calyx radially symmetrical, conspicuous, the 5–14 sepals relatively large, 1–4.5 cm long, greenish, often yellowish and/or maroon on the ventral surface (and sometimes both the ventral and dorsal surfaces), 1.5–12 cm in diameter when fully expanded; flowers solitary on elongate, spongy peduncles up to 3.5 m long; leaves submersed, floating or emergent, the blades ranging from wider than long (essentially orbicular) to as much as 5 times as long as wide, up to 6 dm in length or in diameter, with divergent to overlapping blunt-tipped basal lobes, glabrous to densely pubescent beneath, the major veins arising from the midrib; petioles glabrous to pubescent, up to 3.5 m in length, arising (along with adventitious roots and peduncles) from the nodes of the rhizome; rhizome 1–15 cm in diameter. (2n = 34).

Infraspecific Variation: Variation among clonal populations and between subspecies is exceptionally great; however, variation within clones is minimal. Sterility has been reported among plants intermediate between ssp. *pumilum* and ssp. *variegatum* [often known as *Nuphar rubrodiscum* Morong, *Nymphaea rubrodisca* Greene, *Nymphaea hybrida* Peck, *Nymphoanthus rubrodiscus* (Morong) Fern., *Nuphar* × *hybridum* (Peck) Berg., or × *Nuphar rubrodiscum* (Morong) Fern.], as well as complete fertility in some populations. It may well be that sterility is less prevalent than previously reported, in view of experimental evidence involving intermediates of ssp. *macrophyllum* and ssp. *sagittifolium* in North Carolina (Beal and Southall, 1977), in which the intermediates would not germinate without vernalization but, upon appropriate vernalization treatment, germinated equally as well as their supposed parental subspecies.

Subspecies *macrophyllum* and ssp. *variegatum* are the most tenuously delimited taxa in the genus. In areas where their ranges are parapatric, the presumed distinctive features blend and intergrade with no apparent sterility of the intermediates. As one progresses northward from “*macrophyllum* territory” into “*variegatum* territory,” the petioles become more flattened and more broadly winged. Also the inner surfaces of the sepals and the carpels become more consistently maroon. In fact, in this treatment of *Nuphar luteum* in New York, only those plants lacking both winged petioles and maroon coloration have been treated as ssp. *macrophyllum*. All other combinations have been treated as ssp. *variegatum*.

A specimen of *N. luteum* ssp. *variegatum* was collected from a lily pond, Sag Harbor, Suffolk County by Roy Latham (No. 6792) in 1929. This plant has a leaf length-width ratio of almost 2, reminiscent of the intermediates between ssp. *macrophyllum* and ssp. *sagittifolium* in the Carolinas. Undoubtedly, should this population still exist, it should be possible to experimentally extract genotypes comparable to the more southern coastal form, ssp. *sagittifolium*. In fact, experimental studies comparable to those done in the Carolinas, should throw much light upon the genetic nature of the subspecies and their intermediates in New York.

A single specimen of *N. luteum* (Muenscher and Curtis, 5083, CU) from Highland Lake, New York, has the typical leaf shape and numerous sepals of ssp. *polysepalum*. It also has the winged petiole characteristic of ssp. *variegatum*. This suggests either extreme polymorphism in ssp. *variegatum* or the ephemeral past establishment of ssp. *polysepalum* with subsequent introgression.

Importance: The seeds and rootstocks are well-documented food sources for wildlife and man. The most extensive use of seeds has been by northwestern Indians who parch them (*N. luteum* ssp. *polysepalum*) and grind off the tough hulls. Subspecies *variegatum* has been used in New York and New England where seeds were boiled. Eastern Indians primarily ate rhizomes, after boiling, for their high carbohydrate content. Early reports claim the taste of sheep-liver and state that Indians dove for the “rootstocks” or “stole them from muskrats.”

KEY TO SUBSPECIES

1. Fruit narrowly constricted below the stigmatic disc; stigmatic disc deeply crenate or dentate; anthers mostly 1–2 mm in length; sepals usually 5; petals mostly thin and broadly spatulate.....1a. *N. luteum* ssp. *pumilum*
1. Fruit only slightly, if at all, constricted below the stigmatic disc; stigmatic disc crenate to entire; anthers mostly 5–8 mm long; sepals usually 6 (–9); petals mostly thick and oblong.....(2)
2. Petiole conspicuously flattened and winged on the upper surface; sepals (and carpels) often maroon colored ..
.....1b. *N. luteum* ssp. *variegatum*
2. Petiole terete to oval in cross-section, without wings; sepals usually green and/or yellow on the inner surface; carpels green to yellow1c. *N. luteum* ssp. *macrophyllum*

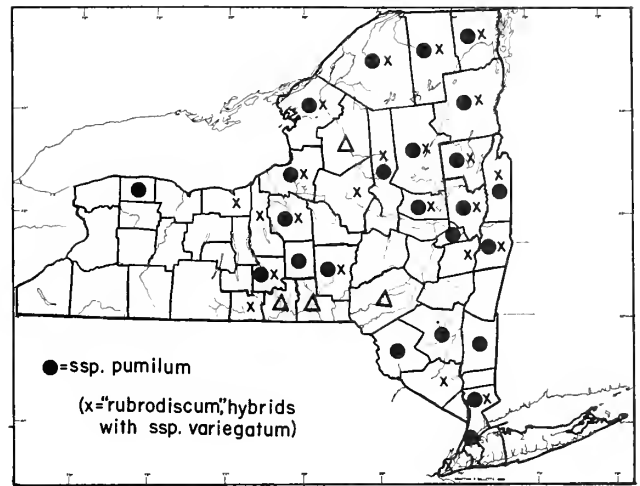
1a. *N. luteum* ssp. *pumilum* (Timm.) Beal

Type Description: Timm. Mag. Nat. Meckl. 2, p. 250, 1795

Synonyms for North American plants: *Nymphaea lutea* β *kalmiana* Michx., *Nymphaea lutea* β *microphylla* Pers., *Nymphaea kalmiana* Sims, *Nuphar kalmiana* Ait. f., *Nuphar minima* Sm., *Nenuphar minumum* Link, *Nuphar luteum kalmiana* Torr. & Gray, *Nymphaea microphylla* (Pers.) Robins & Fernald, *Nuphar microphyllum* (Pers.) Fern., *Nymphozanthus microphyllus* (Pers.) Fern., *Nuphar microphyllum* f. *multisepalum* O. Lakela.

Origin: Eurasia (Native also in North America)

General Distribution in North America: Northeastern Minnesota northward into Newfoundland and southward to southern New Jersey



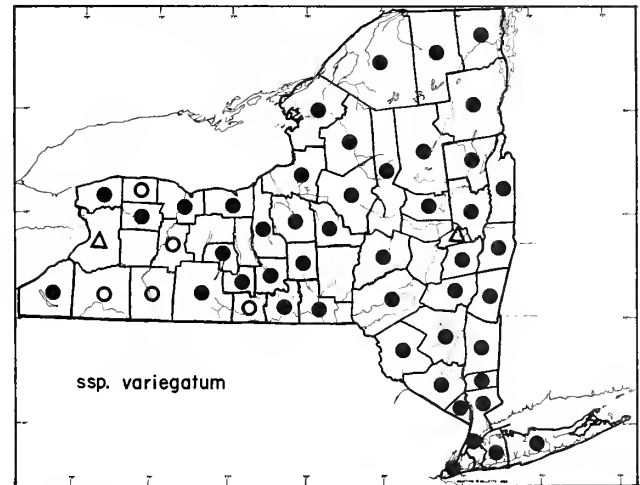
1b. *N. luteum* ssp. *variegatum* (Durand) Beal

Type Description: Engelm. ex Durand in Clinton, 19th Annual Report of the Regents of The University of the State of New York on the Condition of the State Cabinet of Natural History. p. 73. 1866

Synonyms: *Nymphaea advena* Ait. (in part), *Nuphar advena* Ait. f., *Nenuphar advena* Link, *Nuphar americana* Prov. (in part), *Nuphar variegatum* Durand, *Nuphar advena*, var. *variegatum* (Durand) Gray, *Nymphaea variegata* (Durand) Miller, *Nymphaea americana* (Prov.) Miller & Standley, *Nymphozanthus variegatus* (Durand) Fern., *Nymphaea advena* Soland, *Nuphar fraternum* (Miller & Standley) Standley, *Nuphar advena* ssp. *variegatum* (Durand) Clausen

Origin: Northeastern North America

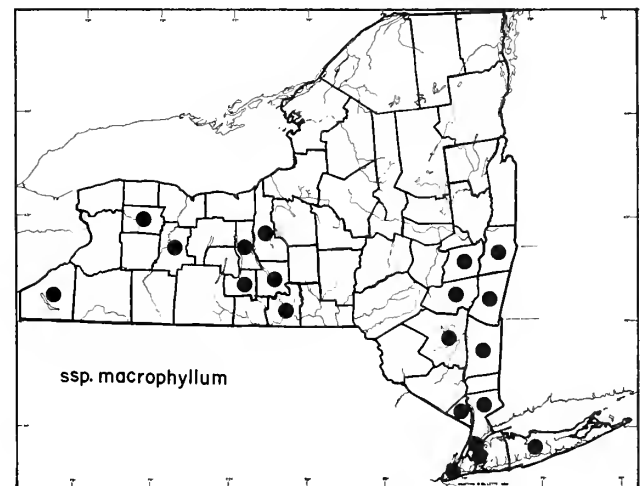
General Distribution: New Jersey to northeastern Pennsylvania, northern Ohio, northern Indiana, northern Illinois, Iowa, Nebraska, and western Montana, northward to the Yukon, Northwest Territories (Great Bear & Great Slave Lakes), northern Alberta, northern Saskatchewan, northern Manitoba, Quebec (as far north as Hudson Bay) and Newfoundland

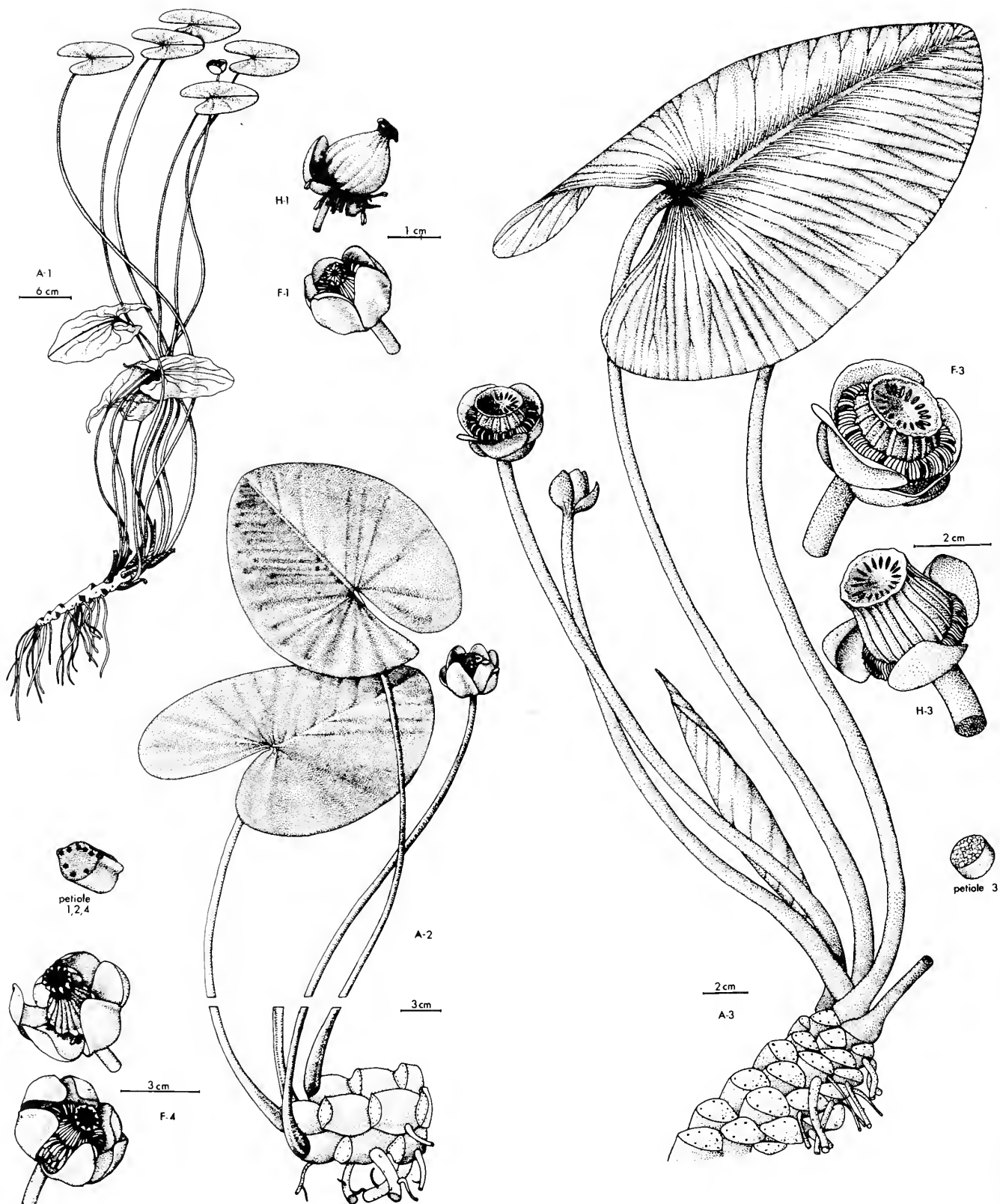


1c. *N. luteum* ssp. *macrophyllum* (Small) Beal

Type Description: Small, Bull. Torrey Bot. Club 25:465-466. 1898

Synonyms: *Nymphaea lutea* sensu Walter, *Nymphaea advena* Ait. (in part), *Nymphaea advena* sensu Michx., *Nymphaea arifolia* Salisb. in Konig & Sims, *Nuphar advena* Ait. f., *Nuphar advena*





Nuphar luteum (L.) Sibth. & Smith. The three subspecies native to New York State are illustrated above, designated as follows: A-1, ssp. *pumilum*; A-2, ssp. *variegatum*; A-3, ssp. *macrophyllum*. Flowers of hybrid intermediates ("× *N. rubrodiscum*") between the two varieties at the left are also shown (F-4).

sensu Pursh, *Nenuphar advena* (Ait.) Link, *Nuphar advena* sensu Walp., *Nuphar americana* Prov. (in part), *Nymphaea macrophylla* Small, *Nymphaea fluviatilis* Harper, *Nymphaea advena* ssp. *erythraea* Miller & Standley, *Nymphaea advena* ssp. *macrophylla* (Small) Miller & Standley, *Nymphona advena* (Soland) Neiuw., *Nymphozanthus advena* (Ait.) Fern., *Nymphozanthus advena* var. *macrophyllus* (Small) Fern., *Nymphozanthus fluviatilis* (Harper) Fern., *Nuphar fluviatile* (Harper) Standley, *Nuphar peteorum* Fern.

Origin: Eastern United States

General Distribution: From western Cuba to northeastern Mexico, northward to Maine, southern Vermont, New York, southern Ontario, central Michigan, southern Wisconsin, Missouri, southwestern Nebraska, eastern Oklahoma and eastern Texas

Note: The complete and more accurate author citation for ssp. *variegatum* would be (Engelmann ex Durand in Clinton) Beal, referring to the extremely confusing situation in which: 1) Clinton was the valid publisher, though remaining anonymous 2) Durand furnished the description, as quoted by Clinton 3) Engelmann was the first to use the epithet, but was said by Clinton to doubt the species at the time. We have employed Recommendation 46D of the International Code in choosing Durand to be retained as author of the description in its entirety.

Nelumbonaceae (Lotus Family)

This is a monogeneric group of primitive, strictly rhizomatous, aquatic plants, consisting of three species. One, *Nelumbo lutea*, a yellow-flowered species, is native to eastern North America and extends southward to Colombia; another *N. nucifera*, is native to the warmer parts of Asia and Australia and has pink flowers. The third species (if distinct) is native to the West Indies. The family, on both morphological and immunological grounds, is of uncertain relationship to other families. Authors have treated *Nelumbo* variously, placing it in the body of Nymphaeaceae with *Cabomba* and *Brasenia*, or placing it in a distinct subfamily, Nelumboideae; still others, more recently, are consistently separating it as a distinct family or even order. The bulk of evidence from the literature places its relationships away from the Nymphaeaceae, closer to some monocot families. Lotus is widely cultivated as an aquatic ornamental. There is considerable doubt that the genus *Nelumbo* is the biblical Lotus, though the tubers are edible.

FAMILY DESCRIPTION

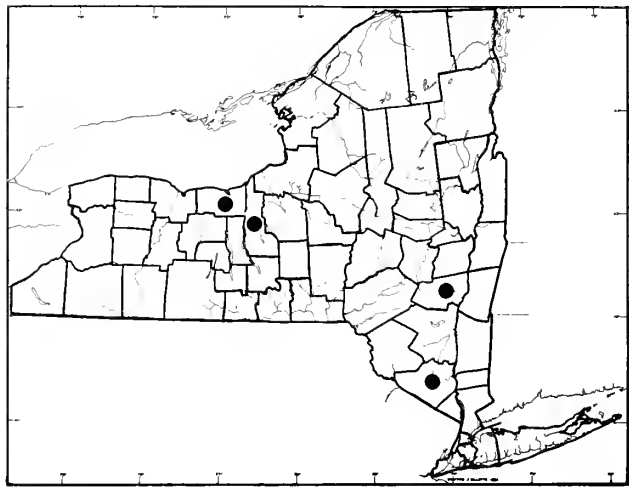
Plants have large, bisexual, radially symmetrical flowers, borne above water level. These are solitary on long, stiff peduncles which arise from the nodes of underwater rhizomes. Carpels (9–39) are separate, enclosed in round pits at the upper, flat surface of a spongy, obconical receptacle. Each short style is tipped with a small, obconical stigma. Stamens are free (± 200), fairly well differentiated into long, ventral anthers and filaments which are basifixed spirally and hypogenously. Outer stamens exhibit increased sterile tissue, but there is an abrupt transition from stamens to petals. Petals are numerous, spirally arranged, early-deciduous, grading into 2–5 more or less persistent sepals. The fruit is an indehiscent nut with a hard pericarp. The pendulous ovule is anatropous. The ovule comes to fill the entire pericarp where, in seed, the embryo is enclosed by a thin, membranous sheath (sometimes interpreted as endospermous). Endosperm and perisperm are absent. A ring around the base of the green plumule becomes 2-lobed, suggesting the presence of one cotyledon rather than two. Leaves of the plumule are peltate, closely resembling more mature leaves. Seedlings float on the surface of the water. Rhizomes are 1–2 cm thick, but produce enlarged, starchy tubers in late season. Peltate leaves (3–6 dm wide) are both floating and emergent, borne on long petioles which arise from nodes of rhizomes as do adventitious roots. Fruits are nut-like, borne in the enlarged receptacle which is woody, obconical and flat-topped, dropping the fruit from open chambers in its surface. The peduncle often reflexes just below the fruiting receptacle. Vegetative portions of the plant are without vessels (except primary xylem of roots) and vascular bundles are scattered, suggesting monocotyledonous relationships.

1. NELUMBO

Common Names: Lotus, Sacred Bean

Authority: Adans, Fam. Pl., vol. 2, p. 76, 1763

These plants are aquatic herbs of circumboreal distribution, known for their large, peltate leaves and edible fruits and tubers. There are three species, one of which is known to have persisted after escape from cultivation in New York State.



1. *Nelumbo lutea* (Willd.) Pers.

Common Names: Lotus, Wankapin, American Lotus, Duck-acorn, Yanquapin, Water Chinquapin, Lotus-lily, Water-nut, Can-dock, Yellow Nelumbo

Type Description: Persoon, Syn. vol. 1, p. 95, 1805

Synonyms: *Nelumbium luteum* Willd., *Nymphaea pentapetala* Walt., *Cyanus luteus* Nutt., *Nelumbo pentapetala* (Walt.) Fern.

Origin: Eastern North America

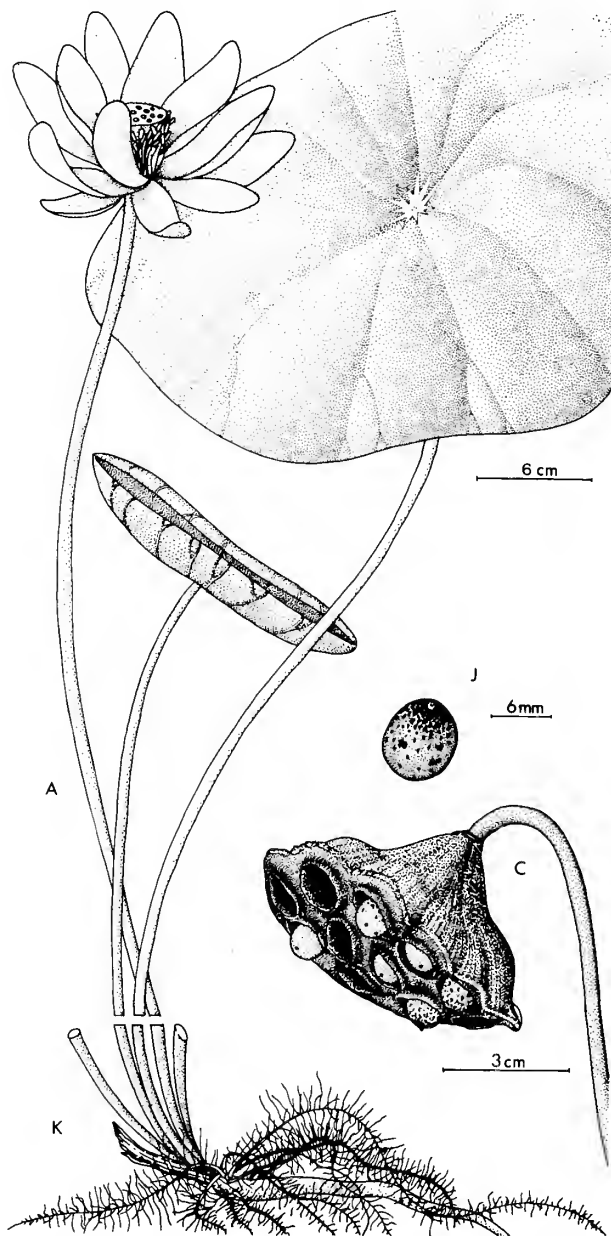
Habitats: Ponds, lakes, slow streams, estuaries, artificial impoundments and sloughs

Habit: A large, perennial, aquatic herb with floating and emergent leaves

Flowering: July–September

Fruiting: September–November

General Distribution: Florida to Texas and northward inland to Iowa, Minnesota and southern Ontario; adventive in New York; coastal populations to New England



Description: Plants with bisexual flowers; **stigmas** 1 per carpel, small, obconical, each borne at the tip of a short **style**; **ovaries** numerous (9–39), unicarpellate, free, obconical, each borne in a pit in the **receptacle** and basally attached; **ovule** 1 per ovary, anatropous, pendulous, becoming a **seed** which fills the indehiscent **fruit**; **embryo** completely filling the **pericarp**, but surrounded by a thin membranous sheath; **endosperm** lacking; **perisperm** lacking; **cotyledons** consisting of two lobes, developing from a ring at the base of the plumule (suggesting a single, fused structure); **plumule** leaves peltate, grading only in size into mature leaves; **fruit** in an aggregate of indehiscent **nutlets**, 0.8–1.5 cm long, borne in pits in a **woody receptacle**; **receptacle** obconic, with a flat, truncated summit, 6–12 cm in diameter, erect to reflexed-pendulous at maturity; **pits in the receptacle** expanding to release

many of the fruit by late fall; **stamens** numerous (± 200), spirally attached, fairly well differentiated into slender **filaments** and elongate, antrorse **anther** sacs, each tipped with a slender, **hooked appendage**; **perianth** radially symmetrical up to 25 cm in diameter, poorly differentiated into calyx and corolla; **petals** 20 or more, 4–12 cm long, 2–6 cm broad, lanceolate to linear with rounded to obtuse tips, yellow and early deciduous (2–3 days); **calyx** of 2–5 **lobes**, green to yellowish, more persistent than petals but otherwise similar; **flowers** borne singly on long peduncles; **bracts** **absent**; **peduncles** glabrous, tough, erect, holding the flower above the water surface, often reflexed at the tip in fruit, arising from the **nodes** of underwater rhizomes; leaves orbicular, centrally peltate, glabrous, leathery, waxy, shedding water readily, 20–50 (70) cm broad, floating or elevated on the stiff petioles up to 1 m above the water surface; **petioles** arising from the nodes of the rhizomes which lie buried horizontally in mud; **rhizome** 1–2 cm thick, producing large, starchy **tubers** in the fall. ($2n = 16$).

Importance: American Indians utilized the tubers as a source of starchy food. The leaf stalks and young leaves were cooked as a vegetable. Seeds, eaten before the seed coat hardens, have a chestnut-like flavor. At later stages, the embryo of the ripe seeds may be removed from the hard fruit coat, cooked and ground for breadstuff. The seeds show remarkable powers of longevity and dormancy, and may be stored indefinitely. The woody fruiting receptacles are often sold for use in dried arrangements, and are unusual and attractive. These “pods” have been used by native American shamans as rattles in ritual healing practices. *Nelumbo* species (both yellow and pink flowered) are often cultivated in ponds, especially farther south.

Cabombaceae (Water-Shield Family)

A family of two genera of strictly aquatic plants, variously treated in the past: 1) as an integral part of the Nymphaeaceae, 2) a distinct subfamily, Cabomboidae, within Nymphaeaceae, or 3) as a distinct family, with perhaps closer relationships to the Ceratophyllaceae or Ranunculaceae. *Brasenia* is monotypic and cosmopolitan, except for Europe; *Cabomba*, with about six species in warmer parts of the world, has only one species which reaches our area.

FAMILY DESCRIPTION

Plants have small, bisexual flowers which are radially symmetrical and axillary on an elongate, cauline axis which arises from a submerged rhizome. The gynoecium is multi-carpellate, consisting of 3–18 free ovaries. The stamens are hypogenous, (3) 6–36, anther sacs dorsal or ventral. The perianth is biseriate, consisting of 3 (rarely 4) petals and 3 (4) sepals. The fruit is an indehiscent pod, containing (1) 2–3 pendulous seeds, each with a small amount of endosperm and copious perisperm. Both genera produce spirally arranged, floating, peltate leaves, but *Cabomba* is dimorphic, producing primarily capillary-dissected, submerged leaves, with the tiny, floating, peltate leaves only near the branch tips subtending the flowers. Both genera produce a milky latex and secrete a mucilaginous covering, but this is much more pronounced in *Brasenia*.

KEY TO GENERA

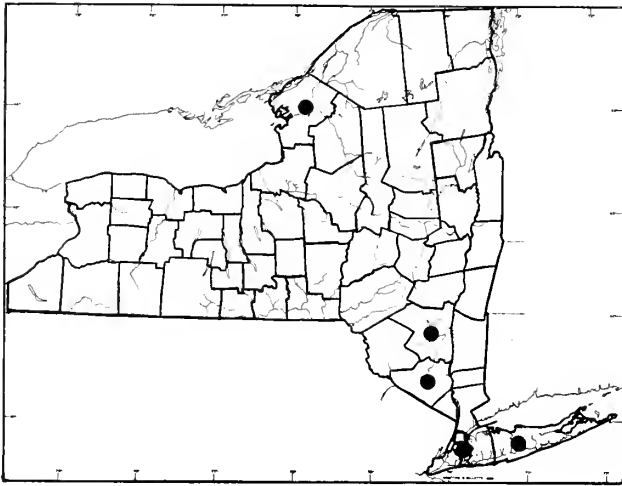
1. Leaves mostly submerged, capillary-dissected, fan-shaped with few, small, peltate, floating leaves; stamens 3–6 in creamy-white flowers.....1. *Cabomba* (p. 31)
1. Leaves uniformly peltate, elliptic, almost all floating; stamens 12–36, in dull, purplish flowers.....2. *Brasenia* (p. 33)

1. CABOMBA

Common Names: Fanwort, Carolina Water-shield, Fish-grass, Washington-plant, Cabomba

Authority: Aublet, Pl. Gui. I. 321. t. 124, 1775

A genus of almost wholly submerged aquatics, with about 6 species in the warmer parts of the Western Hemisphere. One species occurs in New York State as an escape after the dumping of aquaria.



1. *Cabomba caroliniana* Gray

Common Names: Fanwort, Carolina Water-shield

Type Description: Gray, Ann. Lyc. N.Y., vol. 4, p. 47, 1837

Synonyms: *Cabomba aubleti* Michx. (in part), *C. aquatica* DC. not Aubl., *C. viridiflora* Hort.

Origin: Eastern North America

Habitats: Ponds, lakes, sloughs, swamps and quiet streams

Habit: Attached, submerged aquatic, with a few floating leaves and emergent flowers

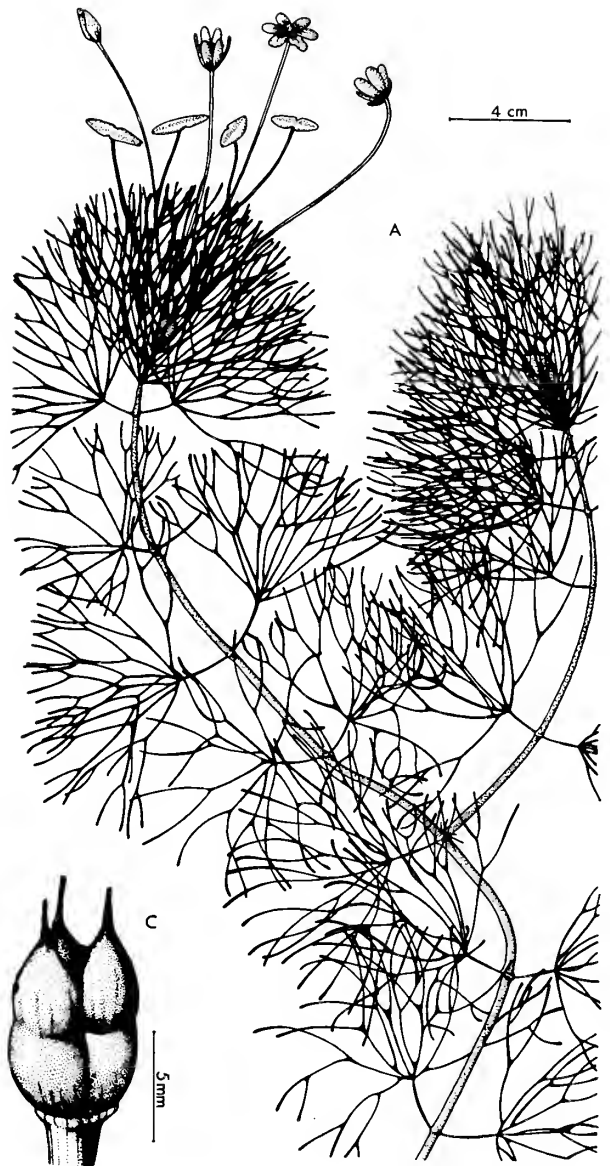
Flowering: May–September

Fruiting: July–November

General Distribution: Florida to Texas, north to Maryland and Virginia (escaping northward to New England)

Description: Plants with bisexual flowers; stigmas 1 per carpel, small, each terminating in a short style; ovaries 3 (2–4) per flower, each of a single carpel, free, each carpel becoming an indehiscent pod in fruit; ovules 1–3 per carpel, attached to the dorsal suture, becoming pendulous seeds and finally enclosed tightly by the pod; endosperm and copious perisperm present; stamens (3) 6, hypogenous, the short anther sacs extrorse; perianth radially symmetrical, 0.9–1.5 cm in length with separate petals and sepals in two whorls of 3 (rarely 4); petals white to cream, short-clawed, one with two yellow-spotted, auriculate lobes at the base; sepals creamy-greenish to rose-tinged, unlobed; flowers borne singly, emergent, on slender peduncles from the axils of small, floating leaves, floating leaves few, alternate, peltate, linear-elliptic, 1.1–2.1 cm in length, entire to irregular or constricted near the petiole connection, often bifid at one end, also slightly pubescent beneath with a slight mucilaginous coating, petioled; submersed leaves opposite or whorled, capillary, fan-shaped, palmately dissected into linear-filiform, often dichotomously branching segments, up to 6 cm broad, subsessile or on petioles to 2 cm in length; stipules absent; nodes and internodes delicate, but tough, not fragmenting easily; stems (as well as leaves) often reddish, plants becoming up to 2.5 m long from a congested, fibrous root system in the substrate. ($2n = 24$).

Importance: Plants are eaten by waterfowl and rough fish, and provide excellent cover for minnows. They are used as substrate by microflora and browsing microfauna, and dense bed of the plants tend to be rich in associated plankton. In southern regions the plants may become a nuisance to small boat traffic. They speed the eutrophication process in shallow lakes. This species is used as a decorative ornamental in aquaria and frequently escapes.

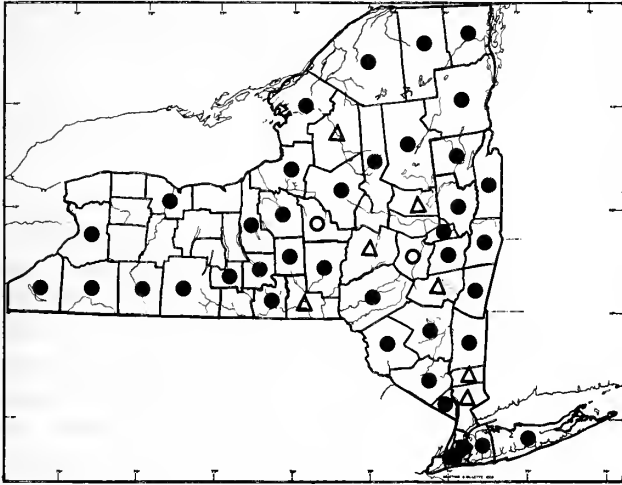


2. BRASENIA

Common Name: Water-shield

Authority: Schreber, Gen. Pl. vol. 1, p. 372, 1789

A monotypic genus of strictly aquatic, herbaceous plants with almost cosmopolitan distribution.



1. *Brasenia schreberi* Gmel.

Common Names: Water-shield, Purple Wen-dock, Dollar-bonnet

Type Description: Gmelin, Syst. Veg. I, p. 853, 1796

Synonyms: *Menyanthes nymphoides* Thunb., *Hydropeltis purpurea* Michx., *Brasenia peltata* Pursh, *Brasenia purpurea* (Michx.) Casp.

Origin: Ancient and uncertain

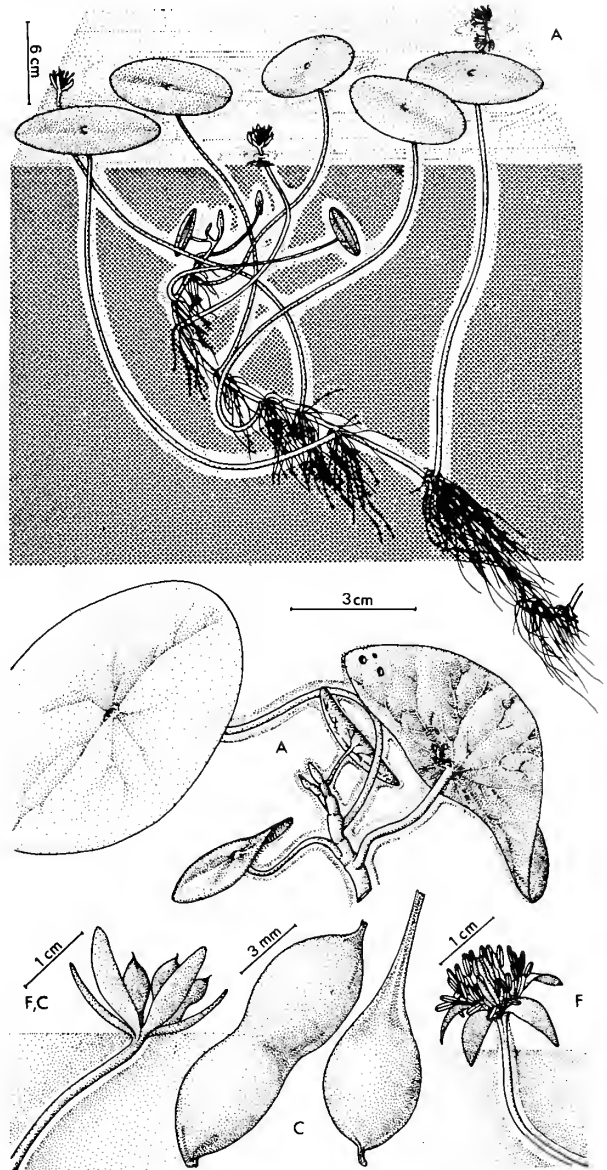
Habitats: Lakes, ponds, ditches and other still waters

Habit: Floating-leaved aquatic; stems usually attached

Flowering: June–September (October)

Fruiting: July–November

General Distribution: Erratic-cosmopolitan (absent in Europe)



Description: Plants with bisexual flowers; **stigmas** 1 per carpel, linear, each borne laterally on a fleshy style; **ovaries** 4–10 (18), free, each of a single **carpel**, becoming a clavate, coriaceous, indehiscent **pod** in fruit; **ovules** 2 (1–3) per carpel, pendulous from the **dorsal suture**, becoming orbicular seeds, 2–3 mm long, with **endosperm** and copious **perisperm**; **stamens** hypogenous, 12–20 (36), with slightly introrse anther sacs, purplish-red; **perianth** radially symmetrical, in two whorls, 1–1.8 cm broad; **petals** 3 (4), dull red-purple, ovate-lanceolate, 0.6–1.5 cm long; **sepals** similar to the petals; **flowers** solitary on axillary **peduncles**; **leaves** alternate, centrally peltate, broadly oval to suborbicular, entire, shiny green to reddish above, red-purple and coated with mucilage below at maturity, 4–9 cm long; **peduncles** slender, purplish, also coated with the **mucilaginous substance**, as are the stems; stems are much-branched and attached (though they may break free and survive) to a slender, creeping **rootstock**. ($2n = 80$).

Importance: The tuberous roots are reportedly eaten as food by Indians in the western United States, and the young leaves and petioles (prior to extensive mucilage formation) are eaten by the Japanese in salads.

Ceratophyllaceae (Hornwort Family)

Members of this group are highly specialized vegetatively to live as submerged aquatics. Their flower structure, however, is relatively primitive, placing the family in Nymphaeales. The position and relationships of the family remain in doubt. The single genus, *Ceratophyllum*, has five species, two of which occur in New York State. They are of ecological importance to fish and waterfowl, and are sometimes grown as aquarium plants.

FAMILY DESCRIPTION

Perennial, submerged aquatics, forming floating mats of stolons and rhizomes, not rooted. Leaves are whorled on the stems and are coarsely to finely dichotomously dissected, with very short petioles (or sessile) and no stipules. Blades are of linear to filiform branching segments with serrulate to ciliate margins, or entire. Vegetation feels rough to the touch by comparison with most other submerged angiosperms. Plants are monoecious. Flowers are minute, regularly symmetrical, borne singly at the nodes. The perianth (sometimes called involucre) is of a single series, the 10–16 lobes fused at the base into a shallow cup. Stamens are erect with short, fleshy filaments, each with a broad connective which projects beyond the 2 anther sacs into 2 (3) lobes. Stamens 8–22, crowded, about equaling the perianth lobes of the male flowers, deciduous prior to anthesis. Carpels are 1 per female flower, exserted, with a long, persistent style, 1-locular with a single, laminar, pendulous ovule. The fruit is a single-seeded, nut-like achene with horn-like spines. The embryo is large, and endosperm is absent.

1. CERATOPHYLLUM

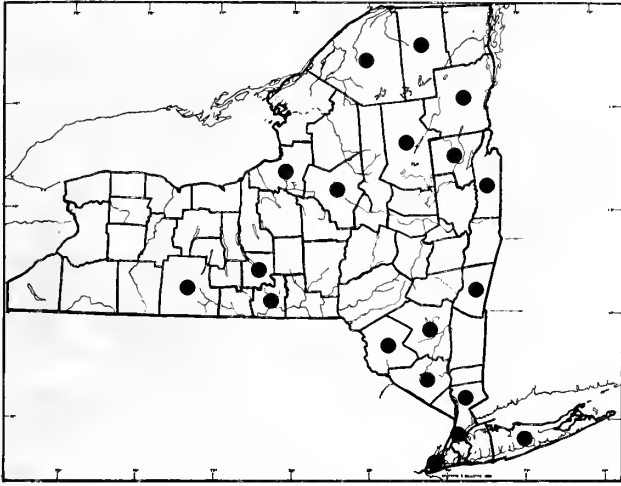
Common Names: Hornwort, Coontail, Cornifle

Authority: Linnaeus, *Species Pl.*, p. 992, 1753

A circumboreal genus of submerged aquatic plants. Two species are found in New York State in lakes, streams and backwaters.

KEY TO SPECIES OF CERATOPHYLLUM

1. Terminal leaf branches often free of teeth, capillary; fruit warty, with more than 2 (4–15) lateral and basal spines, their bases confluent along a narrow ridge.....1. *Ceratophyllum echinatum* (p. 35)
1. Terminal leaf branches mostly toothed, linear to subcapillary; rarely fruiting; fruit smooth to slightly warty, basal spines 2 only.....2. *Ceratophyllum demersum* (p. 36)



1. *Ceratophyllum echinatum* Gray

Common Names: Hornwort, Coontail, Hornweed

Type Description: Gray, Ann. N.Y. Lyc. vol. 4, 1837

Synonym: *C. demersum* L. var. *echinatum* Gray

Origin: Eastern North America

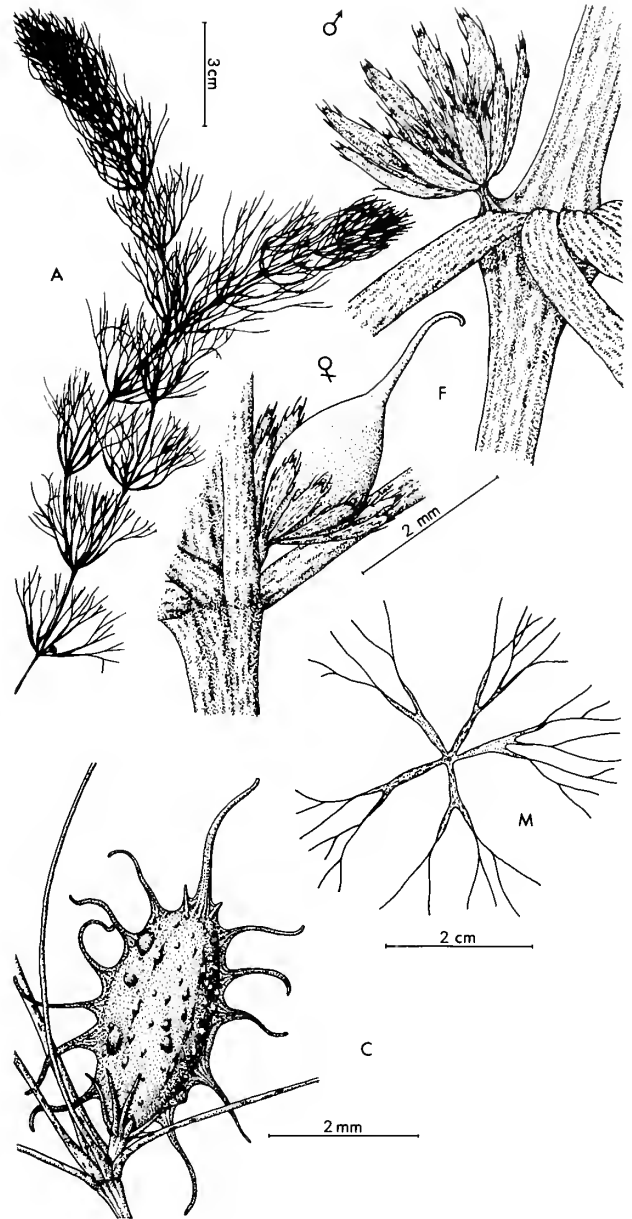
Habitats: A variety of aquatic habitats in still or slow-moving waters, and often deep

Habit: Submerged aquatic, much-branched and rootless

Flowering: July–August

Fruiting: July–September

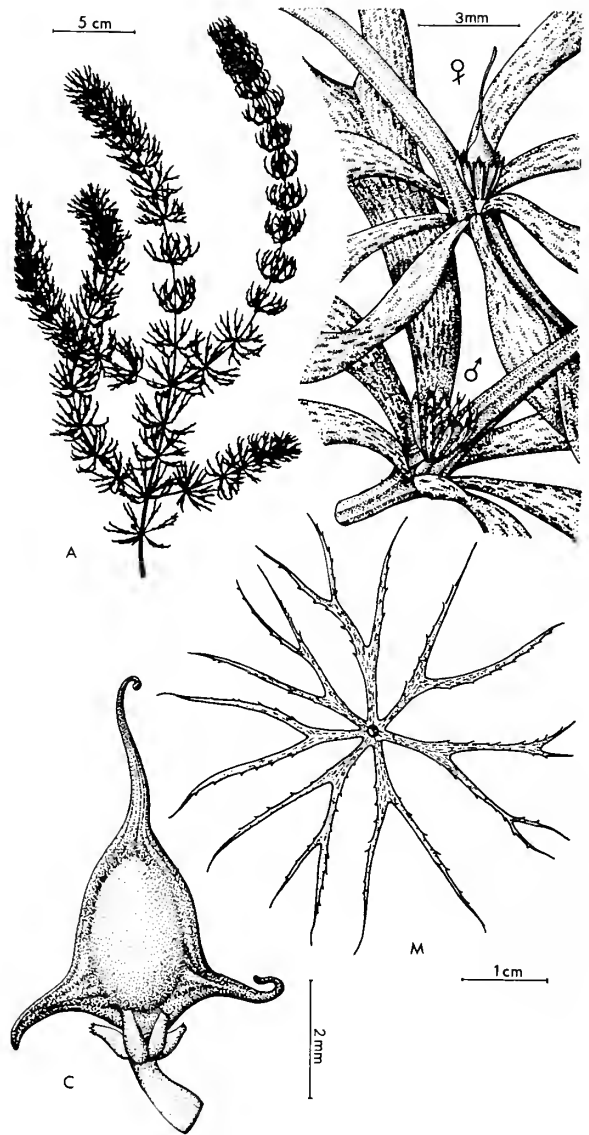
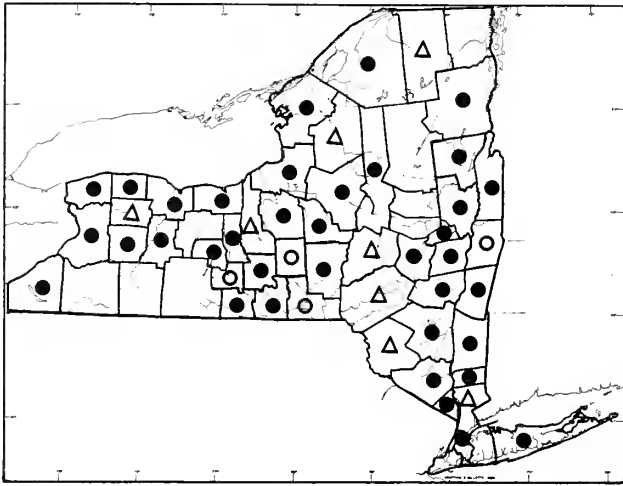
General Distribution: Maine and southwestern Quebec to Minnesota, south to Florida, Texas and Mexico



Description: Plants monoecious; **stigma** 1, **style** 1, filiform, equaling the **ovary** in length, persistent and spine-like in fruit; **ovary** 1 per female flower, becoming warty, oblong **achene** 3–4 mm long, with 4–10 (15) hooked, **basal** and **lateral spines**; **ovule** pendulous, becoming a single **seed** with a large **embryo** and **no endosperm**; **perianth** ("involucre") of 10–16 **lobes** which are strap-like, serrulate and ciliate near the tips, ca. 0.5 mm long, elongating somewhat and persistent at the fruit base; **male flowers** with 10–20 deciduous **stamens**; **anther sacs** 2; **filaments** fleshy, prolonged above the anther sacs into 2 (3) hood-like **floats**; **peduncles** very short; **flowers** minute, solitary, axillary; **leaves** whorled, 3–8 per node, 1.8–2.7 cm long, dichotomously or trichotomously dissected (usually 2–3 times per leaf), the **basal segments** often flattened, linear, with capillary to subcapillary **terminal segments**, margins entire or minutely serrulate-ciliate; **stipules** **absent**; **nodes** slightly swollen; **internodes** very short near branch tips, to 6 cm when fully elongated; **stems** lax, submerged, with numerous lateral branches; **seedling** with two, large, linear, **cotyledons**, cleft leaves and no radicle; **roots** **totally absent**.

Intraspecific Variation: Vegetatively the plants vary in the presence or absence of tiny spines on leaf segments, and in the relative capillarity of terminal segments. Fruit spines also vary in number.

Importance: The achenes and sometimes vegetative parts are eaten by waterfowl.



2. *Ceratophyllum demersum* L.

Common Names: Coontail, Hornwort, Hornweed, Cornifle (Quebec)

Type Description: Linnaeus, Species Pl., p. 992, 1753

Synonym: *C. muricatum* Cham.

Origin: Uncertain

Habitats: Lakes, ponds, slow-moving streams and river backwaters, often in relatively shallow water

Habit: Submerged aquatic, much branched, rootless, forming coarse, dense mats

Flowering: (June) July–August

Fruiting: July–October

General Distribution: Circumboreal, found widely throughout North America

Description: Plants monoecious; stigma 1, style 1, filiform, equaling the ovary in length, persistent and spine-like in fruit; ovary 1 per (female) flower, becoming a smooth to slightly warty oblong achene, 3–4 mm long with 2 stiff basal spines; ovule pendulous, becoming a single seed with large embryo and no endosperm; perianth (“involucre”) of 10–15 lobes which are strap-like, with dentate tips, slightly fused at the base, ca. 0.5 mm, elongating somewhat and persistent in fruit; male flowers with 8–20 deciduous stamens; filaments fleshy, prolonged above the 2 anther sacs into 2 (3) corona-like floats; peduncles very short; flowers minute, solitary, axillary; leaves whorled 3–8 (10) per node, 0.9–2.5 cm long, dichotomously (trichotomously) branched and dissected, the segments linear, usually flattened, with minute to substantial teeth along one side (rarely on both sides or absent from some leaves); stipules absent; leaves virtually sessile; nodes slightly swollen; internodes 3 mm to 5 cm long, gradually increasing away from the apex; stems lax to springy in texture (rough to the touch), very dense, small lateral buds (hibernacula) become dormant and starch-rich, falling to the bottom and overwintering; seedlings have two, large, linear, cotyledons and unbranched first leaves with no radicle or other sign of roots.

Intraspecific Variation: Leaves vary in length, shape and marginal teeth, often on the same individual.

Importance: *Ceratophyllum* is one of the major food sources of waterfowl, which not only eat the fruit and foliage, but seek out the starch, dormant buds in the fall. The plants may also provide breeding grounds and hiding places for small fish. They are important ecologically in crowding out other plant species, changing light conditions where they form dense mats and serving as a substrate for microscopic animals and plants. They are frequently found in close association with green algae, and serve with them to oxygenate the aquatic habitats in which they occur.

APPENDIX I

FUNGI ASSOCIATED WITH PLANT SPECIES IN THIS TREATMENT

To be included on this list, a fungus must occur on a species in this treatment somewhere in the United States. If a fungus occurs in New York State and has not as yet been recorded on a host covered in this treatment, but has been collected on such a host in some other state, it is marked with a single asterisk (*).

Abbreviations of states indicate a literature citation for each. Double asterisks (**) indicate that a herbarium specimen with New York State host information has been seen.

CHYTRIDIALES

Physoderma sp., Leaf Gall on *Saururus cernuus* (Va.)

Synchytrium asari Arth. & Holw., on leaves and petioles of *Asarum canadense* (Minn., Wisc.)

PERONOSPORALES

Pythium marsipium Drechs., Leaf and stem rot of *Nymphaea odorata* (Mass., N. Y., Wisc.)

Pythium proliferum deBary, Leaf and stem rot of *Nymphaea odorata* (Mass., N. Y., Wisc.)

Pythium undulatum Peterson, Leaf and stem rot of *Nymphaea odorata* (Mass., N. Y., Wisc.)

Pythium sp., on *Nymphaea odorata* (Wisc.)

MUCORALES

Endogone fasciculata Thaxt., mycorrhizal with *Liriodendron tulipifera*

Endogone gigantea Nicolson & Gerdemann, mycorrhizal with *Liriodendron tulipifera* (Ind., S. Dak.)

ENTOMOPHTHORALES

Acaulopage dichotoma Drechs., in decaying leaves of *Nymphaea odorata* capturing and consuming amoebae (Wisc.)

ERYSIPHALES

Erysiphe polygoni DC., *Powdery mildew on *Liriodendron tulipifera* (widespread)

Microsphaera alni DC. ex Wint., Powdery mildew on *Magnolia acuminata*

Phyllactinia corylea Pers. ex P. Karst. Powdery mildew on *Liriodendron tulipifera* (N. Y. to Ala. and Mo.), on *Magnolia acuminata* (Ohio, Pa.), and on *Sassafras albidum* (Mich.)

MELIOLALES

Irene araliae Spreng. ex Syd., Black mildew on *Magnolia virginiana* (Miss.)

Irene perseae (F. L. Stev.) Toro, Black mildew on *Persea borbonia* (Ala., Fla., Miss.)

Meliola amphitricha Fr., Black mildew on *Persea borbonia* (Fla., Mich.)

Meliola magnoliae F. L. Stev., on *Magnolia virginiana* (Ga.)

HYPOCREALES

Hypocrea minima Sacc. & Ellis, on *Magnolia* bark (N.J.)

Hypocrea olivacea Cook & Ellis (*H. melaleuca* Ellis & Everh.), bark of *Sassafras albidum* (N. J.) known only from the type locality

Hyponectria magnoliae (Schw.) Barr, on dead leaves of *Magnolia virginiana* (N. J.)

Nectria aureo-fulva Cooke & Ellis, on *Magnolia* sp. (N. J.)

Nectria cinnabarina (Tode ex Fr.) Fr., * on twigs of *Asimina triloba* (W. Va.), on twigs of *Calycanthus floridus* (Md.)

Nectria coccinea (Pers. ex Fr.) Fr., * on bark of various trees including *Magnolia* (Vt. to W. Va., N. Dak.)

Nectria magnoliae Lohman & Hepting, on bark and branches of *Liriodendron tulipifera* (Conn. to N. C., Ohio, Tenn., W. Va.)

Nectria ochroleuca (Schw.) Berk. (= *N. conigena* Ellis & Everh.), on bark of various trees including *Liriodendron tulipifera*, *Lindera benzoin*, and *Magnolia* spp. (N. Y., Ohio to Mo. and La.)
Nectria pallidula Cooke [= *Cucurbitaria pallidula* (Cooke) O. Kuntze], on *Lindera benzoin* (Pa., Tenn.)
Nectria verrucosa Sacc., on *Sassafras albidum* (Ala., Conn., Del., N. J., N. Dak., Pa., S. C.)
Nectria sp., canker on *Liriodendron tulipifera* (W. Va. to N. C. and Tenn.)
Nectria sp., canker on *Magnolia acuminata* (W. Va.)
Nectria sp., (? *N. galligena* Bres.) Branch and trunk canker of *Sassafras albidum* (Conn. to W. Va.)

SPHAERIALES

Acanthostigma berenice (Berk. & Curtis) Sacc., on *Magnolia virginiana* (Fla.)
Anisogramma sp. (= *Apioportha corni* Wehm., illegitimate name), on dead twigs on *Sassafras albidum* (Pa.)
Anthostomella sp., on *Liriodendron tulipifera* (Ga.)
Calospora sp., * on *Liriodendron tulipifera* (Ga.)
Camarops polyspermum (Mont.) Mill., on *Liriodendron tulipifera* (Ga.)
Camarops pugillus (Schw.) Shear, on *Liriodendron tulipifera* (Va.)
Ceratostomella multiannulata Hedge. & Davidson, Blue wood stain of *Liriodendron tulipifera* (Va. to Gulf States)
Ceratostomella pluriannulata Hedge., Blue wood stain of *Liriodendron tulipifera* (Va. to Gulf States)
Cryptovalsa sassafras (Ellis & Everh.) Berl. (= *Diatrypella sassafras* Ellis & Everh.), on branches of *Sassafras albidum* (N. J.)
Cucurbitaria congesta Cooke & Ellis, on *Magnolia* (N. J.)
Daldinia concentrica (Bolt. ex Fr.) Ces. & DeNot. [= *D. vernicosa* (Schw.) Ces.], Wood rot of *Liriodendron tulipifera* and *Sassafras albidum* (Ga., Va.)
Diaporthe biglobosa (Cooke & Ellis) Sacc. (= *Sphaeria biglobosa* Cooke & Ellis), on branches of *Sassafras albidum* (N. J.)
Diaporthe binoculata (Ellis) Sacc. (= *Valsa binoculata* Ellis), on dead branches on *Magnolia virginiana* (N.C., N. J., N. Y. **)
Diaporthe eres Nits. * (= *D. magnoliae* Ellis & Everh.), on dead branches of *Liriodendron tulipifera* (Md.), on dead branches of *Magnolia acuminata* (Ga.)
Diaporthe pardalota (Mont.) Fuckel (= *D. sassafras* Dearn. & House), on *Sassafras albidum* (N. Y. **)
Diaporthe sociata (Cooke & Ellis) Sacc. (= *Valsa sociata* Cooke & Ellis), on *Lindera benzoin* (Mass., Md., N. Y. **, W. Va.)
Endoconidiophora virescens Davidson (*Ceratocystis* sp. ?), Sapstreak, Blue wood stain of *Liriodendron tulipifera* and *Magnolia* (Va. to Gulf States)
Eriosphaeria alligata (Fr.) Sacc., on decaying *Sassafras albidum* trunk (N. Y. **)
Eutypella glandulosa Cooke, on *Sassafras albidum* (N.Y.)
Eutypella linderae (Peck) Berlese (= *Valsa linderae* Peck), on dead branches of *Lindera benzoin* (Ind., N. J., N. Y. **, Ohio)
Fenestella sp., on *Magnolia virginiana* (N. J.)
Glomerella cinquilata (Ston.) Spauld. & Schrenk (= *Gloeosporium fructigenum* Berk.), on twigs and fruits of *Lindera benzoin* (N. J.), on *Sassafras albidum* (Tex.)
Griphosphaeria corticola (Fuckel) Höhn., on branches of *Sassafras albidum* (N. J.)
Hypoxylon hypophlaeum (Berk. & Rav.) J. H. Miller, on *Liriodendron tulipifera* and *Magnolia virginiana* (Ga.)
Hypoxylon microplacum (Berk. & Curtis) J. H. Miller [= *Diatrype microplaca* Berk. & Curtis, *Nummularia microplaca* (Berk. & Curtis) Cooke, *Nummularia gracilentia* Sydow, and *Nummularia scutata* Berk. & Cooke], on dead wood of *Magnolia virginiana* (Ga., N. C.), and on dead branches of *Sassafras albidum* (N. Y. **, Md. to Ala. and Ga., Ind.)
Hypoxylon occidentale Ellis & Everh. ex P. Martin, on *Liriodendron tulipifera* (Ohio)
Hypoxylon sassafras (Schw. ex Fr.) Berk., on *Lindera benzoin* (N. Y. **, Md.), on *Liriodendron tulipifera* (N. Y. **), and on *Sassafras albidum* (N.Y. ** to Ga. and Mo.)
Hypoxylon sp., on *Persea borbonia* (Ga.)
Hypoxylon sp., Wood rot of *Liriodendron tulipifera* (Ga.)
Lasiosphaeria ovina (Pers. ex Fr.) Ces. & DeNot., * on *Liriodendron tulipifera* (Ga.)
Lasiosphaeria pezizula (Berk. & Curtis) Sacc., Wood stain in *Liriodendron tulipifera* (S. C.)

Lasiosphaeria strigosa (Alb. & Schw. ex Fr.) Sacc., on *Liriodendron tulipifera* (Ga.)
Metasphaeria sassafrasicola Tehon & Stout, on leaves of *Sassafras albidum* (Ill.)
Nummularia discincola (Schw.) Cooke, on *Magnolia* (Eastern U.S. and Canada)
Phyllachora perseae Hodges, on *Persea borbonia* (S. C.)
Plagiostoma magnoliae (Ellis) Barr (= *Gnomonia magnoliae* Ellis), on fallen leaves of *Magnolia virginiana* (Md., N. J., Ga.)
Pleuroceras sassafras (Ellis & Everh.) Barr (= *Gnomonia sassafras* Ellis & Everh.), on leaves of *Sassafras albidum* (N. J., Ohio)
Pseudomassaria carolinensis Barr & Hodges, on *Persea borbonia* (S. C.)
Valsa ambiens (Pers. ex Fr.) Fr., * on dead twigs of *Asimina triloba* (Va., W. Va.), on branches of *Magnolia acuminata* (N. Y. **)
Valsaria nigrofacta (Cooke & Ellis) Sacc. (*Valsa nigrofacta* Cooke & Ellis), on *Sassafras albidum* (N. J.)

PHACIDIALES

Lophodermium punctiforme (Fr.) Fuckel, on *Liriodendron tulipifera* (Ga.)
Rhytisma liriodendri Wallr., Black leaf spot on *Liriodendron tulipifera* (Calif., Tex.)

HELOTIALES

Angelina rufescens (Schw. ex Fr.) Duby, * on *Liriodendron tulipifera* (Ga.)
Chlorociboria aeruginosum (Pers. per Fr.) Seaver ex Ram., Korf, & Bat, Green wood stain on rotting *Liriodendron tulipifera* wood (Northern hemisphere, N. Y. **)
Patellariopsis clavispota (Berk. & Br.) Dennis (= *Patellaria* ?), on scale insects on *Liriodendron tulipifera* (Ga.)
Pezizella oenotherae (Cooke & Ellis) Sacc. [= *Sclerotiopsis concava* (Desm.) Shear & Dodge], on *Liriodendron tulipifera* (Ga.), on branches of *Magnolia acuminata* (N. C.)
Sclerotinia gracilipes (Cooke) Sacc., on flower parts, Petal rot of *Magnolia virginiana* (Md., N.J.)
Whetzelinia sclerotiorum (Lib.) Korf & Dumont, Rhizome rot of *Asarum canadense* (N. Y.)

MYRIANGIALES

Myriangium duriae Mont. & Berk., on *Magnolia virginiana*

PLEOSPORALES

Botryosphaeria calycanthi (Schw.) Sacc., on twigs of *Calycanthus floridus* (N. C., Va.)
Botryosphaeria ribis Gross. & Dug., * on branches of *Liriodendron tulipifera* (Fla., Ga., Pa.)
Botryosphaeria ribis var. *achromogena* Gross. & Dug., Canker on *Lindera benzoin* (Md.), on branches of *Liriodendron tulipifera* (Fla., Ga., Pa.)
Didymosphaeria magnoliae J. H. Miller & G. E. Thompson, on dead leaves on *Magnolia virginiana* (Ga.)
Guignardia magnoliae (Schw.) J. H. Miller [= *Sphaeria magnoliae* Schw., *Sphaerella magnoliae* Ellis, *Sphaerella annulata* Cooke, *Laestadia magnoliae* Sacc., and *Mycosphaerella annulata* (Cooke) Miles of USDA Index of Plant Diseases], on *Magnolia virginiana* (Fla., Ga., Miss., N. J., N. C., S. C.)
Microdothella ramularis (Ellis & Everh.) Tassi, on twigs of *Lindera benzoin* (Pa.)
Physalospora fusca N. E. Stevens, on branches of *Sassafras albidum* (Ala.)
Physalospora obtusa (Schw.) Cooke (= *Botrysphaeria* ?, *Sphaeropsis seriata* Peck, *S. punctata* Dearn. & House, *S. linderae* Peck ?, *S. malorum* Peck non Berk.), on *Aristolochia*, on branches of *Calycanthus floridus* (Ga., N. Y., Va.), on branches of *Lindera benzoin*, on branches of *Liriodendron tulipifera* (Md. to Ga. and Tenn.), on branches of *Magnolia*, and on branches of *Sassafras albidum* (N. Y. to Ga. and Miss.)
Physalospora rhodina (Berk. & Curtis) Cooke, * on branches of *Sassafras albidum* (Ala.)

HYSTERIALES

Hysterium pulicare Fr., on *Liriodendron tulipifera*, and on *Sassafras albidum* (N. Y. **)
Karschia stygia (Berk. & Curtis) Masee [= ? *Buellia stygia* (Berk. & Curtis) E. Müller], on *Liriodendron tulipifera* (Mass. to Ga., Mich., Ind., Ohio, Iowa)
Lecanidion atratum (Hedw. ex Fr.) Endlich., * on scale insects on *Liriodendron tulipifera* (Ga.)
Ostreion americanum Duby (= *Lophium sassafras* Schw.), on *Sassafras albidum*

DOTHIDEALES

- Coccoidella scutula* (Berk. & Curtis) Höhn., on living leaves of *Persea borbonia* and *Magnolia* sp. (N. C. to Fla., Miss. and Tex.)
- Didymosphaeria linderæ* Sacc., on *Lindera benzoin* (N.Y. **)
- Dothidea linderæ* Gerard, on branches of *Lindera benzoin* (N.Y. **, Pa.)
- Mycosphaerella exutans* (Cooke) Barr, on living leaves of *Persea borbonia* (Tex.)
- Mycosphaerella glauca* (Cooke) Barr, on *Magnolia virginiana* (Fla., N. J., S. C.)
- Mycosphaerella infuscans* (Ellis & Everh.) Barr, on overwintered petioles of *Liriodendron tulipifera* (W. Va.)
- Mycosphaerella liriodendri* (Cooke) Woron., Leaf spot on *Liriodendron tulipifera* (Ga., Mich., N. Y.)
- Mycosphaerella milleri* Hodges & Haasis, perfect state of *Cercospora magnoliae*
- Mycosphaerella pontederiae* (Peck) House, Leaf spot on *Nuphar luteum* (Ma., Mich., N. Y. **, Va., Wisc.), on *Nuphar x rubrodiscum* (N. Y. **), Leaf spot on *Nymphaea odorata* (Va.)
- Mycosphaerella sassafras* (Ellis & Everh.) Bubak & Kab., on leaves of *Sassafras albidum* (N. Y. to Ga. and Kans.)
- Mycosphaerella tulipiferae* (Schw.) Higgins (= *Depazea tulipiferae* Schw., and *Phyllosticta liriodendri* Cooke), on *Liriodendron tulipifera* (mid-Atlantic to Gulf States)
- Mycosphaerella* sp. (*Sphaerella asiminae* Ellis & Kellerm.), Leaf spot associated with *Phyllosticta asiminae* Ellis & Kellerm., on *Asimina triloba* (Ind., Ohio, W. Va.)
- Mycosphaerella* sp., on *Magnolia virginiana* (Ga.)
- Scirrhia concavuscula* (Ellis & Everh.) Barr [= *Dothidea concavuscula* Ellis & Everh., *Dothidella concavuscula* (Ellis & Everh.) Theiss. & Syd.], on dead branches of *Magnolia virginiana* (N. J.)
- Trichodothis comata* (Berk & Rav.) Theiss. & H. Sydow (*Asterina comata* Berk.), on *Magnolia virginiana* (Ala., Tex., Miss.)

CAPNODIALES

- Capnodium elongatum* Berk. & Desm., Sooty mold on *Liriodendron tulipifera* (cosmopolitan)
- Englerula carnea* (Ellis & G. Martin) Höhn. (= *Asterina carnea* Ellis & G. Martin), Black leaf spot on *Persea borbonia* (Fla.)

MICROTHYRIALES

- Asterina ramularis* Ellis, on *Lindera benzoin* (Pa.)
- Asterina* sp., on leaves of *Persea borbonia* (southern states)
- Chaetothyria* sp. (= *Venturia applanata* Ellis & G. Martin), on leaves of *Magnolia virginiana* (Fla.)
- Lembosia rugispora* Tracy & Earle, Black mildew on *Persea borbonia* (Miss., N. C.)
- Micropeltis alabamensis* Earle, Black leaf spot on *Magnolia virginiana* (Ala.)
- Stigmatophragnia sassafrasicola* Tehon & Stout, on leaves of *Sassafras albidum* (Ill.)

USTILAGINALES

- Entyloma nymphaeae* (D. D. Cunn.) Setch., White smut on *Nuphar luteum* (Conn., Ill., Mass., N. Y., Wisc.), White smut on *Nymphaea odorata* (Conn., Ill., Iowa, Mass., N. Y. **, Ohio, Okla., Wisc.)

TREMELLALES

- Aporpium caryae* (Schw.) Teixeira & Rogers, * on *Liriodendron tulipifera*

SEPTOBASIDIALES

- Septobasidium langloisii* Pat., on scale insects infesting bark of *Magnolia virginiana* (Gulf States)
- Septobasidium tenue* Couch, on scale insects infesting bark of *Magnolia virginiana* (Gulf States)

CORTICIACEAE

- Laeticorticium sulphurellum* (Peck) Gilbertson (= *Hydnum sulphurellum* Peck), * on *Liriodendron tulipifera* (N.C.)
- Merulius interruptus* Bres., White rot in *Liriodendron tulipifera* (Va.)

Phlebia chrysocrea (Berk. & Curtis in Berk.) Burds. in Lombard *et al.* (= *Corticium lividum* Pers. ex Fr.), * on *Liriodendron tulipifera* (S. C.), on *Sassafras albidum* (Ga.)
Phlebia radiata Fr., * on *Liriodendron tulipifera* and *Magnolia virginiana* (widespread)
Serpula atrovirens (Burt) Cooke (= *Merulius atrovirens* Burt), on *Liriodendron tulipifera* (N. C.)

STEREACEAE

Haematostereum gausapatum (Fr.) Pouz. (= *Stereum gausapatum* Fr.), * Wood rot of *Liriodendron tulipifera* logs
Stereum umbrinum Berk. & Curtis, Wood rot of *Liriodendron tulipifera* logs
Tomentella brunneorufa M. J. Larsen, on *Liriodendron tulipifera* (Md.)

SCHIZOPHYLLACEAE

Schizophyllum commune Fr., * Sapwood rot on *Liriodendron tulipifera*, *Magnolia virginiana*, and *Sassafras albidum* (cosmopolitan)
Solenia anomala (Pers. ex Fr.) Fuckel (= *Henningsomyces* ?), * on *Lindera benzoin* (Tenn.)

HYDNACEAE

Hericium erinaceus (Bull. ex Fr.) Pers. (= *Hydnum erinaceus* Bull. ex Fr., *H. caputmedusae* Bull. ex Fr.), * Wood rot on *Liriodendron tulipifera* (Va.)
Radulum magnoliae Berk. & Curtis, on *Magnolia virginiana* (S. C.)

HYMENOCHAETACEAE

Coltricia mowryana Murrill, on *Persea borbonia* (Fla.)
Hymenochaete corrugata (Fr.) Lev. (= *H. agglutinana* Ellis), * Wood rot of *Lindera benzoin* (Conn., Pa.), and *Sassafras albidum* (Va.)
Hymenochaete tabacina (Sow. ex Fr.) Lev., * on dead branches of an *Aristolochia* sp. (Calif.)

POLYPORACEAE

Coriolus hirsutus (Wulfen ex Fr.) Quel. (= *Polyporus hirsutus* Wulfen ex Fr.), * Wood rot in *Liriodendron tulipifera*, *Magnolia* spp., *Persea borbonia* (Fla.), and *Sassafras albidum* (Ind., N.C.)
Coriolus pubescens (Schum. ex Fr.) Quel. (= *Polyporus pubescens* Schum. ex Fr.), * Wood rot in *Liriodendron tulipifera* and *Sassafras albidum*
Coriolus versicolor (L. ex Fr.) Quel. (= *Polyporus versicolor* L. ex Fr.), * Wood rot of *Liriodendron tulipifera*, *Magnolia* spp., and *Sassafras albidum* (Ind., Md., N. C., Va.)
Daedalea confragosa Bolt. ex Fr., Trunk rot of *Sassafras albidum* (Ind., N. Y.)
Daedalea extensa Peck, * Wood rot of *Liriodendron tulipifera*
Daedalea unicolor Bull. ex Fr., * Wood rot of *Liriodendron tulipifera*, and *Magnolia* spp. (widely distributed)
Fomes geotropus Cooke, on *Magnolia* sp. and *Persea borbonia* (Fla.)
Fomes supinus Schw. ex Cooke, on *Persea borbonia* (Fla.)
Gloeophyllum sepiarium (Wulfen ex Fr.) Karst. [= *Lenzites saepiaria* (Wulfen ex Fr.) Fr.], * Wood rot of logs and timber of *Liriodendron tulipifera* (cosmopolitan)
Gloeophyllum trabea (Pers. ex Fr.) Murrill (= *Lenzites trabea* Pers. ex Fr.), * Decay of *Liriodendron tulipifera* lumber
Irpex lacteus (Fr. ex Fr.) Fr. [= *Polyporus tulipiferae* (Schw.) Overh.], Wood rot in *Liriodendron tulipifera* (N. Y. **) generally distributed
Ischnoderma resinosa (Schrad. ex Fr.) Karst. [= *Polyporus resinosa* Schrad. ex Fr., *P. benzoinus* (Wahl.) Fr.], * Wood rot in *Lindera benzoin* and *Liriodendron tulipifera* (northern U. S.)
Lenzites betulina (L. ex Fr.) Fr., * Wood rot of logs and timber of *Liriodendron tulipifera* (cosmopolitan)
Phellinus everhartii (Ellis & Gall.) Pilat (= *Mucronoporus everhartii* Ellis & Gall.), on *Liriodendron tulipifera* (eastern U. S.)
Phellinus gilvus (Schw. ex Fr.) Pat. [= *Polyporus gilvus* Schw. ex Fr.] F.r., * Wood rot of *Sassafras albidum* (Ind., La., Md.)

Phellinus igniarius (L. ex Fr.) Quel. [= *Fomes igniarius* (L. ex Fr.) Kickx.], * White heart rot of *Sassafras albidum* (Ohio, Va.)

Phellinus ribis (Schum. ex Fr.) Quel. [= *Fomes ribis* (Schum. ex Fr.) Gill.], * Red heart rot of *Sassafras albidum* (Md.)

Polyporus adustus Willd. ex Fr., * Wood rot of *Liriodendron tulipifera*

Polyporus amplexans (Murrill) Sacc. & Trott., on *Asimina* (Ga.)

Polyporus caesius Schrad. ex Fr., * Wood rot of *Liriodendron tulipifera* and *Magnolia* spp.

Polyporus dichrous Fr., * Wood rot in *Liriodendron tulipifera*

Polyporus graveolens (Schw.) Fr., Wood rot in *Liriodendron tulipifera*

Polyporus mutabilis Berk. & Curtis, on *Persea borbonia* (Fla.)

Polyporus sulphureus Bull. ex Fr., * Wood rot in *Liriodendron tulipifera* and on *Persea borbonia* (Fla.)

Polyporus zonalis Berk., Wood rot of *Liriodendron tulipifera* (Southern States)

Poria canescens P. Karst., on *Liriodendron tulipifera* (Great Lakes region)

Poria cinerea (Schw.) Cooke, on *Liriodendron tulipifera* (Pa.)

Poria eupora (Karst.) Cooke, * on *Liriodendron tulipifera* (Va.)

Poria ferruginosa (Schrad. ex Fr.) Fr., * Wood rot of *Sassafras albidum*

Poria incrassata (Berk. & Curtis) Burt, on decaying *Liriodendron tulipifera* and *Sassafras albidum* lumber (widely distributed)

Poria isabellina (Fr.) Overh., Sapwood rot of *Asimina triloba* (Va., W. Va.)

Poria medulla-panis (Jacq.) Bres., * ? on *Sassafras albidum* (widely distributed)

Poria punctata (Fr.) Cooke, * on *Asimina triloba* (Va.)

Poria sassafras (Schw.) Cooke, on decaying *Sassafras albidum* wood (Pa.)

Pycnoporus cinnabarinus (Jacq. ex Fr.) Karst. (= *Polyporus cinnabarinus* Jacq. ex Fr.), * Wood rot of *Liriodendron tulipifera* (W. Va.)

Trametes albida (Fr. ex Fr.) Bourdot & Galzin (= *Trametes sepium* Berk.), * Wood rot of *Sassafras albidum* (Ind.)

Trametes malicola Berk. & Curtis, * Wood rot of *Lindera benzoin*

AGARICALES

Armillariella mellea (Vahl. ex Fr.) Karst., * Root rot of *Liriodendron tulipifera* (Va.), Root rot of *Sassafras albidum* (Pa.)

Flammulina velutipes (Fr.) Karst. [= *Collybia velutipes* (Fr.) Kummer], White, spongy trunk rot of *Liriodendron tulipifera* (W. Va.)

Hypholoma sp., * Butt rot of *Liriodendron tulipifera* (W. Va.)

Pleurotus ostreatus (Jacq. ex Fr.) Kummer, * Sapwood rot of *Liriodendron tulipifera* (infection occasional)

Strobilurus conigenoides (Ellis) Sing. (= *Collybia conigenoides* Ellis), * on fallen cones of *Magnolia acuminata* (Tenn.)

Tricholoma panaeolum (Fr.) Quel. var. *caespitosum* Bres., Fairy ring around *Lindera benzoin* (Md.)

Volvariella bombycina (Schaeff. ex Fr.) Sing., * on various trees including *Magnolia* spp.

MONILIALES

Alternaria nelumbii Enlows & Rand, Leaf spot on *Nelumbo lutea* (Okla.?, Tex.)

Arthrobotrys sp., Nematode-capturing fungus occurring on submerged *Liriodendron tulipifera* wood

Beltraniella portoricensis F. L. Stevens & Patil., conidial state of *Pseudomassaria carolinensis* on *Persea borbonia* (S. C.)

Botrytis cinera Pers. ex Fr., * Gray mold blight on *Aristolochia macrophylla* (Conn., Md.)

Cercospora guttulata Ellis & Kellerm., Leaf spot on *Aristolochia macrophylla* (W. Va.), on *Aristolochia* sp. (Ill.)

Cercospora liriodendri Ellis & Harkn. [= *Mycosphaerella tulipifera* (Schw.) Higgins?], on *Liriodendron tulipifera* (N. J., W. Va.)

Cercospora magnoliae Ellis & Harkn. (= *C. glauca* Ellis & Everh. and *Isariopsis magnoliae* Plakidas). This is the conidial state of *Mycosphaerella milleri*; on *Magnolia virginiana* (N. J., N. C., S. C.)

Cercospora nelumbonis Tharp, Leaf spot on *Nelumbo lutea* (Ind., Tex.)

Cercospora nymphaeacea Cooke & Ellis, on *Nuphar luteum* (Del., N. Y. **), on *Nymphaea odorata* (Ill., Ma., Mich., Mo., N. J., N. Y. **, Tex., Wisc.)

Cercospora purpurea Cooke, Leaf spot on *Persea borbonia* (Fla., Ga., Miss.)
Cercospora saururi Ellis & Everh., [? = *Ramularia saururi* (Ellis & Everh.) Tharp.]. Leaf spot on *Saururus cernuus* (Ala., Fla., Ill., Ind., La., N. Y. **, Tex.)
Cercospora serpentariae Ellis & Everh., Leaf spot on *Aristolochia serpentaria* (Ala., Conn., Del.)
Chaetochalara aspera Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Circinotrichum fertile Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Cladosporium fasciculatum Cda., on leaves of *Magnolia virginiana* (Md., N. J., N. Y.)
Codinaea gonotrichodes Shearer & Crane, saprophytic on seeds of *Liriodendron tulipifera* (Ill., Ma.)
Coryne gelatinosa (Ellis & G. Martin) Rehm, on leaves of *Persea borbonia* (Fla.)
Cristulariella pyramidalis Waterman & Marshal, on *Asimina triloba* and *Lindera benzoin* (W. Va.)
Cylindrocladium floridanum Sobers & Seym., experimentally on *Liriodendron tulipifera* in Miss., naturally in N. C.
Cylindrocladium scoparium Morg., on fallen leaves of *Asimina triloba* (W. Va.)
Dichotomophthoropsis nymphaearum (Rand) M. B. Ellis, on *Brasenia schreberi*, *Nuphar luteum*, and *Nymphaea odorata* (Minn.)
Eversia subopaca (Cooke & Ellis) Crane & Schoknecht (= *Torula bigemina* Cooke & Ellis, and *Helminthosporium subopacum* Cooke & Ellis), on *Magnolia virginiana* (N. J.)
Fusarium solani (Mart.) Appel & Wr., * canker on *Liriodendron tulipifera*
Graphium rubrum Rumbold, Pink wood stain of *Liriodendron tulipifera* (Ohio to Miss. and S. C.)
Helminthosporium fumosum Ellis & G. Martin, on leaves of *Persea borbonia* (Fla.)
Helminthosporium macrocarpum Grev., on *Liriodendron tulipifera* and *Magnolia virginiana* (Del.)
Isariopsis linderae (Ellis & Everh.) Sacc. (= *Graphium linderae* Ellis & Everh., *Helminthosporium petersii* Berk. & Curtis, in part), on leaves of *Lindera benzoin* (Ala.?, N. J., W. Va.)
Menisporopsis profusa Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Mycocentrospora asiminae (Ellis & Kellerm.) Deighton (= *Cercospora asiminae* Ellis & Kellerm.), Leaf spot on *Asimina triloba* (Ala., Kans., Md., Miss., Tex.)
Myrothecium roridum Tode ex Fr., * on leaves of *Asimina triloba* (W. Va.)
Ovularia nymphaearum Allesch, Leaf spot on *Nymphaea odorata* (Wash.)
Phymatotrichum omnivorum (Shear) Dug., Root rot of *Asimina triloba*, *Lindera benzoin*, *Liriodendron tulipifera*, and *Sassafras albidum* (Tex.)
Ramularia liriodendri Ellis & Everh., Leaf spot on *Liriodendron tulipifera* (Ala., Del.)
Ramularia saururi (Ellis & Everh.) Tharp., Leaf spot on *Saururus cernuus* (Okla.)
Redbia elegans Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Rhopaloconidium asiminae (Ellis & Morg.) Petr. (= *Phleospora asiminae* Ellis & Morg.), Leaf blotch on *Asimina triloba* (Ill., Ind., Kans., Mo., Ohio, W. Va.)
Scolecobasidium dendroides Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Sirodesmium ellipticum (Cooke) Sacc. (= *Coniosporium ellipticum* ?), on leaves of *Magnolia virginiana* (S. C.)
Sporidesmium rude Ellis, on leaves of *Magnolia virginiana* (N. J.)
Thozetella cristata Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Thozetella radiata (Morris) Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Thozetella tocklaiensis (Agnihotrudu) Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)
Torula ligniperda (Willk.) Sacc., Pink wood stain in *Liriodendron tulipifera* (widespread)
Uberispora simplex (Ichinde) Pirozynski & Hodges, on fallen leaves of *Persea borbonia* (S. C.)

SPHAEROPSIDALES

Actinopelte dryina (Sacc.) Höhn. (= *Actinothyrium gloeosporioides* Tehon), Leaf spot on *Sassafras albidum* (N. J., Ill.)
Asteroma liriodendri Cooke, on leaves of *Liriodendron tulipifera* (Md., S. C.)
Cytospora laxa Berk. & Curtis, on twigs of *Calycanthus floridus* (Md.)
Cytospora leucostoma Sacc. var. *magnoliae* D. Sacc., * on branches of *Liriodendron tulipifera* (Md. Va.)
Cytospora sassafras Ellis & Everh., on twigs of *Sassafras albidum* (Mich., N. Y., W. Va.)
Cytospora sassafrasicola Tehon & Daniels, on bark of *Sassafras albidum* branches injured by fire (Ill.)
Diplodia linderae Ellis & Everh., on *Lindera benzoin* (N. Y.**)

Diplodia liriodendri Peck, on branches of *Liriodendron tulipifera* (Ala., N. Y., W. Va.)
Diplodia officinalis Ellis & Everh., on twigs and branches of *Sassafras albidum* (Mich., N. Y.)
Diplodia radiculicola Tassi, perhaps the conidial state of *Physalospora rhodina* (Berk. & Curtis) Cooke, Root rot of *Aristolochia serpentaria* (Va.)
Diplodia sassafras Tracy & Earle, on twigs and branches of *Sassafras albidum* (Miss.)
Diplodia subcuticularis Dearn. & House, on twigs and branches of *Sassafras albidum* (N. Y. **)
Diplopeltis sassafrasicola Tehon & Stout (= *Pycnoseynesia* ?), on leaves of *Sassafras albidum* (Ill.)
Dothiorella aberrans Peck, on branches of *Asimina triloba* (Ohio)
Dothiorella asiminae Ellis & Everh., on *Asimina triloba* (W. Va.), probably the conidial stage of a *Botryosphaeria*
Dothiorella minor Ellis & Everh., on branches of *Liriodendron tulipifera* (Md., W. Va.)
Dothiorella nelumbii Ellis & F. W. Anderson, on flower parts of *Nelumbo lutea* (Del., Md.)
Dothiorella sp., canker on *Liriodendron tulipifera* (Pa.)
Gloeodes pomigena (Schw.) Colby, on twigs of *Asimina triloba* (Ind.), on branches of *Lindera benzoin* (Ind.), on branches of *Liriodendron tulipifera* (Ind., W. Va.), on branches of *Sassafras albidum* (Ind.)
Hendersonia linderae Sacc., on branches of *Lindera benzoin* (N. Y.**)
Leptothyrium kellermanii Bubak. (spermatial stage of *Mycosphaerella sassafras* ?), on dead leaves of *Sassafras albidum* (Ohio, Pa.)
Leptothyrium liriodendri Cooke, on leaves of *Liriodendron tulipifera* (S. C., W. Va.)
Microdiplodia linderae (Ellis & Everh.) Tassi, on branches of *Lindera benzoin* (Mich., N. Y.**)
Phaeostigme picea (Berk. & Curtis) Syd. (= *Dimerium*), on *Magnolia virginiana* (Ga.)
Phoma microsporella Karst. & Har., on leaves of *Asimina triloba* (Ind., Ohio)
Phoma tulipiferae Schw., on leaves of *Liriodendron tulipifera* (N. Y., Pa.)
Phomopsis sp. (= *Diaporthe magnoliae* Ellis & Everh.), on *Magnolia virginiana* (Fla.)
Phyllosticta asiminae Ellis & Kellerm., Bordered leaf spot or eyespot of *Asimina triloba* (Mo. to Tex., Mich., N. Y.**, Ohio)
Phyllosticta cookei Sacc., Leaf spot on *Magnolia acuminata* (W. Va.), on *Magnolia virginiana* (Fla., Miss., N. J., N. Y.**)
Phyllosticta fatiscens Peck, Leaf spot on *Nuphar luteum* (N. Y.**), and *Nymphaea odorata* (Ill., Iowa, N. J., N. Y.**, Wisc.)
Phyllosticta glauca Cooke, on *Magnolia virginiana* (Ala., Fla., N. C., S. C.)
Phyllosticta illinoensis Tehon & Daniels, Leaf spot on *Sassafras albidum* (Ill., Mass.)
Phyllosticta linderae Ellis & Everh., Leaf spot on *Lindera benzoin* (Del., Ind., W. Va.)
Phyllosticta lindericola Ellis & Everh., Leaf spot on *Lindera benzoin* (W. Va.)
Phyllosticta liriodendri Cooke (= *Phyllosticta liriodendrica* Sacc., *P. circumvallata* Wint.), Leaf spot of *Liriodendron tulipifera* (conidial state of *Mycosphaerella liriodendri*) (widespread, N. Y.**)
Phyllosticta macrospora Ellis & Everh., on living leaves of *Liriodendron tulipifera* (N. Y.**, Pa., Va., W. Va.)
Phyllosticta magnoliae Sacc., on *Magnolia virginiana* (Fla., N. J.)
Phyllosticta micropuncta Cooke, Leaf spot on *Persea borbonia* (Md. to Fla., and Tex.)
Phyllosticta sassafras Cooke, Leaf spot on *Sassafras albidum* (N. Y. ** to Ga.)
Phyllosticta nymphaeacea Ellis & Everh., on *Nuphar luteum* (Ill., Tex.)
Phyllosticta nymphaeicola Tehon & Daniels, on *Nuphar luteum* (Ill.)
Phyllosticta perseae Ellis and G. Martin, on *Persea borbonia* (Fla.)
Pseudodictya sassafrasicola Tehon & Stout, on leaves of *Sassafras albidum* (Ill.)
Septoria asiminae Ellis & Everh. (Nomen nudum ?), Leaf spot on *Asimina triloba* (Tex.)
Septoria sp., Leaf spot on *Sassafras albidum* (N. Y.)
Sphaeronaema magnoliae Peck, on dead twigs of *Magnolia acuminata* (N. Y.**, Pa.)
Sphaeropsis asiminae Ellis & Everh., on branches of *Asimina triloba* (Md., W. Va.)
Sphaeropsis linderae Peck [= *Physalospora obtusa* ?], on dead branches of *Lindera benzoin* (N. Y.**)
Sphaeropsis sassafras Cooke & Ellis (probably not a *Sphaeropsis*), on *Sassafras albidum* (N. Y.**)
Sphaeropsis spp. (probably conidial states of *Physalospora* spp.), cankers and dieback of *Sassafras albidum* (N.Y. to Ala. and Mo.)

MELANCONIALES

Gloeosporium affinis Sacc., on *Sassafras albidum* (Ill.)

Gloeosporium falcatum Dearn. & House, on leaves of *Lindera benzoin* (N. Y.**)

Gloeosporium liriodendri Ellis & Everh., Leaf spot of *Liriodendron tulipifera* (Conn., to N. J. and Tex.)

Gloeosporium sp. [= *Glomerella cingulata* (Ston.) Spauld. & Schrenk], Leaf spot on *Aristolochia macrophylla* (Mass.)

Melanconium magnoliae Ellis & Everh., on dead trunk of *Magnolia virginiana* (N. J.)

Myxosporium coloratum (Peck) Sacc., on twigs of *Liriodendron tulipifera* (N. Y.**)

Myxosporium liriodendri Dearn. & House, on twigs of *Liriodendron tulipifera* (N. Y.**)

Myxosporium longisporum Edg., on twigs of *Liriodendron tulipifera* (N. Y.)

Myxosporium megallanto Dearn., on dead branchlets of *Liriodendron tulipifera* (N. Y.)

Myxosporium tulipiferae Died., on twigs of *Liriodendron tulipifera* (Iowa)

Pestalotia spp., on leaves of *Persea borbonia* (generally distributed)

Septogloem sp., on living leaves of *Liriodendron tulipifera* (N.Y.**).

MYCELIA STERILIA

Ectostroma liriodendri Kunze ex Fr., Tar spot on *Liriodendron tulipifera* (widespread, N. Y.**)

Rhizoctonia solani Kuehn., Seedling blight of *Liriodendron tulipifera* (Ohio, Va.)

Sclerotium sp., on *Nuphar luteum* and *Nymphaea odorata* (Minn.)

APPENDIX II

A list of Some Insects Associated with Plant Species in this Treatment.

ORTHOPTERA

Tettigoniidae

Conocephalus brevipennis (Scud.) on *Nelumbo lutea*

HEMIPTERA

Mesoveliidae

Mesovelia sp. on *Nuphar luteum*

Miridae

Lygus oblineatus (Say) on *Nelumbo lutea*

HOMOPTERA

Cicadellidae

Jassus olitorius (Say) on *Sassafras albidum*

Cercopidae

Philaenus sp. on *Nuphar luteum*

Aphidiidae

Aphis fabae (Scopoli) Bean Aphid on *Aristolochia durior* and *Calycanthus floridus*

Aphis gossypii Glover on *Nelumbo lutea*

Aphis maidis Fitch Corn Leaf Aphid on *Nymphaea odorata*

Aphis sp. on *Asarum canadense*

Macrosiphon liriodendri (Monell) Tulip tree Aphid on *Liriodendron tulipifera*, *Magnolia acuminata*

Nearctaphis bakeri (Cowen) Clover Aphid on *Calycanthus floridus*

Rhopalosiphum nymphaeae (L.), Waterlily Aphid on *Ceratophyllum*, *Nuphar luteum*, and *Nymphaea odorata*

Aleyrodidae

Aleyrodes asarumis (Shimer) on *Asarum canadense*

Coccidae

Aspidiotus camelliae Sign. Greedy Scale on *Magnolia virginiana*

Aspidiotus hederæ (Vall.) Oleander Scale on *Magnolia* (nursery stock)

Aspidiotus perniciosus Comstock, San Jose Scale on *Sassafras albidum*

Aspidiotus townsendi (Ckll.) on *Liriodendron tulipifera*

Cercoplastes floridensis Comstock, Florida Wax Scale on *Magnolia* (nursery stock)

Chionapsis lintneri Comstock on *Lindera benzoin*

Chionapsis salicis-nigrae (Walsh) on *Liriodendron tulipifera*

Chionapsis sylvatica Sanders on *Lindera benzoin*

Coccus hesperidum L. Soft Scale on *Magnolia* (nursery stock)

Icerya purchasi Mask. Cottony-cushion Scale, Fluted Scale on *Magnolia* (nursery stock)

Lecanium corni Bouché, European Fruit Lecanium Scale on *Magnolia*

Lepidosaphes beckii (Newm.) Purple Scale on *Magnolia* (nursery stock)

Lepidosaphes gloverii (Pck.) on *Magnolia* (nursery stock)

Lepidosaphes ulmi (L.) Oystershell Scale on *Liriodendron tulipifera* and *Sassafras albidum*

HEMIPTERA

Coccidae

- Neolecanium cornuparvum* Thro. Magnolia Scale on *Magnolia*
- Parlatoria pergandii* Comstock, Chaff Scale on *Magnolia*
- Pseudococcus comstocki* (Kuw.) Comstock Mealy-bug, on *Magnolia*
- Saissetia oleae* (Bern.) Black Scale on *Magnolia* (nursery stock)
- Toumeyella liriiodendri* Gmelin on *Liriodendron* and *Magnolia*

COLEOPTERA

Cantharidae

- Chauliognathus marginatus* Fab. on *Nuphar luteum*
- Chauliognathus pennsylvanicus* (DeGeer) on *Nelumbo lutea*

Cleridae

- Necrobis rufipes* DeGeer on *Nelumbo lutea*

Mordellidae

- Mordellistena* sp. on *Nelumbo lutea*

Elateridae

- Hypolithus obliquatus* (Mels.) on *Nelumbo lutea*

Dermestidae

- Anthrenus verbasci* L. on *Nelumbo lutea*

Nitidulidae

- Colopterus truncatus* Rand. on *Calycanthus*
- Meligethes* sp. on *Nuphar luteum*

Coccinellidae

- Hippodamia convergens* Guerin on *Nelumbo lutea*
- Hippodamia tridecimpunctata* (Say) on *Nelumbo lutea*

Ptinidae

- Ptinus* sp. on *Nuphar luteum*

Scarabeidae

- Popillia japonica* Newman, Japanese Beetle on *Sassafras albidum* and *Nelumbo lutea*

Cerambycidae

- Bellamira scalaris* (Say) on *Liriodendron tulipifera*
- Brachyleptura circumdata* (Olivier) on *Magnolia* flower
- Centrodera decolorata* (Harris) on *Liriodendron tulipifera*
- Charisalia americana* (Haldeman) on *Liriodendron tulipifera*
- Cyrtinus pygmaeus* Hald. larva in *Liriodendron tulipifera*
- Cyrtophorus verrucosus* (Olivier) on *Lindera benzoin* and *Liriodendron tulipifera*
- Elaphidion mucronatum* (Say) on *Asimina triloba*, *Liriodendron tulipifera* and *Sassafras albidum*
- Elaphidionoides villosus* (Fab.) on *Sassafras albidum*
- Encyclops caerulea* (Say) on *Liriodendron tulipifera*
- Heterachthes pallidus* Haldeman on *Liriodendron tulipifera*
- Heterachthes quadrimaculatus* Fab. larva in *Liriodendron tulipifera*
- Leptostylus aculifer* Say larva in *Liriodendron tulipifera*
- Leptura emarginata* Fab. on *Liriodendron tulipifera*
- Neoclytus acuminatus acuminatus* (Fab.) on *Liriodendron tulipifera* and *Sassafras albidum*
- Oberea ruficollis* Fab. larva in *Lindera benzoin* and *Sassafras albidum*
- Pidonia ruficollis* (Say) on *Magnolia* flowers
- Psenocerus supernotatus* Say larva in *Liriodendron tulipifera*
- Trachysida mutabilis* (Newman) on *Liriodendron tulipifera*
- Tylonotus bimaculatus* Haldeman on *Liriodendron tulipifera*

Chrysomelidae

- Diabrotica undecimpunctata howardi* Barber on *Nelumbo lutea*
- Donacia cincticornis* Newm. on *Brasenia schreberi*, *Nuphar luteum*, *Nymphaea odorata*

- Donacia cincticornis* Newm., var. *tenuis* Sf. on *Brasenia schreberi* and *Nymphaea odorata*
Donacia coerulea Oliv. on leaves of *Nuphar luteum*
Donacia edentata Sf. on flowers and leaves of *Nymphaea odorata*
Donacia liebecki Sf. on flowers and leaves of *Nymphaea odorata*
Donacia megacornis Blatch. on flowers and leaves of *Nuphar luteum* and *Nymphaea odorata*
Donacia militaris Lac. on flowers and leaves of *Nymphaea odorata*
Donacia palmata Oliv. adults and eggs on flowers and leaves of *Nuphar luteum* and *Nymphaea odorata*, larva in rhizomes of *Nuphar*
Donacia parvidens Sf. on flowers and leaves of *Nymphaea odorata*
Donacia piscatrix Lac. on flowers and leaves of *Nymphaea odorata* and occasionally on *Brasenia schreberi*
Donacia proxima Kby. on flowers and leaves of *Nuphar luteum*
Donacia rufescens Lac. on flowers and leaves of *Nymphaea odorata* and occasionally on *Brasenia schreberi*
Donacia texana var. *minor* Sf. on *Nuphar luteum*
Epithrix cucumeris (Harris) Potato Flea Beetle on *Nelumbo lutea*
Pyrhalta nymphaeae (L.) Waterlily Leaf Beetle, on *Nuphar luteum* and *Nymphaea odorata*
- Curculionidae
Odontopus calceatus Say Sassafras Weevil, on *Sassafras albidum*
Prionomerus calceatus Say larvae mining leaves of *Liriodendron tulipifera* and *Sassafras albidum*

LEPIDOPTERA

- Lyonetiidae
Phyllocnistis liriodendrella Clemens larva on *Liriodendron tulipifera* and on *Magnolia*
- Gracilariidae
Gracilaria sassafrasella Chambers larva and pupa on *Sassafras albidum*
Lithocelletis hamadryadella Clemens on *Magnolia*
- Yponomeutidae
Urodus parvula Edwards larva on *Persea borbonia*
- Tortricidae
Archips magnoliana Fernald larva on *Magnolia acuminata*
Phaenocarpa niveiguttana Grote larva on *Sassafras albidum*
Polychrosis liriodendrana Kearfott larva on *Liriodendron tulipifera* and *Magnolia*
Polychrosis liriodendrana Kearfott, var. *magnoliana* Kearfott larva on *Liriodendron tulipifera* and *Magnolia*
Sparganothis saracana Kearfott larva on *Sassafras albidum*
- Pyalididae
Euzophera ostricolorella Hulst. larva in bark of *Liriodendron tulipifera*
Nymphula badiusalis Walker on *Nelumbo lutea*
Nymphula gyralis Hulst. larva on *Nymphaea odorata*
Nymphula maculalis Clemens larva on waterlilies and *Brasenia*, pupa generally under a floating waterlily leaf
Nymphula oblitalis Walker larva on waterlilies
Omphalocera cariosa Lederer larva boring in *Asimina triloba*
Pyrausta fissalis Grote larva and pupa on *Sassafras albidum*
Pyrausta penitalis Grote larva on *Nelumbo lutea* and *Nymphaea odorata*
- Sphingidae
Agrinus cingulata (Fab.) on *Asimina triloba*
Dolba hyleus (Drury) on *Asimina triloba*
- Saturniidae
Antheraea polyphemus (Cramer) on *Liriodendron tulipifera* and *Sassafras albidum*
Automeris io (Fabricius) on *Liriodendron tulipifera*, *Magnolia virginiana* and *Sassafras albidum*
Callosamia (angulifera) Walker larva and pupae on *Liriodendron tulipifera* and *Sassafras albidum*
Callosamia carolina Jones on *Liriodendron tulipifera* and *Magnolia virginiana*
Callosamia promethea (Drury) larva on *Lindera benzoin*, *Magnolia* sp., *Liriodendron tulipifera* and *Sassafras albidum*

- Hyalophora cercropia* (L.) on *Sassafras albidum*
Samia cynthia (Felder and Felder) on *Lindera benzoin* and *Liriodendron tulipifera* and *Sassafras albidum*
- Citheroniidae
Citheronia regalis (Fab.) Hickory Horned Devil, on *Sassafras albidum*
Eacles imperialis (Drury) on *Lindera benzoin* and *Sassafras albidum*
- Arctiidae
Halisidota tessellaris (Abbot and Smith) on *Liriodendron tulipifera*
Hyphantria cunea (Drury) on *Asimina triloba*, *Liriodendron tulipifera* and *Sassafras albidum*
- Noctuidae
Arzama obliqua (Walker) on *Nelumbo lutea*
Bellura gortynoides Walker on *Nuphar luteum*
Bellura melanopyga (Grote) on *Nuphar luteum* and *Nymphaea odorata*
Feltia ducens Walker on *Cabomba caroliniana*
Heliothis zea (Fab.) on *Sassafras albidum*
Neoerastris caduca (Grote) on *Nuphar luteum*
Papapamea buffaloensis (Grote) on *Saururus cernuus*
Septis alia (Guenée) on *Sassafras albidum*
Zale calycanthata (Abbot and Smith) on *Calycanthus floridus* (N.J. and south)
- Notodontidae
Datana drexeli Henry Edwards on *Sassafras albidum*
- Liparidae
Hemerocampa leucostigma (Abbot and Smith) on *Asimina triloba*, *Liriodendron tulipifera* and *Sassafras albidum*
Liparis dispar (L.) on *Lindera benzoin* and *Liriodendron tulipifera* and *Sassafras albidum*
- Zanolidae
Apatelodes torrefacta (Abbot and Smith) on *Asimina triloba*, *Lindera benzoin* and *Sassafras albidum*
- Geometridae
Abbotana clemataria (Abbot and Smith) on *Sassafras albidum*
Epimecis virginaria (Cramer) on *Liriodendron tulipifera*, *Persea borbonia* and *Sassafras albidum*
Erannis tiliaria (Harris) on *Liriodendron tulipifera*
Metarranthis broweri Rupert on *Sassafras albidum*
Metarranthis hypochria (Herrich-Schäffer) on *Sassafras albidum*
Tetracis crocallata Guenée on *Lindera benzoin*
- Papilionidae
Battus philenor (L.) on *Asarum canadense*, *Aristolochia durior* and *A. serpentaria*
Graphium marcellus Cramer Zebra Swallowtail on *Asimina triloba* and *Lindera benzoin*
Papilio cresphontes Cramer Giant Swallowtail on *Persea borbonia*
Papilio glaucus L. Tiger Swallowtail on *Lindera benzoin*, *Liriodendron tulipifera*, *Magnolia acuminata* and *Sassafras albidum*
Papilio palamedes Drury on *Persea borbonia* and *Sassafras albidum*
Papilio troilus L. Blue Swallowtail on *Lindera benzoin*, *Magnolia virginiana* and *Sassafras albidum*
- Nymphalidae
Polygona interrogationis (Fabricius) on *Liriodendron tulipifera*

DIPTERA

- Chironomidae
Cricotopus sp. on *Nelumbo lutea*
- Cecidomyiidae
Cecidomyia hageni Aldr. Leaf gall on *Aristolochia macrophylla*
Cecidomyia tulipiferae O.S. Tulip-tree Midrib Gall on *Liriodendron tulipifera*
Cecidomyia sp. on *Lindera benzoin*
Cecidomyia sp. Tulip-tree Vein Gall on *Liriodendron tulipifera*
Dasineura sassafras Felt on *Sassafras albidum*

- Lasioptera linderæ* Beutm. Spicebush Stem Gall on *Lindera benzoin*
Neolasioptera liriodendri (Felt) on *Liriodendron tulipifera*
- Cecidomyiidae
Thecodiplosis liriodendri O.S. Tulip-tree Spot Gall on *Liriodendron tulipifera*
- Tabanidae
Chrysops sp. on *Nelumbo lutea*
- Syrphidae
Allograpta obliqua Say on *Nelumbo lutea*
Eristalis tenax (L.) on *Nelumbo lutea*
Eristalis sp. on *Nelumbo lutea* and *Nuphar luteum*
Helophilus divisus Loew. on *Nelumbo lutea*
Parhelelophilus laetus (Loew.) on *Nelumbo lutea*
Sphaerophoria cylindrica (Say) on *Nelumbo lutea*
Sphaerophoria sp. on *Nelumbo lutea*
Sphecomyia sp. on *Nelumbo lutea*
Syrphus rectus (Osten Sacken) on *Nelumbo lutea*
- Calliphoridae
Calliphora vomitoria L. on *Nuphar luteum*
- Muscidae
Limnophora naroma (Walker) on *Nelumbo lutea*
- Scatophagidae
Scatophaga sp. on *Nuphar luteum*
- Ephydriidae
Hydrellia sp. on *Nelumbo lutea*
Notiphilia sp. on *Nuphar luteum*
- Chloropidae
Eriobolis longulus (Loew.) on *Nelumbo lutea*

HYMENOPTERA

- Andrenidae
Andrena carlini carlini Cockerell on *Sassafras albidum*
Andrena salictaria Robertson on *Sassafras albidum*
Andrena ceanothi Viereck on *Sassafras albidum*
Andrena forbesii Robertson on *Sassafras albidum*
Andrena hippotes Robertson on *Sassafras albidum*
- Halictidae
Agapostemon radiatus (Say) on *Nelumbo lutea*
Agapostemon virescens (Fab.) on *Nymphaea odorata*
Augochlorella striata (Provancher) on *Nelumbo lutea*
Dialictus cressonii (Robertson) on *Sassafras albidum*
Dialictus illinoensis (Robertson) on *Sassafras albidum*
Dialictus inconspicuus (Smith) on *Nelumbo lutea* and *Sassafras albidum*
Dialictus nymphaearum (Robertson) on *Nelumbo lutea* and *Nymphaea odorata*
Dialictus zephyrus (Smith) on *Sassafras albidum*
Dialictus sp. on *Nelumbo lutea*
Evyaleus arcuatus (Robertson) on *Sassafras albidum*
Evyaleus nelumbonis (Robertson) on *Nelumbo lutea*, *Nuphar luteum*, and *Nymphaea odorata*
Evyaleus pectoralis (Smith) on *Nuphar luteum*
Halictus rubricundus (Christ) on *Nelumbo lutea* and *Sassafras albidum*
Lasioglossum zonulum (Smith) on *Nelumbo lutea*
Sphecodes dichrous Smith on *Sassafras albidum*
Sphecodes minor Robertson on *Sassafras albidum*

Megachilidae

Osmia pumila Cresson pollinating *Sassafras albidum*

Apidae

Apis mellifera L. Honey Bee on *Nelumbo lutea* and *Nuphar luteum*

Bombus bimaculatus Cresson on *Nelumbo lutea*

Bombus impatiens Cresson on *Nelumbo lutea*

Bombus pennsylvanicus (DeGeer) on *Nelumbo lutea*

Bombus vagans F. Smith on *Nelumbo lutea*

BIBLIOGRAPHY

- Aboy, H. E. 1936. A study of the anatomy and morphology of *Ceratophyllum demersum*. Cornell Univ. Thesis.
- Adams, F. S. 1969. Winter bud production and function in *Brasenia schreberi*. *Rhodora* 71: 417-433.
- Ahles, H. 1959. *Aristolochia serpentaria* var. *nashii* as a new name for *A. serpentaria* var. *hastata*. *Jour. Elisha Mitchell Soc.* 75: 130.
- Allen, C. K. 1941. Studies in the Lauraceae. III. *Jour. Arn. Arb.* 22: 1-31.
- . 1945. Studies in the Lauraceae. VI. *Jour. Arn. Arb.* 26: 280-434.
- Andret, M. 1970. Preliminary data on the vegetative reproduction and organogenesis of some aquatic plants. *Ann. Univ. Bucur. Biol. Veg.* 19: 163-182.
- Angeles, L. T., B. D. Canlas Jr., J. A. Concha and P. L. Aligaen. 1970. Toxicity studies on Aristolochic acid isolated from *Aristolochia tagala*. *Acta Med. Philipp.* 6: 139-148.
- Anonymous. 1951. Longevity of *Nelumbo* fruits. *Nature* 168: 905.
- Anonymous. 1970. Tulip-tree, *Liriodendron tulipifera*. *Morton Arb. Quart.* 6: 14-15.
- Bailey, L. H. 1947. The Standard Cyclopedia of Horticulture. Macmillan Co., N. Y., 3639 p.
- Baillon, H. 1871a. Monographie des Piperacees et des Urticacees. *Hist. Pl.* 3: 465-537.
- . 1871b. Monographie des Nymphaeacees. *Hist. Pl.* 3: 77-104.
- Baldwin, J. T. Jr. and B. M. Speese. 1949. Cytogeography of *Saururus cernuus*. *Bull. Torrey Club* 76: 213-216.
- Barr, Margaret E. 1978. The Diaporthales in North America with emphasis on *Gnomonia* and its segregates. *Mycologia Mem.* 7: 1-232.
- Bartrum, D. 1957. *Rhododendrons and Magnolias*. II., London, 176 p.
- Bates-Smith, E. C. 1968. Chemotaxonomy of *Nuphar luteum* (L.) Sm. *Phytochemistry* 7: 459.
- Beal, E. O. 1955. Taxonomic revision of the genus *Nuphar* Sm. Ph.D. dissertation, Iowa State University (microfilm).
- . 1956. Taxonomic revision of the genus *Nuphar* Sm. of North America and Europe. *Jour. Elisha Mitchell Soc.* 72: 317-346.
- . 1977. Manual of Marsh and Aquatic Vascular Plants of North Carolina with Habitat Data. North Carolina Agric. Exper. Sta. Bull. 247, 298 p.
- and R. M. Southall. 1977. Taxonomic significance of experimental selection by vernalization in *Nuphar* (Nymphaeaceae). *Syst. Bot.* 2: 49-60.
- Beal, W. J. 1900. Notes on *Cabomba caroliniana* A. Gray. *Bull. Torrey Club* 27: 86.
- Berry, F. H. 1976. *Phlebia chrysocrea* causes a heart rot of oaks and other hardwoods. *Plant Dis. Rep.* 60: 308-311.
- Bhandari, N. N. 1971. Embryology of the Magnoliales and comments of their relationships. *Jour. Arn. Arb.* 52: 1-39; 285-304.
- Bigelow, J. 1840. *Flor. Bostonensis* Ed. 3., Little & Brown Pub. 468 p.
- Blake, S. F. 1915. Some neglected names in Walter's *Flora Caroliniana*. *Rhodora* 17: 120-137.
- Bolen, E. G., J. W. Bennett and C. Cottam. 1975. Some ecological effects of *Lotus* on submersed vegetation in southern Texas, U.S.A. *Southwest Nat.* 20: 205-214.
- Bowden, W. M. and B. Miller. 1951. Distribution of Papaw, *Asimina triloba* L. in southern Ontario. *Can. Field Nat.* 65: 27-31.
- Boyd, C. E. and W. W. Walley. 1972. Production and chemical composition of *Saururus cernuus* at sites of different fertility. *Ecology* 53: 927-932.
- Bracher, R. W. 1976. Disappearance of Lepidoptera in Indiana and Ohio, U.S.A. *Atala*. 4: 19-30.
- Brinkman, K. A. and H. M. Phipps. 1974. Seeds of Woody Plants of the United States. Agric. Handb. 450, U.S.D.A., Washington, D. C. 883 p.
- Britton, W. E., et al. 1923. The Hemiptera or Sucking Insects of Connecticut. Conn. Geol. and Nat. Hist. Surv., Hartford, 807 p.
- Bruyne, C. de. 1922. Idioplastes et diaphragmes des Nymphaeacees. *Compt. Rend.* 175: 452-455.
- Bukowiecki, H., M. Furmanowa and H. Oledzka. 1972. The numerical taxonomy of Nymphaeaceae. I. Estimation of taxonomic distance. *Acta Pol. Pharm.* 29: 319-327.
- Candolle, A. de. 1821. Sur les affinites naturelles de la famille de Nymphaeacees. *Mem. Soc. Phys. Geneve* 1: 208-244.
- . 1824. Nymphaeaceae. In *Prodr.* 1: 113-116.

- Canright, J. E. 1952. The comparative morphology and relationships of the Magnoliaceae. I. Amer. Jour. Bot. 39: 484-497.
- 1953. Ibid. II. Phytomorph. 3: 355-365.
- 1960. Ibid. III. Amer. Jour. Bot. 47: 145-155.
- 1965. Ibid. IV. Jour. Arn. Arb. 36: 119-140.
- Canright, L. J. 1957. Vegetative propagation of *Liriodendron tulipifera*. Jour. Forest. 55: 892-893.
- Carvell, K. S. and C. F. Koristian. 1955. Production and dissemination of Yellow Poplar seed. Jour. Forest. 53: 169-170.
- Casgary, R. 1856. Les Nymphaeacees fossiles. Ann. Sci. Nat. Bot. IV. 6: 199-222.
- Chassat, J. F. 1962. Recherches sur la ramification chez les Nymphaeacees. Mem. Soc. Bot. Fran. 42: 72-95.
- Chrysler, M. A. 1938. The winter buds of *Brasenia*. Bull. Torrey Club 65: 277-283.
- Clapham, A. P., T. G. Tutin and E. F. Warburg. 1952. Flora of the British Isles. Cambridge Univ. Press, 1591 p.
- Clarke, F. B. 1969. Endotrophic mycorrhizal infection of tree seedlings with *Endogone gigantea* spores. Forest Sci. 15: 134-137.
- Conard, H. S. 1904. Phyllody in *Nelumbo*. Trans. Proc. Bot. Soc. Penn. 1: 350-351.
- 1905. The water-lilies, a monograph of the genus *Nymphaea*. Carnegie Inst. Pub. 4: 1-292.
- 1916. The white water-lily of Iowa. Proc. Iowa Acad. Sci. 23: 621-623.
- 1916. *Nymphaea* and *Nuphar* again. Rhodora 18: 161-163.
- 1917. The white water-lily of Clear Lake, Iowa. Proc. Iowa Acad. Sci. 24: 449-454.
- 1918. The white water-lily of McGregor. Proc. Iowa Acad. Sci. 25: 235-236.
- 1936. Water-lilies, monocots or dicots? Amer. Bot. 42: 104-107.
- Correll, D. S. and H. B. Correll. 1972. Aquatic and Wetland plants of the Southwestern United States E.P.A. Water Poll. Contr. Res. Ser. 16030 DNL 01/72, 1777 p.
- Cramer, J. M., A. D. J. Meeuse and P. A. Teunissen. 1975. A note on the pollination of nocturnally flowering species of *Nymphaea*. Acta Bot. Neerl. 24: 489-490.
- Cronquist, A. 1968. The evolution and classification of flowering plants. Houghton Mifflin Co., Boston, 396 p.
- Curtis, W. 1794. *Liriodendron tulipifera*, common tulip-tree. Bot. Mag. 8: 275.
- Cutter, E. G. 1957a. Studies of morphogenesis in the Nymphaeaceae I. Phytomorphology 7: 45-56.
- 1957b. Ibid. II. Phytomorphology. 7: 57-73.
- 1959. Ibid. IV. Phytomorphology. 9: 263-275.
- 1961. The inception and distribution of flowers in the Nymphaeaceae Proc. Linn. Soc. Bot. 172: 93-100.
- Dahl, A. O. 1949. Cytological studies in *Nymphaea* L. (Abst.) Biol. Bull. 97: 257.
- Dandy, J. E. 1927a. The genera of Magnoliaceae. Kew. Bull. 1927. 257-265.
- 1927b. Key to the species of *Magnolia*. Jour. Roy. Hort. Soc. 52: 260-264.
- Darlington, C. D. 1955. Chromosome Atlas of Flowering Plants. Ed. II. George Allen & Unwin Ltd., London, 519 p.
- Daumann, E. 1930. Das Blütennektarium von *Magnolia* und the Futterkörper in der Blüte von *Calycanthus*. Planta 11: 108-116.
- 1971. Contribution to the pollination ecology of the species *Aristolochia clematitis*. Preslia 43: 105-111.
- Delaigue, M. 1971. Morphological and ontogenetic study of the axillary complex of *Aristolochia clematitis*. Me. Publies Soc. Bot. France, 1971: 167-177.
- Dengler, N. G. 1972. Ontogeny of the vegetative and floral apex of *Calycanthus occidentalis*. Canad. Jour. Bot. 50: 1349-1356.
- DePoe, C. E. 1961. Relationships within the genus *Nuphar* Sm. (Nymphaeaceae) in the Carolinas. North Carolina State Univ. Thesis, 54 p.
- and E. O. Beal. 1969. Origin and Maintenance of clinal variations in *Nuphar* (Nymphaeaceae). Brittonia 21: 15-28.
- Diels, L. 1916. Käferblumen bei den Ranales and ihre Bedeutung für die der Angiospermen. Ber. Deutsch. Bot. Ges. 34: 758-774.
- Dormer, K. J. and E. G. Cutter. 1959. On the arrangement of flowers on the rhizome of some Nymphaeaceae. New Phytol. 58: 176-181.

- Downes, J. A. 1974. Endopterygote insects and the origin of the Angiosperm flower. Int. Congr. Syst. Evol. Bio. I: 9 (Abst.)
- Duchartre, P. 1864. Aristolochiaceae. In A. de Candolle, Prodr. 15: 421-498.
- Dutailly, G. 1877. Sur le *Nuphar luteum*. Bull. Soc. Linn., Paris, 14: 110-112.
- Earle, T. T. 1938. Origin of the seed coats in *Magnolia*. Amer. Jour. Bot. 25: 221-222.
- Elliott, S. 1817. Sketch of the Botany of South Carolina and Georgia. J. R. Schenk, Charleston, S. C., 2 Vols., 1349 p.
- Endress, P. K. 1972. On the comparative developmental morphology, embryology and systematics in Laurales. Bot. Jahrb. Syst. Pflanzengesch. Pflanzengeogr. 92: 331-428.
- Engler, A. 1887. Saururaceae, in Natur. Pflanzenfam. III, 1: 1-3.
- Esau, K. and Kosaki, H. 1975. Leaf arrangement in *Nelumbo nucifera*: a reexamination of a unique phyllotaxy. Phytomorph. 25: 100-112.
- Fairbrothers, D. C. 1958. A naturalized stand Indian Lotus (*Nelumbo nucifera*) in New Jersey. Bull. Torrey Club 85: 70.
- Farwell, O. A. 1936. The color of the flowers of *Nelumbo pentapetala*. Rhodora 38: 272.
- Fassett N. C. 1953. A monograph of *Cabomba*. Castanea 18: 116-128.
- 1957. A Manual of Aquatic Plants. Univ. of Wisconsin Press, 405 p.
- Felt, E. P. 1918. Key to American Insect Galls. N.Y. State Museum Bull. No. 200, 310 p.
- Fernald, M. L. 1919. *Nymphoanthus*, the correct name for the cow lilies. Rhodora 21: 183-188.
- 1934. The name of the American Lotus. Rhodora 36: 23-24.
- 1939. New species, varieties and transfers, IV. Rhodora 423-459.
- 1941. *Ceratophyllum echinatum*. In Another century of additions to the Virginia flora. Rhodora 43: 551-552.
- 1950. Gray's Manual of Botany, Ed. XIII, American Book Co., N. Y., 1632 p.
- and A. C. Kinsey. 1943. Edible Wild Plants of Eastern North America. (Revised by R. Rollins, 1958) Harper & Row, 452 p.
- Filer, T. H. Jr. 1970. Virulence of 3 *Cylindrocladium* species to Yellow Poplar seedlings. Plant. Dis. Rep. 54: 320-322.
- Fogg, J. M. Jr. 1961. The temperate American Magnolias. Morris Arb. Bull. 12: 51-58.
- Forbes, W. T. M. 1923. The Lepidoptera of New York and Neighboring States. Cornell Univ. Press, Ithaca, N. Y. 729 p.
- Freeman, O. M. 1951. New *Magnolia* hybrids. Nat. Hort. Mag. 30: 132-135.
- Frohne, W. C. 1938. Limnological role of higher aquatic plants. Trans. Amer. Microsc. Soc. 57: 256-268.
- Gleason, H. A. 1947. The preservation of well-known binomials. *Nelumbo lutea* vice *N. pentapetala*. Phytologia 2: 201-212.
- 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. Vols. 1-3, New York Bot. Gard. 1726 p.
- and A. Cronquist. 1965. Manual of Vascular Plants of Northeastern United States and Adjacent Canada. D. Van Nostrand Co. 810 p.
- Good, R. D. 1925. The past and present distribution of Magnoliae. Ann. Bot. 39: 409-430.
- 1964. The Geography of Flowering Plants. John Wiley & Sons, Inc., Ed. III, 518 p.
- Grant, V. 1950. The pollination of *Calycanthus occidentalis*. Amer. Jour. Bot. 37: 294-297.
- Gray, A. 1848. Cabombaceae, Nelumbiaceae, Nymphaeaceae. Genera Pl. U. S. 1: 91-104.
- 1858. A short exposition on the structure of the ovule and seed coats of *Magnolia*. Jour. Linn. Soc. 2: 106-110.
- 1867. Manual of the Botany of the Northeastern United States Ed. V., Iveson, Blakemore, Taylor & Co., N. Y. 703 p.
- Gray Herbarium Index. 1968. And Supplements 1969-76. G. K. Hall & Co. 7 Vols., 423 p. and cards.
- Grieve, M. 1931. A Modern Herbal. Republished by Dover Press, 2 Vols., 888 p.
- Gruss, J. 1927. Die Haustoren der Nymphaeaceen. Berl. Deutsch Bot. Ges. 45: 459-466.
- Guedes, M. 1968a. The vegetative leaf and the perianth of some Aristolochias. Flora Abt. Morph. Geobot. Jena 158: 167-179.
- 1968b. The carpel of the tulip-tree, *Liriodendron tulipifera*. Oester. Bot. Zeitsch. 115: 372-378.

- Gupta, S. C. and R. Ahuja. 1967. Is *Nelumbo* a monocot? *Naturwissensch.* 18: 1-3.
- , G. S. Paliwal and R. Ahuja. 1968. The stomata of *Nelumbo nucifera*; formation, distribution and degeneration. *Amer. Jour. Bot.* 55: 295-301.
- Gwynne-Vaughan, D. T. 1896. The arrangement of vascular bundles in certain Nymphaeaceae. *Ann. Bot.* 10: 624-625.
- 1897. On some points in the morphology and anatomy of the Nymphaeaceae. *Trans. Linn. Soc. London*, 5: 287-299.
- Haber, H. 1960. Zur Abgrenzung der Gattung *Aristolochia* L. *Mitteil. Bot. Staats., Münch.* 3: 531-553.
- Haines, R. W. and K. A. Lye. 1975. Seedlings of Nymphaeaceae. *Bot. Jour. Linn. Soc.* 70: 255-265.
- Hall, T. F. 1940. The biology of *Saururus cernuus* L. *Amer. Midl. Nat.* 24: 253-260.
- and W. T. Penfound. 1944. The biology of the American Lotus, *Nelumbo lutea*. (Willd.) Pers. *Amer. Midl. Nat.* 31: 744-758.
- Hardin, J. W. 1954. An analysis of variation within *Magnolia acuminata* L. *Jour. Elisha Mitchell Soc.* 70: 298-312.
- 1972. Studies of the Southeastern United States flora III. Magnoliaceae and Illiciaceae. *Jour. Elisha Mitchell Soc.* 88: 30-32.
- Hartog, C. den. 1970. *Ondinea*, a new genus of Nymphaeaceae, *Blumea* 18: 413-417.
- Heiser, C. B. Jr. 1963. Some observations on pollination and compatibility in *Magnolia*. *Proc. Indiana Acad. Sci.* 72: 259-266.
- Henkel, F., F. Rehnelt and L. Dittmann. 1907. *Das Buch der Nymphaeaceen oder Seerosengewächse*. Darmstadt. 158 p.
- Heritage, B. 1895. Preliminary notes on *Nelumbo lutea*. *Bull. Torrey Club* 22: 265-271.
- Heslop-Harrison, Y. 1955. *Nelumbo* Monograph. *Jour. Ecol.* 43: 342-364.
- Hill, E. J. 1900. An observation on the water-shield (*Brasenia peltata*). *Plant World* 3: 153.
- Hill, T. G. 1906. On the seedling structure of certain Piperale. *Ann. Bot.* 20: 160-175.
- Hitchcock, C. L., et al. 1964. Vascular plants of Pacific Northwest. Part 2: 139-182. Univ. Wash. Press.
- Ho, H. H. 1977. Infection of avocado and other species of *Persea* by *Phytophthora cinnamomi*. *Phytopath.* 67: 1085-1089.
- Hollick, A. 1896. Appendages to the petioles of *Liriodendron*. *Bull. Torrey Club* 23: 249-250 + 2 pl.
- Holm, T. 1926. *Saururus cernuus* L., a morphological study. *Amer. Jour. Sci.* 12: 162-168.
- Hooker, J. D. 1889. *Cabomba aquatica*. *Bot. Mag.* t. 7090.
- House, H. D. 1924. Annotated List of the Ferns and Flowering Plants of New York State. N. Y. State Museum Bull. No. 254, 759 p.
- Hsi-Ching, W. and V. Bing-Sheng. 1966. The structure of the plumule of *Nelumbo nucifera* Gaertn. and the nature of its scale. (Chinese with English summary.) *Acta Bot. Sinica* 14: 126-138.
- Index for Plant Chromosome Numbers for 1956-64. Univ. North Carolina Press, Chapel Hill.
- Index Kewensis Plantarum Phanerogamarum. (and supplements) 1895-1970. Clarendon Press, Oxford.
- Index of Plant Diseases in the United States. 1960. Crops Res. Div. U. S. Dept. Agricult. Handb. No. 165.
- Johnson, D. A. and T. H. King. 1976. A leaf spot disease of 3 genera of aquatic plants in Minnesota Plant Dis. Rep. 60: 726-730.
- 1975. Pathogenicity of *Dichotomophthoropsis nymphaearum* on 3 genera of aquatic plants. *Proc. Amer. Phytopath. Soc.* 2: 61.
- , D. A., E. L. Stewart and T. H. King. 1976. A *Sclerotium* species associated with water-lilies in Minnesota. *Plant Dis. Rep.* 60: 807-808.
- Johnson, D. S. 1900. On the development of *Saururus cernuus* L. *Bull. Bot. Club* 27: 365-372.
- 1905. Seed development in the Piperale and its bearing on the relationship of the order. *Johns Hopkins Univ. Circ.* 178: 28-31.
- Johnson, W. T. and H. H. Lyon. 1976. *Insects that Feed on Trees and Shrubs: An Illustrated Practical Guide*. Cornell Univ. Press, 464 p.
- Jones, E. N. 1931. The morphology and biology of *Ceratophyllum demersum*. *Univ. of Iowa Stud. Bot.* 13: 11-46.
- Jones, J. A. 1938. Overcoming delayed germination of *Nelumbo lutea*. *Bot. Gaz.* 85: 341-343.
- Kalinsky, R. G. 1972. Evidence for selective epiphytism by diatoms on aquatic phanerogams. *Jour. Phycol.* 8: 10-11.

- Kapadia, G. J., et al. 1978. Carcinogenicity of some folk medicinal herbs in rats. Jour. Nat. Cancer Inst. 60: 683-686.
- Keller, I. A. 1894. The glandular hairs of *Brasenia peltata*. Pursh. Proc. Acad. Nat. Sci. Phila. 1894. 188-193.
- Kerwin, J. A. and L. G. Webb. 1972. Foods of ducks wintering in coastal South Carolina 1965-1967. Proc. Annual Conf. Southeast. Assoc. Game Fish Comm. 25: 223-245.
- Khanna, P. 1965. Morphological and embryological studies in Nymphaeaceae II. *Brasenia schreberi* Gmel. and *Nelumbo nucifera* Gaertn. Austral. Jour. Bot. 13: 379-387.
- Klercker, F. de 1885. Sur l'anatomie et le development de *Ceratophyllum*. Bihang. Svensk. Akad. Handl. 9: 1-23.
- Klotzsch, F. 1859. Die Aristolochiaceae des Berliner Herbariums. Monatsb. Acad. Berlin. 1859: 571-626.
- Knight, H. H. 1941. The plantbugs or Miridae of Illinois. Bull. Ill. Nat. Hist. Surv. Div. Vol. 22, part 1, Urbana, Illinois, 234 p.
- Knuth, P. 1909. Handbook of Flower Pollination. Clarendon Press, Oxford.
- Kosakai, H., M. F. Moseley and V. I. Cheadle. 1970. Morphological studies of the Nymphaeaceae V. Does *Nelumbo* have vessels? Amer. Jour. Bot. 57: 487-494.
- Kosar, W. F. 1962. Magnolias native to North America. Jour. Calif. Hort. Soc. 23: 2-12.
- Kostermans, A. J. G. H. 1936-38. Revision of the Lauraceae. I-III. Meded. Bot. Mus. Utrecht 41: 12-50; 42: 500-604; 43: 46-119.
- 1957. Lauraceae. Reinwardtia 4: 193-256.
- 1964. Bibliographia Lauracearum. Bogor 1450 p.
- 1974. Materials for a revision of Lauraceae. Part 4. Reinwardtia 9: 97-115.
- Kristen, U. 1978. On the ultrastructure of submerged glandular papillae of *Brasenia schreberi* and *Cabomba caroliniana*. Cytobiologie 9: 36-44.
- Laegaard, D. 1975. Morphological investigations of vegetative winter buds of trees and shrubs. Part 2. Dan. Dendrol. Arsskr. 4: 5-27.
- Laing, H. E. 1940. Respiration of rhizomes of *Nuphar* and other water plants. Amer. Jour. Bot. 27: 574-581.
- Langlet, O. and E. Soderberg. 1927. Uber die Chromosomenzahlen einiger Nyphaeaceen. Acta. Horti. Berg. 9: 85-104.
- Lawrence, G. H. M. 1951. The Taxonomy of Vascular Plants. Macmillan Co., N. Y. 823 p.
- Lawson, G. 1889. On the Nymphaeaceae. Trans. Roy. Soc. Canada, 6: 97-125.
- Leeuwen, W. A. M. van. 1963. A study of the structure of the gynoecium of *Nelumbo lutea* (Willd.) Pers. Acta. Bot. Neerlandica, 12: 84-97.
- Leonard, M. D. 1963. A list of the Aphids of New York. Rochester Acad. Sci. Proc. 10: 289-428.
- 1968. A Supplement to a list of the Aphids of New York. Rochester Acad. Sci. Proc. 11: 257-361.
- 1971. A Second Supplement to a list of the Aphids of New York. Cornell Univ. Agr. Exp. Sta. Search 1: 1-31.
- 1973. A Third Supplement to a list of the Aphids of New York. Cornell Univ. Agr. Exp. Sta. Search 3: 1-23.
- 1975. A Fourth Supplement to a list of Aphids of New York. Cornell Univ. Agr. Exp. Sta. Search 5: 1-11.
- Li, H. L. 1955. Classification and phylogeny and Nymphaeaceae and allied families. Amer. Midl. Nat. 54: 33-41.
- Linnaeus, C. 1753. Species Plantarum. (facsimile ed.) 1957-59, for the Ray Society by Guaritch Ltd., London, 1200+ p.
- Linsley, E. G. 1961. The Cerambycidae of North America. Part I. University of Cal. Pub. in Ent. Vol. 18, Univ. of Cal. Press, 135 p.
- 1962. The Cerambycidae of North America. Part II. University of Cal. Pub. in Ent. Vol. 19, Univ. of Cal. Press, 102 p.
- 1962. The Cerambycidae of North America. Part III. University of Cal. Pub. in Ent. Vol. 20, Univ. of Cal. Press, 188 p.
- 1963. The Cerambycidae of North America. Part IV. University of Cal. Pub. in Ent. Vol. 21, Univ. of Cal. Press, 165 p.
- 1964. The Cerambycidae of North America. Part V. University of Cal. Pub. in Ent. Vol. 22, Univ. of Cal. Press, 197 p.

- and J. A. Chemsak. 1972. Cerambycidae of North America. Part VI, No. 2, University of Cal. Pub. in Ent. Vol. 80, University of Cal. Press, 186 p.
- 1976. Cerambycidae of North America. Part VI, No. 2, University of Cal. Pub. in Ent. Vol. 80, University of Cal. Press, 186 p.
- Lorch, J. 1959. The perianth of *Aristolochia*, a new interpretation. *Evolution* 13: 415–416.
- Löve, A. and O. J. Solbrig. 1964. I.O.P.B. Chromosome number reports I. *Taxon* 13: 99–110.
- Lyon, H. L. 1901. Observations on the embryology of *Nelumbo*. *Minn. Bot. Studies* 2: 643–655.
- MacKenzie, K. K. 1927. Proper use of the name *Nymphaea*. *Rhodora* 29: 234–237.
- McCutchen, C. W. 1977. The spinning rotation of ash and tulip-tree samaras. *Science* 197: 691–692.
- McDaniel, J. C. 1963. Recent hybridizations with American Magnolias. *Internat. Prop. Soc. Comb. Proc.* 13: 124–132.
- 1967. Self-unfruitfulness of some Magnolias. *Morris Arb. Bull.* 18: 64–69.
- Melville, R. 1969. Studies in floral structure and evolution. I. The Magnoliales. *Kew Bull.* 23: 133–180.
- Metcalf, C. L., W. P. Flint and R. L. Metcalf. 1951. *Destructive and Useful Insects*. McGraw-Hill Co., N. Y., 1071 p.
- Meyer, W. C. 1930. Dormancy and growth studies of the American Lotus, *Nelumbo lutea*. *Pl. Physiol.* 5: 225–234.
- Michaux, F. A. 1803. *Flora Boreali-Americana*. Paris, 340 p.
- Miller, G. S. and P. C. Standley. 1912. The North American species of *Nymphaea*. *Contr. U.S. Nat. Herb.* 16: 63–108.
- Miller, O. K. and D. F. Farr, 1975. An Index of the Common Fungi of North America, J. Cramer Publ. 206 p.
- Mitchell, R. S. and J. K. Dean. 1978. Polygonaceae (Buckwheat Family) of New York State. *Contributions to a Flora of New York State I. N.Y. State Museum Bull. No. 431*, 81 p.
- Mitchell, T. B. 1960–62. Bees of the Eastern United States. Vols. I, II. *North Carolina Agric. Exp. Sta. Tech. Bull.* 141, 538 p., and 152, 557 p.
- Monson, P. H. 1957–58. Variation in *Nymphaea*, the white water-lily in the Itasca State Park region. *Proc. Minn. Acad. Sci.* 25–26: 26–39.
- Moore, R. J. 1973. Index for Chromosome Numbers (1967–71) *Regn. Vegetab.* 90: 1–539.
- Morong, T. 1886. Revision of the North American species of *Nuphar*. *Bot. Gaz.* 11: 164–169.
- Moseley, M. F. 1958. Morphological studies of the Nymphaeaceae I. The nature of the stamens. *Phytomorphology* 8: 1–29.
- 1961. Ibid II. The flowers of *Nymphaea*. *Bot. Gaz.* 122: 233–259.
- 1965. Ibid III. The floral anatomy of *Nuphar*. *Phytomorph.* 15: 54–84.
- 1971. Ibid VI. Development of the flower *Nuphar*. *Phytomorph.* 21: 253–283.
- Muenschler, W. C. 1940. Fruits and seedlings of *Ceratophyllum*. *Amer. Jour. Bot.* 27: 231–233.
- 1944. *Aquatic Plants of the United States*. Comstock Publ. 364 p.
- Muesebeck, C. F. W., K. V. Krombein and H. K. Townes. 1951. Hymenoptera of America north of Mexico: Synoptic Catalog. U.S.D.S. Agr. Monog. No. 2. 1420 p.
- Mulligan, G. A. 1969. I. O. P. B. Chromosome number reports XX. *Taxon* 18: 213–221. (and preceding reports).
- Murray, E. 1972. A *Magnolia* species checklist. *Kalmia* 4: 1–12.
- 1973. *Magnolia* species descriptions. *Kalmia* 5: 1–17.
- Murty, Y. S. 1959. Studies in the order Piperales VIII. A contribution to the study of *Saururus cernuus* L. *Jour. Indian Bot. Soc.* 38: 195–203.
- Mycologia Index. 1968. Volumes 1–58. 1909–1966. The New York Botanical Garden. 1107 p.
- Nash, G. V. 1907. Water-lilies and other aquatics: their relation to horticulture. *New York Bot. Gard. Jour.* 8: 202–220.
- 1920. *Benzoin aestivale*. *Addisonia* 5: 15–16.
- Nicely, K. A. 1965. A monographic study of the Calycanthaceae. *Castania* 30: 38–81.
- Nieuwland, J. A. 1916. Habits of water-lily seedlings. *Amer. Midl. Nat.* 4: 291–297.
- Ogden, E. C., J. K. Dean, C. W. Boylan and R. B. Sheldon. 1976. Field Guide to the Aquatic Plants of Lake George, New York. N.Y. State Museum Bull. No. 426, 65 p.
- Ohga, I. 1923. On the longevity of fruits of *Nelumbo nucifera*. *Bot. Mag. Tokyo*, 37: 87–95.
- 1926. The germination of century-old and recently harvested Indian lotus fruits with special reference to the effect of oxygen supply. *Amer. Jour. Bot.* 13: 754–759.

- Okada, H. and R. Tanaka. 1975. Karyological studies in some species of Lauraceae. *Taxon* 24: 271-280.
- Olson, D. F. Jr. 1969. Silvical characteristics of Yellow-poplar. U.S. Forest. Serv. Res. Pap. 48, 20 p.
- Patch, E. M. 1938. Food Plant Catalogue of the Aphids of the World. Univ. Maine Agric. Expt. Sta. Bull. 393, 431 p. and supplemental index (1945) of 50 p.
- Pax, F. 1891. Lauraceae. In *Natur. Pflanzenfam.* III, 2: 106-126.
- Pearl, R. 1901. Variation in the number of seeds of the lotus. *Amer. Nat.* 40: 757-768.
- 1907. Variation and differentiation in *Ceratophyllum*. *Carnegie Inst. Wash. Publ.* 58.
- Pellissier, F., F. H. Taxu and P. Regli. 1970. Study of morphogenesis and vascular ontogenesis in the leaves of *Aristolochia clematitis*. *Bull. Soc. Phar. Mars.* 19: 71-75.
- Pfeifer, H. W. 1962. The status of the name, *Aristolochia durior* Hill. *Baileya* 10: 4-7.
- 1966. Revision of the North and Central American species of *Aristolochia*. *Ann. Missouri Bot. Gard.* 53: 115-196.
- 1970. A taxonomic revision of the Pentandrous species of *Aristolochia*. Univ. of Conn. Press, Monogr. Ser. 134 p.
- Pieters, A. J. 1901. The plants of western Lake Erie, with observations on their distribution. U. S. Fish Com. Bull. 1901: 57-79.
- Pirone, P. P. 1970. Diseases and Pests of Ornamental Plants. Ronald Press Co., N. Y. 546 p.
- Pironzynski, K. A. and C. S. Hodges, Jr. 1973. New hyphomycetes from South Carolina. *Canad. Jour. Bot.* 51: 157-173.
- Planchon, J. E. 1853a. Etudes sur les Nymphaeacees. *Ann. Sci. Nat. Bot.* III. 19: 17-63.
- 1853b. Enumeration succincte de la famille des Nymphaeacees. *Rev. Hort. Paris* IV. 2: 63-68.
- Prantl, K. 1888. Magnoliaceae. *Nat. Pflanzenfam.* III. 2: 12-19.
- Pring, G. H. 1934. Hybrid Nymphaea. *Missouri Bot. Gard. Bull.* 22: 47-90.
- Raabe, R. D. 1962. Diseases and pests of *Magnolia*. *Jour. Calif. Hort. Soc.* 23: 42-44.
- Raciborski, M. 1894. Die morphologie der Cabombeen und Nymphaeaceen. *Flora, Jena.* 78: 244-279 and 79: 92-108.
- Radford, A. E., H. E. Ahles and C. R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. Univ. North Carolina Press, Chapel Hill, 1183 p.
- Raju, M. V. S. 1961. Morphology and anatomy of the Saururaceae. I. Floral anatomy and embryology. *Ann. Missouri Bot. Gard.* 48: 107-124.
- Ramhorst, J. L. Van and P. A. Florschutz. 1956. A new variety of *Cabomba caroliniana* Gray. *Acta Bot. Neerl.* 5: 342-343.
- Raymond, M. and P. Dansereau. 1949. The geographical distribution of the bipolar Nymphaeaceae, *Nymphaea tetragona* and *Brasenia schreberi*. *Proc. 7th Pacific Sci. Congr.* 7: 122-131.
- Reiter, V. Jr. 1962. Notes on the vegetative propagation of Magnolias. *Jour. Calif. Hort. Soc.* 23: 51-53.
- Richardson, F. C. 1929. Morphological studies of the Nymphaeaceae IV. Structure and development of the flower of *Brasenia schreberi* Gmel. *Univ. Calif. Publ. Bot.* 47: 1-101.
- Ritchar, P. O. 1966. White Grubs and their Allies: A Study of North American Scarabaeoid Larvae. Oregon State Monographs: Studies in Entomology No. 4. Oregon State Univ. Press, Corvallis, 219 p.
- Rousseau, D. 1938. Contribution a l'anatomie comparee des Piperacees. *Arch. Inst. Bot. Liege* 7L 3-45.
- Sansregret, J. 1971. The curious Pawpaw. *Amer. Forests* 77: 37.
- Santamour, F. S. Jr. 1965-66. Biochemical studies in *Magnolia*. *Morris Arb. Bull.* 16: 43-48, 63-64; 17: 65-68.
- 1970. Implications of cytology and biochemistry for *Magnolia* hybridization. *Newsl. Amer. Magnol. Soc.* 7: 8-10.
- 1971. The two Tulip-trees. *Amer. Hort. Mag.* 50: 87-89.
- Sargent, C. S. 1891. *Magnolia*. In *Silva North America* 1:1-16. *Liriodendron*. *Ibid.* 1:19-20.
- Saunders, E. R. 1936. Some morphological problems presented by the flower in the Nymphaeaceae. *Jour. Bot.* 74: 217-221.
- Schaeppi, H. 1935. Untersuchungen uber die Blattentwicklung bei *Ceratophyllum*, *Cabomba* und *Limnophila*. *Planta* 24: 755-769.
- Schaffner, J. H. 1904. Some morphological peculiarities of the Nymphaeaceae and Helobiae. *Ohio Nat.* 40: 83-92.
- Schery, R. W. 1972. Plants for Man. Ed. II. Prentice-Hall, N.J., 657 p.

- Schilling, A. J. 1894. Anatomisch-biologische Untersuchungen über die Schleimbildung der Wasserpflanzen. *Flora* 78: 280–360.
- Schleiden, M. J. 1837. Beiträge zur Kenntniss der Ceratophyteen. *Linnaea* 11: 513–542.
- Schmidt, O. C. 1935. Aristolochiaceae. In A. Engler and K. Prantl, *Natur. Pflanzenfam.* II, 166: 202–242.
- Schneider, E. L. and L. A. Moore. 1977. Morphological studies of the Nymphaeaceae VII. The floral biology of *Nuphar lutea* ssp. *macrophylla*. *Brittonia* 29: 88–99.
- Schroeder, E. M. 1935. Dormancy in seeds of *Benzoin aestivale* L. *Contr. Boyce Thompson Inst.* 7: 411–419.
- Schuster, J. 1906. Über den Polymorphismus bei *Nuphar*. *Allgem. Bot. Syst.* 12: 79–83.
- . 1907. Zur Systematik von *Castalia* und *Nymphaea*. *Bull. Herb. Boiss.* 7: 853–868; 901–916; 981–996.
- Segelman, A. B., F. P. Segelman, J. Karliner and R. D. Sophia. 1976. Sassafras and herb tea—potential health hazards. *Jour. Amer. Med. Assoc.* 236: 477.
- Sethi, M. L. 1976. Identification of volatile constituents of *Sassafras albidum* root oil. *Phytochem. (Oxford)* 15: 1773–1775.
- Seymour, A. B. 1929. *Host Index of the Fungi of North America*. Harvard Univ. Press, 732 p.
- Simon, J. 1970. Comparative serology of the order Nymphaeales. I. Preliminary survey on the relationships of *Nelumbo*. *Aliso* 7: 243–261.
- . 1971. Ibid. II. Relationships of the Nymphaeaceae and Nelumbonaceae. *Aliso* 7: 325–350.
- Sims, J. 1823. *Magnolia acuminata*. *Bot. Mag.* 135: t. 2427.
- Small, J. K. 1931. The Water-lilies of the United States. *Jour. N.Y. Bot. Gard.* 32: 117–121.
- Smith, L. H. 1976. Morphological description of stamens of the Annonaceae. *Florida Sci.* 39: 6 (Abst.)
- Snigirevskaya, N. S. 1964. Contributions to the morphology and systematics of the genus *Nelumbo* Adans. (In Russian.) *Trudy Bot. Inst. Akad. Nauk S.S.S.R. Ser. 1*, 13: 104–172.
- Sohmer, S. H. 1975. The name of the American *Nelumbo*. *Taxon* 24: 491–493.
- . 1977. Aspects of the biology of *Nelumbo pentapetala* (Walter) Fernald, the American Lotus of the upper Mississippi. *Trans. Wisconsin Acad. Sci.* 65: 258–273.
- . 1978. The reproductive biology of *Nelumbo pentapetala* (Nelumbonaceae) on the upper Mississippi River II. The insects associated with the transfer of pollen. *Brittonia* 30: 355–364.
- Spongberg, S. A. 1975. Lauraceae hardy in temperate North America. *Jour. Arn. Arb.* 56: 1–19.
- . 1976. Magnoliaceae hardy in temperate North America. *Jour. Arn. Arb.* 57: 250–312.
- Spring, J. J. 1962. The propagation of Magnolias from seed. *Jour. Calif. Hort. Soc.* 23: 48–50.
- Sprague, T. A. 1928. The standard species of *Nymphaea* L. *Rhodora* 30: 53–59.
- Steenis, J. M. and R. T. Mitchell. 1950. Leaf beetle versus lotus. *Jour. Wildl. Managem.* 14: 478.
- Stone, A., et al. 1965. A Catalog of the Diptera of America North of Mexico. U.S.D.A. Agric. Handb. No. 276, 1696 p.
- Sturtevant, E. L. 1919. *Sturtevant's Edible Plants of the World*. Republished by Dover Press, 1972, 686 p.
- Tanaka, R. and H. Ikada. 1972. Karyological studies in four species of Annonaceae, a primitive Angiosperm. *Jour. Sci. Hiroshima Univ. Ser. B, Div. 2*, 14: 85–105.
- Tarver, D. P. and D. R. Sanders Sr. 1977. Selected life-cycle features of Fanwort. *Jour. Aquat. Pl. Managem.* 15: 18–22.
- Taylor, H. J. (Mrs.). 1927. The history and distribution of Yellow *Nelumbo*, Water-Chinquapin or American Lotus. *Proc. Iowa Acad. Sci.* 34: 119–124.
- Thien, L. B. 1974. Floral biology of *Magnolia*. *Amer. Jour. Bot.* 61: 1037–1045.
- , W. H. Heimermann and R. T. Holman. 1975. Floral odors and quantitative taxonomy of *Magnolia* and *Lioridendron*. *Taxon* 24: 557–568.
- Thorgrimson, O. B. 1947. Magnolias—American species. *Arb. Bull.* 10: 6–7; 26–27.
- Thorne, R. F. 1974. A Phylogenetic classification of the Annoniflorae. *Aliso* 8: 147–209.
- Tietz, H. M. 1972. An Index to the Described Life Histories, Early Stages and Hosts of the Macrolepidoptera of the Continental United States and Canada. Allen Museum of Entomology, Sarasota, Fla. 1041 p.
- Todua, B. T. 1973. Karyology of some woody plants. *Soobshch Akad. Nauk. Gruz. S.S.S.R.*, 72: 485–488.
- Tokura, A. 1937. On the blooming of *Brasenia Schreberi* J. F. Gmel. (I) *Jour. Jap. Bot.* 13: 829–839.
- Trecul, A. 1845. Recherches sur la structure et le développement du *Nuphar luteum*. *Ann. Sci. Nat. Bot.* 4: 286–345.

- Treseder, N. G. 1972. Magnolias and their cultivation. Jour. Roy. Hort. Soc. 97: 336-346.
- Trolinger, J. C. and E. S. Elliott. 1975. The increasing severity of the disease caused by *Cristulariella pyramidalis*. Proc. Nebraska Acad. Sci. 85: 9.
- Troll, W. 1933. Beitrage zur Morphologie des Gynaeceums. 4. Uber das Gynaeceum der Nymphaeaceen. Planta 21: 447-485.
- Tucker, G. E. 1974. The vascular plant family Lauraceae in Arkansas, U.S.A. Arkans. Acad. Sci. Proc. 28: 74-75.
- Tucker, S. C. 1975. Floral development in *Saururus cernuus* (Saururaceae). Part I. Floral initiation and stamen development. Amer. Jour. Bot. 62: 993-1007.
- 1976. Ibid. Part II. Carpel initiation and floral vasculature. Amer. Jour. Bot. 63: 289-301.
- Uphof, J. C. Th. 1968. Dictionary of Economic Plants. 2nd ed., Cramer Publ. 591 p.
- Van der Velde, G. 1976. The significance of nymphaeid water plants for animal life. Netherl. Jour. Zool. 26: 445-446.
- Van Tieghem, P. 1886. Sur l'appareil secretur et les affinites de structure de Nymphaeacees. Bull. Soc. Bot. France 33: 72-76.
- Voss, E. G. 1967. A vegetative key to the genera of submersed and floating aquatic vascular plants of Michigan. Mich. Bot. 6: 35-50.
- Ward, D. B. 1977a. *Nelumbo lutea*, the correct name for the American Lotus. Taxon 26: 227-234.
- 1977b. Keys to the flora of Florida 4. *Nymphaea* (Nymphaeaceae). Phytologia 37: 443-448.
- Weberbauer, A. 1894. Beitrage zur Sammenanatomie der Nymphaeaceen. Bot. Jahrb. 18: 213-258.
- Wettstein, R. von. 1888. Beobachtungen uber den Bau und die Keimung des Samens von *Nelumbo nucifera* Gaertn. Verh. Zool. Bot. Ges., Wien 38: 41-49.
- Wheeler, A. G. Jr. 1977. Spicebush and Sassafras as new North American hosts of Andromeda Lace Bug *Stephanitis takeyai*, Hemiptera, Tingidae. Proc. Entomol. Soc. Wash. 79: 168-171.
- Whitaker, T. W. 1933. Chromosome number and relationship in the Magnoliales. Jour. Arn. Arb. 14: 376-385.
- Wilcox, J. A. 1965. A synopsis of the North American Galerucinae (Coleoptera: Chrysomelidae). N. Y. State Museum and Sci. Ser. Bull. No. 400. 226 p.
- Williams, G. R. 1970. Investigations in the white water-lilies (*Nymphaea*) of Michigan. Mich. Bot. 9: 72-86.
- Wofford, B. E. 1974. A biosystematic study of the genus *Persea* (Lauraceae) in the Southeastern United States of America Assoc. Southeast Biol. Bull. 21: 91 (Abst.)
- Wood, A. 1847. A Class-book of Botany. Ed. 2, Claremont, N. H. 645 p.
- Wood, C. E. Jr. 1958. The genera of woody Ranales in the Southeastern United States. Jour. Arn. Arb. 39: 296-346.
- 1959. The genera of the Nymphaeaceae and Ceratophyllaceae in the Southeastern United States. Jour. Arn. Arb. 40: 94-112.
- 1971. The Saururaceae of the Southeastern United States. Jour. Arn. Arb. 52: 479-485.

INDEX TO LATIN NAMES

	PAGE		PAGE
Anemopsis	14	<i>oblongifolius</i>	9
Annona		<i>occidentalis</i>	8
<i>glabra</i>	6	<i>Castalia</i>	24
<i>triloba</i>	7	Ceratophyllum	
Aristolochia		<i>echinatum</i>	35
<i>arkansaw</i>	22	<i>demersum</i>	35,36
<i>clematitis</i>	19	<i>muricatum</i>	36
<i>convolvulacea</i>	20	Cinnamomum	10
<i>coriacea</i>	21	<i>Clairivillea</i>	25
<i>dodecandra</i>	20	<i>Cyanus</i>	30
<i>durior</i>	22	<i>Dasyphonion</i>	21
<i>grandifolia</i>	22	<i>Endodeca</i>	20
<i>hastata</i>	20	Euryale	23
<i>hirsuta</i>	21	<i>Hoquartia</i>	21,22
<i>hitchcockii</i>	21	<i>Isiphia</i>	21,22
<i>macrophylla</i>	22	<i>Isotrema</i>	21,22
<i>nashii</i>	20	Laurus	10,11,12
<i>officinalis</i>	20	Lindera	
<i>polyrrhizos</i>	20	<i>benzoin</i>	11
<i>sagittata</i>	20	Liriodendron	
<i>serpentaria</i>	20	<i>tulipifera</i>	5
<i>sipho</i>	22	<i>procerum</i>	5
<i>tomentosa</i>	21	Magnolia	
<i>tripteris</i>	21	<i>acuminata</i>	3
Asarum		<i>australis</i>	2
<i>acuminatum</i>	17	<i>brooklynensis</i>	4
<i>ambiguum</i>	17	<i>fraseri</i>	4
<i>canadense</i>	17	<i>glauc</i>	2
<i>reflexum</i>	17	<i>grandiflora</i>	3
Asimina		<i>guatemalensis</i>	3
<i>triloba</i>	7	<i>hypoleuca</i>	3
Barclaya	23	<i>macrophylla</i>	3
Benzoin	11	<i>quiquipeta</i>	4
Borbonia	13	<i>tripetala</i>	3,4
Brasenia		<i>virginiana</i>	2
<i>peltata</i>	33	<i>Mattuschkia</i>	15
<i>purpurea</i>	33	<i>Menyanthes</i>	33
<i>schreberi</i>	33	<i>Nelumbium</i>	30
<i>Butneria</i>	9	Nelumbo	
Cabomba		<i>lutea</i>	30
<i>aubleti</i>	32	<i>pentapetala</i>	30
<i>aquatica</i>	32	<i>Neobiondia</i>	15
<i>caroliniana</i>	32	<i>Nenuphar</i>	25,27,29
<i>viridiflora</i>	32	<i>Nufar</i>	25
Calycanthus		Nuphar	
<i>fertilis</i>	9	<i>advena</i>	27,29
<i>floridus</i>	9	<i>americana</i>	27,29
<i>glaucus</i>	9	<i>fluviatile</i>	29
<i>laevigatus</i>	9	<i>fraternum</i>	27
<i>mohrii</i>	9	<i>kalmiana</i>	27
<i>nanus</i>	9	<i>luteum</i>	25

ssp. macrophyllum	26,27	<i>Nymphona</i>	29
ssp. polysepalum	26	<i>Nymphozanthus</i>	25,26,27,29
ssp. pumilum	26,27	<i>Ondinea</i>	23
ssp. sagittifolium	26	<i>Orchidocarpum</i>	7
ssp. variegatum	26,27	Persea	
<i>microphyllum</i>	27	<i>americana</i>	10,13
<i>minima</i>	27	borbonia	13
<i>minumum</i>	27	<i>Pistolochia</i>	20
<i>peteorum</i>	29	<i>Porcelia</i>	7
<i>variegatum</i>	27	<i>Psophiza</i>	20
Nymphaea		Sassafras	
<i>advena</i>	27	albidum	12
<i>americana</i>	27	<i>officinale</i>	12
<i>arifolia</i>	27	<i>sassafras</i>	12
<i>hybrida</i>	26	<i>variifolium</i>	12
<i>kalmiana</i>	27	<i>Saururopsis</i>	15
<i>lekophylla</i>	24	Saururus	
<i>lutea</i>	27	cernuus	15
<i>microphylla</i>	27	<i>Siphisia</i>	21,22
odorata	24	<i>Spathium</i>	15
<i>pentapetala</i>	30	<i>Tamala</i>	13
<i>rubrodisca</i>	26	<i>Tulipastrum</i>	3
<i>spiralis</i>	24	<i>Tulipifera</i>	5
<i>tuberosa</i>	24	<i>Umbellularia</i>	10
<i>umbilicaulis</i>	25	<i>Uvaria</i>	7
<i>variegata</i>	27	<i>Victoria</i>	23

Contributions Completed to Date¹

1. Mitchell, Richard S. and J. Kenneth Dean, 1978. Polygonaceae, (Buckwheat Family) of New York State. Contributions to a Flora of New York State I. N. Y. State Museum Bull. No. 431, 81 p.
2. Mitchell, Richard S. and Ernest O. Beal. 1979. Magnoliaceae through Ceratophyllaceae of New York State. Contributions to a Flora of New York State II. N. Y. State Museum Bull. No. 435, 62 p.

¹ To purchase copies of these publications, contact:

Gift & Exchange Section
New York State Library
Albany, New York 12234

