

LILIACEAE de Jussieu 1789 (Lily Family)

(also see AGAVACEAE, ALLIACEAE, ALSTROEMERIACEAE, AMARYLLIDACEAE, ASPARAGACEAE, COLCHICACEAE, HEMEROCALLIDACEAE, HOSTACEAE, HYACINTHACEAE, HYPOXIDACEAE, MELANTHIACEAE, NARTHECIACEAE, RUSCACEAE, SMILACACEAE, THEMIDACEAE, TOFIELDIACEAE)

As here interpreted narrowly, the Liliaceae constitutes about 11 genera and 550 species, of the Northern Hemisphere. There has been much recent investigation and re-interpretation of evidence regarding the upper-level taxonomy of the Liliales, with strong suggestions that the broad Liliaceae recognized by Cronquist (1981) is artificial and polyphyletic. Cronquist (1993) himself concurs, at least to a degree: "we still await a comprehensive reorganization of the lilies into several families more comparable to other recognized families of angiosperms." Dahlgren & Clifford (1982) and Dahlgren, Clifford, & Yeo (1985) synthesized an early phase in the modern revolution of monocot taxonomy. Since then, additional research, especially molecular (Duvall et al. 1993, Chase et al. 1993, Bogler & Simpson 1995, and many others), has strongly validated the general lines (and many details) of Dahlgren's arrangement. The most recent synthesis (Kubitzki 1998a) is followed as the basis for familial and generic taxonomy of the lilies and their relatives (see summary below). References: Angiosperm Phylogeny Group (1998, 2003); Tamura in Kubitzki (1998a).

Our "liliaceous" genera (members of orders placed in the Liliales) are therefore divided as shown below, largely following Kubitzki (1998a) and some more recent molecular analyses.

ALISMATALES

TOFIELDIACEAE: *Pleea*, *Tofieldia*.

LILIALES

ALSTROEMERIACEAE: *Alstroemeria*

COLCHICACEAE: *Colchicum*, *Uvularia*.

LILIACEAE: *Clintonia*, *Erythronium*, *Lilium*, *Medeola*, *Prosartes*, *Streptopus*, *Tricyrtis*, *Tulipa*.

MELANTHIACEAE: *Amianthium*, *Anticlea*, *Chamaelirium*, *Helonias*, *Melanthium*, *Schoenocaulon*, *Stenanthium*, *Veratrum*, *Toxicoscordion*, *Trillium*, *Xerophyllum*, *Zigadenus*.

SMILACACEAE: *Smilax*.

ASPARAGALES

AGAVACEAE: *Camassia*, *Manfreda*, *Schoenolirion*, *Yucca*. (or to be included in ASPARAGACEAE)

ALLIACEAE: *Allium*, *Ipheion*, *Nothoscordum*.

AMARYLLIDACEAE: *Crinum*, *Galanthus*, *Hymenocallis*, *Leucojum*, *Lycoris*, *Narcissus*, *Sternbergia*, *Zephyranthes*. (or to be included in ALLIACEAE)

ASPARAGACEAE: *Asparagus*.

HEMEROCALLIDACEAE: *Hemerocallis*. (or to be included in XANTHORRHOACEAE)

HOSTACEAE: *Hosta*. (or to be included in ASPARAGACEAE)

HYACINTHACEAE: *Hyacinthoides*, *Hyacinthus*, *Muscari*, *Ornithogalum*. (or to be included in ASPARAGACEAE)

HYPOXIDACEAE: *Hypoxis*.

IRIDACEAE: *Belamcanda*, *Calydorea*, *Crocus*, *Crocasmia*, *Gladiolus*, *Iris*, *Nemastylis*, *Sisyrinchium*.

ORCHIDACEAE: *Aplectrum*, *Arethusa*, *Calopogon*, *Cleistes*, *Coeloglossum*, *Corallorrhiza*, *Cypripedium*, *Epidendrum*, *Epipactis*, *Galearis*, *Goodyera*, *Habenaria*, *Hexalectris*, *Isotria*, *Liparis*, *Listera*, *Malaxis*, *Platanthera*, *Pogonia*, *Ponthieva*, *Pteroglossaspis*, *Spiranthes*, *Tipularia*, *Triphora*, *Zeuxine*.

RUSCACEAE: *Convallaria*, *Liriope*, *Maianthemum*, *Nolina*, *Polygonatum*. (or to be included in ASPARAGACEAE)

THEMIDACEAE: *Dichelostemma*. (or to be included in ASPARAGACEAE)

DIOSCOREALES

BURMANNIACEAE: *Apteria*, *Burmannia*.

DIOSCOREACEAE: *Dioscorea*.

NARTHECIACEAE: *Alettris*, *Lophiola*, *Narthecium*.

PANDANALES

STEMONACEAE: *Croonia*.

Key to LILIACEAE (sensu stricto)

[FAMILY KEY NEEDS REWORKING]

- 1 Acaulescent herb with 1-several basal leaves; flowers on a leafless scape; tepals yellow or white.
 - 2 Flowers in an umbel at the summit of a leafless scape; fruit a berry; [subfamily *Medeoloideae*] **Clintonia**
 - 2 Flowers solitary and scapose; tepals yellow or white; fruit a capsule; [subfamily *Lilioideae*, tribe *Tulipeae*] .. **Erythronium**
- 1 Cauliscent herb, with leaves on the stem; flowers not scapose; tepals orange, red, yellow, or white).
 - 3 Leaves alternate, at 1-6 nodes; [subfamily *Lilioideae*, tribe *Tulipeae*] **[Tulipa]**
 - 3 Leaves either whorled, at 1-2 nodes only (*Medeola*) or whorled and/or alternate at 7 or more nodes (*Lilium*).
 - 4 Leaves occurring in a single whorl, with fertile plants with a second whorl of leaflike bracts subtending the flowers; flowers yellow; [subfamily *Medeoloideae*] **Medeola**
 - 4 Leaves occurring at several nodes, these variously whorled and/or alternate; flowers orange, red, or yellow;

[subfamily *Lilioideae*, tribe *Lilieae*] ***Lilium***

- 1 Leafy stem unbranched; leaves often dark-spotted; fruit a capsule; [plant an introduced alien, rarely naturalized] ***[Tricyrtis]***
- 1 Leafy stem branched; leaves not dark-spotted; fruit a berry; [plants native].
 - 2 Stems brownish, wiry; inflorescence terminal ***Prosartes***
 - 2 Stems green, rather succulent; inflorescence axillary ***Streptopus***

***Clintonia* Rafinesque 1819**

A genus of 5 species, of temperate to subarctic e. Asia and North America. References: Utech in FNA (2002a); Tamura in Kubitzki (1998a).

- 1 Flowers yellow; berry blue (rarely to whitish-blue); leaf margins glabrous or slightly ciliate; [plants mostly of high elevations] ***C. borealis***
- 1 Flowers white (often marked with purple); berry black; leaf margins copiously retrorsely ciliate, the cilia 2-4 mm long; [plants mostly of middle elevations] ***C. umbellulata***

Clintonia borealis (Aiton) Rafinesque, Bluebead-lily. Mt (GA, NC, VA): spruce-fir forests, northern hardwood forests, less commonly in red oak forests; common (GA Special Concern). Late May-June; July-September. Labrador west to Manitoba, south to NJ, PA, and n. IN, and in the mountains to w. NC, e. TN, and n. GA (Jones & Coile 1988). [= RAB, C, F, FNA, G, K, S, W]

Clintonia umbellulata (Michaux) Morong, Speckled Wood-lily. Mt (GA, NC, SC, VA): red oak and other oak forests, mesic to dry ridges and slopes, less commonly in northern hardwood forests, generally at lower elevations than *C. borealis*, though the two species can co-occur; common. Mid May-June; August-October. An Appalachian endemic: c. NY west to s. OH, south to n. GA (Jones & Coile 1988). *Clintonia alleghaniensis* Harned, differing from *C. umbellulata* in its ultramarine blue berry (vs. black) is known from a number of sites in MD and WV. It has been variously interpreted as a species, a hybrid of *C. borealis* and *C. umbellulata*, or merely an odd form of *C. umbellulata*; it is apparently only a form. [= RAB, C, F, FNA, G, K, W; *Xeniatrum umbellulatum* (Michaux) Small -- S; *C. alleghaniensis* Harned]

***Erythronium* Linnaeus 1753 (Trout Lily)**

A genus of about 25 species, north temperate and subarctic, of North America and Eurasia (especially diverse in w. North America). References: Parks & Hardin (1963)=Z; Mathew (1992)=Y; Allen & Robertson in FNA (2002a); Tamura in Kubitzki (1998a).

Keying Note: Stolons are white shoots produced from the bulb. Most run horizontally, either underground or along the ground surface but beneath leaf litter. Flowering individuals often produce no stolons. The stolon characters in the key below are those of non-flowering individuals and refer to horizontal stolons only.

- 1 Perianth white ***E. albidum***
- 1 Perianth yellow.
 - 2 Petals lacking auricles at base; capsule and ovary distinctly indented (umbilicate) at apex (or rarely truncate in *E. umbilicatum* ssp. *monostolum*, or the ovary when young not yet displaying the apical indentation); mature capsules usually reclining on ground, with the apex downward; stolons 0-1 per bulb; anthers usually lavender, brown, cinnamon, or purple (sometimes yellow).
 - 3 Horizontal stolons 1 per bulb; flecking on perianth segments slight to strong; perianth margins slightly irregular (though not auricled); stigma lobes long; pale spot on adaxial side of perianth segments always present, small to large, usually pale yellow; [plants of high elevations in the Southern Appalachians] ***E. umbilicatum* ssp. *monostolum***
 - 3 Horizontal stolons 0 per bulb; flecking on perianth segments absent to slight; perianth margins entire, smooth; stigma lobes short; pale spot on adaxial side of perianth segments usually present, small to medium, usually white; [plants of lower to mid elevations, widespread in our area] ***E. umbilicatum* ssp. *umbilicatum***
 - 2 Petals with auricles at base; capsule and ovary truncate, rounded, apiculate, or beaked at apex; mature capsules usually held well off ground, the apex oriented horizontally or ascending; stolons usually (1-) 2-5 per bulb; anthers usually yellow (rarely brown or lavender).
 - 4 Capsule distinctly beaked at the apex; petals with well-developed auricles at the base, these encircling a filament ***[E. rostratum]***
 - 4 Capsule truncate, rounded, or apiculate at the apex; petals with small auricles at the base, which do not encircle a filament.
 - 5 Capsule apiculus absent or poorly developed ***E. americanum* ssp. *americanum***
 - 5 Capsule apiculus well developed ***E. americanum* ssp. *harperi***

Erythronium albidum Nuttall, White Trout Lily, Blonde Lilian. Mt (GA, VA), Pd (VA): rich, mesic forests, in very nutrient-rich alluvial soils; rare (VA Rare). March-April. S. Ontario west to MN, south to n. VA, nw. GA, KY, sc. TN, MO, and OK. [= C, K, S, W, Y; *E. albidum* var. *albidum* -- F, G]

Erythronium americanum Ker-Gawler ssp. **americanum**, American Trout Lily. Pd (NC, SC, VA), Mt, Cp (NC, VA): moist bottomland or slope forests, especially over mafic rocks; common in VA, much rarer in NC (NC Watch List). February-April; April-May. New Brunswick west to Ontario and MN, south to sc. NC, c. TN, AR, and OK. It is much rarer than *E. umbilicatum* in NC. *E. americanum* is a tetraploid ($2n = 48$); Parks & Hardin suggest the possibility that it is an allotetraploid involving *E. rostratum* and *E. umbilicatum* as parents. *E. americanum* is larger-flowered, more graceful, and later-blooming than *E. umbilicatum* ssp. *umbilicatum*. [= FNA, GW, K, Y, Z; *E. americanum* -- RAB, F, G, S, in part (also see *E. umbilicatum*); *E. americanum* -- C, W]

Erythronium americanum Ker-Gawler ssp. **harperi** (W. Wolf) Parks & Hardin, Harper's Trout Lily. Mt (GA): moist forests; rare. Ne. TN and nc. TN south to extreme se. TN, nw. GA, and nc. AL. [= FNA, GW, K, Y, Z; *E. americanum* -- S, in part]

Erythronium umbilicatum Parks & Hardin ssp. **monostolum** Parks & Hardin, Southern Appalachian Trout Lily. Mt (NC): high elevation coves, slopes, and grassy balds; uncommon. March-May; April-June. Ssp. *monostolum* is endemic to the high mountains of NC and TN. It approaches the VA border and should be sought, especially in the Grayson Highlands area. *E. umbilicatum* ssp. *monostolum* is a diploid ($2n = 24$). [= FNA, GW, K, Y, Z; *E. americanum* -- RAB, F, G, S, in part; *E. umbilicatum* -- C, W, in part, infraspecific taxa not distinguished]

Erythronium umbilicatum Parks & Hardin ssp. **umbilicatum**, Dimpled Trout Lily. Mt, Pd, Cp (GA, NC, SC, VA): moist bottomland or slope forests, or in rather dry upland habitats; common. February-April (May?); April-June. VA and e. WV south through NC, SC, and e. TN to c. GA, e. AL, and panhandle FL. *E. umbilicatum* ssp. *umbilicatum* is a diploid ($2n = 24$). Mathew (1992) suggests the possibility that an earlier name, *E. nuttallianum* Roemer & Schultes, may apply to this taxon; the two locations mentioned on the type, Pennsylvania and Albany, NY, are outside the known range of the species, however. [= FNA, GW, K, Y, Z; *E. americanum* -- RAB, F, G, S, in part; *E. umbilicatum* -- C, W, in part, infraspecific taxa not distinguished]

Erythronium rostratum W. Wolf, Beaked Trout Lily, ranges from c. TN, MO, and se. KS, south to c. AL, wc. LA, and se. OK. [= FNA, GW, K, Y, Z; *E. americanum* -- S, in part]

Lilium Linnaeus 1753 (Lily)

A genus of about 110 species, of temperate northern hemisphere (especially e. Asia). Many taxonomic problems remain in this genus of showy ornamentals. References: Adams & Dress (1982)=Z; Skinner & Sorrie (2002)=X; Wherry (1946)=Y; Skinner in FNA (2002a); Henry (1946); Tamura in Kubitzki (1998a).

- 1 Dark bulblets produced in many leaf axils; [plant an escaped exotic] **L. lancifolium**
- 1 Dark bulblets never produced; [plant a native, though some species also cultivated].
 - 2 Flowers erect, facing upwards; tepals clawed.
 - 3 Leaves (at least some of them) whorled or verticillate; [plants of the Mountains] **L. philadelphicum** var. **philadelphicum**
 - 3 Leaves all alternate; [plants of the Coastal Plain] **L. catesbaei**
 - 2 Flowers nodding or declined, facing downwards or to the side; tepals narrowed to the base, but not clawed.
 - 4 Leaves smooth on the margins and veins below, or minutely crenulate with scattered to moderately dense translucent papillae (at $10\times$ or more), these rounded and broader than tall (if present).
 - 5 Leaves oblanceolate to obovate, thick in texture (subcoriaceous); inflorescence an umbel of 1-4 (rarely more) flowers; flowering plants 0.4-1.5 m tall; leaves alternate and whorled, often as many as $1/2$ or more of the nodes bearing a single leaf **L. michauxii**
 - 5 Leaves lanceolate, thin in texture; inflorescence a raceme of (1-) 3-30 (-70) flowers; flowering plants 1-3 m tall; leaves mostly whorled, only a few of the lowermost and/or uppermost nodes bearing a single leaf **L. superbum**
 - 4 Leaves densely papillose-scabrid on the margins and usually also the veins beneath (at $10\times$ or more), the papillae elongate (taller than broad).
 - 6 Leaves mostly alternate (the majority of nodes with a single leaf), typically with 1-3 (-5) whorls mid-stem, the remainder of the leaves alternate; plants with both bulbs and rhizomes; tepals recurved $180-360$ degrees from the flower axis; inner tepals (petals) $1.25-1.5\times$ as wide as the outer tepals (sepals); [plants of sphagnum sandhill seepage bogs of the upper Coastal Plain] **L. pyrophilum**
 - 6 Leaves mostly whorled (the majority of nodes with whorls of leaves, typically with 5-15 whorls, sometimes with several alternate leaves at the very bottom and top of the stem; plants with bulbs only; tepals recurved $25-90$ degrees from the flower axis; inner tepals (petals) ca. $1\times$ as wide as the outer tepals (sepals); [plants of various moist to wet habitats of the Mountains, occasionally cultivated and escaped elsewhere].
 - 7 Anthers 5-15 mm long; filaments strongly outcurved, the anthers borne far apart; tepals strongly recurved, usually more than 150 degrees from the axis of the individual flower; [west of the Blue Ridge, in our area in nw. GA and also approaching our area in e. TN] **L. michiganense**
 - 7 Anthers 4-10 mm long; filaments straight or nearly so, the anthers thus borne close together; tepals slightly to moderately recurved, from $10-120$ degrees from the axis of the individual flower; [plants fairly widespread in the Mountains and Piedmont in our area, westwards and northwards].
 - 8 Flowers 3-4 cm in diameter; pistil 3-4 cm long; tepals 3-5.5 cm long, deep red, mucronate by

- extension of the midrib, reflexed less than 45 degrees from the flower axis, the terminal third of the tepals generally gently incurved; anthers 4-6 mm long, completely included within the perianth when viewed from the side **L. grayi**
- 8 Flowers 4.5-9 cm in diameter; pistil 4-6 cm long; tepals 6-8 cm long, yellow, orange to brick-red, acuminate, reflexed 60-120 degrees from the flower axis; anthers 5-10 mm long, exserted to fully included within the perianth when viewed from the side.
- 9 Perianth yellow (rarely orange to red); mid-cauline leaves 5-10× as long as wide **L. canadense** var. **canadense**
- 9 Perianth orange to red; mid-cauline leaves 2-5× as long as wide . **L. canadense** var. **editorum**

Lilium canadense Linnaeus var. **canadense**, Yellow Canada Lily. Mt (NC, VA): wet meadows; uncommon (NC Rare). June-July; late July-September. Apparently ranging from New Brunswick to NC, mostly east of or in the Appalachians; the range is obscured by different interpretations of var. *canadense* and var. *editorum*, by spread from cultivation, and by collections of cultivated plants not clearly so indicated. Some of our plants are definitely var. *canadense*. [= F; *L. canadense* -- RAB, C, FNA, G, GW, S, in part, infraspecific taxa not recognized; *L. canadense* ssp. *canadense* -- K, W, Z; *L. canadense* ssp. *typicum* -- Y]

Lilium canadense Linnaeus var. **editorum** Fernald, Red Canada Lily. Mt, Pd (GA, NC, SC, VA): wet meadows, forest openings; uncommon (GA Special Concern, NC Rare, SC Rare). June-July; late July-September. According to Adams & Dress (1982), who emphasize tepal color in distinguishing the infraspecific taxa, ranging from New Brunswick west to s. Ontario, south (mostly in and west of the Appalachians) to n. GA and n. AL. Wherry (1946) and F emphasize leaf shape, and secondarily flower color, restricting var. *editorum* to a range from PA west to s. IN, south to AL. There has been considerable confusion between *L. canadense* var. *editorum* and *L. grayi*, and populations in sw. VA appear to show some intergradation between the two. [= F; *L. canadense* -- RAB, C, FNA, G, GW, S, in part, infraspecific taxa not distinguished; *L. canadense* ssp. *editorum* (Fernald) Wherry -- K, W, Y, Z]

Lilium catesbaei Walter, Pine Lily, Catesby's Lily, Leopard Lily. Cp (GA, NC, SC, VA): pine savannas sandhill seeps; uncommon (VA Rare). Mid June-mid September; September-November. Se. NC south to FL and west to LA, on the Coastal Plain. [= GW, S; *L. catesbaei* var. *catesbaei* -- RAB; *L. catesbaei* var. *longii* Fernald -- RAB, C, F, G; *L. catesbaei* -- GW, S, infraspecific taxa not distinguished; *L. catesbaei* ssp. *catesbaei* -- K; *L. catesbaei* ssp. *longii* (Fernald) Wherry -- Y; *L. catesbaei* ssp. *typicum* -- Y]

Lilium grayi S. Watson, Gray's Lily, Roan Lily. Mt (NC, VA): bogs, seepages, grassy balds, moist forests, and wet meadows, at medium to high elevations; rare (US Species of Concern, NC Threatened, VA Rare). June-July; August-September. A Southern Appalachian endemic: sw. VA, nw. NC, and ne. TN. Clearly related to *L. canadense* (especially through the somewhat intermediate *L. canadense* var. *editorum*), *L. grayi* appears to be adapted for pollination by Ruby-throated Hummingbirds (Adams & Dress 1982). See *L. canadense* var. *editorum* for additional comments. The two most important strongholds for this rare lily (each with thousands of individuals) are the Roan Mountain massif (Avery and Mitchell counties, NC and Carter County, TN), where it was first found, and Long Hope Valley (Watauga and Ashe counties, NC). Otherwise, it tends to occur in very small, isolated populations in bogs, wet pastures, and seeps. In addition to the characters in the key, *L. grayi* can be distinguished in sterile condition from the 2 more common species of the Mountains by leaves, which are widest near the midpoint, typically 4-6× as long as wide (vs. distinctly wider towards the apex in *L. michauxii*, and widest near the midpoint but typically 10× or more as long as wide in *L. superbum*). Certainly one of our most beautiful wild plants! [= RAB, C, F, G, K, S, W, Y, Z]

* **Lilium lancifolium** Thunberg, Tiger Lily. Pd (NC, VA): disturbed areas, trash heaps; rare, introduced from Asia. The more familiar name, *L. tigrinum*, must be rejected in favor of the older *L. lancifolium* (Ingram 1968). [= C, FNA, K; *L. tigrinum* Ker-Gawler -- F, G]

Lilium michauxii Poiret, Carolina Lily. Mt, Pd, Cp (GA, NC, SC, VA): dry upland forests, ridges, slopes, and ridges; common (uncommon in Coastal Plain). July-August; September-October. S. VA, e. TN, n. AL, c. MS, and e. LA south to s. SC, panhandle FL, s. AL, s. MS, and s. LA. [= C, F, FNA, G, GW, K, W, X, Y, Z; *L. michauxii* -- RAB, in part only (also see *L. iridollae*); *L. carolinianum* Michaux -- S]

Lilium michiganense Farwell, Michigan Lily. Mt (GA): wet prairies and calcareous flatwoods; rare (GA Special Concern). Ontario and MN south to e. TN, KY, nw. GA, AL, AR, and e. OK. [= C, F, FNA, K; *L. superbum* -- G, in part; *L. canadense* Linnaeus ssp. *michiganense* (Farwell) Boivin & Cody]

Lilium philadelphicum Linnaeus var. **philadelphicum**, Wood Lily. Mt (GA, NC, VA): grassy balds, moist to wet meadows (especially in thin soils over rock), open woodlands; rare (GA Special Concern, NC Rare, VA Watch List). June-July; August-October. The species ranges from ME west to British Columbia, south to NC, nw. GA (Jones & Coile 1988), KY, IL, IA, NE, and NM. Var. *philadelphicum*, distinguished by the leaves whorled at 3-6 nodes, 10-15 (-25) mm wide, the capsule 2.5-3.5 (-5) cm long, is eastern and mainly Appalachian, ranging from ME and s. Ontario south to NC, GA, and KY. Var. *andinum* (Nuttall) Ker-Gawler, distinguished by the leaves whorled at 1-2 nodes, 3-10 mm wide, the capsule 4-8 cm long, is western, ranging from OH, MN, and British Columbia south to NM. [= C, F, G, K; *L. philadelphicum* -- RAB, FNA, S, W, no infraspecific taxa recognized; *L. philadelphicum* ssp. *philadelphicum* -- Y]

Lilium pyrophilum M.W. Skinner & Sorrie, Sandhills Bog Lily. Cp (NC, SC, VA): peaty seepage bogs in the Sandhills and peaty swamp margins in the upper Coastal Plain; rare (US Species of Concern, NC Rare). See Skinner & Sorrie (2002) for detailed information on this species. Superficially, this plant is somewhat similar to *L. michauxii*, in its one to several, nodding flowers with recurved tepals, relatively few whorls of leaves, and relatively few leaves per whorl. In addition to the character used in the key, this plant differs from *L. michauxii* in the following ways: flowers not fragrant or only slightly so (vs. flowers strongly fragrant), leaves generally widest near the middle (vs. widest towards the tip), leaves only slightly paler below and lacking a pronounced waxy sheen (vs. leaves strongly bicolored, the lower surface much paler and with a waxy sheen), and habitat in sphagnum, peaty bogs (vs. in xeric to mesic, sandy to loamy soils). [= FNA, X; *L. michauxii* -- RAB, in part (misapplied to these plants); *L. iridollae* M.G. Henry --

K, misapplied]

Lilium superbum Linnaeus, Turk's-cap Lily, Lily-royal. Mt (GA, NC, VA), Pd (GA, NC, VA), Cp (GA, NC, SC, VA): cove forests and moist forests, moist ravines, blackwater stream swamps; common (rare in Piedmont, rare in NC Coastal Plain). July-August; September-October. MA and s. NY south to ne. NC, panhandle FL, and c. MS, southwards primarily in the Appalachians, but extending across the Piedmont to the Coastal Plain of VA and ne. NC, and with a similarly odd extension south of the southern terminus of the Appalachians into the Coastal Plain of GA, w. FL, AL, and MS. The plants of blackwater swamps of se. VA and ne. NC are very narrow-leaved and yellow-tipped; this form, atypical in habitat, range, and morphology has been referred to as "*Lilium* species 1" (Weakley 1993). Further study is needed to determine whether it is a distinct taxon (species, or variety of *L. superbum*) or only a form. [= C, F, FNA, GW, K, S, W, X, Y, Z; *L. superbum* -- G, in a broader sense (including *L. michiganense*)]

Lilium formosanum A. Wallace, Formosa Lily, is introduced at various locations in the Southeast, including Florida and Louisiana (Kartesz 1999), and has been documented from Richmond Co. NC (Sorrie, pers. comm.). [= FNA, K] {not yet keyed}

Medeola Linnaeus 1753 (Indian Cucumber-root)

A monotypic genus, an herb of eastern North America. References: Utech in FNA (2002a); Tamura in Kubitzki (1998a).

Medeola virginiana Linnaeus, Indian Cucumber-root. Mt, Pd, Cp (NC, SC, VA): moist forests, usually with acidic soils; common. Mid April-mid June; September-October. Ranging from Quebec and Ontario west to MN, south to GA, panhandle FL and LA. The tuber is white, crisp, tasting cucumber-like, usually about 5 cm long and 5 mm in diameter. *Medeola* is sometimes mistaken (when sterile) for *Isotria*; *Medeola* has a wiry stem, floccose-pubescent, *Isotria* a fleshy, glabrous stem. Flowering plants have a second, smaller whorl of leaves; the flowers are borne on recurved pedicels beneath the top whorl of leaves. In fruit, however, the pedicels are ascending or erect, bringing the fruits above the top whorl. When the berries are ripe, the leaves of the upper whorl become scarlet at the base, presumably acting as an attractant to animals. [= RAB, C, F, FNA, G, GW, K, S, W]

Prosartes D. Don 1839 (Fairybells, Mandarin)

A genus of 6 species, of temperate e. North America, w. North America, and e. Asia. Dahlgren, Clifford, & Yeo (1985) suggest that American species of *Disporum* are generically distinct from Asiatic species and should be segregated in the genus *Prosartes*, a distinction made as long ago as 1839. Asian *Disporum* species lack the distinctly reticulate venation of our plants, have strictly glabrous foliage (vs. pubescent), have spurred tepals (vs. unspurred), blue or black berries (vs. red or straw-colored), tripartite stigma (vs. not), and other differences (Jones 1951). Further study of generic limits by Shinwari et al. (1994) shows that the separation into *Prosartes* of the American species often assigned to *Disporum* is clearly warranted, based on morphological and karyological grounds. *Prosartes* is much more closely related to *Streptopus* than to (Asian) *Disporum*; (Asian) *Disporum* is more closely related to *Uvularia*. References: Johnson (1968)=Z; Shinwari et al. (1994)=Y; Jones (1951); Tamura, Utech, & Kawano (1992); Shinwari et al. (1994)=X; Utech in FNA (2002a); Tamura in Kubitzki (1998a).

- 1 Fruit glabrous, ellipsoid, weakly triangular in cross-section, the surface smooth and shiny, red when ripe; tepals greenish, unspotted; leaves relatively many, small, and moderately spreading relative to the stem; leaf glabrous on the surface above (except for sparsely pubescent on the midrib and main veins), densely pubescent on the midrib below, sparsely pubescent on the surface below; leaf pubescence weak, often twisted or curled apically (as seen at 10-20×), the leaf therefore very soft to the touch ***P. lanuginosa***
- 1 Fruit pubescent, strongly 3-lobed (or 1- or 2-lobed by abortion), the surface textured and dull, whitish-tan when ripe; tepals whitish, spotted with purple; leaves relatively few, large, and widely spreading relative to the stem; leaf sparsely pubescent on the surface and veins above and below; leaf pubescence stiff, generally straight and perpendicular to the surface (as seen at 10-20×), the leaf therefore slightly rough to the touch ***P. maculata***

Prosartes lanuginosa (Michaux) D. Don, Yellow Mandarin, Yellow Fairybells. Mt (GA, NC, SC, VA), Pd (VA): deciduous forests, especially coves; common. April-May; August-September. Primarily an Appalachian species, ranging from NY and s. Ontario south to n. GA (Jones & Coile 1988) and AL. [= FNA, K, X, Y; *Disporum lanuginosum* (Michaux) Nicholson -- RAB, C, F, G, S, W, Z]

Prosartes maculata (Buckley) A. Gray, Spotted Mandarin, Nodding Mandarin. Mt (GA, NC, VA): nutrient-rich deciduous forests, especially cove forests; rare (NC Watch List, VA Rare). April-May; July-August. This species occurs primarily to the west of NC, known from AL, n. GA, KY, MI, w. NC, OH, TN, w. VA, and WV; its distribution is rather fragmented, and the species is considered rare or uncommon in every state in its range. The fruits are more reminiscent of *Uvularia* than of *Prosartes lanuginosa*. [= FNA, K, X, Y; *Disporum maculatum* (Buckley) Britton -- RAB, C, F, G, S, W, Z]

Streptopus Michaux 1803 (Twisted-stalk)

A genus of about 7 species, temperate to subarctic in Europe, e. Asia, and North America. References: Utech in FNA (2002a); Fassett (1935)=Z; Tamura in Kubitzki (1998a).

- 1 Leaf margins and nodes not coarsely ciliate; leaves strongly cordate-clasping; fruit ellipsoid ***S. amplexifolius* var. *amplexifolius***
- 1 Leaf margins and nodes coarsely ciliate; leaves sessile to somewhat cordate-clasping (especially the lower leaves of robust individuals); fruit globose ***S. lanceolatus* var. *lanceolatus***

Streptopus amplexifolius (Linnaeus) Augustin de Candolle var. ***amplexifolius***, White Mandarin, Pagoda-bells. Mt (NC, VA): moist forests and seepages at high elevations; rare (NC Rare, VA Rare). Late April-early June; late July-September. The species is circumboreal, the range fragmented. Fassett recognized seven varieties, the plants in our area being var. *americanus*. The species ranges from Greenland and Labrador to MN, south (in the mountains and disjunctly) to NC, and in the west from AK (and Kamchatka) south to NM and AZ, in Japan, and in the Alps in Europe. [= K; *S. amplexifolius* -- RAB, FNA, W, infraspecific taxa not distinguished; *S. amplexifolius* var. *americanus* J.A. & J.H. Schultes -- C, F, G, Z; *Tortipes amplexifolius* (Linnaeus) Small -- S]

Streptopus lanceolatus (Aiton) Reveal var. ***lanceolatus***, Eastern Rose Mandarin, Eastern Twisted-stalk. Mt (GA, NC, VA): moist forests at high elevations; uncommon (GA Rare). Late April-early June; late July-September. Fassett (1935) recognized four varieties in *S. roseus*. Reveal (1993) determined that the correct name for the species widely known as *S. roseus* is *S. lanceolatus* (Aiton) Reveal, and he transferred Fassett's varieties. Fassett (and Reveal) considered *S. lanceolatus* var. *lanceolatus* [*S. roseus* var. *perspectus* Fassett] to range from s. Labrador west to MI, south to NJ and PA, and in the mountains to w. NC, e. TN, and ne. GA (Jones & Coile 1988). *S. lanceolatus* var. *longipes* (Fernald) Reveal [*S. roseus* var. *longipes* (Fernald) Fassett] is midwestern, from s. Ontario and nw. PA west to MI, WI, MN, and s. Manitoba. Var. *curvipes* (Vail) Fassett is western, ranging from AK to se. British Columbia and nw. OR. Var. *roseus* was considered to be a Southern Appalachian endemic, differing from var. *perspectus* only in having the pedicel-peduncles entirely glabrous (vs. ciliate with few to many multicellular hairs). The number of hairs on the peduncles varies constantly, and recognition of two varieties in e. North America does not appear warranted; all of our material is then *S. lanceolatus* var. *lanceolatus* [*S. roseus* var. *roseus* (in a broader sense)], which does differ significantly from the more western varieties. [= K; *S. roseus* -- RAB, S, W, infraspecific taxa not distinguished; *S. roseus* var. *roseus* -- C, F, G, K, Z, in a narrow sense; *S. roseus* var. *perspectus* Fassett -- C, F, G, Z; *S. lanceolatus* -- FNA, infraspecific taxa not distinguished; *S. lanceolatus* var. *roseus* (Michaux) Reveal -- K]

***Tricyrtis* Wallich 1826 (Toadlily)**

A genus of about 18 species, of e. Asia. References: Tamura in Kubitzki (1998a).

Tricyrtis hirta (Thunberg) Hooker, Toadlily, native of e. Asia, is cultivated as an ornamental and may escape or persist, as in se. PA (Rhoads & Klein 1993). [= K]

***Tulipa* Linnaeus 1753 (Tulip)**

A genus of about 150 species, of temperate Eurasia (especially w. and c. Asia). References: Tamura in Kubitzki (1998a); Straley & Utech in FNA (2002a).

Tulipa sylvestris Linnaeus, Tulip, Dutch-lily, is very commonly cultivated and is "occasionally naturalized in moist meadows, fields and roadsides" in se. PA (Rhoads & Klein 1993) and MD (Kartesz 1999). [= FNA, K]

MARANTACEAE Petersen in Engler & Prantl 1888 (Arrowroot Family)

A family of about 31 genera and 550 species, herbs and vines, nearly pantropical (absent from Australia), and rarely extending into subtropical and warm temperate regions. References: Kennedy in FNA (2000); Andersson in Kubitzki (1998b).

***Thalia* Linnaeus 1753 (Thalia)**

A genus of 6-7 species, in subtropical and tropical America. References: Kennedy in FNA (2000); Andersson in Kubitzki (1998b).

Thalia dealbata Fraser ex Roscoe, Powdery Thalia. Cp (GA, SC): swamp forests, wet ditches, brackish marshes; rare (GA Rare). May-September; June-October. Ne. SC south to FL, west to TX and OK. [= RAB, FNA, GW, K, S]

MAYACACEAE Kunth 1840 (Bogmoss Family)

A family of a single genus and 4-10 species, of tropical to warm-temperate America and Africa. References: Faden in FNA (2000); Stevenson in Kubitzki (1998b).

***Mayaca* Aublet 1775 (Bogmoss)**

A genus of 4-10 species, of tropical to warm-temperate America and Africa. References: Faden in FNA (2000); Stevenson in Kubitzki (1998b).

Mayaca fluviatilis Aublet, Bogmoss. Cp (NC, SC): marshes, streams, swamp forests, shores of natural lakes, seepage areas, in saturated soil or variously submersed; common. May-July. Ranging from se. NC south to FL, west to se. TX; apparently also in tropical America. The two species previously recognized appear to be only different growth forms, induced by different hydrologic conditions; the matter needs additional study. [= RAB, FNA, GW, K, S; *M. aubletii* Michaux -- RAB, S]

MELANTHIACEAE Batsch 1802 (Bunchflower Family)

A family of about 16 genera and 170 species, mostly temperate and northern hemisphere, but extending into South America. Further modifications of the circumscription of the Melanthiaceae (and re-assignments of genera) are needed; see Zomlefer et al. (2001). References: Dahlgren, Clifford, & Yeo (1985); Zomlefer (1997a, 1999)=Z; Zomlefer (1996, 2003); Tamura in Kubitzki (1998a); Zomlefer et al. (2001).

- 1 Leaves 3, whorled at the summit of the stem ***Trillium***
- 1 Leaves many, not whorled at the summit of the stem.
 - 2 Leaves 1-2 mm wide, linear, stiff, sclerified ***Xerophyllum***
 - 2 Leaves 3-150 mm wide, linear, obovate, or oblanceolate.
 - 3 Flowers pink ***Helonias***
 - 3 Flowers white, cream or yellowish

Chamaelirium
Schoenocaulon
Veratrum
Zigadenus
Anticlea
Amianthium
Stenanthium

Amianthium A. Gray 1837 (Fly-poison)

A monotypic genus, an herb of temperate e. North America. Zomlefer et al. (2001) confirm that *Amianthium* should be treated as a monotypic genus. *Amianthium* has a chromosome number of $2n=32$ (Zomlefer & Smith 2002). Like *Zigadenus*, containing very toxic alkaloids. References: Zomlefer (1997)=Z; Zomlefer & Judd (2002)=Y; Utech in FNA (2002a); Tamura in Kubitzki (1998a).

Amianthium muscivomicum (Walter) A. Gray, Fly-poison. Mt, Pd, Cp (GA, NC, SC, VA): mesic forests, pine savannas, meadows; common. May-July; July-September. S. NY, PA, MO, and OK, south to panhandle FL, MS, and AR. [= FNA, K, Y; *A. muscaetoxicum* -- RAB, C, F, FNA, G, GW, W (an orthographic variant); *Chrosperma muscaetoxicum* (Walter) Kuntze -- S; *Zigadenus muscivomicus* (Walter) Regel -- Z]

Anticlea Kunth 1843 (Death-camas)

Anticlea has a chromosome number of $2n=32$ (Zomlefer & Smith 2002). References: Zomlefer & Judd (2002)=Y; Zomlefer et al. (2001); Schwartz in FNA (2002a).

Anticlea glauca Kunth, White Death-camas. Mt (NC, VA): limestone and dolostone woodlands, glades, cliffs, and outcrops; rare (NC Rare, VA Watch List). July-August; September-October. *A. glauca* is the more eastern component of a complex variously treated as two species or a single variable species, with or without recognized varieties or subspecies. *A. elegans* (in the broadest sense) ranges from Québec and NY west to AK, south to n. OH, n. IN, n. IL, MO, IA, NM, AZ, and n. Mexico; disjunct in the mountains of VA and NC. Two taxa have often been recognized, at the specific, subspecific, or varietal level. The more eastern taxon (epithet "*glauca*" -- see synonymy below) ranges from New Brunswick west to ND, south to NC, TN, and MO, and is distinguished by glaucous foliage, paniculate inflorescence, and tepals often purplish or brownish basally. The more western taxon (epithet "*elegans*"), occurring east to the MN and MO, has the foliage greener, the inflorescence often only racemose, and the tepals yellow. [*Anticlea elegans* (Pursh) Rydberg -- Y; *Zigadenus elegans* Pursh ssp. *glaucus* (Nuttall) Hultén -- K; *Z. glaucus* Nuttall -- RAB, W, Z; *Z. elegans* var. *glaucus* (Nuttall) Preece -- C; *Z. elegans* -- FNA, infraspecific taxa not distinguished; *Zygadenus glaucus* -- G (an orthographic variant); *Anticlea chlorantha* (Richardson) Rydberg -- S]

Chamaelirium Willdenow 1808 (Devil's-bit)

A monotypic genus, an herb of temperate e. North America. References: Zomlefer (1997)=Z; Tamura in Kubitzki (1998a); Utech in

FNA (2002a).

Chamaelirium luteum (Linnaeus) A. Gray, Devil's-bit. Mt, Pd, Cp (GA, NC, SC, VA): moist slopes, bottomlands, wet savannas; common (rare in Coastal Plain). March-May; September-November. Ranging from MA west to Ontario, OH, s. IN, and AR, south to FL and LA. The ecological amplitude and morphologic variability of this species is surprising; it needs additional, more careful, study. *Ch. obovale* Small (or other previously unnamed entities) may warrant recognition at some level. [= RAB, C, F, FNA, G, GW, K, S, W, Z; *Ch. obovale* Small -- S]

Helonias Linnaeus 1753 (Swamp Pink)

A monotypic genus, an herb of temperate e. North America. Although *Helonias* has traditionally been considered a monotypic genus, Takahashi & Kawano (1989) have suggested that the closely related *Heloniopsis* and *Ypsilandra* (both of e. Asia) may be congeneric. References: Zomlefer (1997)=Z; Utech in FNA (2002a); Tamura in Kubitzki (1998a).

Helonias bullata Linnaeus, Swamp Pink. Mt (GA, NC, SC, VA), Cp (VA): bogs, usually under dense shrubs in peaty soils, in the VA Coastal Plain in acidic sandy seepage swamps; rare (US Threatened, GA Threatened, NC Threatened, SC Rare, VA Endangered). April-May; June-July. *H. bullata* ranges from s. NY and NJ to e. VA on the Coastal Plain, and from w. VA through w. NC to nw. SC and ne. GA (Jones & Coile 1988) in the Blue Ridge Mountains. The flowering scape elongates markedly in fruit, reaching 1 m in height. [= RAB, C, F, FNA, GW, G, K, S, W, Z]

Melanthium Linnaeus 1753 (Bunchflower)
(see *Veratrum*)

Schoenocaulon A. Gray 1837 (Feathershank)

A genus of about 10 species of s. North America, Central America, and n. South America. *Schoenocaulon* has a chromosome number of $2n=16$ (Zomlefer & Smith 2002). References: Tamura in Kubitzki (1998a); Frame in FNA (2002a).

Schoenocaulon dubium (Michaux) Small, Florida Feathershank. Cp (GA): dry pine savannas, sandhills; rare (GA Special Concern). S. GA south to peninsular FL. [= FNA, K, S]

Stenanthium (A. Gray) Kunth 1843 (Featherbells, Featherfleece)

A genus of about 4 species, herbs of North America and e. Asia. *Stenanthium*, as redefined by Zomlefer & Judd (2002), has a chromosome number of $2n=20$ (Zomlefer & Smith 2002). References: Zomlefer & Judd (2002)=Y; Zomlefer (1997)=Z; Utech in FNA (2002a); Schwartz in FNA (2002a); Tamura in Kubitzki (1998a). Key adapted in part from F, the taxa and key needing evaluation and (probably) alteration.

- 1 Tepals obovate, the tip rounded-obtuse.
 - 2 Inflorescence a raceme; flowers all bisexual; plants 3-10 dm tall; flowering April-early June; [plants (in our area) of the Coastal Plain] **S. densum**
 - 2 Inflorescence a panicle of racemes; lower flowers of the inflorescence branches bisexual and fertile, the upper staminate or superficially perfect but the pistils nonfunctional (not producing fruits); plants 5-20 dm tall; flowering July-August; [plants (in our area) of the Mountains] **S. leimanthoides**
- 1 Tepals lanceolate, the tip acute-acuminate.
 - 3 Larger leaves to 30 mm wide, thin and membranous-translucent, not strongly ribbed; panicle dense, the branches stiffly ascending, the flowers crowded; perianth 5-10 mm long, greenish; capsules oblong or subcylindric, 9-10 mm long, erect; seeds 5-8 mm long; leaves distributed all along the stem, nearly as dense just below the panicle as at the base; plant to 2.2 m tall and the stem to 2 cm in diameter near its base; [plants of bogs and wet meadows] **S. gramineum** var. **robustum**
 - 3 Larger leaves to 15 mm wide, firm to coriaceous, strongly ribbed; panicle diffuse, the branches ascending, spreading, or drooping, the flowers scattered; perianth 3-8 (-10) mm long, whitish; capsules ovoid to urceolate, 6-9 mm long, deflexed; seeds 5-5.5 mm long; leaves mainly near the base, rapidly reduced upwards; plant to 1.9 m tall and the stem to 1 cm in diameter near its base; [plants of dry to moist upland forests].
 - 4 Perianth 5-10 mm long; plant to 1.9 m tall, the stem 4-10 mm in diameter near the base **S. gramineum** var. **gramineum**
 - 4 Perianth 3-4.5 (-5.0) mm long; plant to 1.0 m tall, the stem 1.5-5 mm in diameter near the base **S. gramineum** var. **micranthum**

Stenanthium densum (Desrousseaux) Zomlefer & Judd, Crow-poison. Cp (GA, NC, SC, VA): pine savannas, pine flatwoods; common, rare in VA (VA Rare). April-early June; late May-July. Se. VA south to FL and west to se. TX, on the Coastal

Plain. See *Z. leimanthoides* for discussion of the taxonomy of the 2 species. *Z. densus* is superficially very similar to *Amianthium muscitoxicum*; *Z. densus* has a conical capsule, 2× or more as long as broad (vs. about 1× as long as broad), a bladeless purple sheath, 3-8 cm long, enclosing the leaves at the base (vs. sheath absent, all leaves with blades), and basal leaves usually 1-3 in number, 3-6 (-10) mm wide (vs. mostly 4 or more in number, mostly 7-10 mm wide). [= Y; *Zigadenus densus* (Desrousseaux) Fernald -- RAB, C, GW, K, Z; *Zigadenus densus* (Desrousseaux) Fernald -- FNA, in a broad sense; *Zygadenus densus* -- G (an orthographic variant); *Tracyanthus angustifolius* (Michaux) Small -- S]

Stenanthium gramineum (Ker-Gawler) Morong var. ***gramineum***, Common Featherbells. Cp, Pd (GA, NC, VA), Mt (NC): moist forests, grassy balds, to 1700m in elevation; uncommon. July-early September; August-October. PA west to IL and MO, south to ne. NC, panhandle FL, and TX. [= F, K; *S. gramineum* -- RAB, C, FNA, G, S, W, Z, infraspecific taxa not distinguished]

Stenanthium gramineum (Ker-Gawler) Morong var. ***micranthum*** Fernald, Small Featherbells. Mt (GA, NC, SC, VA), Pd (GA, NC, VA): dry upland forests and woodlands; uncommon. July-early September; August-October. W. VA and TN south to panhandle FL and n. AL. [= F, K; *S. gramineum* -- RAB, C, FNA, G, S, W, Z, infraspecific taxa not distinguished]

Stenanthium gramineum (Ker-Gawler) Morong var. ***robustum*** (S. Watson) Fernald, Giant Featherbells, Bog Featherbells. Mt (NC, VA?): wet meadows, bogs; rare (NC Watch List). July-early September; August-October. PA south to w. NC. [= F, K; *S. robustum* S. Watson -- S; *S. gramineum* -- RAB, C, FNA, G, W, Z, infraspecific taxa not distinguished]

Stenanthium leimanthoides (A. Gray) Zomlefer & Judd, Pinebarrens Death-camas. Mt (NC, VA), Cp (GA): high elevation rock outcrops, shrub balds, seepage areas at high elevations, in the Coastal Plain in sandhill bogs and wet pine savannas; rare (GA Special Concern, NC Rare, VA Rare). July-August; September-October. As currently interpreted, with a peculiar and disjunct range, occurring on the Coastal Plain of se. NY (Long Island), NJ, and DE, in the mountains from WV and VA south through w. NC to (allegedly) AL, and on the Gulf Coastal Plain, from s. GA to LA. Unpublished studies involving (primarily) Gulf Coast populations of *S. leimanthoides* have questioned its distinctness from *S. densum*. Our plants seem very distinct in many ways. Perhaps inflorescence characters do not reliably distinguish the 2 taxa and so-called *S. leimanthoides* of the Gulf Coast is a paniculate form of *Z. densus* (the real distinguishing characters not at present clear). *S. leimanthoides* in the east follows much the same phytogeographic patterns as *Leiophyllum buxifolium* and *Xerophyllum asphodeloides*; the 3 species occurring together in the Pine Barrens of the s. NJ Coastal Plain and at 1900 m elevation on the summit of Grandfather Mountain, Avery County, NC! [= Y; *Zigadenus leimanthoides* A. Gray -- RAB, C, GW, K, W, Z; *Zigadenus densus* (Desrousseaux) Fernald -- FNA, in a broad sense; *Zygadenus leimanthoides* -- G (an orthographic variant); *Oceanoros leimanthoides* (A. Gray) Small -- S]

***Trillium* Linnaeus 1753 (Trillium, Toadshade, Wake-robin)**

A genus of about 50 species, of e. North America, w. North America, and e. Asia (especially se. North America). The genus *Trillium* in our area is difficult and complex. *Trillium* is now usually separated from the Liliaceae (along with Eurasian genera such as *Paris*) into the Trilliaceae (Zomlefer 1996, Kato et al. 1995, Kawano & Kato 1995, and others) or less drastically as part of the Melanthiaceae (Chase et al. 2000). The traditional division of the genus into two well-marked subgenera, subgenus *Trillium*, the pedicellate trilliums, and subgenus *Phyllantherum*, the sessile-flowered trilliums, has been partly supported by molecular and morphological phylogenetic studies (Kawano & Kato 1995, Kato et al. 1995). These studies support the monophyly of subgenus *Phyllantherum*, but suggest that subgenus *Trillium* consists of several groups which are only rather distantly related (Kawano & Kato 1995, Kazempour Osaloo et al. 1999; Farmer & Schilling 2002). Most species are slow-growing perennials; seedlings and juveniles are one-leaved ("monilliums"), recognizable by the similar color, texture and venation of the single leaf to the three leaves of mature plants. In some species, such as *T. pusillum*, individual plants remain in the single-leaf stage for long periods of time, and populations may consist largely of juvenile plants. References: Patrick (1986)=Z; Freeman (1975)=Y; Case & Case 1997=X; Patrick in Wofford (1989); Case in FNA (2002a); Mitchell (1990); Kato et al. (1995); Kawano & Kato (1995); Tamura in Kubitzki (1998a); Zomlefer (1996); Farmer & Schilling (2002). Key adapted from Z, unpublished keys of J.D. Freeman, and other sources.

Identification notes: Teratological forms are frequent in some species, as, for instance, leaves, sepals, and stamens in 2's or 4's, petals sepaloid, or sepals petaloid, and so forth.

- 1 Leaves mottled with 2-3 different shades of green (very rarely the mottling not apparent); flower sessile; [subgenus *Phyllantherum*] **Key A**
- 1 Leaves solid green; flower on a pedicel (the pedicel sometimes very short or essentially absent in *T. pusillum*); [subgenus *Trillium*].
 - 2 Petals relatively thick in texture, straight-margined, maroon or white, rarely yellow or green (if white, turning brown with age); stigmas thicker at base, tapering gradually toward tip, distinct; ovary purple-black, maroon, pink, or white, 6-angled; [*Erectum* group] **Key B**
 - 2 Petals relatively delicate in texture, wavy-margined, white to deep pink (if white, generally fading to pink with age); stigmas thin, uniform in thickness from base to apex, somewhat fused at the base into a short style; ovary greenish-white to white, 3- or 6-angled or -lobed **Key C**

Key A -- trilliums with sessile flowers and mottled leaves (subgenus *Phyllantherum*)

- 1 Scape more-or-less decumbent in a gentle S-shape, the leaves lying on the ground, or nearly so; flower fragrance putrid; [*T. sessile* group].

- 2 Anther dehiscence extrorse (towards the outside of the flower); stamens about 0.25× as long as the petals; upper stem puberulent; petals 4-10 cm long; filaments 2-5 mm long; [plants approaching our area in GA] ***T. decumbens***
- 2 Anther dehiscence introrse (towards the inside of the flower); stamens about 0.5× as long as the petals; upper stem glabrous; petals 2.5-5.5 cm long; filaments 1-2 mm long; [plants known in our area only in sc. SC] ***T. reliquum***
- 1 Scape erect, straight, the leaves borne well above the ground (the leaf tips sometimes nearly touching the ground); flower fragrance various.
 - 3 Sepals abruptly deflexed between and below the leaves, distinctly descending below a horizontal plane; filaments about as long as incurved anthers; [*T. recurvatum* group].
 - 4 Leaves sessile or subsessile, borne in a descending or drooping manner (similar to the sepals); petals usually more than 4× as long as wide ***T. lancifolium***
 - 4 Leaves distinctly petiolate, borne in an ascending manner (strongly contrasting in position with the strongly deflexed sepals); petals usually ca. 2× as long as wide ***T. recurvatum***
 - 3 Sepals erect, ascending, or spreading, usually borne at or above a horizontal plane; filaments much shorter than the upright anthers.
 - 5 Petals spreading to horizontal, with 1-2 spiral twists (looking something like an airplane propellor); anther dehiscence extrorse (towards the outside of the flower); [*T. sessile* group] ***[T. stamineum]***
 - 5 Petals erect to slightly spreading, not spirally twisted; anther dehiscence introrse (towards the outside of the flower), or latrorse (towards the side).
 - 6 Petals broadly spatulate, clawed; petals pale lemon-yellow (the claws greenish or maroon); flower fragrance clove-like; [plants of the Savannah River drainage, from sw. NC southeastwards along the GA-SC border]; [*T. sessile* group] ***T. discolor***
 - 6 Petals lanceolate, elliptic, obovate, or oblanceolate, but not broadly spatulate and distinctly clawed; petals maroon-red, purplish-brown, yellow, or green; flower fragrance various; [plants collectively widespread in our area].
 - 7 Stigmas more than 1.5× as long as the ovary; stamens about 0.5× as long as the petals; anther connectives prominently prolonged into a beak 1.0-5.0 mm long (beyond the anther sacs); [*T. sessile* group] ***T. sessile***
 - 7 Stigmas as long as the ovary or shorter; stamens less than 0.5× as long as the petals; anthers blunt, the connectives extended less than 1.0 mm beyond the anther sacs.
 - 8 Ovary ellipsoid; leaves acute, the margins of the outer 1/3 more or less straight; leaf blade mottled with 3 or more shades of green, the palest shade forming a very conspicuous pale green streak along the midvein; [plants of the Coastal Plain and fall-line area of GA, AL, and FL panhandle]; [*T. sessile* group].
 - 9 Stem 2.5-3× as long as the leaves; petals oblanceolate-obovate, usually 1.5-3× as long as wide ***T. decipiens***
 - 9 Stem 1-2× as long as the leaves; petals narrowly elliptic to oblanceolate-obovate, usually 3-5× as long as wide ***T. underwoodii***
 - 8 Ovary ovoid; leaves acute to acuminate, the margins of the outer 1/3 convex; leaf blade mottled with 2-3 shades of green, paler shades sometimes prominent along the midvein, but not as above; [plants collectively widespread in our area]; [*T. maculatum* group].
 - 10 Ovary 3-angled at base of stigmas (rarely hexagonal); petals narrowly spatulate (appearing clawed), mostly 4.5× or more as long as wide; outer whorl of stamens broader, anther dehiscence introrse ***T. maculatum***
 - 10 Ovary hexagonal or 6-ridged at base of stigmas; petals elliptic-oblanceolate to oblanceolate, mostly less than 4× as long as wide; stamens uniform, anther dehiscence introrse or lateral.
 - 11 Flower fragrance fruity-spicy, like green apples or *Calycanthus* (rarely musky); petals maroon, bronze, green, yellow; portions of ovary and stamens purplish during anthesis ***T. cuneatum***
 - 11 Flower fragrance lemon-like; petals greenish-yellow darkening to yellow; ovary and stamens greenish-white during anthesis ***T. luteum***

Key B -- trilliums with unmottled leaves and pedicellate flowers, of the *Erectum* Group

- 1 Pedicel abruptly declined below the leaves; leaves petiolate to subsessile (or even sessile); petals recurved between the sepals.
 - 2 Stamens far exceeding the pistil, filaments as long as the ovary or longer, at least partly maroon, the anther sacs yellow to maroon; ovary small, globose, 3-12 mm long; flower fragrance pungent, rose-like; pedicel long, 3-13 cm long; petals strongly overlapping, usually maroon (rarely white or whitish) ***T. vaseyi***
 - 2 Stamens at most 1.5× longer than the pistil, filaments shorter than the ovary, white, the anther sacs lavender to vivid purple (or albino); ovary large, ovoid, 10-17 mm long; flower fragrance weak, like green apples; pedicel short, 1.5-3 cm long; petals not strongly overlapping, usually white (rarely maroon).
 - 3 Anthers 7.5 mm long or less, about as long as the filaments or shorter; petals narrowly elliptic to obovate, often scarcely larger than the sepals, delicate, occasionally margined in pink or green; [plants of damp forests south to n. VA] ***T. cernuum***

- 3 Anthers 7.0 mm long or more, longer than the filaments; petals ovate to elliptic, much broader than the sepals; [plants of mesic forests north to n. NC] ***T. rugelii***
- 1 Pedicel inclined, erect or declined (the flower generally borne above the leaves); leaves sessile to subsessile; petals variously disposed, generally spreading in the same plane as the sepals or forming a cup concealing the ovary in side view (then recurved toward the apex).
 - 4 Anthers creamy-white, 2-5× as long as the filaments; ovary white to pink (rarely darker), ovoid (widest near the base); stigmas prominent, nearly as long as the ovary; flower fragrance weakly sweet to musty ***T. flexipes***
 - 4 Anthers creamy-white, yellowish, or purplish, at most 2.2× as long as the filaments; ovary purple-black to maroon (or albino), subglobose; stigmas smaller, less than 0.3× as long as the ovary; flower fragrance variable (see below).
 - 5 Petals lanceolate to narrowly ovate or elliptic, spreading from base in the same plane as the sepals, rarely more than 2× as broad as the sepals; sepals 0.5-0.8× as long as the pedicel. weakly sulcate-tipped (keeled and upturned near apex); flower fragrance unpleasant, musty ***T. erectum***
 - 5 Petals ovate, overlapping in some instances and forming a cup-shaped base, variably recurved apically, more than 2× as broad as the sepals; sepals less than 0.5 as long as the pedicel, sulcate-tipped; fragrance pleasant, sweet to fungal.
 - 6 Sepals 0.4-0.7× as long as the pedicel; leaves broadly elliptic; stamens 1.2-1.8× pistil height; flowers generally large, petals much longer than the sepals; sepals green; petals usually white (rarely maroon); flower fragrance sweet, like green apples; [plants of sw. NC and nw. SC in our area] ***T. simile***
 - 6 Sepals 0.2-0.4× as long as the pedicel; leaves broadly obovate; stamens 0.9-1.6× pistil height; flowers relatively small, petals only slightly longer than the sepals; sepals suffused with purple; petals usually maroon (rarely white); flower fragrance fungal, like fresh mushrooms; [plants of sw. VA and nw. NC in our area] ***T. pulcatum***

Key C -- trilliums with unmottled leaves and pedicellate flowers, of various affinities

- 1 Petals white with triangular red blaze (rarely entirely white or pinkish); anther sacs lavender to white, dehiscence extrorse; fruit a red berry; leaves long-acuminate; [plants of acidic sites in the Mountains, generally strongly associated with either *Pinus*, *Tsuga*, *Picea*, *Rhododendron*, or other heaths] ***T. undulatum***
- 1 Petals white to deep pink, lacking a red blaze; anther sacs yellow, dehiscence introrse; fruit a white to greenish-white, fleshy, irregularly dehiscent capsule; leaves obtuse to acute (or somewhat acuminate in *T. grandiflorum*); [plants of less distinctly acidic sites, collectively widespread in our area].
 - 2 Pedicel declined below the leaves (rarely erect); sepals arcuate-recurved; anthers irregularly twisted outward; pollen egg-yolk yellow ***T. catesbaei***
 - 2 Pedicel inclined above leaves to strictly erect; sepals not arcuate-recurved; anthers erect, regular; pollen light yellow.
 - 3 Sepals about as broad as the petals or broader, obtuse; leaves obtuse; anthers purplish-green between anther sacs; pedicel erect through fruiting.
 - 4 Pedicel 1-4 mm long ***T. pusillum* var. *virginianum***
 - 4 Pedicel 5-30 mm long ***T. pusillum* var. *pusillum***
 - 3 Sepals narrower than the petals, acute; anthers white to greenish-white between the anther sacs; leaves obtuse, acute, or acuminate; pedicel somewhat angled from the vertical.
 - 5 Ovary obscurely 3-lobed; leaves less than 5 cm long, blue-green, obtuse ***T. nivale***
 - 5 Ovary sharply 6-angled (-winged); leaves more than 5 cm long, green, acute to acuminate.
 - 6 Petals obovate, tightly rolled at base, abruptly flared near the apex; leaves broadly elliptic, acuminate; style minute, less than 1.0 mm long ***T. grandiflorum***
 - 6 Petals elliptic, loose, gradually separating; leaves ovate, acute; style conspicuous, more than 1.5 mm long ***T. persistens***

Trillium catesbaei Elliott, Catesby's Trillium, Bashful Trillium, Rosy Wake-robin. Pd, Mt (GA, NC, SC), Cp (GA, NC): bottomland forests, mesic slopes, cove forests; common (uncommon in Mountains). Late March-early June; July-August. Nc. NC south to sw. GA and se. AL, north in the interior to n. AL and se. TN, centered in the Piedmont from NC to GA, but extending into the Mountains and Coastal Plain. Petals white to pink. [= RAB, FNA, K, S, W, X, Z]

Trillium cernuum Linnaeus, Northern Nodding Trillium. Mt (VA): damp forest with *Fraxinus nigra* and *Ulmus americana*; rare (VA Rare). Late April-May. Newfoundland, Hudson Bay area, and se. Saskatchewan south to n. VA, ne. WV, n. IN, n. IL, n. IA, and SD. Petals white, pink, maroon, or green. [= FNA, K, W, X, Z; *T. cernuum* -- RAB, C, F, S, in part (apparently also including *T. rugelii*)]

Trillium cuneatum Rafinesque, Sweet Betsy, Purple Toadshade, Large Toadshade, Wedge-petal Trillium, Bloody Butcher. Pd, Mt (GA, NC, SC, VA?), Cp (GA): in rich soils of cove forests, moist slopes, and bottomlands, usually over mafic or calcareous rocks; uncommon, but locally abundant (VA Watch List). Mid March-April; late May-June. Centered in the Southern Appalachians (but is more abundant in adjacent physiographic provinces), extending north to the Highland Rim of KY, west to the Interior Low Plateau of TN, south to the Coastal Plain of MS and AL, and east to the Piedmont of GA, SC, and NC. Petals maroon, yellow, green, or various intermediate shades. [= C, F, FNA, K, W, X, Y, Z; *T. cuneatum* var. *cuneatum* -- RAB; *T. viride* Beck -- F, misapplied with respect to NC material; *T. viride* var. *luteum* (Muhlenberg) Gleason -- G, in part and misapplied (also see *T. luteum*); *T. hugeri* -- S; *T. underwoodii* -- S, misapplied]

Trillium decipiens Freeman, Deceptive Trillium. Cp (GA): moist forests; uncommon. W. FL and sc. AL east to ec. GA, and might be expected in SC, near the Fall Line. It is similar to *T. underwoodii*. [= FNA, K, X, Y, Z]

Trillium decumbens Harbison, Decumbent Trillium. Mt (GA): moist forests; uncommon. Se. TN (Chester et al. 1993) south and west to nw. GA and nc. AL; it should be sought in extreme sw. NC, an extremely "under-botanized" area. [= FNA, K, S, X, Y, Z]

Trillium discolor Wray ex Hooker, Pale Yellow Trillium, Pale Trillium, Small Yellow Toadshade. Mt (GA, NC, SC), Pd (GA, SC): rich cove forests, restricted to the Savannah River drainage; rare (GA Special Concern, NC Threatened, SC Rare). Late March-early May; June-July. Endemic to the Savannah River drainage of nw. SC, ne. GA, and sw. NC, occurring in the Blue Ridge and Piedmont. In NC it is restricted to a few sites along the Whitewater and Thompson Rivers. Petals pale yellow, with maroon or greenish claws. [= RAB, FNA, K, S, W, X, Y, Z]

Trillium erectum Linnaeus, Red Trillium, Purple Trillium, Stinking Willie, Stinking Benjamin, Wake-robin. Mt (GA, NC, SC, VA): wooded slopes, usually at middle to high elevations; common. April-early June; July-August. New Brunswick, Québec, and MI south to w. NC, nw. SC, n. GA, e. TN, IN, and se. WI. Petals maroon, white, yellow, green, or various intermediate shades. [= C, K, W, X, Z; *T. erectum* var. *erectum* -- RAB, in part only (also see *T. sulcatum*); *T. erectum* -- F, G, S, in part only (also see *T. sulcatum*); *T. erectum* var. *erectum* -- FNA; *T. erectum* var. *album* (Michaux) Pursh -- FNA]

Trillium flexipes Rafinesque, Bent White Trillium. Mt (GA, NC, VA): moist coves over mafic or calcareous rocks; rare (GA Special Concern, NC Rare, VA Rare). E. PA, s. Ontario and s. MN south to w. NC, nw. GA, n. AL, n. MS, mostly west of the Blue Ridge, but scattered in the Blue Ridge of NC, and disjunct east of the Blue Ridge in DE, PA, and MD. Petals white or maroon. [= C, F, FNA, K, W, X, Z; *T. erectum* var. *vaseyi* -- RAB, in part; *T. gleasoni* Fernald -- G; *T. declinatum* (Gray) Gleason -- S, misapplied]

Trillium grandiflorum (Michaux) Salisbury, Large-flowered Trillium, White Trillium, Great White Trillium. Mt (GA, NC, SC, VA), Pd (NC, SC, VA): rich coves and mesic slopes, also less typically on ridges over "rich" rock types; common (SC Rare). April-May; July-August. S. Québec, s. Ontario, MI, and MN, south to NJ, c. NC, nw. SC, n. GA, n. AL, s. IL, and IA. Petals white to pink. [= RAB, C, F, FNA, G, K, S, W, X, Z]

Trillium lancifolium Rafinesque, Lanceleaf Trillium, Narrowleaf Trillium. Pd (SC), Mt (GA), Cp (GA): rich forests over marble, limestone, and other calcareous substrates, floodplain forests; rare (GA Special Concern, SC Rare). Late March-April. Nc. SC and se. TN south through w. GA and AL to panhandle FL and se. AL. Petals purple, green, or greenish-purple. [= FNA, K, Y, X, Z; *T. lanceolatum* (S. Watson) Boykin ex Small -- RAB, S]

Trillium luteum (Muhlenberg) Harbison, Yellow Trillium, Yellow Toadshade, Wax Trillium, Lemon-scented Trillium. Mt (GA, NC, VA*): moist coves over mafic or calcareous rocks, restricted to the vicinity of the Great Smokies; uncommon (but locally abundant). Mid March-April; late May-June. Nearly endemic to the Southern Appalachians: w. NC, e. TN, nw. GA, and se. KY, allegedly disjunct in c. AL (planted and escaped in the Mountains of VA). Petals yellow. [= C, F, FNA, K, W, X, Y, Z; *T. cuneatum* var. *luteum* (Muhlenberg) Ahles -- RAB; *T. viride* Beck var. *luteum* (Muhlenberg) Gleason -- G, in part only (also see *T. cuneatum*); *T. sessile* -- S, in part, misapplied]

Trillium maculatum Rafinesque, Mottled Trillium, Spotted Trillium. Cp, Pd (GA, SC): rich forests and floodplains, over calcareous materials such as coquina limestone ("marl") or on shell middens; uncommon. March-mid April. S. SC south to n. FL, west to sc. AL. Petals maroon or yellow. [= FNA, K, X, Y, Z; *T. viride* -- RAB, misapplied; *T. sessile* -- S, in part, misapplied]

Trillium nivale Riddell, Snow Trillium, Dwarf White Trillium. Mt (VA): rocky, calcareous forests; rare (VA Rare). MA, sw. PA, MI, WI, s. MN, and e. SD south to n. VA, KY, s. IN, s. IL, s. MO, and se. NE. Petals white to pink. [= C, F, FNA, G, K, X, Z]

Trillium persiens Duncan, Persistent Trillium. Mt (GA, SC): acidic forests with hemlocks and heaths; rare (US Endangered, GA Endangered, SC Rare). April. Endemic to a short stretch of the Tallulah-Tugaloo river system in nw. SC and ne. GA. Petals white to pink. [= FNA, K, W, X, Z]

Trillium pusillum Michaux var. *pusillum*, Carolina Least Trillium, Carolina Dwarf Trillium. Cp (GA, NC, SC), Mt (NC): bottomland forests along small streams in the upper Coastal Plain, ecotones of calcareous savannas and swamp forests in the lower Coastal Plain, moist slopes in the Mountains; rare (US Species of Concern, GA Special Concern, NC Endangered, SC Rare). Late March-May; June-July. *T. pusillum* is somewhat reminiscent of a tiny *T. grandiflorum*. The species as a whole has a highly disjunct and fragmented range, involving most of the Southeastern states. The complex includes *T. texanum* Buckley (of TX), *T. pusillum* var. *ozarkanum* (Palmer & Steyermark) Steyermark (of the Ozarks), and the taxa discussed below. Our area has two named varieties, and a third putative variety, under study. Var. *pusillum* (as currently circumscribed) ranges from the Coastal Plain of e. NC south to SC, west to the Blue Ridge of NC, and west into AL, TN, and other states. The putative new variety currently under study would include all material from the Blue Ridge of NC and south and west of it, leaving the typic variety as endemic to the Coastal Plain of NC and SC. The recognition of varieties in *T. pusillum* is problematic; variation seems essentially clinal. Petals white to pink. [= C, F, FNA, K, X; *T. pusillum* -- RAB, G, S, Z, infraspecific taxa not distinguished; *T. pusillum* var. "*alabamicum*" -- X (nomen nudum)]

Trillium pusillum Michaux var. *virginianum* Fernald, Virginia Least Trillium, Virginia Dwarf Trillium. Cp (NC, VA), Mt (VA): swamps and bottomland forests, also mesic beech islands in swamp forests, moist forests along small mountain streams; rare (US Species of Concern, NC Endangered, VA Rare). Late March-May; June-July. Var. *virginianum* occurs in the Coastal Plain of se. VA and ne. NC, and disjunct in the mountains of w. VA, e. WV, and w. MD. It occurs in The Glades, Grayson County, VA within a kilometer of the Alleghany County, NC border, and may be found to occur in the northwestern Mountains of NC, as well as in the northeastern Coastal Plain of NC. Var. *monticulum* Bodkin & Reveal has been controversial; see Cabe (1995) and Cabe & Werth (1995) for additional discussion of variation within *T. pusillum* in Virginia and elsewhere. Petals white to pink. [= C, F, FNA, K, X; *T. pusillum* -- G, S, Z, infraspecific taxa not distinguished; *T. pusillum* var. *monticulum* Bodkin & Reveal (populations from the mountains of VA and WV); *T. pusillum* var. *monticola* -- X, orthographic variant]

Trillium recurvatum Beck, Prairie Trillium, Prairie Wake-robin. Mt (NC): rich soils of cove over calcareous rock; rare (NC Rare). Primarily a midwestern species, *T. recurvatum* ranges from w. OH west to s. MI, s. WI, and e. IA, south to c. TN, c. AL, c. MS, n. LA, and e. TX, with disjunct occurrences in the Cumberland Plateau of e. TN, e. KY, and w. NC (in the Hot Springs Window). The single known NC occurrence appears to be native. Petals maroon or yellow. [= C, F, FNA, G, K, S, X, Y, Z]

Trillium reliquum J.D. Freeman, Relict Trillium. Pd (GA, SC), Cp (GA): rich forests on bluffs and ravine slopes; rare (US Endangered, GA Endangered, SC Rare). Mid March-late April. Known from two disjunct areas, along the Savannah River in the vicinity of Augusta, on the border of SC (Aiken County) and GA (Richmond counties), and along the Chattahoochee River in sw. GA (Clay and Early counties). [= FNA, K, X, Y, Z]

Trillium rugelii Rendle, Southern Nodding Trillium. Mt, Pd (GA, NC, SC): rich woodlands and forests over mafic or calcareous rocks; rare (NC Watch List, SC Rare). W. NC and e. TN south to c. GA, and c. AL. Petals white or maroon. [= FNA, K, W, X, Z; *T. cernuum* -- RAB, C, F, S, in part (apparently including *T. rugelii*); *T. cernuum* var. *macranthum* A.J. Eames & Wiegand -- C, G]

Trillium sessile Linnaeus, Sessile Trillium, Sessile Toadshade, Toad Trillium. Mt (VA), Pd (VA), Cp (NC, VA): rich forests, in NC limited to very rich soils of natural levees and lower slopes along the Roanoke River; uncommon in VA, rare in NC (NC Rare). Primarily a species of the northern Midwest, *T. sessile* ranges from MD, w. PA, w. NY, s. MI, n. IL and n. MO, south to e. VA, ne. NC, c. TN, n. AL, and n. AR. The easternmost occurrences are disjunct populations east of the Blue Ridge, in MD, VA, and along the Roanoke River in ne. NC. Petals maroon or green. [= C, F, FNA, G, K, W, X, Y, Z]

Trillium simile Gleason, Sweet White Trillium. Mt (GA, NC, SC): very rich soils of slopes and coves over mafic or calcareous rocks, often also in or near seepage; rare (GA Special Concern, NC Rare, SC Rare). Late March-early May; June-July. A Southern Appalachian endemic: Blue Ridge of w. NC, nw. SC, e. TN, and n. GA. Petals white or very rarely maroon. [= FNA, K, S, W, X, Z; *T. erectum* var. *vaseyi* -- RAB, in part]

Trillium sulcatum T. Patrick, Southern Red Trillium, Barksdale Trillium. Mt (GA, NC, VA): coves and moist slopes; uncommon (GA Special Concern). Primarily a species of the sedimentary rock Appalachians, *T. sulcatum* ranges from s. WV, sw. VA, and e. KY south to nw. NC (where it enters the Blue Ridge), w. TN, nw. GA, and ne. AL. This species seems quite distinctive for its small, generally maroon flowers (with strongly sulcate sepals purplish as well), borne on very long pedicels. Petals maroon or white. [= C, FNA, K, W, X, Z]

Trillium underwoodii Small, Underwood's Trillium. Cp (GA): moist forests; uncommon. N. FL north to wc. GA and c. and s. AL; it is the only erect trillium with the stems less than 2× as long as the leaves. [= FNA, K, S, X, Y, Z]

Trillium undulatum Willdenow, Painted Trillium, Striped Wake-robin. Mt (GA, NC, SC, VA): acidic soils of ridges, slopes, and bog margins, mostly at high elevations and often associated with *Rhododendron*, *Tsuga*, *Pinus*, or *Picea*; common (SC Rare). Late April-May; late July-August. New Brunswick e. Québec, s. Ontario, and MI, south to w. NC, nw. SC, n. GA, e. TN, and ne. OH. Of all our species, this is the species best adapted to acidic soils. Petals white with a red blaze. [= RAB, C, F, FNA, G, K, S, W, X, Z]

Trillium vaseyi Harbison, Sweet Trillium, Vasey Trillium, Sweet Beth. Mt (GA, NC, SC), Pd (GA): cove forests; uncommon. This species is a Southern Appalachian endemic: w. NC and e. TN south to nw. SC, n. GA, and ne. AL. Perhaps the largest trillium species, with the stems to 7 dm tall. Petals maroon or white. [= FNA, K, S, W, X, Z; *T. erectum* var. *vaseyi* (Harbison) Ahles -- RAB, in part only (also see *T. simile* and *T. flexipes*)]

Trillium stamineum Harbison, Twisted Trillium, ranges from c. TN (Chester et al. 1993) south to c. AL, and e. MS. [= FNA, K, S, X, Y, Z]

Veratrum Linnaeus 1753 (White-hellebore)

A genus of about 55 species, herbs of temperate Northern Hemisphere. *Veratrum* is here interpreted broadly, including *Melanthium*, following the molecular phylogeny work of Zomlefer et al. (2003). References: Zomlefer (1997)=Z; McNeal & Shaw in FNA (2002a); Bodkin & Utech in FNA (2002a); Tamura in Kubitzki (1998a); Zomlefer et al. (2003).

- 1 Leaves all linear, 1-2 (-3) cm wide; tepals greenish white to creamy white (sometimes fading brownish); [section *Fuscoveratrum*] **V. virginicum**
- 1 Leaves (at least the basal) oblanceolate to obovate or elliptic, 3-15 cm wide (the upper leaves sometimes linear); tepals yellowish green, green, or maroon.
 - 2 Leaves strongly plicate, 6-15 cm wide; tepals pubescent, 8-13 mm long, 3-5 mm wide, with a conspicuous pair of glands near the base of the tepal blade (these sometimes more or less fused); filament free from the tepals; [section *Veratrum*] **V. viride**
 - 2 Leaves not at all to slightly plicate, 3-14 cm wide; tepals glabrous, 4-9 mm long, 1-3 mm wide (3-5 mm wide in *V. latifolium*), with either conspicuous (*V. latifolium*) or diffuse (*V. parviflorum* and *V. woodii*) glands; filament fused to the basal claw of the tepal; [section *Fuscoveratrum*].
 - 3 Tepals 3-5 mm wide, the blade of the tepal abruptly narrowed to a claw, the blade nearly as wide as long, with undulate margins, and 2 conspicuous succulent glands; leaves 1-7 cm wide **V. latifolium**
 - 3 Tepals 1-3 mm wide, the blade gradually narrowed to the base, the blade much longer than wide, with entire margins, and with diffuse glandular areas; leaves 3-12.5 cm wide.
 - 4 Tepals pale to olive green, 4-7 mm long; ovaries glabrous; leaves 4.5-14 cm wide; [common in Mountains in our area] **V. parviflorum**
 - 4 Tepals dark maroon, 6-9 mm long; ovaries densely pubescent; leaves 3-10 cm wide; [plant a rare disjunct in our area] **V. woodii**

Veratrum latifolium (Desrousseaux) Zomlefer, Crisped Bunchflower. Mt (GA, NC, SC, VA), Pd, Cp (NC, SC, VA): moist forests; uncommon (rare in Coastal Plain and Piedmont) (GA Special Concern). July-August; September-October. An

Appalachian endemic: CT south to NC and SC. [= Z; *Melanthium hybridum* Walter -- RAB, C, F, G, W, misapplied; *Melanthium latifolium* Desrousseaux -- FNA, K, S]

Veratrum parviflorum Michaux, Mountain Bunchflower. Mt (GA, NC, SC, VA): moist to rather dry forests, up to at least 1700m; common. July-early September; August-October. A Southern Appalachian endemic: WV and KY south to VA, NC, n. GA, and TN. [= RAB, C, G, W, Z; *Melanthium parviflorum* (Michaux) S. Watson -- F, FNA, K, S]

Veratrum virginicum (Linnaeus) Aiton, Bog Bunchflower, Virginia Bunchflower. Cp (GA, NC, SC, VA), Mt, Pd (NC, SC, VA): savannas, bogs, seepage bogs, wet forests; uncommon (SC Rare). June-August; August-October. Widespread in e. North America. This species is superficially quite similar to *Zigadenus glaberrimus*, which, in addition to characters given in the family key, has the stem glabrous (vs. pubescent in *M. virginicum*). [= Z; *Melanthium virginicum* Linnaeus -- RAB, C, F, FNA, G, GW, K, S, W; *Melanthium dispersum* Small -- S]

Veratrum viride Aiton, White-hellebore, Indian Poke, Green Hellebore, Cornhusk Lily. Mt (GA, NC, VA), Pd (VA): seeps, streambanks, wet boulderfields; common (GA Special Concern). June-August; July-September. Widespread in ne. North America, ranging from Québec and Ontario south in the mountains to NC, TN, and ne. GA. The closely related *V. eschscholtzii* A. Gray, sometimes treated as *V. viride* ssp. *eschscholtzii* (A. Gray) A. & D. Löve or *V. viride* var. *eschscholtzii* (A. Gray) Breitung, is western, ranging from AK to OR. This plant is strongly poisonous; an insecticide was formerly manufactured from the roots. [= RAB, C, F, G, GW, S, W, Z; *V. viride* -- K, in the broad sense; *V. viride* var. *viride* -- FNA]

Veratrum woodii J.W. Robbins ex Wood, Ozark Bunchflower, Wood's False-hellebore. Mt (GA, NC), Cp (GA): circumneutral soil of woodlands over mafic rocks (such as amphibolite) or other calcareous substrates; rare (GA Rare, NC Rare). July; September. Primarily Ozarkian, but extending in scattered populations eastwards as far as sw. GA, nw. GA, sc. TN, and sw. NC (Polk County). [= C, F, G, Z; *Melanthium woodii* (J.W. Robbins ex Wood) Bodkin -- FNA, K; *V. intermedium* Chapman -- S]

Xerophyllum Michaux 1803 (Turkeybeard, Beargrass)

A genus of 2 species, rather woody herbs of temperate North America. The other species in the genus is the western beargrass, *X. tenax* (Pursh) Nuttall, widely distributed in the western Cordillera. References: Zomlefer (1997)=Z; Utech in FNA (2002a); Tamura in Kubitzki (1998a).

Xerophyllum asphodeloides (Linnaeus) Nuttall, Turkeybeard, Beargrass, Mountain-asphodel. Mt (GA, NC, SC, VA), Pd (NC, SC, VA): dry ridges and slopes in the mountains, primarily in dry, strongly acidic sites which burn periodically, such as pine/heath woodlands and forests, heath balds, and xeric oak forests, most of the populations in the Blue Ridge Escarpment, often associated with *Pinus rigida* or *P. pungens*, disjunct to similar sites on quartzite monadnocks of the upper Piedmont; uncommon (GA Rare, NC Watch List, SC Rare). May-June; July-August. In two disjunct areas; the Coastal Plain of s. NJ and DE, and the Southern Appalachians from w. VA south to e. TN, w. NC, nw. SC, and ne. GA. Sterile plants resemble tussocks of a bunchgrass, but the leaf bases are white and flattened and are obviously not those of a grass. The leaves remain green throughout the winter. [= RAB, C, F, FNA, G, K, W, Z]

Zigadenus Michaux 1803 (Death-camas) (also see *Anticlea*, *Stenanthium*)

As redefined, a monotypic genus of se. North America. A molecular systematics study by Zomlefer et al. (2001) gives strong support to a treatment recognizing *Zigadenus* as monotypic (*Zigadenus glaberrimus*), *Anticlea* (including for our area the former *Zigadenus elegans* ssp. *glaucus*), *Stenanthium* (including for our area *Stenanthium* spp. and the former *Zigadenus densus* and *Z. leimanthoides*). *Zigadenus* (as redefined) has a tentatively reported chromosome number of 2n=52 (Zomlefer & Smith 2002). References: Zomlefer (1997)=Z; Tamura in Kubitzki (1998a); Zomlefer et al. (2001); Schwartz in FNA (2002a).

- 1 Leaves strongly keeled, (5-) 10-20 mm wide; plant colonial, from thick, hard, horizontal, short-creeping rhizomes covered with fibrous old leaf bases; inner tepals (petals) 7-17 mm long, distinctly clawed, acute-acuminate, bearing 2 glands well above the base ***Zigadenus glaberrimus***
- 1 Leaves slightly or not at all keeled, 2-12 mm wide; plant solitary, from a bulbous or semibulbous base; inner tepals (petals) 3-6 or 7-12 mm long, clawed or not, bearing either a single (sometimes obscure to essentially invisible) gland near the base or a bilobed gland well above the base.
 - 2 Inner tepals (petals) 7-12 mm long, clawed, with a single bilobed gland borne well above the base; [plants of calcareous habitats in the Mountains] [see *Anticlea elegans*]
 - 2 Inner tepals 3-6 mm long, not clawed, with a single, unlobed gland borne near the base (this often difficult or impossible to see, consisting only of a greenish line at the very base of the tepal); [plants of acid habitats of the Mountains and Coastal Plain]; [section *Oceanoros*].
 - 3 Inflorescence a raceme; flowers all bisexual; plants 3-10 dm tall; flowering April-early June; [plants (in our area) of the Coastal Plain] [see *Stenanthium densum*]
 - 3 Inflorescence a panicle of racemes; lower flowers of the inflorescence branches bisexual and fertile, the upper staminate or superficially perfect but the pistils nonfunctional (not producing fruits); plants 5-20 dm tall; flowering July-August; [plants (in our area) of the Mountains] [see *Stenanthium leimanthoides*]

Zigadenus glaberrimus Michaux, Large Death-camas, Snakeroot. Cp (GA, NC, SC, VA): sandhill seepage bogs, pine

savannas, pocosin edges; common, rare in VA (VA Rare). Late June-early September; August-November. Se. VA south to panhandle FL, west to se. TX, on the Coastal Plain. This species is superficially more similar to *Melanthium virginicum* than to the other species of *Zigadenus*. *Z. glaberrimus* has the stem and inflorescence axis glabrous (vs. scurfy-pubescent in *M. virginicum*). [= RAB, C, FNA, GW, K, Z; *Zygadenus glaberrimus* -- G, S (an orthographic variant)]

NAJADACEAE de Jussieu 1789 (Naiad Family)

A family of a single genus and about 40 species, nearly cosmopolitan. The Najadaceae should perhaps be merged into the Hydrocharitaceae (Haynes, Holm-Nielsen, & Les 1998b). References: Haynes in FNA (2000); Haynes (1979)=Z; Haynes & Hellquist (1996); Haynes, Holm-Nielsen, & Les in Kubitzki (1998b).

Najas Linnaeus 1753 (Naiad, Bushy-pondweed, Water-nymph)

A genus of about 40 species, nearly cosmopolitan. Probably better included in the Hydrocharitaceae (Angiosperm Phylogeny Group (2003). References: Haynes in FNA (2000); Haynes (1979)=Z; Haynes & Hellquist (1996); Haynes, Holm-Nielsen, & Les in Kubitzki (1998b).

Identification notes: counts of leaf-teeth do not include the broadened, sheathing base of the leaf. Seeds are necessary for the identification of most species.

- 1 Plants dioecious; lower side of the midvein of the leaves prickly; [subgenus *Najas*] [***N. marina***]
- 1 Plants monoecious; lower side of the midvein of the leaves smooth; [subgenus *Caulinia*].
 - 2 Leaf-teeth multicellular, evident at 10× magnification, 7-15 per side; leaves becoming recurved late in the season; seed-coat pitted, the areoles distinctly wider than long, in ca. 12-18 ladder-like rows ***N. minor***
 - 2 Leaf-teeth unicellular, not evident at 10× magnification, more than 20 per side (except 13-17 per side in *N. gracillima*); leaves spreading to ascending; seed-coat smooth or pitted, if present the areoles longer than wide or about as long as wide.
 - 3 Seeds smooth, glossy, obovate, broadest above the middle; anthers 1-locular ***N. flexilis***
 - 3 Seeds pitted, dull, cylindric, fusiform, or elliptic, broadest at the middle; anthers 1- or 4-locular.
 - 4 Style offset from the apex of the seed; anthers unilocular ***N. gracillima***
 - 4 Style at the apex of the seed; anthers 4-locular ***N. guadalupensis* var. *guadalupensis***

Najas flexilis (Willdenow) Rostkovius & Schmidt, Northern Naiad. Cp, Pd, Mt (VA): lakes and rivers; uncommon. July-August. Ranging from Newfoundland west to Ontario, south to VA, MD, MO, and NE; also in the west from Alberta and Saskatchewan south to OR and UT. [= C, F, FNA, G, K, S, W, Z]

Najas gracillima (A. Braun ex Engelmann) Magnus, Slender Naiad, Bushy Naiad. Mt, Cp (NC, SC, VA), Pd (NC, VA): ponds and lakes; uncommon. July-October. Ranging from Nova Scotia west to MN, south to NC, AL, and MO; disjunct in CA. Haynes (1979) reports that this species cannot tolerate pollution and is apparently declining in abundance. [= RAB, C, F, FNA, G, K, W, Z]

Najas guadalupensis (Sprengel) Magnus var. ***guadalupensis***, Common Naiad, Southern Naiad. Cp, Pd, Mt (NC, SC, VA): lakes and rivers; common. July-October. Var. *guadalupensis* ranges from ME west to Alberta and WA, south to n. South America. Haynes (1979) interprets the species as including 3 other varieties -- var. *floridana* Haynes & Wentz (in FL, north to AL and GA and to be sought in SC), var. *muenscheri* (Clausen) Haynes (endemic to the Hudson River), and var. *olivacea* (Rosendahl & Butters) Haynes (nearly limited to states bordering the Great Lakes). They differ in characteristics of the leaf and seed (see Haynes 1979). Haynes & Hellquist (1996) treat all infraspecific taxa as subspecies rather than varieties. [= C, K, Z; *N. guadalupensis* -- RAB, F, G, GW, S, W, infraspecific taxa not distinguished; *N. guadalupensis* ssp. *guadalupensis* -- FNA]

* ***Najas minor*** Allioni, Spinyleaf Naiad. Pd, Mt, Cp (NC, SC, VA): ponds, lakes, and reservoirs, particularly where eutrophic; uncommon, native of Eurasia. July-October. This species is apparently a rather recent introduction to North America, now widespread in e. North America. Haynes (1979) reports that it is becoming more abundant in e. North America because of its tolerance for polluted, eutrophic waters. [= RAB, C, F, FNA, G, GW, K, W, Z]

Najas filifolia Haynes, Narrowleaf Naiad. Cp (GA): lakes; rare (GA Special Concern). Sw. GA (Jones & Coile 1988) to FL (Haynes in FNA 2000). [= FNA, K] {not yet keyed}

Najas guadalupensis (Sprengel) Magnus var. ***floridana*** Haynes & Wentz, in GA and FL. [*N. guadalupensis* ssp. *floridana* Haynes & Wentz] Haynes & C.B. Hellquist -- FNA, K] {not yet keyed}

Najas marina Linnaeus, Holly-leaf Naiad, occurs both n. and s. of our area and should be sought. It occurs in brackish or calcareous waters. It is dioecious (vs. monoecious in our 4 species), and has the lower side of the midvein of the leaves prickly (vs. smooth in our 4 species). [= FNA, K]

NARTHECIACEAE E.M. Fries 1846 (Bog-asphodel Family)

As circumscribed here (excluding Tofieldiaceae), a family of about 4 genera and 40 species, of e. Asia, e. North America, n. Europe, and the Guyana Shield of n. South America. Reveal & Zomlefer (1998) place the Nartheciaceae in the monotypic order Nartheciales. References: Zomlefer (1997b, 1999); Reveal & Zomlefer (1998); Tamura in Kubitzki (1998a).

Aletris Linnaeus 1753 (Colic-root, Stargrass)

As circumscribed here (including *Metanarthecium*), a genus of about 30 species, of e. North America and e. Asia. References: Weigant (2002)=X; Ward (1978)=Y; Zomlefer (1997b)=Z; Tamura in Kubitzki (1998a); Sullivan in FNA (2002a).

- 1 Perianth white to creamy-white (rarely pinkish).
 - 2 Perianth 6-10 mm long, cylindric at anthesis, 2-3× as long as broad, the perianth lobes narrowly deltoid (longer than broad); fruiting perianth markedly constricted above the middle **A. farinosa**
 - 2 Perianth 4-6 mm long, campanulate at anthesis, ca. 1× as long as broad, the perianth lobes broadly deltoid (about as long as broad); fruiting perianth somewhat narrowed above the base **A. obovata**
- 1 Perianth golden yellow (often faded in dried specimens).
 - 3 Perianth short-cylindric or campanulate at anthesis, 1-2× as long as broad, the perianth lobes not spreading; [flowering May-July] **A. aurea**
 - 3 Perianth long-cylindric at anthesis, 2.5-4× as long as broad, the perianth lobes spreading somewhat; [flowering March-May] [**A. lutea**]

Aletris aurea Walter, Golden Colic-root. Cp (NC, SC, VA): pine savannas, seepage bogs, pine flatwoods; uncommon (VA Rare). Mid May-July; August. Ranging from s. MD south to c. peninsular FL, west to e. TX and se. OK. Flowering several weeks later than *A. farinosa* when growing together. [= RAB, C, F, FNA, G, GW, K, S, X, Y, Z]

Aletris farinosa Linnaeus, Northern White Colic-root, Mealy Colic-root. Cp, Mt, Pd (NC, SC, VA): pine savannas, pine flatwoods, seepage bogs, upland woodlands, roadbanks; common. Late April-early June; July-August. Ranging from s. ME, s. Ontario, and se. MN south to s. GA, FL (Wunderlin 1998), LA, and TX. [= RAB, C, F, FNA, G, GW, K, S, W, X, Z]

Aletris obovata Nash ex Small, Southern White Colic-root. Cp (SC): pine savannas; rare (SC Rare). May-early June; August. Ranging from se. SC south to c. peninsular FL, west to s. MS. [= RAB, FNA, GW, K, S, X, Y, Z]

Aletris lutea Small occurs as far north as e. GA, in immediate proximity to the SC border, south to s. FL, and west to e. LA (Weigant 2002). The report by F of *A. lutea* Small as far north as se. VA is in error. A specimen collected in se. NC has recently been annotated as *A. lutea*, but it appears to be *A. farinosa*. [= FNA, GW, K, S, X, Y, Z]

Lophiola Ker-Gawler 1814 (Golden Crest)

A monotypic genus, of temperate e. North America. As here interpreted to include *L. americana* and *L. septentrionalis*, *Lophiola* is monotypic, consisting only of *L. aurea*. *Lophiola* is quite unlike any other genus, and its familial position has been problematic. Often treated in the Haemodoraceae (as in RAB, C, G, GW), *Lophiola* is better placed in the Nartheciaceae (or a very broad Liliaceae), as shown by studies of anatomy, pollen ultrastructure, and chemistry, though its placement in that family is also not without problems (Edwards, Churchill, & Weiss 1970, Simpson & Dickson 1981, Simpson 1983, Zavada 1983, Zavada, Xu, & Edwards 1983, Ambrose 1985). References: Zomlefer (1997b)=Z; Tamura in Kubitzki (1998a); Robertson in FNA (2002a).

Lophiola aurea Ker-Gawler, Golden Crest. Cp (GA, NC): mucky depressions in wet savannas, and in adjacent ditches; rare (GA Special Concern, NC Endangered). Late May-June; August-September. A species of Southeastern Coastal Plain affinities, but with a peculiar, fragmented distribution, occurring primarily on the Gulf Coast from FL and sw. GA west to MS, with disjunct segments of range in se. NC, n. DE and s. NJ, and Nova Scotia. Only a few populations remain in NC. [= C, FNA, K, S, Z; *L. americana* (Pursh) Wood -- RAB, F (the NJ-DE material), G, GW; *L. septentrionalis* Fernald -- F (the Nova Scotian material)]

Narthecium Hudson 1762 (Asphodel)

A genus of about 8 species, many narrow disjuncts, collectively with a very fragmented distribution in the temperate Northern Hemisphere. References: Small (1924)=Z; Zomlefer (1997b)=Y; Utech in FNA (2002a); Tamura in Kubitzki (1998a); Schumacher (1947)=X; Sorrie & Weakley (in prep.)=W.

- 1 Tepals 4-6 mm long; capsule 10-14 mm long; pedicels stout, about as long as the subtending bracts; [plants of Coastal Plain seeps and savannas] **N. americanum**
- 1 Tepals 6-9 mm long; capsule 8-10 mm long; pedicels slender, distinctly longer than the subtending bracts; [plants of mountain bogs] **N. montanum**

Narthecium americanum Ker-Gawler, Yellow Asphodel. Cp (SC): wet seepages or savannas; rare (US Species of Concern, NC Endangered, SC Rare). June-July; August-September. Ranging in s. NJ and DE; disjunct in c. SC. It is still possible that this species will be relocated in our area, perhaps in mucky seepages in the Sandhills. [= C, F, G, W, X; *Narthecium americanum* --

RAB, FNA, GW, K, W, Y, in part only (also see *N. montanum*); *Abama americana* (Ker-Gawler) Morong -- S, Z]

Narthecium montanum (Small) C.H. Grey, Appalachian Yellow Asphodel. Mt (NC): bogs; rare (apparently extinct). With the drainage of the bogs of East Flat Rock, Henderson County, this species was apparently extirpated. It is still possible that it will be relocated, in bogs in Henderson or Transylvania counties, NC. Small (1924, 1933) considered the NC mountain population a distinct species, based on its longer, more slender pedicels, larger sepals, petals, and stamens, and smaller capsules. Schumacher (1947), in the most thorough worldwide assessment of *Narthecium*, agreed, and Sorrie & Weakley (in prep.) concur, based on an herbarium analysis of the characters of all taxa in the genus. The morphological distinctions (and geographic disjunction) between *N. montanum* and *N. americanum* are as great or greater as those between most species recognized worldwide in the genus. [= W, X; *Narthecium americanum* – RAB, FNA, GW, K, W, Y, in part; *Abama montana* Small -- S, Z]

NOLINACEAE Nakai 1943 (Beargrass Family)
(see **RUSCACEAE**)

ORCHIDACEAE (Orchid Family)

A family of about 800 genera and 19,000 species, perennial (rarely annual), mycotrophic herbs and vines. Only a small minority of orchid species worldwide are terrestrial rather than epiphytic; only *Epidendrum conopseum* in our flora shows the common epiphytic habit. References: Luer (1972) and Luer (1975)=L; Correll (1950)=X; Romero-González, Fernández-Concha, Dressler, Magrath, & Argus in FNA (Williams & Williams (1983); Brown (2003); Homoya (1993); Correll (1937); Pridgeon et al. (1999a, 1999b, 1999c).

Subfamily Cypridipodioideae: *Cypripedium*

Subfamily Orchidoideae

Tribe Orchideae

Subtribe Orchidinae: *Coeloglossum*, *Galearis*, *Habenaria*, *Platanthera*

Tribe Cranichideae

Subtribe Cranichidinae: *Ponthieva*

Subtribe Goodyerinae: *Goodyera*

Subtribe Spiranthininae: *Spiranthes*

Subfamily Vanilloideae

Tribe Pogoniae: *Cleistes*, *Isotria*, *Pogonia*

Keying Note: Flowering plants are necessary for use of the key to genera.

- 1 Plant epiphytic, growing on the branches or trunks of trees in swamps ***Epidendrum***
- 1 Plant terrestrial, growing on soil.
 - 2 Leaves absent at flowering, or with a solitary leaf with a purplish undersurface withering at about the time of flowering.
 - 3 Flowers with a spur ***Tipularia***
 - 3 Flowers without a spur.
 - 4 Flowers white, the lip, sepals, and petals all predominantly white ***Spiranthes***
 - 4 Flowers pink, greenish, yellowish, or purplish, the lip sometimes white or marked with white, the sepals and petals colored.
 - 5 Flower solitary; lip strongly bearded ***Arethusa***
 - 5 Flowers in spikes or racemes; lip not bearded.
 - 6 Lip with 2 fleshy ridges near the base; pollinia 4; plants mycoparasitic and never with leaves ***Corallorrhiza***
 - 6 Lip with 3-7 ridges near the base or extending most of the length of the lip; pollinia 4 or 8; plants either mycoparasitic and never with leaves, or with a plicate winter leaf withering shortly before flowering.
 - 7 Plants with a plicate winter leaf withering shortly before flowering (the withered remnant usually detectable); pollinia 4; veins of the petals and sepals not strikingly different in color than the intervein areas; lip with 3 ridges ***Aplectrum***
 - 7 Plants never with leaves and saprophytic; pollinia 8; veins of the petals and sepals strikingly different in color than the intervein areas; lip with 5-7 ridges ***Hexalectris***
 - 2 Leaves present at flowering (*Cleistes* with a foliaceous bract at the summit of the stem).
 - 8 Leaf solitary.
 - 9 Leaf basal.
 - 10 Flower with a spur ***Platanthera***
 - 10 Flower without a spur.
 - 11 Flower solitary; leaf plicate ***Arethusa***
 - 11 Flowers in a raceme or spike.
 - 12 Flowers relatively large, purple, pink, to rarely white, the lip oriented upwards ***Calopogon***
 - 12 Flowers relatively small, whitish, the lip oriented downwards ***Spiranthes***
 - 9 Leaf cauline.

- 13 Flower solitary (-4), pink (rarely nearly white); [subfamily *Vanilloideae*; tribe *Pogonieae*].
 - 14 Sepals brown to purple, linear or narrowly oblanceolate, 3-6.5 cm long, about 5 mm wide; leaf coriaceous **Cleistes**
 - 14 Sepals pink (rarely white), elliptic or oblanceolate, 1.3-2.7 cm long, 3-11 mm wide; leaf herbaceous **Pogonia**
- 13 Flowers in spikes or racemes, 5-many, reddish, yellowish, or greenish.
 - 15 Flower without a spur; petals, sepals, and lip 1-3 mm long **Malaxis**
 - 15 Flower with a spur; petals, sepals, and lip 3-25 mm long **Platanthera**
- 8 Leaves 2-many.
 - 16 Lip inflated, pouch-like or slipper-like, 2-6 cm long **Cypripedium**
 - 16 Lip not inflated, or if so, then 0.3-1.1 cm long.
 - 17 Leaves basal (sometimes with bladeless sheaths upwards on the stem).
 - 18 Leaves plicate.
 - 19 Lip oriented upwards; flowers pink to white **Calopogon**
 - 19 Lip oriented downwards; flowers greenish, purplish-brown, or yellowish.
 - 20 Leaves ovate to elliptic, 2-5× as long as wide; plant 1-3 dm tall **Liparis**
 - 20 Leaves linear-lanceolate, more than 10× as long as wide; plant 3-14 dm tall **Pteroglossaspis**
 - 18 Leaves smooth, often creased at the midrib, but not plicate.
 - 21 Lip with a spur.
 - 22 Flowers bicolored, the lip white, the sepals and petals pink; leaves 2 **Galearis**
 - 22 Flowers not bicolored, the lip, petals, and sepals similarly colored; leaves 2-5.
 - 23 Lip deeply divided into 3 linear segments; leaves 3-5 **Habenaria**
 - 23 Lip entire; leaves 2 **Platanthera**
 - 21 Lip without a spur.
 - 24 Leaf blades more-or-less horizontally oriented, flat against the ground or 1-2 cm above it.
 - 25 Lip oriented upwards **Ponthieva**
 - 25 Lip oriented downwards.
 - 26 Leaves variegated with white; lip saccate **Goodyera**
 - 26 Leaves green, not variegated; lip not saccate **Spiranthes**
 - 24 Leaf blades ascending.
 - 27 Leaves linear to lanceolate, 2-4 **Spiranthes**
 - 27 Leaves elliptic to ovate, 2.
 - 28 Lip broadest near its apex **Liparis**
 - 28 Lip broadest near its base, tapering to the apex **Malaxis**
 - 17 Leaves cauline.
 - 29 Leaves plicate; lip saccate **Epipactis**
 - 29 Leaves smooth, often creased at the midrib, but not plicate; lip not saccate.
 - 30 Leaves whorled, terminating the stem **Isotria**
 - 30 Leaves alternate or opposite, not terminating the stem.
 - 31 Leaves 2, opposite, near the middle of the stem **Listera**
 - 31 Leaves (2-) 3-many, alternate, variously distributed on the stem.
 - 32 Lip without a spur.
 - 33 Leaves ovate, 0.8-2.0 cm long **Triphora**
 - 33 Leaves linear, 1-8 cm long **Zeuxine**
 - 32 Lip with a spur; leaves linear, lanceolate, or narrowly elliptic, 5-40 cm long (at least the larger more than 5 cm long).
 - 34 Lip divided into 3 linear divisions, the divisions not further divided, fringed, or eroded **Habenaria**
 - 34 Lip not divided into 3 divisions, or divided into 3 divisions but the divisions not linear.
 - 35 Spur saccate, 2-3 mm long, the orifice minute **Coeloglossum**
 - 35 Spur elongate and slender, 4-50 mm long, the orifice larger ... **Platanthera**

Aplectrum Torrey 1818 (Puttyroot, Adam-and-Eve)

A genus of 2 species, 1 in e. North America and 1 in Japan (Sheviak & Catling in FNA (2002a). References: Sheviak & Catling in FNA (2002a).

Identification notes: Like *Tipularia*, *Aplectrum* has a single, overwintering leaf, purplish on the underside, and withering prior to the appearance of the flowering stalk; they are readily separable by leaf shape, texture, and veining (see *Tipularia*).

Aplectrum hyemale (Muhlenberg ex Willdenow) Torrey, Puttyroot, Adam-and-Eve. Mt, Pd (GA, NC, SC, VA), Cp (VA): rich, mesic forests; common. May-June. Widespread in ne. North America, from Québec and MN, south to SC, GA, AL, and OK. [=

RAB, C, F, FNA, G, GW, K, L, S, W, X]

Arethusa Linnaeus 1753 (Dragon's-mouth, Bog-rose, Arethusa)

A monotypic genus (Sheviak & Catling in FNA 2002). References: Sheviak & Catling in FNA (2002a).

Identification notes: The combination of the following characters serves to separate *Arethusa* from other, vaguely similar, genera: flowers magenta, solitary and scapose, the lip descending, the other 2 petals and 3 sepals erect or ascending. *Calopogon* has a leafy stem, the inflorescence a raceme, the lip crested but oriented upwards. *Pogonia* has solitary, pale pink flowers, with a descending, bearded lip, but the stem has a well-developed, flat leaf, 1-2.5 cm wide, the flower is subtended by a well-developed, leaf-like, floral bract, and the 2 lower sepals are spreading-descending. *Cleistes* has 3 brown to purplish brown sepals.

Arethusa bulbosa Linnaeus, Dragon's-mouth, Bog-rose, Arethusa. Mt (NC, SC, VA): bogs; rare (NC Endangered, SC Rare, VA Rare). May-June. Widespread in ne. North America, south to NJ and IN and to NC and SC in the mountains, rare south of ME, MI, and MN. The lanceolate, plicate leaf (15-30 cm long, 2-4 mm wide) develops after flowering, the flowering plant thus consisting (aboveground) of the solitary scape only. The lip is crested with fimbriate ridges, marked with yellow and purple. [= RAB, C, F, G, GW, K, L, S, W, X]

Calopogon R. Brown 1813 (Grass-pink)

A genus of 5 species (one with two varieties), endemic to e. North America. The only other taxon is *C. tuberosus* var. *simpsonii* (Chapman) Magrath of s. FL. References: Goldman, Magrath, & Catling in FNA (2002a). Key adapted from Goldman, Magrath, & Catling in FNA (2002a).

Identification notes: The lip is oriented upwards.

- 1 Petals wider towards the tip than towards the base; lip usually as wide as or wider than long; flowers strongly fragrant ***C. multiflorus***
- 1 Petals equal or narrower towards the tip than towards the base; lip usually narrower than long; flowers scentless or mildly fragrant.
 - 2 Leaf appressed to the inflorescence during flowering; flowers less than 1 cm apart; flowers not fragrant; flowers of each plant opening simultaneously ***C. barbatus***
 - 2 Leaf not appressed to the inflorescence during flowering; flowers more than 1 cm apart; flowers faintly to distinctly fragrant; flowers of each plant opening nearly simultaneously to sequentially.
 - 3 Lateral sepals 10-15 mm long, falcate, widely spreading ***C. pallidus***
 - 3 Lateral sepals 15-28 mm long, weakly falcate to straight.
 - 4 Flowers of each plant opening nearly simultaneously; dilated distal portion of middle lip lobe usually much narrower than long, triangular to broadly rounded; stigma typically flat against column surface; corms elongate, forked ***C. oklahomensis***
 - 4 Flowers of each plant opening sequentially; dilated distal portion of middle lip lobe usually much wider than long, typically anvil-shaped; stigma at angle to column surface; corms globose to elongate, not forked ***C. tuberosus* var. *tuberosus***

Calopogon barbatus (Walter) Ames, Bearded Grass-pink. Cp (GA, NC, SC): savannas, sandhill seeps; rare (NC Watch List, SC Rare). April-early May. A Southeastern Coastal Plain endemic, ranging from se. NC south to c. FL and west to e. LA. [= RAB, FNA, GW, K, L, X; *Limodorum parviflorum* (Lindley) Nash -- S]

Calopogon multiflorus Lindley, Many-flowered Grass-pink. Cp (GA, NC, SC?): pine savannas, pine flatwoods, pitcher plant bogs; rare (GA Special Concern, NC Rare). May-June. A Southeastern Coastal Plain endemic, ranging from FL and e. GA to LA, with disjunct populations in Onslow Co., NC. Reported for SC (Charleston/Berkeley Co. line) (P. McMillan 2000). [= FNA, GW, K, L, X; *Limodorum multiflorum* (Lindl.) C. Mohr. -- S]

Calopogon oklahomensis D.H. Goldman, Oklahoma Grass-pink. Cp (GA, SC): pine savannas; rare. Ranging from e. SC and MN south to s. GA and e. TX. [= FNA]

Calopogon pallidus Chapman, Pale Grass-pink. Cp (GA, NC, SC, VA): savannas, sandhill seeps; uncommon (VA Rare). May-July. A Southeastern Coastal Plain endemic, ranging from se. VA south to FL and west to LA. [= RAB, C, F, FNA, G, GW, K, L, X; *Limodorum pallidum* (Chapman) C. Mohr -- S]

Calopogon tuberosus (Linnaeus) Britton, Sterns, & Poggenberg var. ***tuberosus***, Common Grass-pink. Cp, Mt, Pd (GA, NC, SC, VA): savannas, sandhill seeps, floating peat mats, in the Piedmont and Mountains in bogs; uncommon, rare in Mountains and Piedmont (VA Watch List). April-July. Widespread in e. North America, also in Cuba and the West Indies; var. *simpsonii* (Chapman) Magrath occurs in FL, Cuba, and the West Indies. [= FNA, K, L; *C. pulchellus* R. Brown -- F, G, RAB, X; *C. tuberosus* -- C, GW, W, infraspecific taxa not distinguished; *Limodorum tuberosum* Linnaeus -- S]

Cleistes L.C. Richard ex Lindley 1840 (Spreading Pogonia, Rosebud Orchid)

As traditionally circumscribed, a genus of about 55 species, primarily of tropical America. The circumscription of this genus is uncertain (Cameron & Chase 1999; Cameron et al. 1999; Pridgeon et al. 1999c); it appears that North American "*Cleistes*" is not closely related to South American *Cleistes* (which includes the type of the genus), and either a new genus will need to be named to house our two species, or alternatively, *Pogonia*, *Isotria*, and N. American "*Cleistes*" could be combined into *Pogonia*. References: Catling & Gregg (1992)=Z; Gregg & Catling in FNA (2002a); Gregg (1991).

- 1 Column 13-19 mm long; lip 21-33 (-38.5) mm long, the basal 3/4 of the central keel of the lip with 5-7 discontinuous and irregular ridges; sepals (25-) 30-40 (-44) mm long; petals 2-3 cm long; distance between median leaf and floral bract 3-16 cm ***C. bifaria***
- 1 Column 21-25 (-29) mm long; lip (26-) 34-56 mm long, the basal 3/4 of the central keel of the lip with 1-3 parallel, continuous low ridges; sepals (31-) 40-56 (-65) mm long; petals 3.5-5 cm long; distance between median leaf and floral bract 9-20 cm ***C. divaricata***

Cleistes bifaria (Fernald) Catling & Gregg, Small Spreading Pogonia. Mt (GA, NC, SC, VA), Cp, Pd (GA, NC, SC): savannas, sandhill seeps, moist to fairly dry meadows, dry ridgetops under pines (where seasonally moist); uncommon (GA Special Concern, VA Rare). May-July. The species ranges in the Mountains and Piedmont from WV south through w. VA, e. KY, w. NC, and e. TN to w. SC, n. GA and n. AL, and in the Coastal Plain from se. NC to c. peninsular FL and west to e. LA. Catling & Gregg (1992) make a convincing case for the recognition of *C. bifaria* and *C. divaricata* as specifically distinct, based on differences in morphology, range, phenology (in the sympatric portions of their ranges), and floral fragrance. The co-occurrence of the two species at such sites as the Green Swamp, Brunswick County, NC, where phenologically separated, supports their taxonomic status. Where co-occurring, *C. bifaria* flowers on average about 10 days before *C. divaricata*. [= FNA, K, Z; *C. divaricata* -- RAB, C, G, GW, K, L, S, W, X, in part only; *C. divaricata* var. *bifaria* Fernald -- F; *Pogonia bifaria* (Fernald) P.M. Brown & Wunderlin]

Cleistes divaricata (Linnaeus) Ames, Large Spreading Pogonia. Cp (GA, NC, SC, VA): pine savannas; uncommon (VA Rare). May-mid June. The species ranges from s. NJ to sw. GA and ne. FL, in the Coastal Plain. [= FNA, K, Z; *C. divaricata* -- RAB, C, G, GW, K, L, S, W, X, in part only (see also *C. bifaria*); *C. divaricata* var. *divaricata* -- F; *Pogonia divaricata* (Linnaeus) R. Brown]

***Coeloglossum* Hartman 1820 (Frog Orchid, Long-bracted Orchid)**

Usually regarded as a monotypic genus, of north temperate regions of the Old and New World. However, *Coeloglossum* is probably not distinct from *Dactylorhiza* Neck. ex Nevski; *Coeloglossum* is the older name, and *Dactylorhiza* is suggested for nomenclatural conservation (Pridgeon et al. 1997, 1999b; Bateman et al. 1997). The taxonomic and nomenclatural outcome is uncertain. References: Sheviak & Catling in FNA (2002a); Bateman, Pridgeon, & Chase (1997)=Z.

Coeloglossum viride (Linnaeus) Hartman var. ***virescens*** (Muhlenberg ex Willdenow) Luer, Long-bracted Frog Orchid. Mt (NC, VA): moist woods; uncommon, rare south of VA (NC Rare). April-June. The species is circumboreal; var. *virescens* is e. Asian and North American, in e. North America south in the Appalachians to NC. It is generally more "southern" than the typic var. *viride*, which is more completely circumboreal, widespread in n. Eurasia and far northern North America. [= K, L, W; *Habenaria viridis* (Linnaeus) R. Brown var. *bracteata* (Muhlenberg ex Willdenow) Reichenbach ex A. Gray -- RAB, C, F, G, X; *Coeloglossum viride* (Linnaeus) Hartman -- FNA; *Coeloglossum bracteatum* (Muhlenberg ex Willdenow) Parlatores -- S; *Dactylorhiza viridis* (Linnaeus) R.M. Bateman, Pridgeon, & M.W. Chase -- Z]

***Corallorhiza* Gagnebin 1755 (Coralroot)**

A genus of about 15 species, distributed in north temperate regions of the Old and New World. The closest relative of *Corallorhiza* in our flora is *Aplectrum* (Freudenstein 1992). The mycotrophic nature of *Corallorhiza* is well established, but the exact means of the transfer of nutrients from the fungal hyphae to the orchid is not yet understood. References: Freudenstein (1992, 1997, 1999)=Z; Magrath & Freudenstein in FNA (2002a).

- 1 Lip with two lateral teeth or lobes; lateral sepals spreading to down-curved.
 - 2 Middle lobe of lip expanded slightly or not at all distally, the ratio of the width of the dilated part to the base of the mid-lobe less than 1.5; floral bracts averaging 0.5-1.0 mm long ***C. maculata* var. *maculata***
 - 2 Middle lobe of the lip distinctly expanded, the ratio of the width of the dilated part to the base of the midlobe greater than 1.5; floral bracts averaging 1.0-2.8 (-4.5) mm long ***C. maculata* var. *occidentalis***
- 1 Lip without lateral teeth or lobes (though sometimes erose or minutely toothed near its apex); lateral sepals arching, upcurved, or forward-directed.
 - 3 Sepals and petals 5-7.5 mm long; dorsal sepal more than 4.5 mm long, 3-nerved; flowering April-July.
 - 4 Lip with prominent, thickened, involute margins; flowering mid to late July ***C. bentleyi***
 - 4 Lip planar; flowering April-May ***C. wisteriana***
 - 3 Sepals and petals 3-4.5 mm long; dorsal sepal less than 4.5 mm long, 1-nerved; flowering August-October.
 - 5 Perianth closed or nearly so (cleistogamous); lip 1.7-2.2 mm wide, straight; column lacking or with only poorly developed basal ventral auricles; stigma 0.2-0.5 mm wide ***C. odontorhiza* [cleistogamous form]**

- 5 Perianth open (chasmogamous); lip 2.1-3.7 mm wide, bent downwards at a nearly right angle; column with 2 prominent auricles at the base on the ventral surface; stigma 0.7-1.0 mm wide **C. odontorhiza** [chasmogamous form]

Corallorhiza bentleyi Freudenstein. Mt (VA): {habitat}; rare. This species is known from Morgan County, WV and Giles County, VA. The species was recently named and was known (at the time of publication) from only a single population (Freudenstein 1999). It has since been found in VA. It is most closely related to *C. striata* Lindley. [= FNA, Z]

Corallorhiza maculata (Rafinesque) Rafinesque var. **maculata**, Eastern Spotted Coralroot. Mt (GA, NC, VA): moist forests, northern hardwood forests; uncommon (GA Special Concern). July-August. Var. *maculata* is irregularly distributed in much of North America, primarily northern, from Newfoundland Quebec, and MN south to PA, OH, and IN, and south in the Appalachians to ne. GA, in the west from British Columbia south to s. CA, s. AZ, and s. NM. Var. *mexicana* (Lindley) Freudenstein *ined.* is restricted to Mexico. [= FNA, Z; *C. maculata* -- RAB, C, F, G, K, L, S, W, X, in part, infraspecific taxa not distinguished]

Corallorhiza maculata (Rafinesque) Rafinesque var. **occidentalis** (Lindley) Ames, Western Spotted Coralroot. Mt (VA): forests; rare (VA Rare). May-July. Var. *occidentalis* (Lindley) Ames has a distribution similar to var. *maculata*, except that in the east it ranges south only to PA, s. Ontario, and WI, with a disjunct population in VA. [= FNA, Z; *C. maculata* -- RAB, C, F, G, K, L, S, W, X, in part, infraspecific taxa not distinguished]

Corallorhiza odontorhiza (Willdenow) Poir., Autumn Coralroot. Mt, Pd, Cp (GA, NC, SC, VA): forests; uncommon. August-October. The cleistogamous form is the more common, and is widespread in e. North America, from ME, NY, s. Ontario, MI, and MN south to SC, c. GA, c. AL, n. MS, c. AR, and e. OK. The chasmogamous form is less common, and is scattered in ne. United States and adjacent Canada, in Ontario, CT, PA, MI, IA, IN, DC, NC, and TN, and in Mexico (Chiapas, Distrito Federal, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Oaxaca, Puebla, Sonora), Guatemala, and Nicaragua. It may be recognized as a variety; see synonymy. [= RAB, C, F, G, L, S, W, X; *C. odontorhiza* var. *pringlei* (Greenman) Freudenstein -- FNA, K, Z; *C. odontorhiza* var. *odontorhiza* -- FNA, K, Z; *C. pringlei* Greenman]

Corallorhiza wisteriana Conrad, Spring Coralroot. Mt, Pd, Cp (GA, NC, SC, VA): moist forests; rare (NC Watch List). April-May. Widespread in e. North America, from NJ, PA, OH, IN, IL, MO, and OK south to FL, and TX, and also in the Rockies from MT and w. SD south to s. Mexico. [= RAB, C, F, FNA, G, K, L, S, W, X, Z]

Corallorhiza trifida Chatelain, south to DC {specimen at NCU}, MD, WV, PA, and NJ (Magrath & Freudenstein in FNA 2002, Kartesz 1999). [= FNA, K] {not yet keyed}

Cypripedium Linnaeus 1753 (Lady's-slipper)

A genus of about 40-50 species, north temperate in distribution. References: Sheviak (1994)=Z; Case et al. (1998); Wallace & Case (2000)=Y; Sheviak in FNA (2002a); Pridgeon et al. (1999c). Key to yellow-flowered species adapted from Sheviak (1994).

- 1 Plant scapose, with 2 basal leaves; pouch-like lip of flower with a longitudinal fissure, pink (rarely nearly white); [section *Acaulia*] **C. acaule**
- 1 Plant caulescent, with (2) 3-7 leaves alternate on the stem; pouch-like lip of flower with a rounded orifice, yellow or pink (rarely white).
 - 2 Pouch-like lip of flower pink and white (rarely all white); lateral petals and dorsal sepal white, not twisted, obtuse to acute; [section *Obtusipetala*] **C. reginae**
 - 2 Pouch-like lip of flower yellow or white; lateral petals and dorsal sepal brown, purplish brown, or yellow, slightly to strongly twisted, acuminate-attenuate; [section *Cypripedium*].
 - 3 Pouch-like lip of flower white, 1.5-2.5 cm long; orifice margin acute on the apical margin; [plants of calcareous barrens] **C. candidum**
 - 3 Pouch-like lip of flower bright yellow, pale yellow, or rarely white, (2.0-) 2.2-6.3 cm long (if pale yellow or white, then > 4 cm long); orifice margin rounded-occute on the apical margin; [plants of various habitats].
 - 4 Dorsal sepal 3.5-5.0 cm wide; pouch orifice 2.7-4.5 cm long; pouch-like lip 4.5-6.3 cm long, pale yellow or creamy white; plants robust, typically 5-8 dm tall **C. kentuckiense**
 - 4 Dorsal sepal 1.5-2.9 cm wide; pouch orifice 0.5-1.3 cm long; pouch-like lip (2.0-) 2.2-5.8 cm long, medium to rich yellow; plants not as robust, typically 2-5 (-6) dm tall.
 - 5 Outer surface of uppermost sheathing bract glabrous or sparsely or inconspicuously pubescent when young; pouch-like lip 15-29 mm long; flower scent intense and sweet [**C. parviflorum** var. **makasin**]
 - 5 Outer surface of uppermost sheathing bract densely and conspicuously silvery-pubescent when young, or rarely glabrescent; pouch-like lip 2.0-5.4 cm long; flower scent moderate to faint, rose-like or pungent-musty.
 - 6 Pouch-like lip 2.2-3.4 cm long; sepals and lateral petals usually densely and minutely spotted with dark reddish brown or purple, thus appearing uniformly dark **C. parviflorum** var. **parviflorum**
 - 6 Pouch-like lip (2.0-) 3.0-5.8 cm long; sepals and lateral petals unmarked (greenish-yellow), or more often streaked, blotched, striped or reticulately marked with dark reddish brown or purple (but generally not extensively blotched) **C. parviflorum** var. **pubescens**

Cypripedium acaule Aiton, Pink Lady's-slipper, Moccasin-flower. Pd, Mt (GA, NC, SC, VA), Cp (NC, SC, VA): dry to mesic, acid forests and woodlands, often under pine or other conifers; common. April-July. Ranging from Newfoundland west to n.

Alberta, south to NC, SC, TN, n. IN, and MN. [= RAB, C, F, FNA, G, K, L, W, X; *Fissipes acaulis* (Aiton) Small -- S]

Cypripedium candidum Muhlenberg ex Willdenow, White Lady's-slipper. Mt (VA): calcareous barrens; rare (VA Rare). Ranging from NY and NJ west to ND, south to w. VA and MO. [= C, F, FNA, G, K, L, X]

Cypripedium kentuckiense C.F. Reed, Kentucky Yellow Lady's-slipper. Cp (GA, VA): sandy ravine bottoms and springhead seeps along small streams; rare (GA Special Concern, VA Rare). First reported for our area by Weldy et al. (1996). *C. kentuckiense* C.F. Reed is similar to *C. parviflorum* var. *pubescens* and, in addition to the site discovered in e. VA, reaches e. TN (Franklin and Scott counties, Cumberland Plateau) and e. KY. Case et al. (1998) studied isozymes of *C. kentuckiense* and related *Cypripedium* spp.; the recognition of *C. kentuckiense* as a species was supported. [= C, FNA, K, Y, Z; often included in a broad concept of *C. calceolus*, *C. pubescens*, or *C. calceolus* var. *pubescens* by most earlier authors]

Cypripedium parviflorum Salisbury var. ***parviflorum***, Small Yellow Lady's-slipper. Mt (GA?, NC, VA): mesic forests, seepy forests over amphibolite, other habitats; uncommon (NC Watch List). April-June. Rather widespread in North America, south in the east to NC and GA. The exact range, abundance, and habitats of this species in our area are obscure, because of confusion with the more northern var. *makasin* (Farwell) Sheviak and small-flowered forms of var. *pubescens*. See Sheviak for a discussion of why North American plants of yellow lady's-slippers are recognized as a species distinct from the European *C. calceolus* Linnaeus [= FNA, Y, Z; *C. calceolus* Linnaeus var. *pubescens* -- RAB, G, X, in part; *C. parviflorum* -- K, S, in the narrow sense; *C. calceolus* var. *parviflorum* (Salisbury) Fernald -- C, F, L, W]

Cypripedium parviflorum Salisbury var. ***pubescens*** (Willdenow) Knight, Large Yellow Lady's-slipper. Mt (GA, NC, SC, VA), Pd (GA, NC, SC, VA), Cp (VA): rich mesic forests; uncommon (NC Watch List, SC Rare). April-June. Widespread in e. North America. [= FNA, Y, Z; *C. calceolus* Linnaeus var. *pubescens* (Willdenow) Correll -- RAB, G, X, in part only (also see *C. parviflorum* var. *parviflorum*); *C. pubescens* Willdenow -- K, S; *C. calceolus* var. *pubescens* (Willdenow) Correll -- C, F, L, W]

Cypripedium reginae Walter, Showy Lady's-slipper, Queen Lady's-slipper. Mt (GA?, NC*, VA): over circumneutral to basic rocks, or (allegedly) in mossy wet forests under *Rhododendron*; rare (NC Watch List, VA Rare). May-June. Widespread in ne. North America, south to NC, GA, TN, and MO. The native occurrence of this species in NC is questionable; the only definite specimen the author has seen from the state is from an implausible habitat for the species (highly acid humus under rhododendron). [= RAB, C, F, FNA, G, K, L, S, W, X]

C. parviflorum Salisbury var. *makasin* (Farwell) Sheviak ranges south to PA and NJ (Kartesz 1999). Var. *makasin* is the northern, small-flowered plant, characteristically of calcareous fens, often confused with var. *parviflorum*. It may reach our area. [= K, Y, Z]

Epidendrum Linnaeus 1759 (Green-fly Orchid)

A genus of about 1000 species, of tropical (and rarely subtropical) America. References: Hágsater in FNA (2002a).

Epidendrum magnoliae Muhlenberg, Green-fly Orchid. Cp (GA, NC, SC): epiphytic on limbs of trees, especially *Taxodium*, in blackwater river swamps, usually on relatively horizontal limbs mixed with *Pleopeltis polypodioides*, also rarely in crevices of Altamaha Grit outcrops; rare (NC Rare, SC Rare). July-October. The northernmost epiphytic orchid, ranging from se. NC south to FL and west to LA; also in ne. Mexico. See Correll (1936) for additional discussion of this species at its northern limit. Hágsater (2000) indicates that *E. magnoliae* Muhlenberg has nomenclatural priority over *E. conopseum* R. Brown. [= FNA; *E. conopseum* Aiton f. -- RAB, L, X; *E. conopseum* var. *conopseum* -- K; *Amphiglottis conopsea* (Aiton filius) Small -- S]

Epipactis Zinn 1757 (Helleborine)

A genus of about 25 species, of w. North America, Eurasia, and n. Africa (Brown & Argus in FNA 2002). References: Brown & Argus in FNA (2002a).

* ***Epipactis helleborine*** (Linnaeus) Crantz, Broad-leaved Helleborine. Mt (NC, VA): forests; rare, introduced from Europe. June-September. This species has been collected a handful of times in various parts of the mountains, some of the colonies dating back to the early 1960's; it has become common in ne. United States and se. Canada. [= C, F, FNA, K, L, X; *E. latifolia* (Linnaeus) Allioni -- G]

Eulophia R. Brown ex Lindley 1823 (also see *Pteroglossaspis*)

A genus of about 215 species, pantropical (Romero-González in FNA 2002). References: Romero-González in FNA (2002a).

Eulophia alta (Linnaeus) Fawcett & Rendle, Wild Coco, occurs from s. GA south through the FL peninsula into the West Indies, Mexico, Central America, and South America. {confirm occurrence in GA -- reported in FNA} [= FNA, GW, K; *Platypus altus* (Linnaeus) Small -- S]

Galearis Rafinesque 1833 (Showy Orchis)

A genus of 3-6 species, of e. North America and e. Asia. References: Sheviak & Catling in FNA (2002a); Pridgeon et al. (1999b).

Galearis spectabilis (Linnaeus) Rafinesque, Showy Orchis. Mt (GA, NC, SC, VA), Pd (NC, VA), Cp (VA): rich, deciduous forests, most typically over calcareous or mafic rocks; common (SC Rare). April-July. New Brunswick and Québec west to MN, south to GA and AR. [= FNA, K, L, W; *Orchis spectabilis* Linnaeus -- RAB, C, F, G, X; *Galeorchis spectabilis* (Linnaeus) Rydberg -- S]

Goodyera R. Brown 1813 (Rattlesnake Orchid)

A genus of about 55-100 species, widespread in distribution but primarily Northern Hemisphere. References: Kallunki in FNA (2002a); Pridgeon et al. (1999c).

- 1 Leaves dark green, the upper surface variegated with pale green, the midrib only irregularly and narrowly pale green, most of the network of pale green variegations broad (0.5-1 mm wide), with a dark green center line (thus the variegations appearing double), the outlines of the variegations finely and irregularly toothed; inflorescence secund, primarily one-sided, or loosely spiraled **G. repens**
- 1 Leaves blue-green, the upper surface variegated with white, the midrib broadly whitened (1-3 mm wide), the remainder of the network of white variegations narrow (less than 0.5 mm wide), generally lacking any internal variation in color, the outlines of the variegations smooth; inflorescence cylindric, not secund or one-sided **G. pubescens**

Goodyera pubescens (Willdenow) R. Brown, Downy Rattlesnake-orchid. Mt, Pd, Cp (NC, SC, VA): dry to moist forests and woodlands; common. June-August. Ranging from New Brunswick west to Ontario and MN, south to panhandle FL, MS, and AR. One of the commonest of orchids throughout much of its range. [= RAB, C, F, FNA, G, K, L, W, X; *Peramium pubescens* (Willdenow) MacM. -- S]

Goodyera repens (Linnaeus) R. Brown, Lesser Rattlesnake-orchid. Mt (NC, VA): moist forests, usually under conifers and rhododendrons; uncommon (NC Watch List, VA Watch List). June-September. A circumboreal species of northern North America and Eurasia, this species is approaching its southern limit in NC. [= FNA, K, L, W; *Goodyera repens* var. *ophioides* Fernald -- RAB, C, F, G, X; *Peramium ophioides* (Fernald) Rydberg -- S]

Goodyera tessellata Loddiges, Checkered Rattlesnake-plantain, south to MD, PA, and NJ (Kallunki in FNA 2002, Kartesz 1999). [= FNA, K] {not yet keyed}

Habenaria Willdenow 1805 (Longspur Orchid, Habenaria)
(also see *Coeloglossum*, *Platanthera*)

A genus of about 600 species, tropical and subtropical in the Old World and New World. References: Pridgeon et al. (1999b).

- 1 Spur 4-10 cm long **H. quinqueseta**
- 1 Spur 0.4-1.4 cm long **H. repens**

Habenaria quinqueseta (Michaux) A. Eaton, Long-horned Habenaria. Cp (GA, SC): pine flatwoods, pinelands, Altamaha Grit outcrops, rarely in swamps; rare (GA Special Concern, SC Rare). August-October. *H. quinqueseta* (in the narrow sense) ranges from SC south to s. FL, west to se. TX. The related *H. macroceratitis* Willdenow, differing in its spur 12-18 cm long (vs. 4-10 cm) occurs in peninsular FL; also in the West Indies, Mexico, Central America, and n. South America. [= K; *H. quinqueseta* var. *quinqueseta* -- L; *H. quinqueseta* -- RAB, GW, S, X, in a broad sense (including *H. macroceratitis*)]

Habenaria repens Nuttall, Water-spider Orchid, Floating Orchid. Cp (GA, NC, SC, VA?): blackwater swamps, pools, banks of creeks and rivers; rare (NC Watch List, VA Rare). April-November. This species ranges from NC south to FL and west to TX, also in the West Indies, Mexico, Central America, and n. South America. Reported from se. VA. [= RAB, GW, K, L, S, X]

Hexalectris Rafinesque 1825 (Crested Coralroot)

A genus of about 7 species, mycotrophic, of s. North America. References: Catling & Engel (1993)=Z; Goldman, Coleman, Magrath, & Catling in FNA (2002a).

Hexalectris spicata (Walter) Barnhart var. **spicata**, Crested Coralroot, Brunetta. Pd, Mt, Cp (GA, NC, SC, VA): dry forests and woodlands, especially over mafic or calcareous rocks, such as diabase, gabbro, calcareous siltstone, and dolomite (though sometimes in distinctly acid situations); rare (NC Rare, VA Watch List). July-August. Var. *spicata* is widespread in se. North America, ranging from MD, OH, and MO south to FL, TX, and Mexico. Var. *arizonica* (S. Watson) Catling & Engel, an autopolinating relative, is distributed from e. TX west to AZ, south into Mexico. The yellow and purple flowers borne on a brown stem present a very peculiar color combination. The genus is primarily Mexican. [= FNA, Z; *H. spicata* -- RAB, C, F, G, K, L, S, W, X, infraspecific taxa not distinguished]

***Isotria* Rafinesque 1808 (Whorled Pogonia, Five-leaves, Fiveleaf Orchid)**

A genus of 2 species, of e. North America. Cameron & Chase (1999) indicate that *Isotria* should perhaps be included in a more broadly circumscribed *Pogonia* (as was often done prior to 1922). References: Mehrhoff & Homoya in FNA (2002a).

Identification notes: Sterile *Isotria* is sometimes confused with *Medeola*. *Medeola* has a wiry-textured stem, with floccose hairiness, at least towards the base. *Isotria* has a fleshier stem lacking hairs.

- 1 Sepals 12-30 mm long, greenish-brown; lip 10-15 mm long; pedicel of fruit (0-) 5-10 (-15) mm long; plant glaucous, the stem whitish-green ***I. medeoloides***
- 1 Sepals 35-60 mm long, purple-brown; lip 20-25 mm long; pedicel of fruit (12-) 20-55 mm long; plant scarcely glaucous (if at all), the stem generally purplish ***I. verticillata***

Isotria medeoloides (Pursh) Rafinesque, Small Whorled Pogonia, Little Five-leaves. Mt (GA, NC, SC), Pd (NC, VA), Cp (NC): moist forests, in the mountains and upper Piedmont usually with *Pinus strobus*; rare (US Endangered, GA Threatened, NC Endangered, SC Rare, VA Endangered). May-June. Widespread (but very local) in ne. North America, from s. ME and MI south to c. and e. WV, w. VA, w. NC, e. TN, and n. GA. The reproductive biology of this species was studied by Vitt & Campbell (1997). Van Alstine et al. (1996) discuss the habitats of known occurrences in Virginia. [= RAB, C, F, FNA, G, K, L, W, X; *I. affinis* (C.F. Austin) Rydberg -- S; *Pogonia affinis* C.F. Austin]

Isotria verticillata (Muhlenberg ex Willdenow) Rafinesque, Large Whorled Pogonia, Larger Five-leaves. Mt, Pd, Cp (GA, NC, SC, VA): moist to dry forests; common (uncommon in GA, SC, NC). April-July. Widespread in e. North America, from ME and MI south to panhandle FL and e. TX. [= RAB, C, F, FNA, G, K, L, S, W, X; *Pogonia verticillata* (Muhlenberg ex Willdenow) Nuttall]

***Liparis* L.C. Richard 1817 (Wide-lip Orchid, Twayblade)**

A genus of about 250-350 species, cosmopolitan. References: Magrath in FNA (2002a).

- 1 Lip (8-) 10-12 mm long, pale purple; pedicels 11-18 mm long, equal to or longer than the capsule ***L. liliifolia***
- 1 Lip 4-5.5 mm long, yellowish-green; pedicels 3-7 mm long, shorter than the capsule ***L. loeselii***

Liparis liliifolia (Linnaeus) L.C. Richard ex Ker-Gawler, Large Twayblade, Mauve Sleekwort, Russet-witch, Brown Wide-lip Orchid. Mt (GA, NC, SC, VA), Pd (GA, NC, VA), Cp (NC, VA): moist forests, floodplains; uncommon (SC Rare). May-July. Widespread in ne. North America, ranging from VT and Ontario west to MN, south to GA and AR; also in China. [= RAB, C, F, FNA, G, GW, K, L, S, W, X]

Liparis loeselii (Linnaeus) L.C. Richard, Fen Orchid, Loesel's Twayblade, Bog Twayblade, Yellow Wide-lip Orchid. Mt (NC, VA), Cp (NC, VA), Pd (VA): seepages at moderate to high elevations in the mountains, mucky bay swamps (dominated by *Persea palustris* and *Magnolia virginiana*) at about sea level on the Outer Banks, and other moist, seepy habitats, especially over mafic or calcareous rocks; rare (NC Rare, VA Rare). May-July. Widespread in ne. North America, ranging from Nova Scotia and Quebec west to Mackenzie and British Columbia, south to ne. NC, sw. NC, AL, AR, KS, NE, and WA. [= RAB, C, F, FNA, G, GW, K, L, S, W, X]

***Listera* R. Brown 1813 (Twayblade)**

A genus of about 25 species, boreal, north temperate, and south temperate (Magrath & Coleman in FNA 2002). References: Magrath & Coleman in FNA (2002a).

- 1 Lip usually cleft about one-third its length, the two lobes oblong, with rounded apices ***L. smallii***
- 1 Lip usually cleft about two-thirds its length, the two lobes linear, with acute apices.
 - 2 Lip 6-10 mm long, lacking prominent teeth near the base (but with 2 vertically-oriented lobes); pedicels and raceme axis glandular-puberulent; sepals and petals 1-2 mm long ***L. australis***
 - 2 Lip 3-5 mm long, with 2 prominent teeth near the base, these diverging horizontally; pedicels and raceme axis glabrous; sepals and petals 1-5-3 mm long ***L. cordata* var. *cordata***

Listera australis Lindley, Southern Twayblade. Cp (GA, NC, SC, VA), Pd (GA), Mt (NC): swamps, second terraces in floodplain forests, wet woods under *Rhododendron maximum*; uncommon (GA Special Concern, NC Watch List, SC Rare). March-July. Mainly a Southeastern Coastal Plain species, from NJ south to FL and west to e. TX, but also scattered north into VT and s. Canada. [= RAB, C, F, FNA, G, GW, K, L, W, X; *Ophrys australis* (Lindley) House -- S]

Listera cordata (Linnaeus) R. Brown var. ***cordata***, Heartleaf Twayblade, Lesser Twayblade. Mt (NC): habitat not known; rare (NC Watch List). June-July. A widespread circumboreal species of n. Eurasia and n. North America, south to NC (at least formerly, not seen in this century). Var. *cordata* is widespread in ne. United States and widespread in Canada; var. *nephrophylla* (Rydberg) Hultén is widespread in nw. North America. [= FNA, K, L; *L. cordata* -- RAB, C, F, G, W, X, infraspecific taxa not distinguished]

Listera smallii Wiegand, Appalachian Twayblade, Small's Twayblade, Kidneyleaf Twayblade. Mt (GA, NC, SC, VA): shaded swamps, wet slopes, nearly always beneath *Rhododendron maximum*; uncommon (GA Special Concern, SC Rare, VA Watch List). June-July. A Southern and Central Appalachian endemic, ranging from s. PA south to nw. SC and ne. GA. [= RAB, C, FNA, G, GW, K, L, W, X; *Ophrys smallii* (Wiegand) House -- S]

Listera convallarioides (Swartz) Nuttall was attributed to NC by Correll (1950); this record is almost certainly an error.

Malaxis Solander ex Swartz 1788 (Adder's-mouth)

A genus of about 250-300 species, nearly cosmopolitan. References: Catling (1991)=Z; Catling & Magrath in FNA (2002a). Key adapted from Catling (1991).

- 1 Leaves 2-5; lip oriented upwards, erect, entire, obtuse to acuminate ***M. spicata***
- 1 Leaf solitary; lip oriented downwards, deflexed, 3-lobed (the central lobe smaller than the 2 lateral lobes).
 - 2 Lip pointed, acuminate, lacking lateral lobes [***M. brachypoda***]
 - 2 Lip bifid, with 2 well-developed lateral lobes on either side of a smaller central lobe.
 - 3 Pedicels (4-) 5-10 (-13) mm long (and more than 5 mm long in plants with inflorescences over 45 mm long); basal lobes of the lip not prominent, 0.4-1.1 mm long, mostly less than 1.5× as long as the apical lateral lobes and less than 0.6× as long as the length from the base to the tip of the mid-lobe; inflorescences densely flowered above, the lower flowers soon withering ***M. unifolia***
 - 3 Pedicels 3-5 (-5.8) mm long (even in plants with inflorescences over 80 mm long); basal lobes of the lip prominent, 0.75-1.1 mm long, usually 1.5-2 (-2.5)× as long as the apical lateral lobes and 0.6 or more × as long as the length from the base to the tip of the mid-lobe; inflorescences loosely flowered above, the lower flowers withering slowly ***M. bayardii***

Malaxis bayardii Fernald, Appalachian Adder's-mouth. Mt (NC, VA), Pd (NC), Cp (VA): dry, open, upland forests, shale barrens; rare (NC Rare, VA Watch List). July-September. Ranging from s. NY and se. MA south through CT, RI, NJ, PA, and VA to w. and c. NC, mostly in the mountains (but somewhat disjunct on the Coastal Plain of VA). See Catling (1991) for further discussion of the distinction of *M. bayardii* from *M. unifolia*. [= F, FNA, K, Z; *M. unifolia* -- RAB, C, G, GW, L, S, W, X, in part]

Malaxis spicata Swartz, Florida Adder's-mouth. Cp (GA, NC, SC, VA): maritime swamp forests, calcareous but mucky swamps in the outer Coastal Plain, spring-fed swamps, wet hammocks; rare (GA Special Concern, NC Rare, VA Rare). July-August. Ranging from se. VA south to FL, and in the n. West Indies. [= RAB, C, FNA, G, GW, K, L, S, X; *M. floridana* (Chapman) Kuntze -- F]

Malaxis unifolia Michaux, Green Adder's-mouth. Cp, Mt, Pd (GA, NC, SC, VA): bogs, moist forested slopes; uncommon (rare in Piedmont and Coastal Plain). June-August. Widespread in e. North America, from Newfoundland and FL west to MN, IA, MO, e. OK, and e. TX; also in Mexico, Cuba, the West Indies, and Central America. [= F, FNA, K, Z; *M. unifolia* -- RAB, C, G, GW, L, S, W, X, in part only (also see *M. bayardii*)]

Malaxis brachypoda (A. Gray) Fernald, White Malaxis, ranges as far south as sc. PA (Rhoads & Klein 1993) and NJ (Kartesz 1999), in moist forests and bogs; it is additionally reported by F to range south to the Mountains of TN, the documentation unknown. [= F, K; *M. monophyllos* (Linnaeus) Swartz var. *brachypoda* (A. Gray) Morris & Eames -- C, FNA, G, L, X; *M. monophyllos* (Linnaeus) Swartz ssp. *brachypoda* (A. Gray) Å. & D. Löve]

Platanthera L.C. Richard 1817 (Fringed Orchid, Fringeless Orchid)

A genus of about 200 species, largely of the temperate northern hemisphere, extending south into tropical Central America and tropical se. Asia. References: Sheviak in FNA (2002a); Reddoch & Reddoch (1993); Pridgeon et al. (1999b).

Identification Notes: hybrids are frequent and are not keyed; they are generally intermediate in characters and are found in mixed populations of the two parents. Further information follows the species accounts.

- 1 Lip entire, finely toothed, or eroded (neither fringed nor deeply divided into 3 lobes).
 - 2 Leaves basal, 1 or 2, orbicular, (5-) 8-25 cm wide, prostrate on the ground, the stem naked or with a few bladeless bracts.
 - 3 Stem bractless [***P. hookeri***]
 - 3 Stem with bracts.
 - 4 Corolla spur 28-47 mm long; hemipollinarium 4.6-6.8 mm long; seeds (0.72-) 0.76-0.97 mm long [***P. macrophylla***]
 - 4 Corolla spur 14-28 mm long; hemipollinarium 3.0-4.8 mm long; seeds 0.54-0.72 (-0.79) ***P. orbiculata***
 - 2 Leaves cauline, 1-10 or more, mostly lanceolate, 1-5 cm wide, ascending, the stem with at least 1 (usually several) bladed leaves.
 - 5 Lip 11-15 mm long; spur mostly 40-50 mm long ***P. integrilabia***
 - 5 Lip 2-8 mm long; spur 4-23 mm long.

- 6 Flowers green, greenish-white, yellowish-green, yellowish-white, or dull-white.
 - 7 Larger stem leaves usually 1, rarely 2, near the middle of the stem; raceme 2-9 cm long, 2-3.5 cm in diameter; lip without a tubercle on the upper surface near the base, also lacking lateral auricles near the base ***P. clavellata***
 - 7 Larger stem leaves usually 2 (-5), near the middle of the stem or towards its base; raceme 5-20 cm long, 1.2-2 cm in diameter; lip with a tubercle on the upper surface near the base, also usually with 2 lateral auricles.
 - 8 Most bracts of the inflorescence shorter than the flowers they subtend (the lowermost few exceeding the flowers); flowers sparsely distributed; lip orbicular, 1-1.5× as long as broad, yellowish-green ***P. flava* var. *flava***
 - 8 Most bracts of the inflorescence exceeding the flowers they subtend (the uppermost few sometimes shorter than the flowers); flowers densely distributed; lip oblong, 2-3× as long as broad, green ***P. flava* var. *herbiola***
- 6 Flowers golden-yellow or bright-white.
 - 9 Flowers golden-yellow; spur 4-8 mm long; lip minutely crenulate, directed downwards ***P. integra***
 - 9 Flowers bright-white; spur 11-23 mm long; lip entire, directed upwards ***P. nivea***
- 1 Lip either fringed, deeply divided into 3 lobes, or both.
 - 10 Lip not deeply divided into 3 lobes, deeply fringed; flowers white, yellow, orange.
 - 11 Flowers white; spur 15-50 mm long.
 - 12 Spur 15-26 mm long, ca. 1× as long as the ovary; lip narrowed to a very short isthmus (between the base and the fringed portion) ***P. blephariglottis* var. *blephariglottis***
 - 12 Spur 30-50 mm long, ca. 2× as long as the ovary; lip narrowed to an extended isthmus ***P. blephariglottis* var. *conspicua***
 - 11 Flowers yellow to orange; spur 5-33 mm long.
 - 13 Spur 20-33 mm long; undivided portion of lip 8-12 mm long ***P. ciliaris***
 - 13 Spur 5-10 mm long; undivided portion of lip 4-6 mm long.
 - 14 Spur 4-10 mm long; spur orifice keyhole-shaped ***P. chapmanii***
 - 14 Spur 8-17 mm long; spur orifice circular ***P. cristata***
 - 10 Lip deeply divided into 3 lobes, the lobes deeply fringed, shallowly fringed, eroded, or entire; flowers purple or greenish-white or yellowish-white.
 - 13 Lateral lobes of lip deeply fringed (nearly or entirely to the point of junction with the central lobe of the lip); flowers greenish-white or yellowish-white.
 - 14 Perianth greenish-white; lateral petals linear-spatulate, less than 2 mm wide, blunt, entire to inconspicuously crenulate; lateral sepals deflexed ***P. lacera***
 - 14 Perianth white or cream; lateral petals cuneate to broadly obovate, 4-12 mm wide, toothed; lateral sepals divergent ***P. leucophaea***
 - 13 Lateral lobes of lip entire, eroded, or shallowly fringed (generally no more than half way from the apex to the point of junction with the central lobe of the lip); flowers purple.
 - 15 Lobes of lip eroded or entire, few (if any) of the segments more than 1 mm long ***P. peramoena***
 - 15 Lobes of lip shallowly fringed, most or all of the segments more than 1 mm long.
 - 16 Lobes of lip fringed from a third to a half of the way to the base of the lobes; opening to nectary widely rounded (the pollen sacs spread widely apart); spur 20-26 mm long ***P. grandiflora***
 - 16 Lobes of the lip fringed less than a third of the way to the base of the lobes; opening to nectary dumbbell-shaped (the pollen sacs close together); spur 12-20 mm long ***P. psychodes***

Platanthera blephariglottis (Willdenow) Lindley var. ***blephariglottis***, Small White Fringed Orchid. Cp (GA, NC, SC, VA): seepages, sandhill-pocosin ecotones; uncommon (GA Special Concern). July-September. Newfoundland west to MI, south to GA. [= FNA, K; *Habenaria blephariglottis* (Willdenow) Hooker var. *blephariglottis* -- RAB, X, in part; *H. blephariglottis* var. *blephariglottis* -- F, in part only (possibly misapplied); *H. blephariglottis* -- GW, infraspecific taxa not distinguished; *B. blephariglottis* (Willdenow) Rydberg -- S, in part only (possibly misapplied); *P. blephariglottis* (Willdenow) Lindley -- W, infraspecific taxa not distinguished]

Platanthera blephariglottis (Willdenow) Lindley var. ***conspicua*** (Nash) Luer, Large White Fringed Orchid. Cp (GA, NC, SC, VA): savannas, seepages, sandhill-pocosin ecotones; uncommon (but locally abundant) (GA Special Concern, VA Rare). July-September. NC south to FL, west to TX. Previous studies (such as Hardin 1961) used different characters, and interpreted the infraspecific taxa differently. [= FNA, K, L; *Habenaria blephariglottis* (Willdenow) Hooker var. *blephariglottis* -- RAB, X, in part only; *H. blephariglottis* var. *conspicua* (Nash) Ames -- C, F; *H. blephariglottis* -- GW, infraspecific taxa not distinguished; *Blephariglottis conspicua* (Nash) Small -- S, in part (also see *Platanthera integrilabia*); *B. blephariglottis* (Willdenow) Rydberg -- S, in part only (possibly misapplied)]

Platanthera chapmanii (Small) Luer, Chapman's Orange-fringed Orchid. Cp (GA): pine savannas; rare (GA Special Concern). S. GA and n. FL; e. TX. Previously generally confused with the hybrid between *P. ciliaris* × *cristata* (*P. × chapmanii*). See Folsom (1984). [= FNA, K; *Blephariglottis chapmanii* Small -- S] {add synonymy}

Platanthera ciliaris (Linnaeus) Lindley, Yellow Fringed Orchid. Cp, Mt, Pd (GA, NC, SC, VA): savannas, moist roadbanks, meadows, pastures; common (rare in Piedmont). July-September. Widespread in e. North America, *P. ciliaris* is probably our most common and least habitat-specific *Platanthera*. [= FNA, K, L, W; *Habenaria ciliaris* (Linnaeus) R. Brown -- RAB, C, F, G, GW, X; *Blephariglottis ciliaris* (Linnaeus) Rydberg -- S]

Platanthera clavellata (Michaux) Luer, Small Green Wood Orchid. Mt, Pd, Cp (GA, NC, SC, VA): seepages, bogs, swamps,

other wet places; common (uncommon in Piedmont). June-September. Widespread in e. North America. [= FNA, K, L, W; *Habenaria clavellata* (Michaux) Sprengel -- RAB, C, G, GW, X; *H. clavellata* var. *wrightii* Olive -- RAB; *H. clavellata* (Michaux) Sprengel var. *clavellata* -- F; *Gymnadeniopsis clavellata* (Michaux) Rydberg -- S]

Platanthera cristata (Michaux) Lindley, Crested Fringed Orchid, Golden Fringed Orchid. Cp (GA, NC, SC, VA), Mt (NC, SC, VA): savannas, bogs, moist roadsides; uncommon (rare in Mountains). June-September. *P. cristata* is more limited to the Coastal Plain than the related *P. ciliaris*, ranging from s. MA south to FL and west to TX, and also inland in KY, TN, AR, SC, and NC. [= FNA, K, L, W; *Habenaria cristata* (Michaux) R. Brown -- RAB, C, F, G, GW, X; *Blephariglottis cristata* (Michaux) Rafinesque -- S]

Platanthera flava (Linnaeus) Lindley var. *flava*, Southern Rein Orchid, Southern Gypsy-spike. Cp, Pd (GA, NC, SC, VA): shaded wet places, such as swampy forests; uncommon (rare in Piedmont) (VA Watch List). March-September. Var. *flava* has a scattered range in se. and sc. United States, primarily (but not solely) on the Coastal Plain, north to MD and IL; remarkably disjunct in s. Nova Scotia, where it occurs associated with other disjuncts from the Southeastern Coastal Plain. See Homoya (1993) for additional discussion of the two varieties of *P. flava*; he suggests that specific status may be warranted. [= FNA, K, L; *Habenaria flava* (Linnaeus) R. Brown var. *flava* -- RAB, C, F, G, X; *Habenaria flava* -- GW, infraspecific taxa not distinguished; *Perularia scutellata* (Nuttall) Small -- S; *Perularia bidentata* (Elliott) Small -- S]

Platanthera flava (Linnaeus) Lindley var. *herbiola* (R. Brown) Luer, Tubercled Rein Orchid, Northern Gypsy-spike. Mt (NC, VA): bogs, seepages; rare (GA Special Concern, NC Rare, VA Watch List). May-September. Var. *herbiola* is more northern, widespread in ne. North America, south (in the mountains) to NC. See Homoya (1993) for additional discussion of the two varieties of *P. flava*; he suggests that specific status may be warranted. [= FNA, K, L, W; *Habenaria flava* (Linnaeus) R. Brown var. *herbiola* (R. Brown) Ames & Correll -- RAB, C, F, G, X; *Perularia flava* (Linnaeus) Farwell -- S, apparently misapplied]

Platanthera grandiflora (Bigelow) Lindley, Large Purple Fringed Orchid, Plume-royal. Mt (GA, NC, VA): bogs, seepages, moist places at high elevations; rare (NC Rare, VA Rare). June-August. Widespread in ne. North America, south in the mountains to NC and n. GA. [= FNA, K, L, W; *Habenaria psycodes* (Linnaeus) Sprengel var. *grandiflora* (Bigelow) Gray -- RAB, C, G, X; *Habenaria fimbriata* (Aiton) R. Brown -- F; *Blephariglottis grandiflora* (Bigelow) Rydberg -- S]

Platanthera integra (Nuttall) Gray ex Beck, Golden Fringeless Orchid, Yellow Fringeless Orchid. Cp (GA, NC, SC), Mt, Pd (NC): savannas in the Coastal Plain, bogs in the Mountains and Piedmont; rare (GA Special Concern, NC Threatened, SC Rare). July-September. Essentially endemic to the Southeastern Coastal Plain, ranging from s. NJ south to FL and west to se. TX, with disjunct occurrences in TN (Eastern Highland Rim) and in bogs at low elevations of the Blue Ridge of NC. It is apparently now extirpated in the Mountains and Piedmont of NC. [= FNA, K, L; *Habenaria integra* (Nuttall) Sprengel -- RAB, C, F, G, GW, X; *Gymnadeniopsis integra* (Nuttall) Rydberg -- S]

Platanthera integrilabia (Correll) Luer, Monkey Face Orchid, White Fringeless Orchid. Mt (GA, NC, SC, VA), Pd (GA): bogs, red maple - gum swamps, seeps and streambanks; rare (US Species of Concern, GA Threatened, NC Endangered, SC Rare, VA Rare). July-September. Endemic to KY, e. TN, sw. VA, w. NC, nw. SC, n. GA, n. AL, and n. MS, primarily in the Cumberland Plateau. See Zettler, Ahuja, & McInnis (1996) for a discussion of pollination. [= FNA, K, L, W; *Habenaria blephariglottis* (Willdenow) Hooker var. *integrilabia* Correll -- RAB, F, X; *H. correlliana* Cronquist -- C; *Habenaria blephariglottis* var. *holopetala* (Lindley) A. Gray]

Platanthera lacera (Michaux) G. Don, Green Fringed Orchid, Ragged Fringed Orchid, Ragged Orchid. Mt, Pd, Cp (GA, NC, SC, VA): swamps, bogs, seepages; uncommon, rare in Piedmont and Coastal Plain (SC Rare). June-August. Widespread in ne. North America, south to SC, GA, AL, AR, and OK. Var. *terrae-novae* (Fernald) Luer is not distinct, and is based on hybrid swarms involving *P. lacera* and *P. psycodes* (Catling 1997). [= FNA, K, W; *Habenaria lacera* (Michaux) R. Brown -- RAB, C, G, GW, X; *Habenaria lacera* var. *lacera* -- F; *Blephariglottis lacera* (Michaux) Farwell -- S; *P. lacera* var. *lacera* -- L]

Platanthera leucophaea (Nuttall) Lindley, Prairie Fringed Orchid. Mt (VA): damp calcareous meadows; rare (US Threatened, VA Rare). May-July. Ranging from ME west to NE, south to w. VA, nw. PA, c. OH, c. IN, IL, MO, and OK. [= FNA, K, W; *Habenaria leucophaea* (Nuttall) A. Gray var. *leucophaea* -- C; *Habenaria leucophaea* (Nuttall) A. Gray -- G, X]

Platanthera nivea (Nuttall) Luer, Snowy Orchid, Bog-spike. Cp (GA, NC, SC): wet savannas; rare (GA Special Concern, NC Rare). May-September. Essentially a Southeastern Coastal plain endemic, *P. nivea* ranges from s. NJ south to FL and west to TX, disjunct in Coffee County, TN (Eastern Highland Rim). This species is even more irregular than most *Platanthera* in its flowering, whole populations sometimes not flowering for a number of years. The flowers are so white as to seem illuminated from within. This species was once locally abundant in the outer Coastal Plain of the Carolinas and further south; Correll (1950) describes "large colonies of this species which form a blanket of white over the landscape." See also the picture in B.W. Wells' Natural Gardens of North Carolina. [= FNA, K, L; *Habenaria nivea* (Nuttall) Sprengel -- RAB, C, F, G, GW, X; *Gymnadeniopsis nivea* (Nuttall) Rydberg -- S]

Platanthera orbiculata (Pursh) Lindley, Large Round-leaved Orchid, Dinner-plate Orchid. Mt, Pd (NC, VA): moist hardwood forests, especially over amphibolite; uncommon (rare in Piedmont). June-September. Ranging from Newfoundland and Labrador west to AK, south to PA (and in the mountains to NC and TN), OH, IN, MN, SD, and OR. Reddoch & Reddoch (1993) have shown that *P. orbiculata* differs from *P. macrophylla* at the species level; see note below for further discussion. Pollination is by night-flying moths, likely noctuids. [= FNA; *Habenaria orbiculata* (Pursh) Lindley -- RAB; *Habenaria orbiculata* var. *orbiculata* -- C, F; *Habenaria orbiculata* -- G, W, X, in a broad sense (also including *P. macrophylla*); *P. orbiculata* var. *orbiculata* -- K, L; *Lysias orbiculata* (Pursh) Rydberg -- S]

Platanthera peramoena (A. Gray) A. Gray, Purple Fringeless Orchid, Purple Spire Orchid, Pride-of-the-peak. Mt (GA, NC, SC, VA), Pd (NC, VA), Cp (VA): bogs, seepages, moist forests; rare (GA Special Concern, NC Rare, SC Rare, VA Rare). June-October. Ranging from NJ, s. PA, OH, c. IL, and se. MO south to nw. SC, n. GA, n. AL, c. MS, and c. AR. See Spooner & Shelly (1983) for a review of information about this species. [= FNA, K, L, W; *Habenaria peramoena* A. Gray -- RAB, C, F, G, GW, X; *Blephariglottis peramoena* (A. Gray) Rydberg -- S]

Platanthera psycodes (Linnaeus) Lindley, Small Purple Fringed Orchid, Butterfly Orchid. Mt (GA, NC, SC, VA): northern

hardwood forests, other moist forests, seepages, bogs; uncommon (GA Special Concern). June-August. Widespread in ne. North America, south in the mountains to n. GA. [= FNA, K, L, W; *Habenaria psycodes* (Linnaeus) Sprengel var. *psycodes* -- RAB, C, G, X; *Habenaria psycodes* -- F, GW; *Blephariglottis psycodes* (Linnaeus) Rydberg -- S]

Platanthera aquilonis Sheviak, south to NJ and PA. [= FNA; *P. hyperborea* (Linnaeus) Lindley var. *hyperborea* -- K, misapplied; *Habenaria hyperborea* (Linnaeus) R. Brown var. *hyperborea*, misapplied] {not yet keyed; add synonymy}

Platanthera hookeri (Torrey & A. Gray) Lindley, Hooker's Orchid, ranges south to s. PA, in rich moist forests. [= FNA, K, L; *Habenaria hookeri* Torrey -- C, F, G, X]

Platanthera huronensis (Nuttall) Lindley, south to NJ (Sheviak 2002, Kartesz 1999) and PA (Kartesz 1999). [= FNA, K; *Habenaria hyperborea* (Linnaeus) R. Brown var. *huronensis* (Nuttall) Farwell] {not yet keyed; add synonymy}

Platanthera macrophylla (Goldie) P.M. Brown is apparently reported from NC and VA by Luer (1975). I have seen no verification of this distribution, nor is it validated by Reddick & Reddick (1993) or Sheviak in FNA (2002). *P. macrophylla* does range south to sw. PA and might be expected in montane VA. It generally occurs in coniferous swamps, from Nova Scotia west to n. MI, south to sw. PA and MD (Kartesz 1999). [= FNA, K; *P. orbiculata* var. *macrophylla* (Goldie) Luer -- L; *Habenaria orbiculata* (Pursh) Torrey var. *macrophylla* (Goldie) B. Boivin -- C, F; *Habenaria orbiculata* -- G, X, in a broad sense (also including *P. macrophylla*)]

The following hybrids are known from our area; others should be expected:

Platanthera xandrewsii (M. White) Luer [*P. lacera* × *psycodes*]. This hybrid is known from several locations in the Mountains. It is distinguished by characteristics intermediate between the two parents, especially the purple to pale lavender flowers, the central lobe of the lip long and narrow and deeply fringed.

Platanthera xbicolor (Rafinesque) Luer [*P. blephariglottis* × *ciliaris*]. This hybrid is rather common in the Coastal Plain, and can sometimes be found by the hundreds where both parents are abundant. The flowers from a distance appear a pale, creamy orange; when observed more closely, they prove to be bicolored, the broader portions pale orange, the fringed portions white.

Platanthera xcanbyi (Ames) Luer [*P. blephariglottis* × *cristata*]. This hybrid is known from a few locations in the Coastal Plain. It is intermediate between the parents.

Platanthera xchannellii Folsom [*P. ciliaris* × *cristata*]. This hybrid is known from several sites in the Coastal Plain (Charleston County, SC), Piedmont (Iredell County, NC), and Mountains (Henderson County, NC). It can be distinguished by its intermediate morphology, especially the spur 11-15 mm long. Folsom (1984) discusses the closely related *P. chapmanii* (Small) Luer, ranging from se. GA to panhandle FL, and in e. TX, which he recognizes as a species, based on its occurrence in populations independent of its parents, pollination biology, and subtle morphologic distinction from *P. xchannellii*.

Pogonia Antoine Laurent de Jussieu 1789 (Rose Pogonia, Pogonia)
(also see *Cleistes*, *Isotria*)

A genus of 3 species, of temperate e. North America and e. Asia. Cameron & Chase (1999) indicate that molecular analyses indicate that there may be merit in the traditional broad circumscription of *Pogonia* to include *Isotria* and N. American taxa of *Cleistes*. References: Catling & Sheviak in FNA (2002a).

Pogonia ophioglossoides (Linnaeus) Ker-Gawler, Rose Pogonia, Snakemouth, Beardflower, Ettercap, Addermouth. Cp (GA, NC, SC, VA), Mt (NC, SC, VA), Pd (GA, NC, SC, VA): savannas, bogs, especially in open peaty or gravelly situations; uncommon (rare in Piedmont and Mountains) (VA Watch List). May-June. Widespread in e. North America. [= RAB, C, FNA, G, GW, K, L, S, W, X; *P. ophioglossoides* var. *ophioglossoides* -- F]

Ponthieva R. Brown 1813 (Shadow Witch)

A genus of about 30-53 species, of tropical and warm temperate America. References: Ackerman in FNA (2002a); Pridgeon et al. (1999b).

Ponthieva racemosa (Walter) C. Mohr, Shadow Witch. Cp (GA, NC, SC, VA): bottomlands, floodplains, moist ravines, nearly always over calcareous rock ("marl" or coquina limestone); rare (GA, Special Concern, NC Rare, SC Rare, VA Watch List). September-October. Ranging from se. VA south to FL and west to se. TX, disjunct in the Eastern Highland Rim, TN, and south into Central and South America. The basal rosette of leaves, white (suffused with green) flowers in fall, and habitat are distinctive. [= RAB, C, F, FNA, G, GW, K, S, X; *P. racemosa* var. *racemosa* -- L]

Pteroglossaspis Reichenbach filius 1878 (Wild Coco)

A genus of 7-10 species, of s. North America, Cuba, Colombia, and tropical Africa (Romero-González in FNA 2002). References: Romero-González in FNA (2002a).

Pteroglossaspis ecristata (Fernald) Rolfe, Spiked Medusa, Smooth-lipped Eulophia. Cp (GA, NC, SC): mesic pinelands, with blackjack oak; rare (US Species of Concern, GA Special Concern, NC Endangered, SC Rare). June-September. The species ranges from se. NC south to FL, west to LA, and in the West Indies (Cuba); it is very rare in our area. The long (to 7 dm), plicate leaves are distinctive among our orchids. Small individuals can be mistaken for *Calopogon* when not in bloom. *Pteroglossaspis* differs, however, in having the stem covered from node to node by a succession of sheaths (vs. the sheaths much shorter) and in having the leaves 2-3 on a separate shoot emerging from the corm before the bloom-stalk (vs. leaf 1, on the bloom-stalk). [= FNA, K; *Eulophia ecristata* (Fernald) Ames -- RAB, L, X; *Triorchos ecristatus* (Fernald) Small -- S]

Spiranthes L.C. Richard 1817 (Ladies'-tresses, Pearl-twist, Spiral Orchid)

A genus of about 30-40 species, mainly north temperate, but with species scattered in other areas. The *Spiranthes* flora of our region is still rather poorly understood. This treatment, already rather different from RAB (1968) will undoubtedly change further. References: Sheviak & Brown in FNA (2002a); Luer (1975); Sheviak (1991); Pridgeon et al. (1999c). Key adapted largely from Sheviak & Brown in FNA (2002a).

Identification notes: flowering plants are necessary for identification of the species.

- 1 Rachis of inflorescence with all hairs **not** glandular, tapering to a pointed tip; [flowering March-September] ***S. vernalis***
- 1 Rachis of inflorescence **either** glabrous **or** with some or all hairs gland-tipped, capitate or clavate.
 - 2 Lip bright yellow or orange-yellow, with greenish veins; sepals and petals pure white; [flowering May-July] ***S. lucida***
 - 2 Lip **either** white, **or** lip yellowish and lacking greenish veins; sepals and petals creamy, ivory, yellow, or greenish; flowering February-December].
 - 3 Lip with conspicuous, terminally widened, greenish (rarely yellowish) diverging veins extending nearly to the tip; [flowering March-July].
 - 4 Flowers white, with green veins; sepals appressed; flowers 6-9 mm long ***S. praecox***
 - 4 Flowers creamy green, with darker green veins; flowers 10-17 mm long ***S. sylvatica***
 - 3 Lip lacking conspicuous, terminally widened, greenish diverging veins (veins not terminally widened); [collectively flowering February-December].
 - 5 Rachis glabrous; flowers gaping from near middle, the tubular portion less than 3 mm long; lip pure white; [flowering June-September] ***S. tuberosa***
 - 5 Rachis pubescent or glabrous; flowers gaping only from beyond the middle, the tubular portion more than 3 mm long; lip white, creamy, yellow, or centrally green; [collectively flowering February-December].
 - 6 Inflorescence with 3 or 4 flowers per cycle of spiral, the spiral usually tight and obscure, but then with 3 or 4 secondary ranks of flowers evident; [collectively flowering August-December] **Key A**
 - 6 Inflorescence with 5 or more flowers per cycle of spiral, the spiral usually open and obvious; [collectively flowering February-December] **Key B**

Key A

- 1 Petals ca. 6 mm long; lower portion of stem with recurved-spreading leaves ***S. ovalis* var. *erostellata***
- 1 Petals 7.5 mm long or longer; leaves wholly basal, or lower portion of stem with recurved-spreading blades, or leaves absent at flowering.
 - 2 Lip only slightly or not at all differentiated from the petals; buds often failing to open (but setting seed through agamospermy); column normal, or abnormal or aborted; leaves usually absent at flowering ***S. cernua***
 - 2 Lip clearly differentiated from petals; buds opening into normal flowers; column normal; leaves present or absent at flowering.
 - 3 Basal calli relatively short and conic, a wide as high, and usually less than 1 mm long; lateral sepals free and spreading, often over the top of the flower; leaves absent at flowering; [plants of dry calcareous barrens of the Ridge and Valley and westward, in our area in sw. VA] ***S. magnicamporum***
 - 3 Basal calli 1-2 mm long; lateral sepals more or less appressed (very rarely spreading over the top of the flower); leaves present at flowering; [plants of various dry to wet sites, collectively widespread in our area].
 - 4 Upper margin of the lateral sepals obviously separated from the adjacent margin of the dorsal sepal, the separation abrupt at the base (commonly by about 1 mm); lip strongly curving from the claw (the resulting angle 20-60 degrees), cuneate at the base; perianth creamy, yellowish, or greenish white; [plants of upland, dry to mesic sites] ***S. ochroleuca***
 - 4 Upper margin of the lateral sepals touching (or nearly so) the adjacent margin of the dorsal sepal, or only gradually separated with distance from the base; lip not strongly curving from the claw (angle less than 30 degrees), cordate to truncate at the base; perianth white to creamy or ivory, the center of the lip ivory to pale yellowish or rarely greenish; [plants primarily of wet sites, such as bogs, fens, marshes, bottomland swamps].
 - 5 Plants to about 50 cm tall, not colonial; leaves comparatively slender, flaccid-membranaceous with thickened midrib, the petioles of the basal leaves less than 6 mm wide; leaves wholly basal or the lower sheaths with ascending-spreading blades; perianth usually 8-11 mm long; lip membranaceous to fleshy, less than 7 mm long; [plants widespread in our area] ***S. cernua***

- 5 Plants to over 100 cm tall, forming clonal colonies via stolons; leaves broad, stiffly aerenchymatous-thickened, the petioles of basal leaves 7 mm or more wide; leaves up the stem, with spreading recurved blades on the lower cauline sheaths, frequently also on the upper, with leaves extending to the inflorescence; perianth 10-15 mm long (sometimes smaller in depauperate plants); lip fleshy, usually over 7 mm long; [plants of the Coastal Plain] ***S. odorata***

Key B

- 1 Lateral sepals widely diverging from the base, 8-10 mm long; lip dilated at base, oblong toward tip, yellow centrally; inflorescence secund to twisted usually only a half-turn from bottom to top; [flowering late October-December] ***S. longilabris***
- 1 Lateral sepals spreading to appressed, not widely diverging, 3.8-10 mm long; lip ovate to oblong-quadrate, lacking a distinct basal dilation, white or creamy centrally; inflorescence usually with several spiral cycles (rarely nearly secund); [flowering February-November].
 - 2 Lip with lacerate-dentate tip; leaves usually linear, more than 30× as long as wide, persistent and present at flowering; [flowering May-August] ***S. laciniata***
 - 2 Lip with undulate to crisped tip; leaves lanceolate to ovate or obovate, less than 30× as long as wide, **either** persistent and present at flowering, **or** withering prior to flowering.
 - 3 Flowers comparatively large and stout, the perianth 5-12 mm long, white to yellowish, the lip often darker centrally but not green or greenish yellow; leaves ascending, relatively slender, not ovate or obovate, present at flowering; rachis conspicuously and densely glandular-pubescent; [flowering August-November].
 - 4 Lip truncate at the tip, 5-7.5 mm long; flowers yellowish, creamy, or ivory, arcuate-nodding for most to all the length of the perianth; [plants from PA northwards] [***S. casei* var. *casei***]
 - 4 Lip acute to rounded at the tip, usually more than 7.5 mm long; flowers white to yellowish, arcuate-nodding only at the base of the perianth; [plants widespread in our area] ***S. cernua***
 - 3 Flowers comparatively small and slender, the perianth usually less than 5.5 mm long; leaves strictly basal, spreading and ovate to obovate or oblanceolate; rachis glabrous or densely but minutely glandular-pubescent; [flowering February-September].
 - 5 Rachis densely pubescent; flowers yellowish to pale greenish yellow, the lip yellow centrally; [flowering February-April]; [plants of s. SC southwards and westwards] ***S. brevilabris***
 - 5 Rachis glabrous or sparsely and minutely pubescent; flowers yellowish to white, the lip yellowish or green centrally; [flowering February-September]; [plants collectively widespread in our area].
 - 6 Flowers yellowish to pale greenish yellow; lip yellow centrally ***S. floridana***
 - 6 Flowers white, lip green centrally.
 - 7 Leaves oblanceolate, withering at anthesis; lateral sepals spatulate, green at base; flowering February-May ***S. eatonii***
 - 7 Leaves ovate to obovate or elliptic, spreading, present or absent at anthesis; lateral sepals acuminate, white throughout; flowering July-September.
 - 8 Flowers densely arranged on the spike (ratio of spike length in mm: flower number less than 2.3); entire plant essentially glabrous; leaves usually absent at anthesis; [flowering earlier, mostly July] ***S. lacera* var. *gracilis***
 - 8 Flowers laxly arranged on spike (ratio of spike length in mm: flower number equal to or greater than 2.3); inflorescence capitate-pubescent; leaves usually persisting through anthesis; [flowering later, mostly August-September] ***S. lacera* var. *lacera***

Spiranthes brevilabris Lindley. Cp (GA, SC): pine savannas; rare (GA Rare). Se. SC south to s. GA and n. FL, and west to se. TX, in dry to moist open sites. [= FNA, K; *S. gracilis* (Bigelow) Beck var. *brevilabris* (Lindley) Correll – GW]

Spiranthes cernua (Linnaeus) L.C. Richard, Nodding Ladies'-tresses. Mt, Pd, Cp (GA, NC, SC, VA): bogs, swamps, ditches, usually in acidic, sphagnum situations; common (uncommon in Piedmont and Coastal Plain). July-November. Widespread in e. North America. [= FNA, G, K, L, W; *S. cernua* var. *cernua* -- RAB, C, F, GW, L, X; *Ibidium cernuum* (Linnaeus) House -- S]

Spiranthes eatonii Ames ex P.M. Brown, Eaton's Ladies'-tresses. Cp (GA, NC, SC, VA): dry to moist pine flatwoods; uncommon (GA Rare). February-May. A Southeastern Coastal Plain endemic: se. VA south to FL, west to se. TX. Apparently previously confused with *S. lacera*, *S. floridana*, *S. brevilabris*, and *S. tuberosa*, but distinctive in the combination of spring blooming season, white flowers, and basal, narrowly oblanceolate leaves (Brown 1999). [= FNA, K]

Spiranthes floridana (Wherry) Cory, Florida Ladies'-tresses. Cp (GA, NC, SC): wet savannas, other moist sites; rare (GA Rare, NC Rare). April-May. A Southeastern Coastal Plain endemic: se. NC south to FL and west to TX, a Southeastern Coastal Plain endemic. [= FNA, K; *S. brevilabris* Lindley var. *floridana* (Wherry) Luer – L; *S. gracilis* (Bigelow) Beck var. *floridana* (Wherry) Correll -- RAB, GW, X; *Ibidium floridanum* Wherry -- S]

Spiranthes lacera (Rafinesque) Rafinesque var. ***gracilis*** (Bigelow) Luer, Southern Slender Ladies'-tresses. Mt, Pd, Cp (GA, NC, SC, VA): fields, meadows, pastures, woodlands; uncommon. August-September. Widespread in se. North America, north to s. NH, MI, WI, and KA. [= C, FNA, K, L, W; *S. gracilis* (Bigelow) Beck var. *gracilis* -- RAB, GW, X; *S. gracilis* -- F (sensu stricto); *S. gracilis* -- G (apparently including *S. lacera* var. *lacera*); *Ibidium gracile* (Bigelow) House -- S]

Spiranthes lacera (Rafinesque) Rafinesque var. ***lacera***, Northern Slender Ladies'-tresses. Mt (NC, VA): clearings, openings; rare. July. Ranging from Nova Scotia and New Brunswick west to Saskatchewan, south to sw. NC, w. VA, TN, and MO. {The

occurrence of this species in NC is documented by a specimen at DUKE, collected at 5200 feet on Tusquitee bald}. [= C, FNA, K, L, W; *S. lacera* -- F (sensu stricto); *S. gracilis* -- G, L, X (in part)]

Spiranthes laciniata (Small) Ames, Lace-lip Ladies'-tresses. Cp (GA, NC, SC): pond cypress depressions and savannas, swamps; rare (NC Rare, SC Rare). May-August. Ranging from NJ south to FL and west to se. TX, a Southeastern Coastal Plain endemic. [= RAB, C, FNA, K, L, X; *S. xilaciniata* -- F, GW; *Ibidium laciniatum* (Small) House -- S]

Spiranthes longilabris Lindley, Giant Spiral Orchid. Cp (GA, NC, SC): wet savannas; rare (GA Rare, NC Threatened, SC Rare). Late October-December. A Southeastern Coastal Plain endemic: se. NC south to FL and west to LA. [= RAB, FNA, GW, K, L, X; *Ibidium longilabre* (Lindley) House -- S]

Spiranthes lucida (H.H. Eaton) Ames, Shining Ladies'-tresses. Mt (NC, VA): sunny seepage over amphibolite or other basic rock; rare (NC Rare, VA Rare). June. Widespread in ne. United States, south to NC, e. TN, sc. TN (Chester et al. 1993), MO, and KS. The species was reported for NC by Fernald (1950) and by Small (1933), but was not treated by RAB; its occurrence in NC was verified in 1992 by its discovery in a seepage area in Ashe County. [= C, F, FNA, G, K, L, W, X; *Ibidium plantagineum* (Rafinesque) House -- S]

Spiranthes magnicamporum Sheviak, Great Plains Ladies'-tresses. Mt (GA, VA): grassy barrens and glades over limestone; rare (GA Endangered, VA Rare). Primarily in the Great Plains, from ND south to TX, east (often as widely disjunct populations) to sw. Ontario, se. PA, sw. VA (Ludwig 1999), KY, TN, and nw. GA. [= C, FNA, K, L; *S. cernua* -- G, in part (included in a broad concept of *S. cernua* by earlier authors); *S. cernua* var. *cernua* -- F, X, in part]

Spiranthes ochroleuca (Rydberg) Rydberg, Yellow Nodding Ladies'-tresses. Mt (NC, VA): meadows and pastures at moderate to high elevations, up to at least 1500m in elevation; rare (NC Rare, VA Rare). September-October. Largely northeastern, extending south in the mountains to NC. See Sheviak & Catling (1980) and Catling (1983a) for further information on this species. [= FNA, K, L, W; *S. cernua* var. *ochroleuca* (Rydberg) Ames -- C, F, X; *Ibidium ochroleucum* (Rydberg) House -- S]

Spiranthes odorata (Nuttall) Lindley, Fragrant Ladies'-tresses, Marsh Ladies'-tresses. Cp (GA, NC, SC, VA): swamps and marshes; uncommon (VA Rare). September-November. A Southeastern Coastal Plain endemic: se. VA south to FL and west to se. TX. [= F, FNA, G, K, L; *S. cernua* var. *odorata* (Nuttall) Correll -- RAB, C, GW, L, X; *Ibidium odoratum* (Nuttall) House -- S]

Spiranthes ovalis Lindley var. ***erostellata*** Catling, Oval Ladies'-tresses. Pd (NC, SC, VA), Cp (GA, NC, SC), Mt (GA, VA): swamp forests, bottomland forests; uncommon (GA Rare). August-November. Var. *erostellata* is fairly widespread in se. North America, ranging from sc. PA, MI, and IL south to panhandle FL, s. MS, and s. LA. Var. *ovalis* is limited to AR, LA, and TX, differing in having a viscidium and rostellum. See Catling (1983b) for further information about this variety and its biology. [= C, FNA, K, W; *S. ovalis* -- RAB, F, G, GW, L, X, infraspecific taxa not distinguished; *Ibidium ovale* (Lindley) House -- S; ? *S. montana* Rafinesque]

Spiranthes praecox (Walter) S. Watson, Grass-leaved Ladies'-tresses, Giant Ladies'-tresses. Cp (GA, NC, SC, VA), Pd (NC, VA), Mt (GA, VA): savannas, swamps, bogs; uncommon (rare in Piedmont). March-July. A Southeastern Coastal plain endemic: NJ south to FL and west to TX. [= RAB, C, F, FNA, G, GW, K, L, W, X; *Ibidium praecox* (Walter) House -- S]

Spiranthes sylvatica P.M. Brown, Woodland Ladies'-tresses, Pale Green Ladies'-tresses. Cp (GA, NC, SC, VA): live oak hammocks, other woodlands; rare (GA Rare). VA south to c. peninsular FL, west to e. TX. [included in the concept of *S. praecox* by previous authors]

Spiranthes tuberosa Rafinesque, Little Ladies'-tresses, Little Pearl-twist. Mt, Pd, Cp (GA, NC, SC, VA): in a wide variety of habitats, especially relatively well-drained woodlands and fields; common. June-September. Widespread in se. North America, north to MA, OH, and MO. [= C, F, FNA, G, K, L, W; *S. grayi* Ames -- RAB, L, X; *S. tuberosa* var. *grayi* (Ames) Fernald -- F; *Ibidium beckii* (Lindley) House -- S, misapplied]

Spiranthes vernalis Engelm. & Gray, Spring Ladies'-tresses. Cp, Pd, Mt (GA, NC, SC, VA): savannas, bogs, marshes, fairly dry fields; common (uncommon in Piedmont, rare in Mountains). March-July (-early September in the mountains). Ranging from MA to FL and west to TX and SD, also in Mexico and Central America. [= RAB, C, F, FNA, G, GW, K, L, W, X; *Ibidium vernale* (Engelm. & Gray) House -- S]

Spiranthes casei Catling & Cruise var. *casei*, ranging from Nova Scotia and ME west to WI, south to PA, in moist to dry open sites. [= FNA, K]

Spiranthes ovalis Lindley var. ***ovalis***, in GA. [= FNA, K] {not yet keyed}

Spiranthes romanzoffiana Chamisso, south to PA. [= FNA, K] {not yet keyed}

Tipularia Nuttall 1818 (Crane-fly Orchid)

A genus of 3 species; the other species of the genus are e. Asian (1 in Japan and 1 in the Himalayas) (Catling & Sheviak in FNA 2002). References: Catling & Sheviak in FNA (2002a).

Identification notes: The leaves are present during the winter, withering before the flowering stalk appears, the plant thus occasionally mistaken for one of the saprophytic orchids. The leaves are usually purple underneath, a characteristic shared with *Aplectrum*, but *Tipularia* leaves are ovate, less than 10 cm long, and are not notably plicate along the veins (vs. *Aplectrum*, with leaves narrowly elliptic, 10-20 cm long, and notably plicate along the very prominent, white, cartilaginous veins).

Tipularia discolor (Pursh) Nuttall, Crane-fly Orchid. Pd, Cp, Mt (GA, NC, SC, VA): in a wide variety of mesic to rather dry forests; common. July-September. Widespread in e. North America, ranging from se. MA, s. NY, OH, IN, and s. MI south to FL

and TX. Along with *Goodyera pubescens*, *Tipularia* is one of the commonest orchids in NC (indeed in e. North America). [= RAB, C, F, FNA, G, K, L, W, X; *T. unifolia* (Muhlenberg) Britton, Sterns, & Poggenberg -- S]

Triphora Nuttall 1818 (Three Birds Orchid)

A genus of about 25 species, of e. North America, the West Indies, and Central and South America (Medley in FNA 2002).
References: Medley in FNA (2002a).

Triphora trianthophora (Swartz) Rydberg ssp. ***trianthophora***, Three Birds Orchid, Nodding Pogonia, Nodding Ettercap. Mt (GA, NC, SC, VA), Cp, Pd (NC, SC, VA): humid forests and swamps, rhododendron thickets, especially on rotten logs or on humus; rare (GA Rare, NC Watch List, SC Rare, VA Rare). July-September. The species is widespread (but scattered) in e. North America, and south into Central America. Ssp. *trianthophora* occurs Maine and Ontario west WI, south to FL and e. TX; disjunct in nc. Mexico; ssp. *mexicana* (S. Watson) Medley occurs from Mexico south to Central America. The flowers are extremely ephemeral, making the species very difficult to locate. [= FNA; *T. trianthophora* – RAB, C, F, G, GW, K, L, S, W, X, infraspecific taxa not distinguished]

Zeuxine Lindley 1826 (Soldier Orchid)

A genus of about 26 species, of tropical and subtropical Old World (introduced elsewhere). References: Ackerman in FNA (2002a).

* ***Zeuxine strateumatica*** (Linnaeus) Lindley, Lawn Orchid, Soldier Orchid. Cp (GA): lawns, rare, introduced from Asia. [= FNA, GW, K, L]