THE CORNACEAE IN THE SOUTHEASTERN UNITED STATES[1]

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CORNACEAE Dumortier, Anal. Fam. Pl. 33, 34. 1829, "Corneae," nom. cons.
(DOGWOOD FAMILY)

Trees or shrubs [rarely perennial herbs]. Flowers small, bisexual [unisexual in dioecious species], regular. Floral tube adnate to the ovary; calyx lobes small to obsolete. Petals 4 [5], [rarely absent], inserted on an epigynous disc. Stamens equal in number to the petals and alternate with them. Ovary inferior, 1–4-locular, with a single pendulous, anatropous ovule in each locule. Fruit a drupe [rarely a berry]. Embryo straight; endosperm copious. (Excluding Alangiaceae DC., Garryaceae Lindl., and Nyssaceae Dumort.) TYPE GENUS: *Cornus* L.

A rather heterogeneous family of seven to sixteen genera, depending upon the generic and familial concepts adopted, with about 100 species, mainly in north-temperate regions, a few in the Tropics, in Africa, Madagascar, South America, and also in New Zealand; only *Cornus* occurs in eastern North America.

The family has been placed in the Umbellales on the basis of its few-carpellate inferior ovary, reduced calyx, and tendency toward a many-flowered umbellate inflorescence. The anatomy of Cornaceae differs in many respects from that of the Umbelliferae and Araliaceae, but the secretory ducts and extrorse micropyle of *Mastixia* Blume are thought by some authors to link Cornaceae with Araliaceae. Biochemical studies have shown aucubin to be present in Cornaceae but absent from Umbelliferae and Araliaceae. Garryaceae, Alangiaceae, and Nyssaceae are very closely re-

[1] Prepared for a generic flora of the southeastern United States, a joint project of the Arnold Arboretum and the Gray Herbarium of Harvard University made possible through the support of George R. Cooley and the National Science Foundation and under the direction of Carroll E. Wood, Jr., and Reed C. Rollins. The treatment follows the pattern established in the first paper in the series (Jour. Arnold Arb. 39: 296–346. 1958) and continued to the present paper. The area covered includes North and South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas, and Louisiana. The descriptions apply primarily to the plants of this area, with supplementary information in brackets. References marked with an asterisk have not been seen by the author.

I am grateful to Dr. Wood for his generous suggestions and valuable criticisms and to Dr. George K. Brizicky for his patient guidance and discussion. I am also grateful to Dr. R. H. Eyde for his comments on the manuscript. The typescript was prepared by Mrs. Gordon W. Dillon, and the plate is the work of Arnold D. Clapman.

lated families more or less recently segregated from the Cornaceae. Although studies by Moseley and Beeks and by Eyde (1964) confirm the affinity of Garryaceae with Cornaceae, the highly specialized amentiferous structure of its inflorescence appears to justify treating the group as a separate family. Nyssaceae and Cornaceae have been grouped together as the Cornales, but on the basis of their valvate petals Hutchinson places Cornaceae and Araliaceae (one tribe of which has imbricate petals) in an order Araliales next to the Cunoniales and distinct from the Umbelliferae, which have imbricate petals. Serological studies on *Nyssa* L., *Davidia* Baill., and *Cornus* may be interpreted to support the separation of Nyssaceae from Cornaceae. In anatomy and morphology the Cornaceae resemble the Caprifoliaceae in many ways, and the pollen, in particular, is similar to that of *Viburnum* and *Sambucus*. Metcalfe and Chalk draw attention to a similarity between Cornaceae and Hydrangeaceae in wood anatomy.

Within the family, Harms separated the subfamilies Curtisioideae and Mastixioideae, both with seeds with an adaxial (ventral) raphe, from the Cornoideae, which have seeds with an abaxial (dorsal) raphe. Wangerin divided the Cornoideae into four tribes: Toricellieae, Helwingieae, Corneae, and Griselineae. The Toricellieae and Helwingieae are considered distinct families by some workers, and studies of pollen morphology (Chao) and wood anatomy (Li & Chao) support this treatment. On the basis of wood anatomy, Adams has proposed the removal of *Aucuba* Thunb. and *Kaliphora* Hook. f. to separate tribes. The position of *Corokia* A. Cunningh. is doubtful (cf. Eyde). Engler places it near *Argophyllum* J. R. & G. Forst. in the Saxifragaceae subfam. Escallonioideae. Eyde, on the basis of floral anatomy, rejects the assignment of *Corokia* to Cornaceae, but questions certain points in Engler's alternative taxonomic treatment.

Pollination is probably by insects; *Griselinia* Gmel. is believed to be wind pollinated, but at least one species produces nectar (Percival, New Phytol. **60**: 235. 1961). Some species of *Helwingia* Willd., *Corokia, Griselinia, Aucuba,* and many species of *Cornus* are cultivated for their ornamental value; and some also possess medicinal properties. *Curtisia dentata* (Burm. f.) C. A. Sm. (*C. faginea* Ait.) is a useful African hardwood tree.

Chromosome numbers of $2n = 16, 18, 20, 22, 27, 32, 36, 44$, ca. 72, 120, and 144 have been reported.

REFERENCES:

ADAMS, J. E. Studies in the comparative anatomy of the Cornaceae. Jour. Elisha Mitchell Sci. Soc. **65**: 218–244. 1949.

BAILLON, H. Sur les affinités des *Helwingia*. Bull. Soc. Linn. Paris **1**: 137–139. 1877. [See also J. DECAISNE, Ann. Sci. Nat. Bot. II. **6**: 65–76. *pls. 6, 7.* 1836.]

———. Cornacées. Hist. Pl. **7**: 66–83. 1879. [Includes *Garrya*.]

BENTHAM, G., & J. D. HOOKER. Cornaceae. Gen. Pl. **1**: 947–952. 1867. [Includes *Nyssa, Garrya* Dougl. ex Lindl., and *Alangium*.]

BROWN, F. B. H. Cornaceae and allies in the Marquesas and neighboring islands.

Bishop Mus. Bull. **52**: 1–22. 1928. [A rather speculative account of the relationships between *Corokia*, *Lautea* F. Br., and *Cornus*.]

CHAO, C. Y. Comparative pollen morphology of the Cornaceae and allies. Taiwania **5**: 93–106. 1954. [Alangiaceae, Garryaceae, Helwingiaceae, Nyssaceae, Toricelliaceae.]

COULTER, J. M. Geographical distribution of North American Cornaceae. Proc. AAAS **39**: 319–322. 1890.

——— & W. H. EVANS. A revision of North American Cornaceae. Bot. Gaz. **15**: 30–38, 86–97. 1890. [See also Bot. Jahrb. **15**(Lit.): 28. 1893.]

DALLIMORE, W. Useful woods of Cornaceae. Bull. Misc. Inf. Kew **1916**: 96–99. 1916.

ENGLER, A. Saxifragaceae. Nat. Pflanzenfam. ed. 2. **18a**: 74–226. 1930. [*Corokia* placed in subfam. Escallonioideae, 215.]

EYDE, R. H. Inferior ovary and generic affinities of *Garrya*. Am. Jour. Bot. **51**: 1083–1092. 1964. [See also F. A. HALLOCK, Ann. Bot. **44**: 771–812. *pl. 36*. 1930.]

———. Floral anatomy and systematic position of *Corokia*. (Abstr.) *Ibid*. **52**: 650. 1965.

FAIRBROTHERS, D. E., & M. A. JOHNSON. Comparative serological studies within the families Cornaceae (dogwood) and Nyssaceae (sour gum). Pp. 305–318 *in* C. A. LEONE, ed., Taxonomic biochemistry and serology. New York. 1964. [See also Am. Jour. Bot. **48**: 534. 1961.]

FAURE, A. L. Étude organographique, anatomique et pharmacologique de la famille des Cornacées. Thèse, Univ. Lille. 221 pp. 1924.

GOPINATH, D. M. A contribution to the embryology of *Alangium Lamarckii* Thw. with a discussion of the systematic position of the Alangiaceae. Proc. Indian Acad. Sci. B. **22**: 225–231. 1945. [See also MITRA, J. N., & R. M. DATTA, Bull. Bot. Soc. Bengal **3**: 11–15. 1949,* *A. chinense* (Lour.) Harms.]

HALLIER, H. Ueber Gaertner'sche Gattungen und Arten unsicherer Stellung, einige Rubiaceen, Sapotaceen, Cornaceen und über versunkene Querverbindungen der Tropenländer. Rec. Trav. Bot. Néerl. **15**: 27–122. 1918.

HARMS, H. Die Gattungen der Cornaceen. Ber. Deutsch. Bot. Ges. **15**: 21–29. 1897.

———. Cornaceae. Nat. Pflanzenfam. III. **8**: 250–270. 1898. [Includes *Alangium*, *Davidia*, *Garrya*, and *Nyssa*.]

HILLEBRAND, G. R., & D. E. FAIRBROTHERS. Phytoserological correspondence among selected genera of the Cornales, Garryales, Rosales, Rubiales, and Umbellales as an indication of the taxonomic position of the genus *Viburnum*. (Abstr.) Am. Jour. Bot. **52**: 648. 1965.

HOAR, C. S. A comparison of the stem anatomy of the cohort Umbelliflorae. Ann. Bot. **29**: 55–63. *pls. 4, 5*. 1915. [Cornaceae, Araliaceae, and Umbelliferae.]

HORNE, A. S. The polyphyletic origin of the Cornaceae. Rep. Brit. Assoc. Advanc. Sci. **1911**: 585. 1912.

———. A contribution to the study of the evolution of the flower, with special reference to the Hamamelidaceae, Caprifoliaceae, and Cornaceae. Trans. Linn. Soc. II. Bot. **8**: 239–309. *pls. 28–30*. 1914. [Cornaceae, 261–296.]

HU, H. H. Notulae systematicae ad florem sinensium V. Bull. Fan Memorial Inst. Biol. **5**(Bot.): 305–318. 1934. [Toricelliaceae, fam. nov., 311–313; closely related to Araliaceae and Cornaceae.]

HUTCHINSON, J. Neglected generic characters in the family Cornaceae. Ann. Bot. II. **6**: 83–93. 1942.

KIRCHHEIMER, F. Umbelliflorae: Cornaceae. *In*: W. JONGMANS, ed., Fossil. Catal. II. **23**: I–XXII, 1–188. 1938. [Fossil records for the family; includes Nyssaceae.]

KUBITZKI, K. Zur Kenntnis des unilokularen Cornaceen-Gynözeums (Cornaceen-Studien I). Ber. Deutsch. Bot. Ges. **76**: 33–39. 1963.

LI, H. L., & C. Y. CHAO. Comparative anatomy of the woods of the Cornaceae and allies. Quart. Jour. Taiwan Mus. **7**: 119–136. *pls. 1–8*. 1954. [Alangiaceae, Garryaceae, Helwingiaceae, Nyssaceae, Toricelliaceae.]

MAEKAWA, F. Aucuba and its allies; the phylogenetic consideration on the Cornaceae. (In Japanese.) Jour. Jap. Bot. **40**: 41–47. 1965.*

MIKI, S. Endocarp remains of Alangiaceae, Cornaceae and Nyssaceae in Japan. Jour. Inst. Polytech. Osaka Univ. D. **7**: 275–297. 1956. [Stone structure of fossil and living representatives.]

MOSELEY, M. F., & R. M. BEEKS. Studies of the Garryaceae — I. The comparative morphology and phylogeny. Phytomorphology **5**: 314–346. 1955. [Relationships with Cornaceae and other families discussed.]

NAKAI, T. Cornaceae in Japan. Bot. Mag. Tokyo **23**: 35–45. 1909. [Discussion of subgenera and sections of several genera.]

PALM, B., & A. A. L. RUTGERS. The embryology of *Aucuba japonica*. Rec. Trav. Bot. Néerl. **14**: 119–126. 1917.

PARIS, R. The distribution of plant glycosides. Pp. 337–358 *in* T. SWAIN, ed., Chemical plant taxonomy. London & New York. 1963. [Distribution of aucubin, 355.]

RICKETT, H. W. Cornales. N. Am. Fl. **28B**: 297–316. 1945. [Cornaceae, Nyssaceae.]

SERTORIUS, A. Beiträge zur Kenntnis der Anatomie der Cornaceae. Bull. Herb. Boiss. **1**: 469–484, 496–512, 551–570, 614–639. 1893.

TAKHTAJAN, A. Die Evolution der Angiospermen. viii + 344 pp. Jena. 1959. [Cornales, 238–240; Cornaceae, *sensu lato*, divided into 7 families.]

TAUBERT, P. Revision der Gattung *Griselinia*. Bot. Jahrb. **16**: 386–392. 1892.

WANGERIN, W. Die Umgrenzung und Gliederung der Familie der Cornaceae. Bot. Jahrb. **38**(Beibl. 86): 1–88. 1906.

———. Cornaceae. Pflanzenreich **4**: 1–110. 1910.

1. **Cornus** Linnaeus, Sp. Pl. 1: 117. 1753; Gen. Pl. ed. 5. 54. 1754.

Deciduous trees or shrubs [rarely perennial herbs]. Leaves opposite, rarely alternate, simple, usually petiolate, exstipulate; blade entire, or obscurely serrate, pinnately veined, often pubescent, the lower surface occasionally covered with a fine network of short hairs or papillae and sometimes with appressed, erect, or curling, simple or characteristic bifid hairs. Inflorescences terminal or axillary, dichotomously branched, ebracteate cymes or panicles, [or bracteate umbelliform cymes,] or heads (reduced cymes) surrounded by petal-like involucral bracts and an inner ring of small, obtuse, membranaceous bracteoles. Flowers bisexual [unisexual in dioecious species], epigynous, sessile or short pedicellate. Floral tube turbinate, urceolate or campanulate, adnate to the ovary; calyx lobes 4, distinct or obsolete. Petals 4, valvate in bud, inserted on the margin of a fleshy nectariferous disc, oblong or ovate, white, purple, or yellow.

Stamens 4, exserted; filaments filiform or subulate; anthers oblong, 2-locular, dorsifixed, versatile, introrse, longitudinally dehiscent; pollen small or medium, prolate, tricolporate, reticulate or granular [occasionally united in tetrads]. Gynoecium (1)2(3)-carpellate, syncarpous; style single, filiform or columnar, sometimes dilated below the stigma; stigma capitate or truncate; ovary inferior, adnate to the floral tube and to the disc, (1)2(3)-locular, 1 locule sometimes aborting; ovules solitary in each locule, pendulous, anatropous, with abaxial raphe, micropyle superior. Fruit a globose, ellipsoid, or ovoid drupe; stone 2(rarely 1)-seeded, furrowed, rarely with a distinct pit at the apex. Seeds oblong, compressed; endosperm copious; embryo as long as the endosperm, straight, the cotyledons foliaceous, radicle terete and near the micropyle. Embryo sac development of the Fritillaria type in some species, reported to be of the normal (Polygonum) type in others. (Including *Afrocrania* (Harms) Hutchins., *Benthamidia* Spach, *Bothrocaryum* (Koehne) Pojark., *Chamaepericlymenum* Hill, *Dendrobenthamia* Hutchins., *Swida* Opiz.[2]) LECTOTYPE SPECIES: *C. mas* L.; see B. C. Dumortier, Florula Belgica 83. 1827, and P. A. Rydberg, Bull. Torrey Bot. Club 33: 147. 1906.[3] (Name from Latin, *cornu*, a horn, presumably because of the hardness of the wood.) — DOGWOOD.

A genus of about 60 species, mainly of temperate regions of the Northern Hemisphere, but extending to Central and South America, with one species in Africa; some 17 species in North America and about six in our area.

The treatment of the genus has varied widely, some authors recognizing a number of segregate genera, others treating these divisions as either subgenera or sections. Eight subgenera compose the genus as delimited here (cf. Ferguson, Jour. Arnold Arb. 47: 100–105. 1966); four are represented in the United States, and three in our area. Only the correct sectional or generic names are given here as synonyms of the subgenera.

All but two of the species in the southeastern United States are members of subg. KRANIOPSIS Raf. (sect. *Thelycrania* Dumort.; *Swida* Opiz), characterized by ebracteate cymose or paniculate inflorescences appearing

[2] Although usually given as *Svida* and originally published as *Swjda*, the orthography used here seems to be most in accord with the International Code (Art. 73, Note 6), which prescribes the change from "j" to "i," thus making the name pronounceable.

[3] Hutchinson (Ann. Bot. II. 6: 83–93. 1942) proposed *Cornus sanguinea* L. as lectotype species because it is a more typical representative of the genus and because *C. mas* L. was removed to the genus *Macrocarpium* Nakai (Bot. Mag. Tokyo 23: 38. 1909). He incorrectly cited Britton and Brown (Illus. Fl. No. U. S. 2: 660. 1913) as the earliest authors to select *C. mas* as lectotype species. Rehder (Bibliogr. Cult. Trees Shrubs 496. 1949) also adopted *C. sanguinea* as lectotype. However, *Cornus* was effectively typified by Dumortier (Florula Belgica 83. 1827) when he established the section *Cornotypus* which included only *C. mas*. Rydberg selected *C. mas* as lectotype species in 1906, and, in 1908, Britton (N. Am. Trees 741), a year earlier than Nakai proposed his genus *Macrocarpium*, also selected the same species. Furthermore, *C. sanguinea* is a component of both *Swida* Opiz (Berchtold & Opiz, Oekon.-tech. Fl. Böhmens 2: 174. 1838) and *Thelycrania* (Dumort.) Fourreau (Ann. Soc. Linn. Lyon II. 16: 394. 1868).

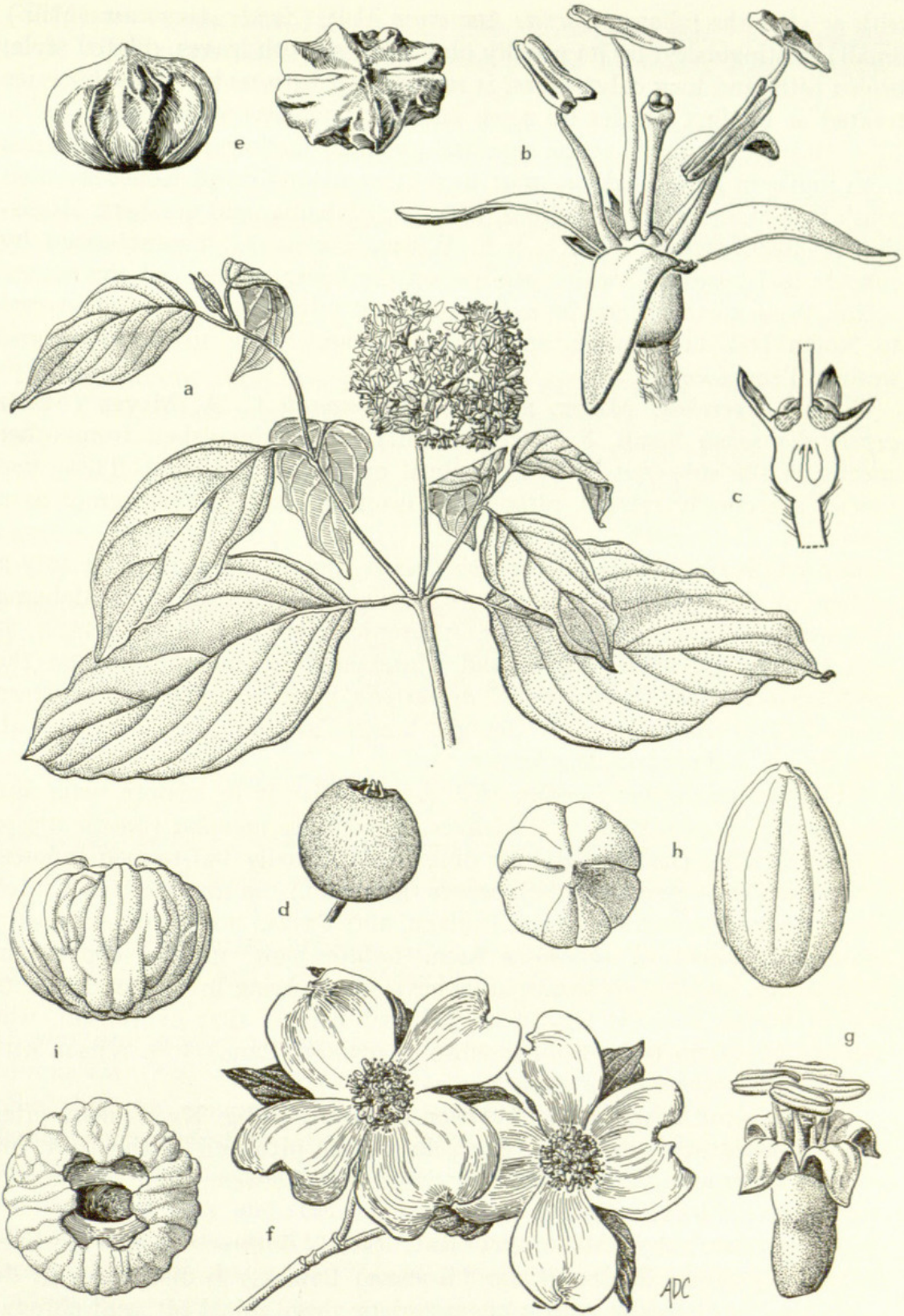

FIG. 1. **Cornus.** a–e, *C. Amomum* subsp. *Amomum*: a, flowering branchlet, × 1/2; b, flower, × 6; c, flower (with petals and stamens removed) in semi-diagrammatic vertical section to show nectariferous disc and two-locular ovary with solitary, pendulous ovules, × 6; d, mature drupe, × 2; e, stone in lateral view and from above, × 4. f–h, *C. florida*: f, flowering branchlet seen from above, × 1/2; g, flower, × 4; h, stone from above and in lateral view, × 4. i, *C. alternifolia*: i, stone in lateral view and from above to show apical pit.

with or after the foliage. *Cornus Amomum* Mill. (*Swida Amomum* (Mill.) Small), distinguished by its usually blue fruit, smooth leaves, dilated style, brown pith, and long calyx lobes, is represented with us by two subspecies treated as distinct species by some authors. Subspecies *Amomum*, $2n = 22$, with leaves rounded at the base and green on the lower surface, extends from southern New England, west to southern Illinois and Kentucky, and south to Tennessee, the Carolinas, Georgia, Alabama, and northern Mississippi; subsp. *obliqua* (Raf.) J. S. Wilson, $2n = 22$, characterized by cuneate leaf bases and white papillae on the lower surfaces of the leaves, occurs from northwestern New England and adjacent Canada, westward to North Dakota, Kansas, and Nebraska, and south to Arkansas and western Tennessee.

Cornus asperifolia Michx. and *C. Drummondii* C. A. Meyer (*Swida asperifolia* sensu Small, *S. Priceae* Small) are distinguished from other species in the subgenus by their scabrid upper leaf surfaces. These two species are closely related, although Wilson has treated the former as a subspecies (*microcarpa* (Nash) J. S. Wilson) of *C. foemina*. *Cornus microcarpa* Nash (*Swida microcarpa* (Nash) Small) appears to be only a variant of *C. asperifolia*. *Cornus Drummondii*, occurring from Alabama and western Tennessee to Texas, Arkansas, Nebraska, and Ontario, is separated by its white drupes and white papillose indumentum on the lower surface of the leaves from *C. asperifolia*, a species of the southeastern Coastal Plain from Florida to Georgia, South Carolina, and Alabama with blue drupes and nonpapillose leaves.

The complex *Cornus foemina* Mill. is distinctive in its smooth twigs and the smooth upper surface of the leaves. Subspecies *foemina* (*Swida stricta* (Lam.) Small), characterized by blue fruits, usually flat-topped inflorescences, and red young branches, occurs throughout the southeastern United States and extends to Delaware, Indiana, and Texas. Some workers regard the closely allied *C. racemosa* Lam. (white fruit, usually convex inflorescences, and brown young branches) as occurring in the southeastern United States, but the treatment followed here is that of Wilson, who regards this taxon as *C. foemina* subsp. *racemosa* (Lam.) J. S. Wilson with a distribution to the north of our area.

The frequent hybridization between species of subg. KRANIOPSIS often makes identification difficult. The color of the pith and of the fruit, important taxonomic characters for distinguishing between some of the subspecies, should be recorded by collectors.

The similar subg. MESOMORA Raf. (sect. *Bothrocaryum* (Koehne) Harms ex Nakai; *Bothrocaryum* (Koehne) Pojark.) is distinctive in the alternate leaves, stones with a characteristic deep apical pit, and chromosome number. It includes only *Cornus controversa* Hemsl., $2n = 20$, of eastern Asia, and *C. alternifolia* L. (*Swida alternifolia* (L.) Small), $2n = 20$, widespread in the northeastern United States and adjacent Canada and extending southward through eastern Tennessee, the Carolinas, Georgia, and Alabama to northwestern Florida (Gadsden County), and westward to Minnesota and northern Arkansas.

Subgenus CYNOXYLON (Raf.) Raf. (sect. *Cynoxylon* Raf.; *Benthamidia* Spach; *Cynoxylon* (Raf.) Small), characterized by woody habit, flowers aggregated into sessile heads surrounded by large, white, petaloid involucral bracts, and free, thin-fleshed drupes, is represented by *Cornus florida* L. (*Cynoxylon floridum* (L.) Small), $2n = 22$, widespread in our area (but probably absent from southern Florida) and extending north to southern Maine and Ontario, and west to eastern Texas and Kansas, with the disjunct but doubtfully distinct var. *Urbiniana* (Rose) Wangerin in Mexico (Nuevo Léon and Veracruz). A calciphile, it is one of the most characteristic and conspicuous spring-flowering trees of the eastern United States.

The herbaceous subg. ARCTOCRANIA Endl. ex Reichenb. (sect. *Cornion* Spach; *Chamaepericlymenum* Hill) is represented in the eastern United States by *Cornus canadensis* L., bunchberry, $2n = 44$, of transcontinental distribution northward and sporadic occurrence southward to California and New Mexico, in the West, and to Pocahontas County, West Virginia, in the East. Wherry has suggested that the migration of *C. canadensis* southward "is restricted by its inability to establish itself in soils which are heated above 65° [F.] [18° C.] during the summer."

The morphological relationships between the subgenera appear to be reticulate. (See also Rickett, 1950.) A number of interspecific hybrids are known, but only a single hybrid between subgenera, *Cornus* × *acadiensis* Fern. (*C. alternifolia* × *C. stricta* [*C. stolonifera*]), has been recorded. Basic chromosome numbers of 9, 10, and 11 have been reported: $2n = 18$ in subg. CORNUS; 20 in MESOMORA; 22 in BENTHAMIA, CYNOXYLON, and KRANIOPSIS; and 22 or 44 in ARCTOCRANIA. (A triploid count of 27 has also been recorded for *C. mas*, $2n = 18$.) Serological studies support the distinctness of subg. ARCTOCRANIA, CYNOXYLON, and KRANIOPSIS but show a close relationship between subg. BENTHAMIA (*C. Kousa* Buerger ex Miq., $2n = 22$) and subg. CYNOXYLON (*C. florida* and *C. Nuttallii* Audubon).

Flowers are usually homogamous, but may be proterandrous in subg. ARCTOCRANIA (e.g., *Cornus suecica* L., $2n = 22$), with exposed nectar secreted by the epigynous disc surrounding the style. Pollination is probably accomplished by insects, including small creeping Coleoptera and some Diptera and Hymenoptera. Cross-pollination is favored by the differing lengths of style and stamens, but self-pollination may also occur by the spreading of the stamens to touch neighboring flowers.

Fossils of *Cornus* have been reported from late Cretaceous, Tertiary, and Pleistocene strata. The remains include leaf impressions, stones, wood, and pollen.

Many species, especially *Cornus florida*, are cultivated as ornamentals. *Cornus florida* contains a bitter principle, cornine, which has been used for its medicinal properties. The wood of some species is valuable for its hard, smooth, fine texture and is used for tool handles, cotton reels, meat skewers, and charcoal.

REFERENCES:

Under family references see HUTCHINSON, NAKAI, RICKETT, and WANGERIN.

AMMONS, N., & E. L. CORE. The dogwoods of West Virginia. Castanea **10:** 88–91. 1945. [See also STRAUSBAUGH & CORE, Fl. W. Va. 3: 690–693. 1958.]

BEAN, W. J. *Cornus florida*, var. *rubra*. Bot. Mag. **136:** *pl. 8315*. 1910. [Forma *rubra* (Weston) Palmer & Steyerm.]

———. *Cornus Nuttallii* and its allies. Bull. Misc. Inf. Kew **1915:** 177–179. *2 pls*. 1915. [*C. florida, C. Kousa, C. capitata.*]

BORTHWICK, H. A. Light effects on tree growth and seed germination. Ohio Jour. Sci. **57:** 357–364. 1957. [*C. florida.*]

BOYNTON, K. R. *Cornus stricta*. Addisonia **8:** 13, 14. *pl. 263*. 1923. [*C. foemina.*]

BRITTON, E. G. Wild plants needing protection. 9. "Flowering dogwood" (*Cynoxylon floridum*). Jour. N. Y. Bot. Gard. **14:** 133, 134. *pl. 120*. 1913. [*C. florida.*]

BUGALA, W. A new system of the extent [sic] genus *Cornus* L. (In Polish; Russian & English summaries.) Ann. Sect. Dendrol. Soc. Bot. Pologne **9:** 205–210. 1953. [Discussion of system proposed by POJARKOVA, 1950.]

BUHL, C. A. The nomenclature of some species of *Cornus*. Rhodora **37:** 222, 223. 1935. [Favors *C. obliqua* Raf. over *C. Purpusii* Koehne and *C. stricta* Lam. over *C. candidissima* Mill.]

CHOPRA, R. N., & H. KAUR. Some aspects of the embryology of *Cornus*. Phytomorphology **15:** 353–359. 1965. [*C. alternifolia, C. Amomum, C. macrophylla, C. oblonga, C. stolonifera.*]

CUNO, J. B. Utilization of dogwood and persimmon. U. S. Dep. Agr. Bull. **1436:** 1–43. 1926.*

DALLIMORE, W. The uses of *Cornus* wood. Bull. Misc. Inf. Kew **1915:** 179–181. 1915.

D'AMATO, F. Osservazioni cito-embriologiche su *Cornus mas* L. con particolare riguardo alla sterilità di un biotipo triploide. (English summary.) Nuovo Gior. Bot. Ital. II. **53:** 170–210. 1946.

DANDY, J. E. Some new names in the British flora. Watsonia **4:** 47. 1957. [Notes on nomenclature of *Thelycrania*; adopts *T. sericea* (L.) Dandy for *Cornus stolonifera* Michx. Also see FOSBERG.]

DAVIS, O. H. Germination and early growth of *Cornus florida, Sambucus canadensis* and *Berberis Thunbergii*. Bot. Gaz. **84:** 225–263. 1927.

DERMEN, H. Cytological studies of *Cornus*. Jour. Arnold Arb. **13:** 410–416. *pl. 53*. 1932. [Undocumented chromosome counts of 23 spp.]

FARWELL, O. A. Concerning some species of *Cornus* of Philip Miller. Rhodora **33:** 68–72. 1931. [*C. Amomum, C. candidissima, C. foemina.*]

———. *Eukrania* and *Cynoxylon* not genera of Rafinesque. *Ibid.* **34:** 29, 30. 1932. [Subgenera of *Cornus.*]

———. *Cornus*, a reply. Torreya **42:** 130. 1942. [Further maintains *Cynoxylon* and *Eukrania* of Rafinesque are subgenera.]

FERNALD, M. L. A hybrid *Cornus* from Cape Breton. Rhodora **43:** 411, 412. 1941. [*C.* × *acadiensis.*]

FOSBERG, F. R. *Cornus sericea* L. (*C. stolonifera* Michx.) Bull. Torrey Bot. Club **69:** 583–589. 1942.

HANN, R. M., & C. E. SANDO. Scyllitol from flowering dogwood (*Cornus florida*). Jour. Biol. Chem. **68:** 399–402. 1926.*

HARA, H. The nomenclature of the flowering dogwood and its allies. Jour. Arnold Arb. **29:** 111–115. 1948. [Maintains *Benthamidia* as a genus.]

HOLM, T. Medicinal plants of North America. 34. *Cornus florida* L. Merck's Rep. **18:** 318–321. 1909.* [See also Bot. Jahresb. **37**(1): 994. 1912.]

HOWARD, R. A. Registration lists of cultivar names in *Cornus* L. Arnoldia **21:** 9–18. 1961.

KANO, R. Über ein neues mechanisches Gewebe in den Blättern der *Cornus*-Arten. Bot. Mag. Tokyo **51:** 926–930. 1937.

KIRCHHEIMER, F. Über die Fachverhältnisse der Früchte von *Cornus* L. und verwandter Gattungen. Planta **36:** 85–102. 1948.

KOEHNE, E. Die Sektion *Microcarpium* der Gattung *Cornus*. Mitt. Deutsch. Dendrol. Ges. **12:** 27–50. 1903.

KRAFT, H. D. The natural habitat of *Cornus mas* L. with some remarks about classification of plant communities. (In Dutch; English summary.) Nederl. Dendrol. Ver. Jaarb. **20:** 169–201. 1957.

KURZ, H., & R. K. GODFREY. Trees of northern Florida. xxxiv + 311 pp. Gainesville, Fla. 1962. [*Cornus*, 246–250.]

MEYER, C. A. Sur quelques espèces de *Cornus* appartenant au sous-genre *Thelycrania*. Ann. Sci. Nat. Bot. III. **4:** 58–74. 1845. [See also Mém. Acad. Sci. St.-Pétersb. Sci. Nat. VI. **5**(Bot.): 191–223. 1846.*]

MORSE, W. C. Contribution to the life history of *Cornus florida*. Ohio Nat. **8:** 197–204. 1907.

NAIR, G. V., & E. VON RUDLIFF. Isolation of hyperin from red-osier dogwood (*Cornus stolonifera* Michx.) Canad. Jour. Chem. **38:** 2531–2533. 1960.* [*C. sericea* L.]

OLSEN, C. The structure and biology of Arctic flowering plants, II. 9. Cornaceae. Medd. Grønl. **37:** 127–150. 1914. [*C. canadensis*, *C. suecica*.]

OSWALD, F. W. A new color form of cornel from New Jersey. Phytologia **5:** 337, 338. 1956. [*C. racemosa* f. *caeruleocarpa* Oswald.]

POJARKOVA, A. De systemate generis Linneani *Cornus* L. (In Russian & Latin.) Not. Syst. Leningrad **12:** 164–180. 1950. [Divides *Cornus* into 6 genera.]

———. De sectione *Benthamia* (Lindl.) Nakai generis *Cynoxylon* Raf. (In Russian & Latin.) *Ibid.* 181–195.

RAYMOND, M., & J. KUCYNIAK. *Cornus racemosa* in Quebec. Rhodora **49:** 23, 24. 1947.

RICKETT, H. W. *Cornus Amomum* and *Cornus candidissima*. Rhodora **36:** 269–274. 1934.

———. On nomenclature in *Cornus*. *Ibid.* **38:** 51. 1936. [See also *C. Drummondii*, *ibid.* 99, 100.]

———. *Cornus asperifolia* and its relatives. Am. Midl. Nat. **27:** 259–261. 1942.

———. The names of *Cornus*. Torreya **42:** 11–14. 1942. [See also "*Cornus* again," *ibid.* 131, concerning the generic status of *Cynoxylon* and *Eukrania*.]

———. *Cornus stolonifera* and *Cornus occidentalis*. Brittonia **5:** 149–159. 1944.

———. New combinations in *Cornus*. Bull. Torrey Bot. Club **72:** 223. 1945.

———. *Cornus* in Mexico, with notes on the evolution of the genus. Anal. Inst. Biol. México **21:** 83–94. 1950.

SANDO, C. E. Inositol from blackberry (*Rubus argutus* Link) and flowering dogwood (*Cornus florida*). Jour. Biol. Chem. **68:** 403–406. 1926.*

SARGENT, C. S. *Cornus*. Silva N. Am. **5:** 63–72. *pls. 212–216.* 1893. [*C. florida*, *C. Nuttallii*, *C. alternifolia*.]

SCHAFFNER, J. H. Key to the Ohio dogwoods in the winter condition. Ohio Nat. **6**: 419. 1905.

SHANK, C. K. The leaf and stem anatomy of *Cornus florida* in relation to light exposure. Am. Midl. Nat. **19**: 419–426. 1938.

SIMS, J. *Cornus florida*. Bot. Mag. **15**: *pl. 526*. 1801.

SMALL, J. K. A Kentucky cornel. Torreya **1**: 54, 55. 1901. [*C. Priceae.*]

SOJÁK, J. *Swida hungarica* (Kárp.) in der Tschechoslowakei. Acta Dendrol. Cechosl. **3**: 105–107. 1962. (See also Novit. Bot. Del. Sem. Hort. Bot. Univ. Carol. Prag. **1960**: 9–11. 1960.) [Notes on the nomenclature of *Cornus*.]

STANDLEY, P. C. The genus *Cornus* in South America. Trop. Woods **43**: 16, 17. 1935.

STRAKA, H. Die Pollenmorphologie der europäischen *Cornus*-Arten und einiger ähnlicher Pollentypen. Flora **141**: 101–109. 1954. (See also reprint in Grana Palyn. II. **1**(1). 1954.) [*C. mas, C. sanguinea, C. suecica.*]

TIEGHEM, P. VAN. Structure de quelques ovules et parti qu'on en peut tirer pour améliorer la classification. Jour. Bot. Morot **12**: 197–220. 1898. [Single thick integument in *Cornus*.]

TOMASZEWSKA, E., & M. TOMASZEWSKI. The chemical composition of fruits of the edible *Cornus mas* L. and *Cornus officinalis* Sieb. et Zucc. (In Polish; English summary.) Arb. Kórnickie **2**: 239–241. 1957.*

TRALAU, H. The recent and fossil distribution of some boreal and arctic montane plants in Europe. Ark. Bot. II. **5**: 533–582. *pls. 1–8*. 1963. [*Cornus suecica*, 545–547.]

WHERRY, E. T. Temperature relations of the bunchberry, *Cornus canadensis* L. Ecology **15**: 440–443. 1934.

WILKINSON, A. M. Floral anatomy of some species of *Cornus*. Bull. Torrey Bot. Club **71**: 276–301. 1944. [Sixteen spp. in 5 subg.]

———. The floral anatomy and morphology of some species of *Cornus* and of the Caprifoliaceae. Abstr. Theses Cornell Univ. **1945**: 184–187. 1946.*

WILSON, J. S. Variation of three taxonomic complexes of the genus *Cornus* in eastern United States. Trans. Kan. Acad. Sci. **67**: 747–817. 1965. [*C. Amomum, C. Drummondii, C. foemina.*]

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