

# Rhodora

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## CALLITRICHE IN THE NEW WORLD

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(continued from p. 155)

5. *C. sepulta* Wats., Proc. Amer. Acad. 14: 298. 1879; Wats., Bot. Calif. 2: 77. 1880; Morong, Bull. Torrey Club 18: 235. 1891; Howell, Fl. N. W. Amer. 218. 1898.—**Oregon:** Salem, 1871, *Hall 459* (TYPE in GH, ISOTYPES in CM, MO, NY); Silverton, June 1871, *Hall* (MO).

This is very close to *C. marginata*, differing mainly in its thicker nearly linear one-nerved leaves (Fig. 5a). Morong and Howell obviously drew their descriptions from that of Watson. Watson wrote that *S. sepulta* resembles a terrestrial form of *C. marginata*; his description of the latter species, however, betrays the fact that his *C. marginata* was a mixture of the true *C. marginata* and the more aquatic *C. longipedunculata*.

6. *C. Nuttallii* Torr. U. S. Rept. Expl. Miss. Pacific 4: 135. 1857; Hegelm. Verhandl. Bot. Ver. Brandenburg 9: 16. 1867; Engelm. in Gray, Man. ed. 5: 428. 1867; Morong, Bull. Torrey Club 18: 235. 1891; Small, Fl. Southeastern U. S. 723. 1903; Fernald in Gray's Manual, ed. 8: 973. 1950. *C. pedunculosa* Nutt. Trans. Amer. Phil. Soc. N. S. 5: 140. 1835, not *C. pedunculata*.—Fruit on pedicels of various lengths, buried in the mud at maturity, 1 mm. wide, 0.6–0.8 mm. high, 0.3–0.5 mm. thick; mericarps with flat faces, the margins with a thin wing that is curled toward the face to give the appearance of thickened margins (Figs. 6a, 6b); stigmas about 0.8 mm. long, sometimes persistent and loosely ascending or somewhat reflexed; filaments 0.2–0.5 mm. long; anthers 0.2–0.3 mm. wide; leaves 3–4 mm. long, 0.5–1.5 mm. wide, oblanceolate-obovate, very obscurely 3-veined.—Gulf Coast, Alabama to eastern Texas, inland to central Alabama, Arkansas and the Coastal Plain of Texas.—**Alabama:** Richmond, Dallas Co., April 1, 1933, *Harper 3027* (US, GH); Citronelle, March 17, 1897, *Baker* (MO, NY); Auburn, Lee Co., April 16, 1898, *Earle & Baker*, mixed with *C. peploides* and *C. heterophylla* (NY); Mobile, March 18, 1892, *Mohr* (NY), March 10, 1892, *Mohr*, mixed with *C. peploides*.

(NY), March 31, 1892, *Mohr*, mixed with *C. peploides* (US). **Mississippi:** Biloxi, March 15, 1898, *Tracy 5339* (NY, CM, US, MO). **Arkansas:** "from Arkansas to the Pottoe"—Nutt., *Trans. Amer. Phil. Soc. N. S.* 5: 140. 1837—this would be Fort Smith, COTYPE cited by Hegelmaier (MO). **Louisiana:** without locality, *Hale*, COTYPE cited by Hegelmaier (MO, GH mixed with *C. terrestris*); Chinchuba, April 21, 1891, *Langlois*, mixed with *C. peploides* (NY); Sidell Station, March 24, 1886, *Langlois* (NY); Alexandria, *Hale* (US); Monroe, April 13, 1901, *Trelease* (MO); Madisonville, May 4, 1888, *Joor* (MO). **Texas:** College Station, Brazos Co., March 1, 1938, *Cory 27926* (GH); Houston, April 17, 1900, *Bush 22*, mixed with *C. peploides* (MO); Bastrop Co., March 9, 1947, *Tharp 47034* (MO).

Notes on the structure and habit of this species, by Prof. Wm. M. Carpenter with a collection from Louisiana (NY), were quoted in part in the *Torrey Bulletin* 6: 173. 1877, and seem worth quoting again, in full: "Callitriche—resembles *C. terrestris* but differs from it in some respects. Bracts 2, opposite, calyx inconspicuous. Petals 0. Style o/o. Germ at first spherical, afterward reniform. Small, procumbent, diffuse. Lvs. uniform, oblong obovate, rounded at summit, at base tapering to a petiole, opposite, connate. The flower is axillary, the germ sessile at first, but afterward peduncled; the peduncles turning downward and the reniform fruit is buried beneath the surface in the same manner as in the *Arachis hypogea*. It grows in little patches as the *C. terrestris*, which it differs from in the circumstance of burying the fruit, and somewhat in the form of the fruit. It roots at the lower joints and being also attached to the ground by the elongated peduncles it is very hard to detach from the soil. Grows in old fields, damp soils. Flowers from Feb. to June."

7. ***C. peploides*** Nutt. *Trans. Amer. Phil. Soc. N. S.* 5: 141. 1835; Engelm. in Gray, *Man.* ed. 5: 428. 1867; Hegelm. *Verhandl. Bot. Ver. Brandenburg* 9: 17. 1867; Morong, *Bull. Torrey Club* 18: 238. 1891; Chapman, *Fl. s. U. S.* ed. 3: 420. 1897; Small, *Fl. Southeastern U. S.* 723. 1903. *C. Drummondii* Hegelm. *Monogr. Gattung Callitriche* 60. 1864.—Fruit black when ripe, 0.5–0.8, mm. usually 0.7 mm. wide, not quite so high; mericarps narrowed and elongated at base, pushing against each other so that each is bent at an angle with the face, and the fruit appears greatly thickened at base; stigmas about 0.2 mm. long, often persistent and loosely reflexed; filaments about 0.2 mm. long; anther about 0.1 mm. wide; stems rooting below, so presumably creeping, the erect branches 1–5 cm. high (Nuttall says "Stems perfectly erect"); leaves only slightly crowded at the tips of the branches, 2–5 mm. long, cuneate to spatulate-obovate, 1–3-nerved but often so faintly so as to appear nerveless.—Coastal South Carolina and Florida, through Alabama and rarely Tennessee to Louisiana and southeastern Arkansas, southeastern Texas and eastern Mexico to Costa Rica.

**C. peploides** var. **peploides**. Base of mericarps turned nearly or quite at right angles to the face of the fruit, so that the fruit is nearly as thick as wide (Fig. 7a); margin of carpels rounded or obtusely angled.—South Carolina, Tennessee and southern Arkansas, south to Cuba and northeastern Mexico.

**South Carolina:** St. Helena Island, May 5, 1899, *Cuthbert 336* (NY). **Georgia:** Tebeauville,<sup>1</sup> April, 1869, *Canby* (MO); Faceville, Decatur Co., March 31, 1847, *Thorne & Muenscher 2539* (Herb. Thorne). **Florida:** Hibernia, March, 1869, *Canby* (MO, UC, US, CM); So. Jacksonville, April 13, 1897, *Churchill* (MO, GH); Jacksonville, March, *Curtiss 2462a* (US, MO, NY, CM, GH); Ormond, March 15, 1904, *Fuller* (GH); Miami, May, 1877, *Garber* (GH); Jacksonville, June 1898, *Hitchcock* (CM); So. Jacksonville, April 13, 1897, *Lighthipe 727* (NY); Fort Meyers, Lee Co., March 19, 1916, *Standley 24* (US, MO, NY, CM, GH); Orange Co., Orlando, March 17, 1946, *Standley 92644* (CM). **Alabama:** Auburn, Lee Co., March 24, 1897, *Earle & Baker* (MO) and March 16 (NY—mixed with *C. Nuttallii* & *C. heterophylla*); Mobile, several dated in March, 1892, *Mohr*, sometimes mixed with *C. Nuttallii* (US, NY). **Tennessee:** Nashville, May, *Gattinger 2463*, mixed with *C. terrestris* (US). **Arkansas:** "banks of the Mississippi, and on the margins of ponds," *Nuttall*, mixed with *C. terrestris* & *C. Nuttallii* (ISOTYPE in NY). **Louisiana:** Covington, March 5, 1920, *Arsène 11931* (US); New Orleans, *Drummond*, probably ISOTYPE of *C. Drummondii* Hegelm. (NY, GH); Baton Rouge, Jan. 21, 1874, *Joor* (MO); Mandeville, April 21, 1891, *Langlois* (NY); Plaquemines Co., April 5, 1883, *Langlois 60* (NY); St. Martinsville, March 6, 1885, *Langlois* (NY); Sidell Station, March 24, 1886, *Langlois* (NY). **Texas:** Gonzales Co., March 28, 1927, *Bogusch 959* (US); Houston, April 17, 1900, *Bush 22*—mixed with *C. Nuttallii* (MO); Alligator Lake, Jackson Co., April 2, 1936, *Drushel 10014* (US); Houston, April 1, 1872, *Hall 544* (US, MO—mixed with *Elatine triandra* var. *obovata*, NY, CM); Houston, Nov. 27, 1877, *Joor* (MO); Harris Co., May 1877, *Joor* (US); Palmetto State Park, Gonzales, March 29, 1941, *Innes 660* (GH); Wilson Co., March 5, 1937, *Parks 21345* (GH); Hungerford, Wharton Co., March 9, 1914, *Palmer 4893* (MO, CM); House Mt., Llano Co., May, 1885, *Reverchon 1589* (US, MO, CM); Austin, May 19, 1922, *Tharp 1504* (US); San Jacinto Co., March 30, 1935, *Tharp 47003* (MO, UC); Palmetto State Park near Ottine, Gonzales Co., March 1, 1936, *Tharp 47004* (UC); Smith's Point, Chambers Co., Oct. 8, 1936, *Tharp 47006* (MO); Rockport Point, Aransas Co., April 2, 1932, *Tharp 47011* (UC); Austin, Travis Co., March 10, 1937, *Tharp 47013* (MO, UC); Galveston Island, May 1843, *Lindheimer* (MO). **Cuba:** in fl. St. John, Mantanzas, *Rugel 234bis*, mixed with *C. occidentalis* (NY); Chirreva, Feb. 28, 1860–64, *Wright 2547*, mixed with *C. occidentalis* (MO, GH). **Mexico:** San José, Tamaulipas, Feb. 17, 1939, *LeSueur 126* (GH); Huauchinango, Puebla, March 27, 1945, *Sharp 45374* (WVA).

**C. peploides** var. **semialata**, n. var.,<sup>2</sup> base of mericarps only slightly twisted so that the fruit is a little strumose at base (Fig. 7b); margins of carpels narrowly winged at summit (Fig. 7b).—**Mexico:** Tepic, Nayarit, Feb. 11, 1927, *Jones 22877*, ISOTYPE of *C. mexicana* Jones, *nomen nudum* (GH, UC); Morales, San Luis Potosi, 1876, *Schaffner 123a* in part (GH); Puebla, State of Puebla, Oct. 7, 1906, *Arsène 367* (US); Huauchinango, Puebla, March 24, 1945, *Sharp 43311* (WVA); Chinantla, Puebla, *Liebmann* (CM); Barranca of Texola, near Jalapa, April 30, 1899, *Pringle 7817* (US, GH); Jalapa, Nov. 28, 1905,

<sup>1</sup> A railroad station abandoned in 1870, according to Dr. Wilbur H. Duncan, *in litt.*

<sup>2</sup> **C. peploides** var. **semialata**, var. nov., fructibus ad basem substrumosis, ad apicem anguste alatis. Jalapa, Mexico, Nov. 28, 1905, *Trelease 20*, TYPE in Herb. Missouri Botanical Garden.

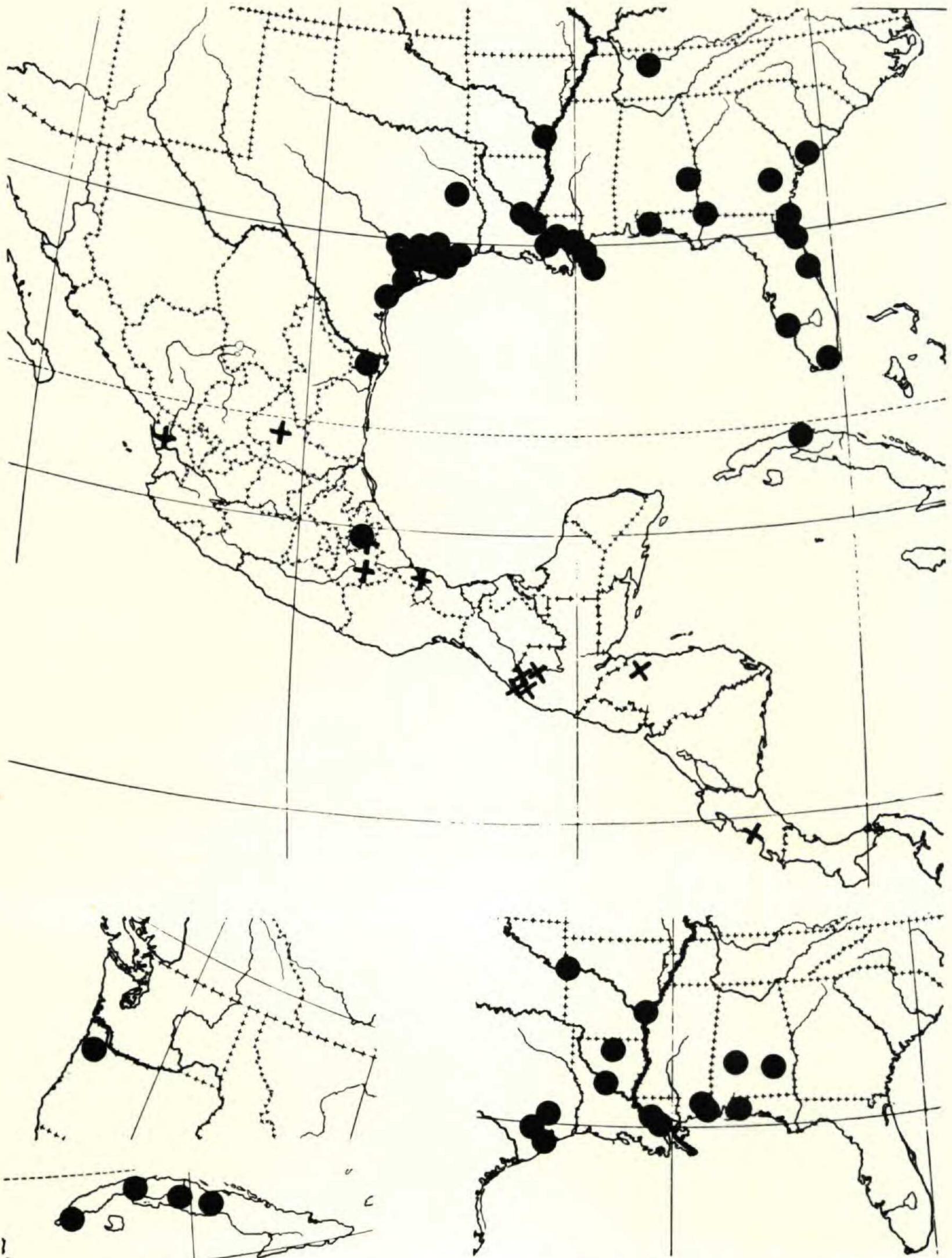
*Trelease 20* (TYPE in MO); Colipa, Dept. Vera Cruz, March, 1841, *Liebmann 1086* (UC); Wartenberg, near Tantoyuca, Prov. Huasteca [Vera Cruz], 1856, *Ervendberg 143* (GH). **Honduras:** Siguatepeque, Dept. Comayagua, alt. 1080–1400 m., Feb. 14–27, 1928, *Standley 56535* (CM, US).

In Mexico and Central America several species, otherwise very distinct, coexist with the production of some very closely similar entities. To judge from available material, these entities are actually quite distinct but the points of distinction are minute. *C. peploides* var. *peploides*, of southern United States and north-eastern Mexico, admits of no confusion with *C. deflexa* var. *subsessilis*—compare Figs. 7a and 2b. In *C. peploides* var. *semialata* there is a more or less close approach to *C. deflexa*, in that the strumose base of the fruit is less developed and there is a wing at the summit of the mericarp (Fig. 7b). Extreme individuals of *C. peploides* var. *semialata*, with the bases of the mericarps only very slightly twisted, so that the face of the fruit is nearly as flat as that of *C. deflexa* var. *subsessilis*, may be positively distinguished by the wing: in *C. peploides* var. *semialata* only the summit of the mericarp is winged, while in *C. deflexa* var. *subsessilis* the wing extends to and somewhat around the base of the mericarp.

***C. peploides* var. *media***, n. var.<sup>1</sup>, base of mericarps only slightly twisted so that the fruit is a little strumose at base (Figs. 7c, 7d); margin of mericarps thickened and with a narrow wing turned outward.—**Guatemala:** near Cobán, Dept. Alta Verapaz, alt. 1260–1440 m., March 26–April 15, 1939, *Standley 70448* (TYPE in Chicago Natural History Museum); Dept. Quezaltenango, Aguas Amargas, alt. about 2450 m., Jan. 14, 1941, *Standley 83331* (CM); Dept. Quezaltenango, above Mujuliá, between San Martín Chile Verde and Colomba, alt. about 1800 m., Feb. 1, 1941, *Standley 85717* (CM); Dept. Quezaltenango, Río Samalá, opposite Santa María de Jesús, alt. 1500 m., Jan. 21, 1940, *Steyermark 35073* (CM); Dept. Huehuetenango, above Macx, between Todos Santos and San Martín, Sierra de los Cuchumatanes, alt. 2500–3000 m., Sept. 6, 1942, *Steyermark 51930* (CM); Chichivac, Dept. Chimaltenango, alt. 2400–2700 m., Nov. 7, 1933, *Skutch 657* (US); Cobán, Alta Verapaz, 1908, *Türckheim 2066* (US). **Costa Rica:** La Hondura, Prov. San José, alt. 1300–1700 m., March 2–4, 1924, *Standley 36203* (US, CM).

*C. peploides* var. *media* approaches *C. deflexa* var. *subsessilis* on the one hand, and *C. Nuttallii* on the other. The wing, while less developed down the sides and base of the mericarp, is turned outward as may be observed on some young fruits of *C. deflexa*.

<sup>1</sup> ***C. peploides* var. *media***, var. nov., fructibus ad basem substrumosis; marginibus incrassatis cum ala recurvata. Cobán, Guatemala, March 25–April 15, 1939, *Standley 70448*, TYPE in Chicago Natural History Museum.



5 (middle left). *C. sepulta*. 6 (lower right). *C. Nuttallii*. 7 (above). *C. peploides*, var. *peploides* (dots), var. *semialata* (crosses), and var. *media* (x's). 8 (lower left). *C. occidentalis*.

The thickened edge of the mericarp, rimmed with the slightly developed wing turned at right angles to the face (Fig. 7d) is suggestive of *C. Nuttallii* (Fig. 6a).

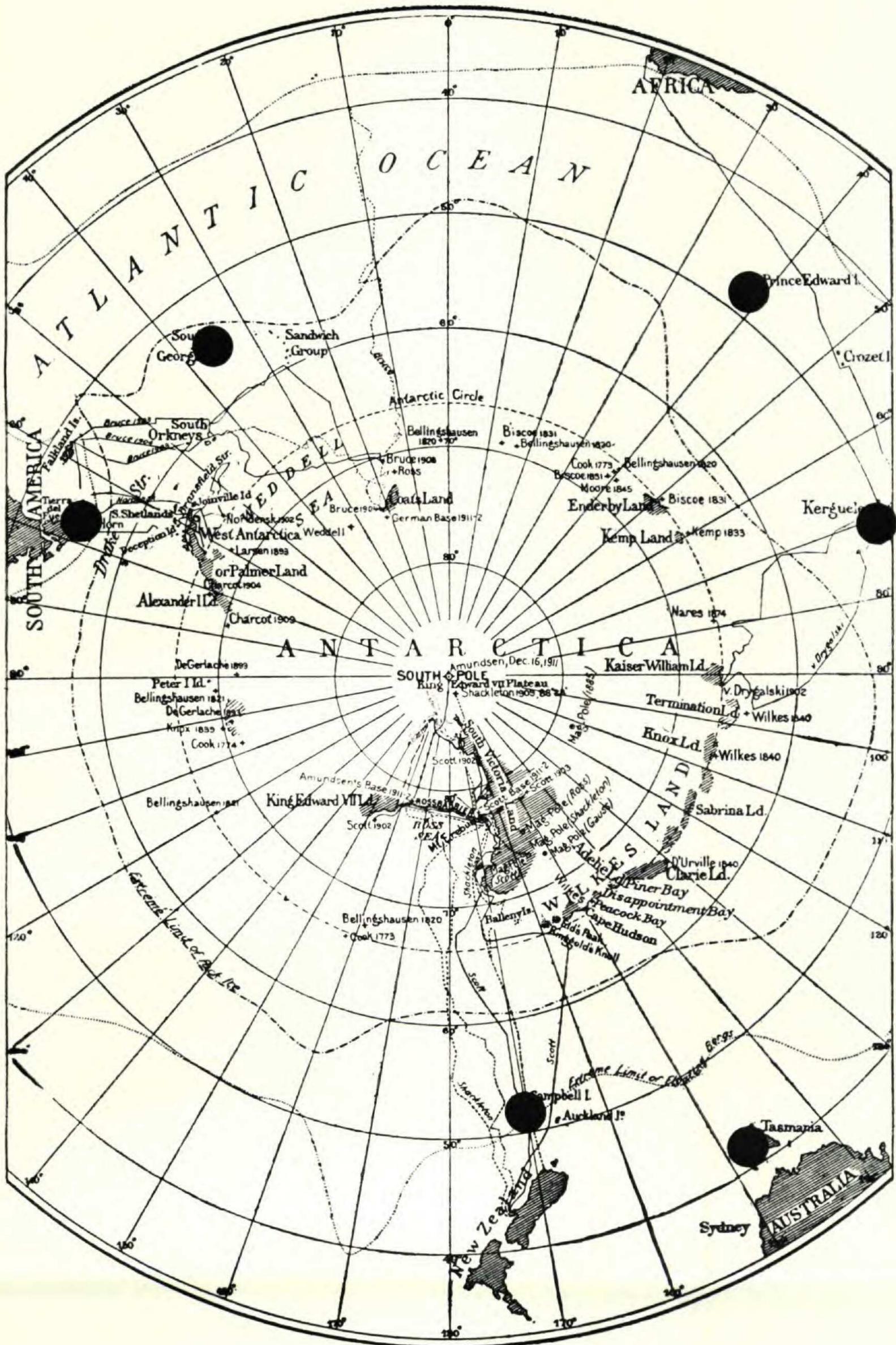
8. ***C. occidentalis*** Hegelm. Monographie Gattung Callitriche 57. 1864; Hegelm. Verhandl. Bot. Ver. Brandenburg 9: 14. 1867. *C. microcarpa* Engelm. ex Hegelm. Verhandl. Bot. Ver. Brandenburg 10: 113. 1869.—Fruit 0.3–0.4 mm. wide, usually a little higher, with rather straight sides, narrowed toward the base (Fig. 8); mericarps with lower ends pushing against each other and bending outward so that the fruit appears strumose at base; stigmas nearly obsolete, usually persisting as minute stubs scarcely exerted between the upper lobes of the mericarps; filaments 0.1–0.2 mm. long; anthers minute, less than 0.1 mm. wide; leaves 2–5 mm. long, obovate to oblanceolate, faintly 1–3-nerved.—Known only from **Cuba**: Chirreva, July 28, 1860–64, *Wright 2547* (GH, MO); Los Remates, Dec. 26, 1860–64, *Wright 2548*, ISOTYPE of *C. microcarpa* (GH, MO); fl. St. John, Matanzas, *Rugel 234bis* (NY—mixed with *C. peploides*); Playa de Mariano, Prov. Havana, Feb. 22, 1910, *Britton & Wilson 4515* (NY); Trinidad Mts., Santa Clara, Los Cocos to Rio Negro, 430 meters alt., March 6, 1910, *Britton & Wilson 5127* (NY).

No material was cited with the original description of *C. occidentalis*, but in 1867 a single collection was cited: Cuba (“in paludosis exsiccatis Masmarisen, April 1824” K. K. W. H.).

*C. microcarpa* was based on *Wright 2548*, which seems inseparable from the other collections of *C. occidentalis*. Dr. Engelm. mann’s carefully mounted stems (MO) show several fruits, and their identity is unmistakable.

9. ***C. antarctica*** Engelm. ex Hegelm. Verh. Bot. Ver. Brandenburg 9: 20. 1867.—Fruit almost round (Fig. 9b), 1.1–1.3 mm. wide; mericarps with rounded edges and flat faces; stigmas 1.4–2.7 mm. long; anthers 0.5–1.5 mm. wide, on filaments up to about 1 cm. in length; stems fleshy and stout, blackening in drying, creeping below, with ascending or erect branches 2–6 cm. long and often branching at the nodes; leaves at lower rooting nodes reduced to scarious spatulate evanescent scales; upper leaves 2.3–6.5 mm. long, 1.3–1.7 mm. wide, 3-nerved, apparently rather fleshy and often blackening in drying, broadly rounded above, with wide scarious bases connected by a broad wing (Fig. 9a); peltate scales often abundant and conspicuous, especially about the nodes.—Probably terrestrial, on islands from 40° South to Antarctica.—Bay of Isles, South Georgia Island, Feb. 3, 1913, *Murphy 1764* (NY). Hermit Island, Cape Horn, *Hooker* (MO). Campbells Island, *Hooker* (cited by Hegelm., l. c.). Tasmania, *Gunn* (MO). Kerguelen’s Land, *Kidder* (NY, CM, US, MO, GH); Kerguelen’s Land, *Hooker*, COTYPE (MO, GH). Marion Island, Dec. 5, 1874, *Mosely* (GH). Antarctic America, *Hooker*, COTYPE (GH, MO).

10. ***C. verna*** L. emend. Kütz., and most modern European authors. *C. palustris* L. emend. Britton & Brown, and of many North American authors. The original description of Linnaeus, and many following, of which a few are cited here, were completely ambiguous, only the foliage being described in detail. The following names, then, apply only to the Section *Callitriche* in



9. *C. antarctica*.

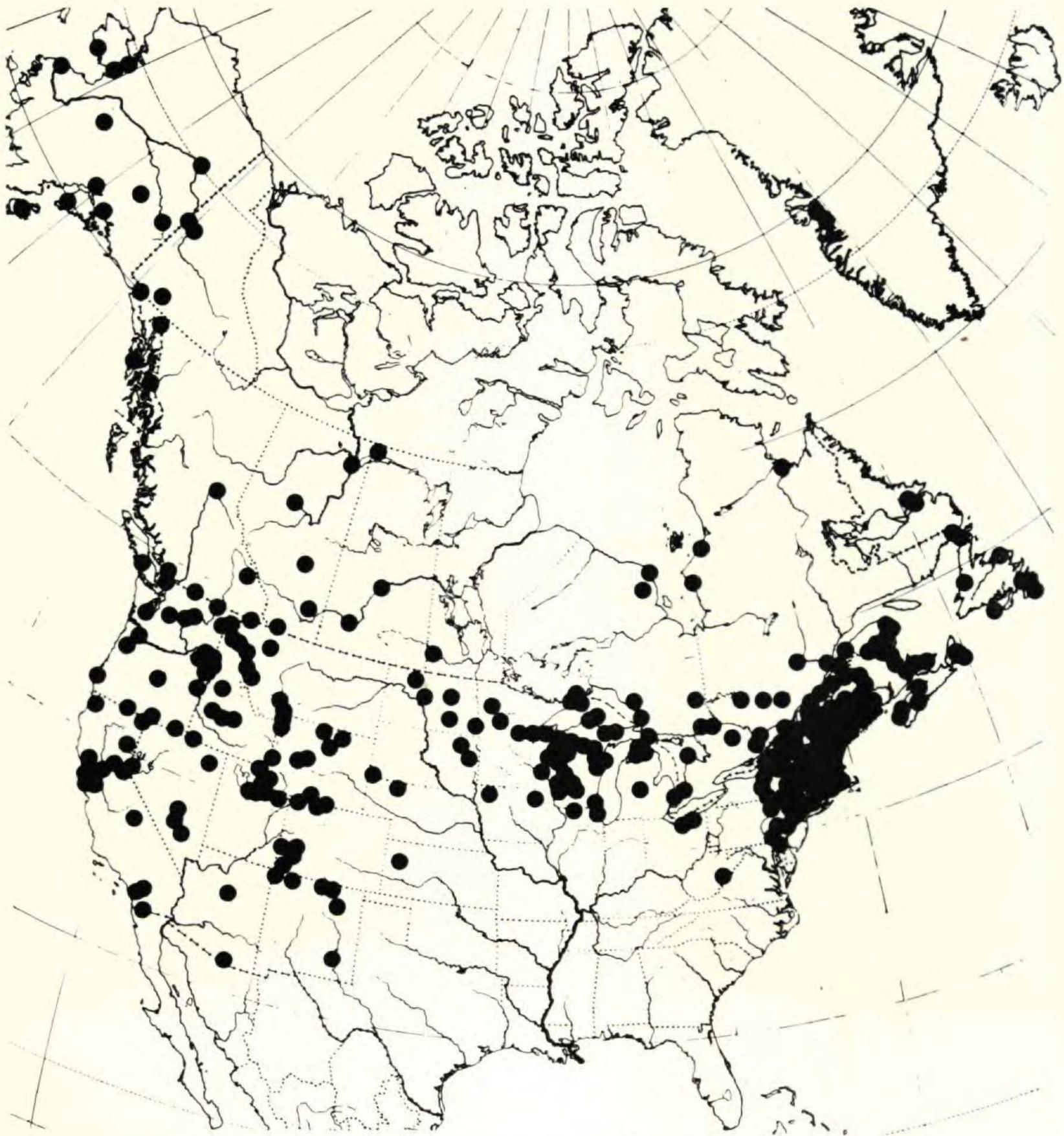
general: *C. verna* L., Fl. Suec. ed. 2: 2. 1755; Sp. Pl. ed. 2, 1: 6. 1762; Oeder, Fl. Dan. 1: t. 129. 1764; Michx. Fl. Bor.-Am. 1: 2. 1803; Wahlenb. Fl. Lap. 2: 1812; R. & S. Syst. 1: 46. 1817; Spreng. Syst. ed. 16, 1: 20. 1817; DC. Prod. 3: 70. 1828.

The first name clearly applicable to species no. 10 of the present treatment was *C. verna* as used by Kützing, who described the fruit, and as used by most European and many American authors since his time: *C. verna* Kütz. in Reichenb. Pl. Crit. Cent. IX. Tab. 881. 1831; Kütz. Linnaea 7: 175. 1832; Kütz. in Reichenb. Icones V. Tab. cxli. fig. 4746. 1841; Lönnroth, Obs. Crit. Pl. 17. 1854; Hegelm. Monogr. Callit. 55. 1864; Hegelm. Verhandl. Bot. Ver. Brandenburg 9: 22. 1867; Howell, Fl. N. W. Am. 218. 1897; Samuelsson, Festschrift Carl Schröter 623. 1925; Pearsall, Bot. Soc. & Exch. Club Br. Isles 10: 863. 1935; Glück in Pascher, Süßwasser-Flora Mitteleuropas 15: 288. 1936; Hultén, Fl. Aleutian Islands 238. 1937.

*C. palustris* L. Sp. Pl. 2: 969. 1753 was also based on foliage only, and is completely ambiguous as to application. It was revived by Morong, Mem. Torrey Club 5: 215. 1894, based on *C. verna*. Were *C. verna* L. and *C. palustris* L. exactly synonymous it might be argued that the application of *C. verna* as fixed by Kützing automatically fixed that of the older *C. palustris*, but since the descriptions and synonyms of these two names were not exactly the same, each must stand on its own feet. The first recognizable description of *C. palustris* was in Britton & Brown, Ill. Fl. 2: 382. 1897, and the name has been taken up by several subsequent American authors including: Small, Fl. S. E. U. S. 723. 1903; Robinson & Fernald in Gray's Manual, ed. 7: 550. 1908; Coulter & Nelson, New Man. Rocky Mt. Bot. 312. 1909; Henry, Fl. S. Br. Col. 200. 1915; Rydb. Fl. Rocky Mts. 548. 1917; Munz, Man. S. Calif. Bot. 291. 1935; Jepson, Fl. Calif. 2: 434. 1935; Fassett, Man. Aquat. Pl. 241. 1940; Peck, Man. Higher Pl. Ore. 466. 1941; Muenscher, Aquat. Pl. U. S. 261. 1944; Roland, Fl. N. S. 342. 1947; Fernald in Gray's Man. ed. 8: 973. 1950. *C. stenocarpa* Hegelm. Verhandl. Bot. Ver. Brandenburg 10: 114. 1869. See discussion under *C. longipedunculata*.

Fruit 0.6–1.4 mm. wide, the height always exceeding the width, the width greatest above the middle (Fig. 10a, d, g, i, l, n, q, t), the thickness at base greater than at summit (Figs. 10c, f, j, k, o, r, u); face of mericarps sharply reticulate, the reticulations appearing more or less clearly in vertical rows (Figs. 1 & 2 on Plate 1167); margins of carpels widely spreading (Figs. 10b, e, h, m, s) with a definite scarious wing that is always widest at summit and runs a greater or lesser distance down the sides; leaves very variable, the lower submersed ones often linear, 0.3–1.0 mm. wide, 1-nerved, shallowly bidentate at apex (Fig. 10w), the upper ones often dilated (Figs. 10g, p), and the terminal frequently in a floating rosette, but various intermediates present on many plants. Young fruits of *C. verna*, when pressed, sometimes widen as they flatten, to simulate in outline those of *C. heterophylla*.—In shallow water or stranded on the mud, from Greenland to Alaska, south to southeastern Pennsylvania and northeastern Maryland, and in the mountains to West Virginia, northern Ohio, southern Michigan, northern Illinois, northern Iowa, western Nebraska, western Kansas, southern New Mexico, southern Arizona, and southern California, perhaps in Mexico; Europe; Asia.—Relatively few of the many collections examined are cited below.

**Greenland:** Jakobshavn, Aug. 3, 1937, *Porsild 411* (GH, NY, US); Godhavn, July 27–28, 1937, *Porsild 294* (GH). **Labrador:** Straits of Belle Isle, Blanc Sablon River, Sept. 3, 1925, *Fernald, Wiegand & Long 28639* (GH). **New-**

10. *C. verna*, range in the New World.

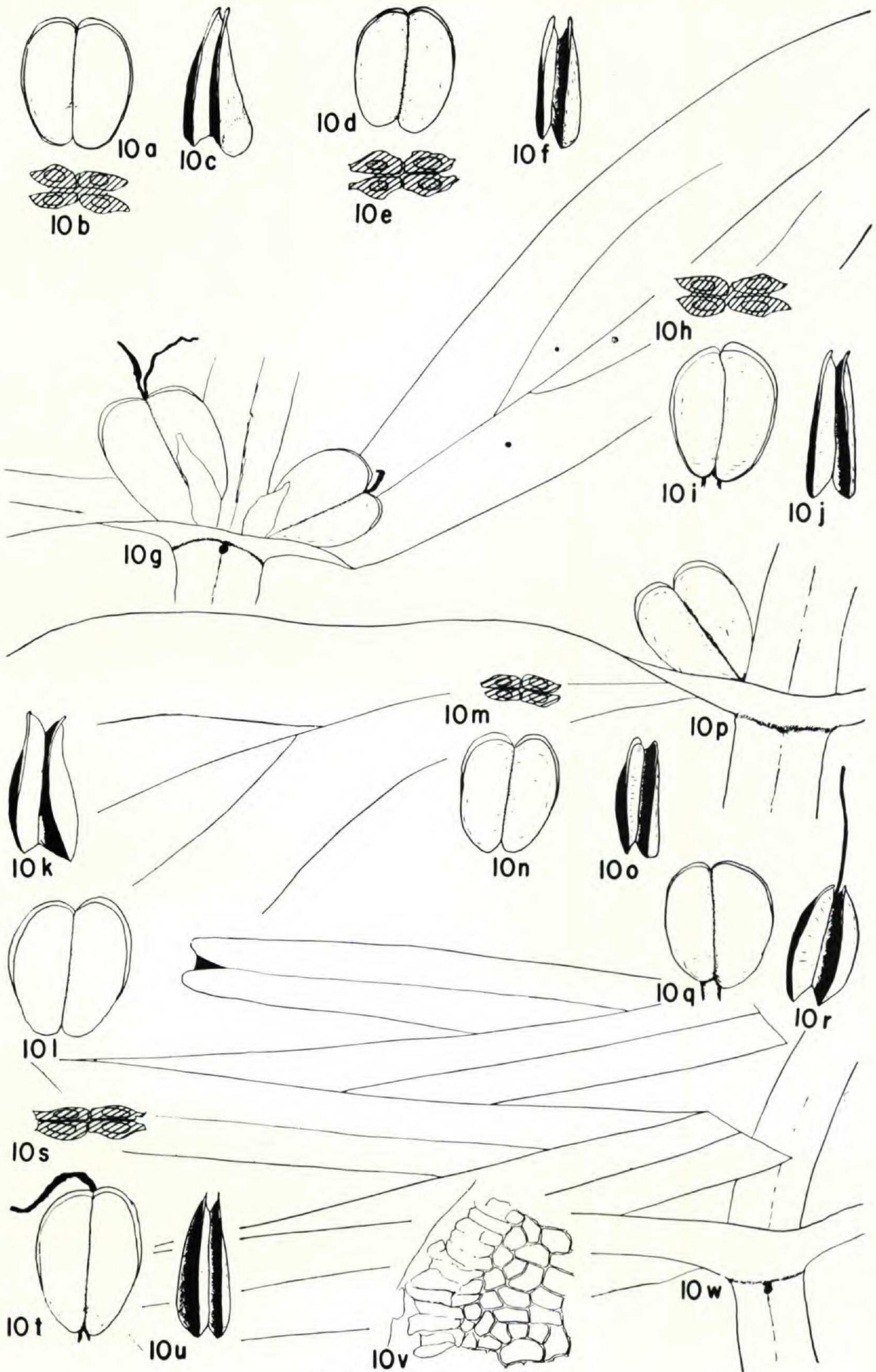
**foundland:** Quiddy Viddy Lake, Aug. 2, 1894, *Robinson & Schrenk 229* (US, NY, GH, CM); Bay of Islands, 1896, *Waghorne 37* (MO); Trepassy, Avalon Peninsula, Aug. 16, 1924, *Fernald, Long & Dunbar 26819* (GH). **St.-Pierre et Miquelon:** St.-Pierre, Aug. 17, 1901, *Arsène 328* (GH). **Quebec:** Lake Memphremagog, Aug. 16, 1886, *Churchill* (GH); Bic, Rimouski Co., July 22, 1907, *Fernald & Collins 1111* (GH); Cap à L'Aigle, July 18, 1905, *Macoun 67928* (GH); 113 miles north of Mont-Laurier, Aug. 3-5, 1941, *Victorin, Rolland & Blain 126* (MO, GH); Thetford, Megantic Co., Aug. 5, 1920, *Victorin 11250* (US, GH); Cascapedia River, Bonaventure Co., Aug. 29, 1947, *Fassett 27795* (WIS). **Prince Edward Island:** Southport, Queens Co., July 9, 1912, *Fernald & St. John 7726* (US, GH). **New Brunswick:** St. Andrew's, Aug. 7, 1900, *Fowler* (US, GH); Grande Anse, Aug. 22, 1913, *Blake 5518* (US, MO, GH).

**Nova Scotia:** Grand Pré, July 10, 1901, *Howe & Lang 371* (NY); George River, Cape Breton Co., Aug. 29, 1920, *Bissell & Linder 21765* (GH); Middleton, Annapolis Co., July 21, 1920, *Fernald & Pease 21762* (GH). **Maine:** Van Buren, July 22, 1893, *Fernald 46* (CM, US, MO, GH, UC, NY); Mt. Desert, Aug. 17, 1892, *Redfield 16704* (MO); York, Aug. 12, 1894, *Bicknell 5575* (NY). **New Hampshire:** Jackson, Aug. 1, 1890, *Churchill* (MO); Hanover, July 12, 1910, *Williams* (GH, MO); Errol, Coös Co., Sept. 5, 1917, *Fernald & Pease 17075* (NEBC); Peterboro, Hillsboro Co., Aug. 25, 1927, *Batchelder* (NEBC—approaching *C. heterophylla*). **Vermont:** Burke Swamp, Stowe, July 3, 1884, *Knight* (NY). **Massachusetts:** Saugus, Essex Co., Oct. 14, 1938, *Svenson 3002* (GH); Sheffield, Berkshire Co., July 8, 1920, *Churchill* (GH, MO). **Connecticut:** Bridgeport, July 9, 1899, *Eames 93* (GH). **New York:** Orange Co., July, 1864, *Austin* (MO, CM); Cedarville, Herkimer Co., *Paine* (MO); Utica, June, 1895, *Haberer 782* (GH); Clove, Dutchess Co., Sept. 2, 1915, *Standley & Bollman 12304* (US). **New Jersey:** Closter, several collections in 1864 & 1865, *Austin* (MO, NY). **Pennsylvania:** Northampton, Aug. 29, 1923, *Churchill* (GH); McCalls Ferry, York Co., July 5–7, 1904, *Rose & Painter 8172* (US). **Maryland:** Havre de Grâce, Sept. 20, 1902, *Shull 405* (US, NY); Notley Hall, 1894, *Coville 35* (US). **West Virginia:** Blister Swamp, Pocahontas Co., Aug. 12, 1931, *Core* (NY). **Ontario:** Golden Lake, July 26, 1899, *Umbach* (US, CM); North Bay, Nipissing Co., Aug. 16, 1933, *Victorin, Rolland & Meilleur 45345* (GH); Schreiber, Thunder Bay District, Aug. 31, 1937, *Hosie, Losee & Bannan 1441* (GH). **Ohio:** Florence, Erie Co., Aug. 28, 1895, *Mosely* (US). **Michigan:** Rumley, Alger Co., July 27, 1936, *Hermann 8290* (US, NY); Fort Gratiot, Nov. 20, 1870, *Gillman* (MO); Ironwood, July 28, 1909, *Clemens* (US). **Wisconsin:** Fort Howard [Green Bay], Aug. 28, 1890, *Schuette* (NY, CM, GH); Long Lake, Portage, Columbia Co., Sept. 29, 1945, *Fassett 22305* (US, WIS). **Illinois:** Glencoe, July, 1912, *Sherff* (MO); Fountaindale, 1871, *Bebb* (CM). **Minnesota:** Squaw Lake, Itasca Park, Clearwater Co., July 13, 1933, *Moyle 854* (US, NY, CM, UC, MO, GH); Milaca, Mille Lacs Co., July, 1892, *Sheldon* (US, GH). **Iowa:** Clay Co. 7 miles east of Ruthven, Aug. 13, 1935, *Hayden 9558* (US, NY, MO, GH); Jessup, Oct. 27, 1893, *Everman* (CM). **Manitoba:** Hamiota, June 23, 1906, *Macoun & Herriot* (CM, NY, GH). **North Dakota:** Leeds, several collections in 1901 & 1902, *Lunell* (GH, NY); Bloom, June 15, 1911, *Bergman 166* (CM). **South Dakota:** Kirk, Black Hills, Aug. 27, 1910, *Murdoch 4338* (GH, CM, NY); Custer, Black Hills, July 25, 1892, *Rydberg 571* (GH, US, NY). **Nebraska:** Kennedy, July 8, 1891, *Bates* (GH). **Saskatchewan:** Yorkton, July 7, 1906, *Macoun & Herriot 72363* (CM, NY); Saskatoon, June 26, 1934, *Fraser*

## PLATE 1172

(Numbers same as in keys and descriptions)

10. *C. verna*. 10a. Face of fruit,  $\times 30$ . California, *Wheeler 3803* (US). 10b. Cross-section of fruit,  $\times 30$ . Same collection. 10c. Edge view of fruit,  $\times 30$ . Same collection. 10d. Face view of fruit,  $\times 30$ . Maryland, *Coville 35* (US). 10e. Cross-section of fruit,  $\times 30$ . Same collection. 10f. Edge view of fruit,  $\times 30$ . Same collection. 10g. Portion of stem and leaves, 2 fruits, each with a bract,  $\times 30$ . Michigan, *Clemens* (US). 10h. Cross-section of fruit,  $\times 30$ . Same collection. 10i. Face of fruit,  $\times 30$ . Same collection. 10j. Edge view of fruit,  $\times 30$ . Same collection. 10k. Edge view of fruit,  $\times 30$ . Alaska, *Trelease 43796* (US). 10l. Face view of fruit,  $\times 30$ . Same collection. 10m. Cross-section of fruit,  $\times 30$ . Japan, *Nakobe* (US). 10n. Face view of fruit,  $\times 30$ . Same collection. 10o. Edge view of fruit,  $\times 30$ . Same collection. 10p. Portion of stem, leaves, and a fruit,  $\times 30$ . Same collection. 10q. Face view of fruit,  $\times 30$ . Sweden, *Lindstrom* (GH). 10r. Edge view of fruit,  $\times 30$ . Same collection. 10s. Cross-section of fruit,  $\times 30$ . Quebec, *Marie-Victorin 11250* (US). 10t. Face of fruit,  $\times 30$ . Same collection. 10u. Edge view of fruit,  $\times 30$ . Same collection. 10v. Portion of wing and face of fruit,  $\times 187.5$ . New Brunswick, *Fowler* in 1900 (US). 10w. Portion of stem with linear 1-nerved submersed leaf,  $\times 30$ . Quebec, *Marie-Victorin 11250* (US).



CALLITRICHE VERNA

(CM). **Alberta:** Fort McMurray, junction of Athabaska and Clearwater Rivers, Sept. 11, 1935, *Raup 7097* (GH); Wolf Creek, Craigmyle District, Aug. 15, 1925, *Brinkman 1839* (US—mixed with *C. hermaphroditica*). **Montana:** Chestnut, vicinity of Bozeman, Sept. 23, 1905, *Blankinship 187* (US, CM); Glacier National Park, Aug. 9, 1932, *Maguire 902* (GH). **Wyoming:** Pine-dale, Sublette Co., July 23, 1922, *Payson & Payson 2805* (US, CM, MO, GH, UC); Ranchester, July 13, 1896, *Nelson 2288* (MO). **Colorado:** Empire, Aug., 1874, *Engelmann* (MO, GH); Chicken Creek, W. La Plata Mts., June 27, 1898, *Baker, Earle & Tracy 151* (US, CM, NY, MO); Breckenridge, Summit Co., Aug., 1901, *Mackenzie 359* (MO). **New Mexico:** Pecos River National Forest, Aug. 11, 1908, *Standley 4889* (US, GH, NY); Chama, Rio Arriba Co., July 9, 1911, *Standley 6660* (US). **Idaho:** Alturas Lake, Blaine Co., Aug. 11, 1916, *Macbride & Payson 3726* (US, NY, MO, GH, UC); Forks of St. Mary's River, Coeur d'Alene Mountains, July 6, 1895, *Leiberg 1175* (US, CM, NY, GH, UC, MO). **Utah:** Big Cottonwood Cañon, below Silver Lake, July 11, 1905, *Rydberg 6885* (US, NY); Uintas, July, 1869, *Watson 391* (NY, GH), and Aug., 1869, *390* (US, NY). **Arizona:** Tucson, April, 1881, *Lemmon Herbarium* (US, NY, MO, GH); Flagstaff, July, 1889, *Greene* (NY). **Alaska:** Bell Isl., Sulphur Springs, Aug. 22, 1915, *Walker 955* (US, CM, NY); Unga, Shumagin Islands, July 16, 1899, *Saunders 4379c* (US); Sitka, July 10, 1914, *Anderson 97* (US). **Yukon:** White Horse, Sept. 2, 1902, *Macoun 58511* (NY). **British Columbia:** Barclay Sound, Vancouver Island, Aug. 8, 1887, *Macoun* (NY); Lake Osoyoos, between Lat. 49° and 49° 50', and Long. 119° 20' and Long. 119° 35', May 31, 1905, *Macoun 79520* (NY). **Washington:** Usk, July 30, 1902, *Kreager 352* (US, NY, GH); Leavenworth, Aug. 26, 1901, *Umbach* (CM, NY). **Oregon:** Farewell Bend, Crook Co., July 17, 1894, *Leiberg 459* (US, NY, GH, CM, UC); Keno, Klamath Co., July 8, 1920, *Peck 9389* (MO, GH, NY). **Nevada:** Park's Station, 25 miles north of Elko, Aug. 3, 1913, *Hitchcock 978* (US, NY, MO, GH); Toiyabe National Forest, Nye Co., July 15, 1945, *Maguire & Holmgren 25786* (NY, GH). **California:** Warner Mts., Modoc Co., Aug. 15, 1935, *Wheeler 3863* (US, NY, MO, GH); Russian River, Sonoma Co., 1864, *Bolander 3870* (US); Julian, San Diego Co., June, 1882, *Parish 1404* (CM). **Mexico:** Colipa, Dep. Vera Cruz, "reg. calid.", March, 1841, *Liebmann 1086* (GH—the collection was identified by Ostenfeld as *C. deflexa*  $\beta$ . *Austini*, and is so far from the rest of the range of *C. verna* that the possibility of a confusion of labels must be considered, particularly in view of the fact that this number in UC is *C. peploides* var. *semialata*).

11. *C. albomarginata*, n. sp., fructibus 0.9–1.0 mm. latitudine, 1.0–1.5 mm. altitudine, altitudine latitudinem plerumque maiore; carpellis manifeste reticulatis fuscis, cum ala alba distincta; foliis 4–6 mm. longis, 1–2 mm. latis, obovatis, subpetiolatis.—Fruits 0.9–1.0 mm. wide, 1.1–1.5 mm. high, usually a little higher than wide (Fig. 11a); commissural groove about as wide as deep (Figs. 11b, 11c); face of carpels clearly reticulate and dark-colored, clearly differentiated from the whitish wing at summit of fruits and often also at the base and slightly developed down the sides; leaves 4–6 mm. long, 1–2 mm. wide, the blades obovate or subrotund, tapering to long margined petioles; upper leaves in a floating rosette.—**Chile:** Cordillera de Santiago, 2700 m. alt., March, 1899, *Reiche* (GH).

Although represented by but one small specimen, this appears to be a very distinct species. The fruits are usually a little narrower toward the base than toward the summit, but a few

have nearly parallel sides. Only rotund leaves are represented on the type specimen, which looks enough like Fig. 4 on Plate 1169 to have served as its original, but of course leaves of other types may be expected in almost all members of the Section *Callitriche*.

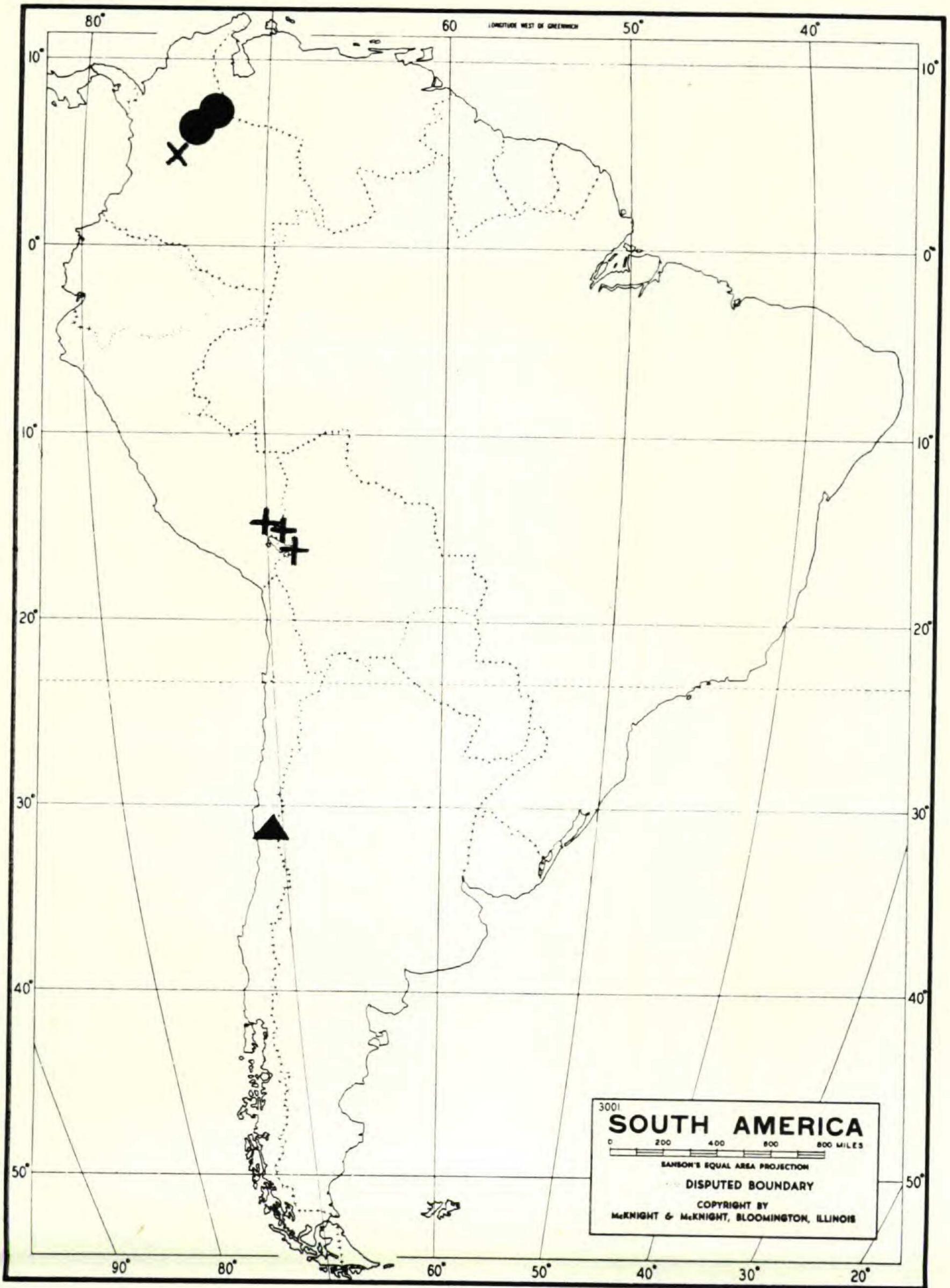
12. ***C. heteropoda*** Engelm. ex Hegelm. Verh. Bot. Ver. Brandenburg 9: 40. 1867. Fruit 1.2–1.4 mm. wide, 1.2–1.5 mm. high, the height equalling (Fig. 12c) or slightly exceeding (Fig. 12g) the width; edges of carpels wingless, rounded or very obtusely angled (Figs. 12b, 12d, 12e, 12h) with a broad V-shaped commissural groove between them; fruit sessile or on pedicels up to 15 mm. long on the same plant; leaves linear and 1-nerved below and broadly ovate above, or all of the ovate-rotund type, or, when plants are stranded on shore, oblong and of firmer texture.—High mountains of southeastern Peru and northwestern Bolivia.—**Peru**: pools in Distichia moor, 4200–4500 m. alt, La Raya, Department of Cusco, April 22, 1925, *Pennell 13493* (GH, CM). **Bolivia**: Prov. Larecaja, vic. Sorata, in lacunis uliginosis, 1859 and/or 1860, *Mandon 1496* and/or *1456* (TYPE in MO, ISOTYPES in MO, GH, NY); without locality, *Bang 1887* (GH, US, NY, CM, MO); LaPaz, Dec. 29, 1930, *Buchtien 8436* (US); Tunari, April 5, 1892, *Kuntze* (NY).

The variations in leaf-patterns almost exactly parallel those of *C. heterophylla* as illustrated in Plate 1168. The leaves may be even larger than in that species and reach 5 mm. in width in the *Bang* collection.

Young fruits, when pressed very flat, may appear obscurely winged, but mature fruits on the same plant serve to dispel the illusion.

It is difficult to determine whether there are two Mandon collections, or if there is but one. The sheet in NY bears clearly the number *1456* and the date 1860. The sheet in GH has, in less legible figures, the number *1456* and the date 1859. The two sheets in MO have no date (except “ex Hb. A. Gray 1865” on one mounted fragment): one sheet is numbered *1496*, and has in a pocket mounted fragments two of which are marked, respectively, *1496* and *1496a*; the other is labelled, “mixta cum no. *1496*.” Engelmann at one time had separated the two sheets as different species, but eventually published them as one.

13. ***C. heterophylla*** Pursh emend. Darby. *C. heterophylla* Pursh, Fl. Amer. Sept. 1: 3. 1814, *nomen ambiguum*; Darby, Bot. Southern States 311. 1841; Engelm. in Gray's Manual ed. 5: 429. 1867; Hegelm. Verhandl. Bot. Ver. Brandenburg 9: 20. 1867; Britton & Brown, Ill. Fl. 2: 382. 1897; Small, Fl. Southeastern U. S. 723. 1903; Howell, Fl. N. W. Am. 218. 1918, in part; Robinson & Fernald in Gray's Manual ed. 7: 550. 1908; Rydb. Fl. Prairies &



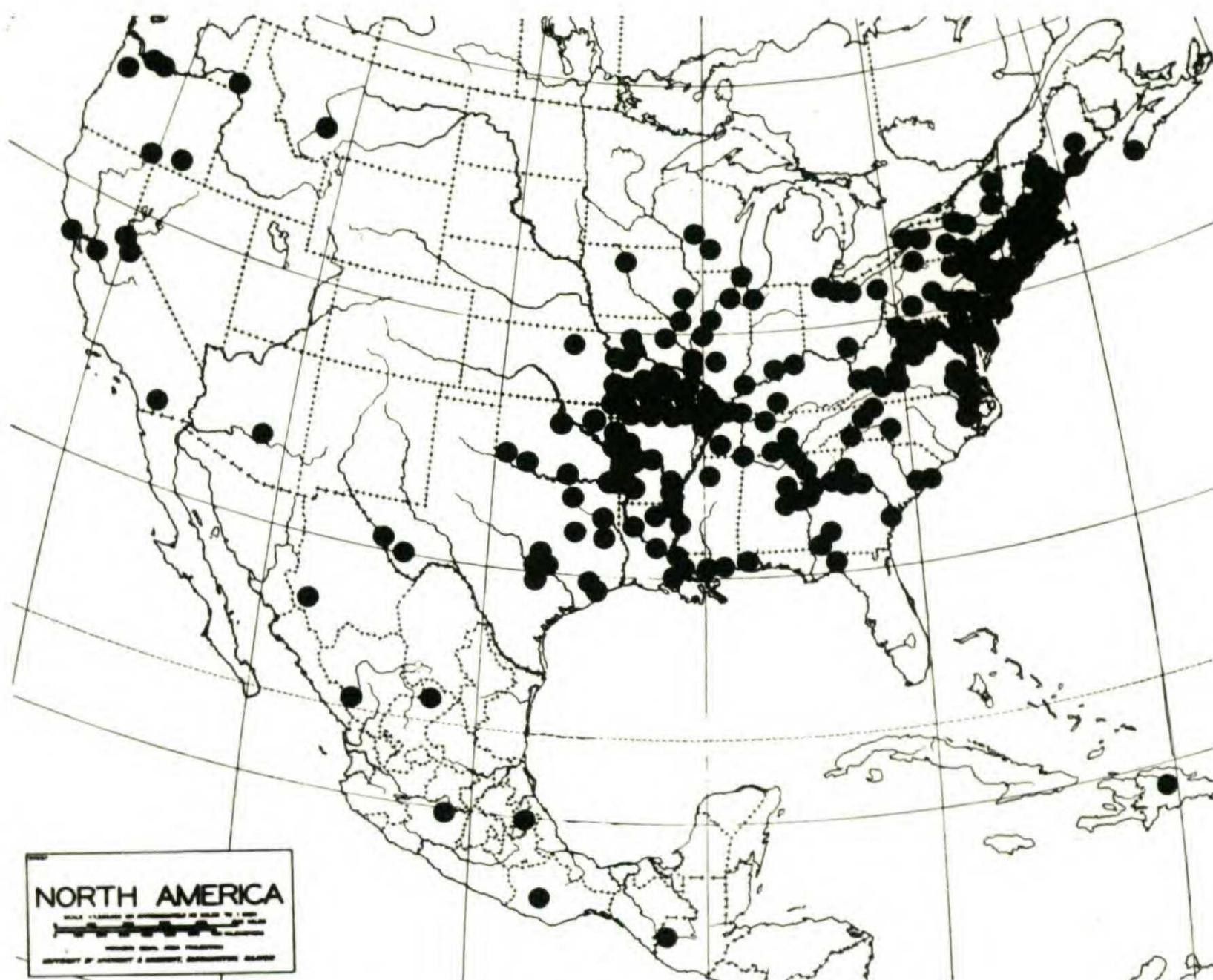
11. *C. albomarginata* (triangle). 12. *C. heteropoda* (crosses). 14. *C. quindiensis* (x). 17. *C. nubigena* (dots).

Plains 522. 1932; Fassett, Man. Aquat. Pl. 241. 1940; Muenscher, Aquat. Pl. U. S. 260. 1944; Fernald, Gray's Manual, ed. 8: 974. 1950. *C. Asagraei* Hegelm. Monogr. Gattung Callitriche 54. 1864. *C. Tuerckheimii* Urb. Symb. Ant. 7: 265. 1912.—Fruit 0.6–1.2 mm. wide, the height equalling the width (Figs. 13a, 13j, 13x, 13Ag, 13Ak), or not more than 0.1 mm. greater (Figs. 13d, 13Aa, 13Ae, 13Ap) or 0.1 mm. less (Figs. 13e, 13m, 13w, 13Ag) than the width; carpels more broadly rounded at summit than at base so that the outline of the fruit is slightly heart-shaped (all figures listed above), convex on the face and thickest just above the base (Figs. 13b, 13f, 13k, 13n, 13r, 13Ab, 13Ai, 13Aq); margins of fruits wingless or rarely with a very narrow wing (Figs. 13i, 13p, 13v, 13z) at the summit; styles 1–6 mm. long, erect or spreading, persistent or caducous; leaves of many types, often linear and one-nerved at the lower nodes with a rosette of floating obovate leaves (Figs. 4 & 9 on Plate 1168), or all linear, or all obovate, or oblong on plants stranded on the mud (Figs. 1 & 6 on Plate 1168); linear one-nerved leaves shallowly bidentate at tip with an enlarged but scarcely excurrent nerve-ending (Figs. 13h, 13s, 13An, 13Ao).

- a. Fruits (0.6–) 0.7–0.8 (rarely –1.0) mm. wide and high.....  
 .....*C. heterophylla* var. *heterophylla*.  
 a. Fruits (0.8–) 0.9–1.1 (–1.2) mm. high and wide.....  
 .....*C. heterophylla* var. *Bolanderi*.

**C. heterophylla** var. **heterophylla**. *C. heterophylla* Darby, l. c., and probably of Pursh, l. c. *C. Asagraei* Hegelm. l. c.—Southwestern Nova Scotia and central Maine to Florida and Dominican Republic, westward through northern New York, southern Ontario, northern Ohio, northern Illinois and Iowa, rarely to southcentral Wisconsin, and southward with a western border in Kansas, Oklahoma and Texas, to Guatemala; in the western states from western Montana and central Arizona to Washington, Oregon and California where it grades into the more abundant var. *Bolanderi*.—Only a few of the many collections are cited here. **Nova Scotia**: Rockville, Yarmouth Co., July 14, 1920, *Pease & Linder 21760* (GH). **Maine**: Chemo Stream, July, 1895, *Harvey 345(1)* (US); North Berwick, July 17, 1891, *Parlin* (GH, NEBC). **New Hampshire**: Gorham, Sept. 14, 1916, *Pease 16863* (NEBC—approaching *C. verna*); West Ossipee, Sept. 21, 1855, *Boott* (NEBC); Head Pond, Berlin, Aug. 4, 1920, *Pease 17827* (NEBC); Walpole, July 13, 1901, *Fernald 231* (NY, US, MO, GH, UC, CM). **Massachusetts**: Charles River near Riverview, July, 1895 (GH); Waverly, Aug. 15, 1892, *Harper* (wis); Ashland, July 21, 1877, *Morong* (MO); Chilmark, Martha's Vineyard, June 19, 1917, *Seymour 1261* (NY, GH); Harwich, Barnstable Co., Aug. 13, 1918, *Fernald & Long 17043* (NEBC—approaching *C. anceps*); Deerfield, *Herb. Torrey* (MO). **Rhode Island**: East Providence, Phillipsdale, June 2, 1906, *Reynolds 068* (GH); Providence, May 8, 1892, *Collins* (US). **Connecticut**: Southington, Aug. 21, 1895, *Andrews* (GH); Franklin, June 23, 1906, *Woodward* (GH). **New York**: Wading River, Long Island, July 23, 1877, *Miller* (MO, US); Sand Lake, near Albany, 1863, *Austin* (MO); Caroline, Tompkins Co., May 23, 1915, *Wiegand 4500* (MO, GH); Buffalo, *Clinton* (MO); Berlin, Rensselaer Co., Sept. 18, 1932, *House 20174* (GH); Black Rock Forest, Orange Co., July 23, 1936, *Raup 7697* (GH); Black Rock Forest, Aug. 1, 1936, *Raup 7794* (GH—some fruits approach *C. anceps*). **New Jersey**: Delaware Valley, Warren Co., Sept. 9, 1917, *Barton* (GH); Hackensack River, Closter, June, 1865, *Austin* (MO, GH); Collingswood, Camden Co., June 19, 1926, *Adams 298* (MO, GH). **Pennsylvania**: Philadel-

phia, Aug., 1832, Moser (COTYPE of *C. deflexa*  $\beta$  *Austini*—MO, NY); Phillipsburg, Center Co., Aug. 29, 1939, Wahl 411 (GH); West Chester, Darlington (MO); Naomi Pines Lake, Pocono Plateau, July 29, 1904, Harshberger (some fruits close to *C. anceps*—NY, CM, MO). **Delaware:** Townsend, May 17, 1883, Commons (MO, NY). **Maryland:** Shad Point, Wicomico Co., Aug. 17, 1906, Shreve & Jones 1181 (US); Garrett Co., Sept. 19, 1881, Smith (US, GH); Beltsville, Prince Georges Co., Sept. 3, 1916, McAtee 2697 (US). **District of Columbia:** Potomac Flats, May 11, 1890, Coville (US). **Virginia:** Luray, Aug. 26, 1901, Steele & Steele 45 (MO, US, NY, GH); Barcroft, May 13, 1928, McAtee 3379 (US); Port Norfolk, May 24, 1912, Robinson 323 (GH); Sebrell, Southampton Co., May 22, 1939, Fernald & Long 9970 (GH); Burgess Station, Dinwiddie Co., May 19, 1939, Fernald & Long 9969 (GH). **North Carolina:** Williamston, Martin Co., June 21, 1927, Wiegand & Manning 1850 (GH); Biltmore, April, 1897, Biltmore Herbarium 1725 (GH, US, NY). **South Carolina:** Georgetown Landing, Georgetown Co., April 10, 1932, Weatherby & Griscom 16575 (US, GH). **Georgia:** Stone Mountain, May 24, 1897, Eggert (MO); Winterville, Clarke Co., May 8, 1941, Duncan 29 (GA). **Florida:** "In paludibus, ad lac. Jamony," April, 1843, Rugel (MO, NY); Tallahassee, Berg (NY). **Ontario:** Niagara, July 8, 1901, Macoun 44411 (GH). **Ohio:** Kimball, Erie Co., May 26, 1897, Moseley (MO, GH); Windham Twp., Portage Co., Aug. 31, 1924, Webb 5522 (GH). **West Virginia:** Morgantown, Monongalia Co., May 20, 1945, Bartholomew 520 (WVA, MO, US, GH); Harman, Randolph Co., Sept. 12, 1904, Greenman 159 (GH). **Kentucky:** Croley, Aug. 28, 1923, McFarland & Anderson 319 (MO, US); Murray, Calloway Co., July 22, 1937, Smith & Hodgdon 4146 (GH). **Tennessee:** Nashville, April, 1880, Gattinger 2464 (NY, US, MO, CM); Natchez Trace Parkway, Wayne Co., April 24, 1947, McDougal 1261 (US); Tullahoma, Coffee Co., May 14, 1939, Svenson 10117 (US, MO, GH); Pelham, Grundy Co., May 15, 1939, Svenson 10151 (WIS). **Alabama:** Auburn, Lee Co., March 26, 1897, Earle & Baker (NY, MO, CM) and April 16, 1898 (US—mixed with *C. terrestris*); Talladega Co., July 17–19, 1900, Pollard & Maxon 243 (US, NY). **Indiana:** Griffith, Lake Co., July 12, 1920, Deam 31640 (GH); Mt. Vernon, Posey Co., June 15, 1935, Hermann 6648 (GH). **Wisconsin:** Devils Lake, Sauk Co., Aug. 5, 1897, Umbach (WIS, GH, CM); Morrison Creek Falls, Jackson Co., Aug. 10, 1938, Catenhusen (WIS). **Illinois:** Skokie Marsh, Glencoe, June 12, 1911, Sherff (MO, CM); Athens, Menard Co., 1861, Hall (US, MO, GH); 5 miles west of Kankakee, June 1, 1941, Schneider 1893 (WIS—fruit close to *C. anceps*). **Mississippi:** Biloxi, March 10, 1898, Tracy 4976 (NY, US, MO, GH, CM). **Iowa:** Ruthven, Palo Alto Co., May 19, 1937, Hayden 5084 (GH); Moscow, Muscatine Co., June 28, 1917, Shimek (MO). **Missouri:** St. Louis, May, 1842, Geyer (MO, NY); Eagle Rock, Barry Co., Sept. 29, 1896, Bush 57 (US, MO, NY); Long Run, Ozark Co., July 11, 1937, Steyermark 23244 (MO, CM). **Arkansas:** Mt. Magazine, Havana, June 6, 1931, Haas 2006 (US); between West Fork and Devils Den State Park, Washington Co., April 18, 1939, Fassett 20931 (WIS, MO, GH); Magnet Cove, Hot Springs County, April 30, 1939, Demaree 19036 (MO, CM). **Louisiana:** Natchitoches, April 27, 1915, Palmer 7403 (MO, US); St. Martinsville, March, 1888, Langlois (MO). **Kansas:** Riley Co., 1895, Hitchcock 975 (MO, US, GH, NY). **Oklahoma:** Cherokee Nation, Aug. 20, 1895, Blankinship (MO, US, GH); Verdigris, Oct. 5, 1894, Bush 149 (MO, GH). **Texas:** Houston, April 16, 1872, Hall 543 (CM, US, MO, GH, NY); Blanco River, Wright (NY); Little Aguja Canyon, Davis Mountains, Jeff Davis Co., June 12, 1931, Moore & Steyermark 3080 (US, MO, NY, GH, CM). **Montana:** Helena, Aug., 1892, Starz (MO). **Idaho:** Juliaetta,

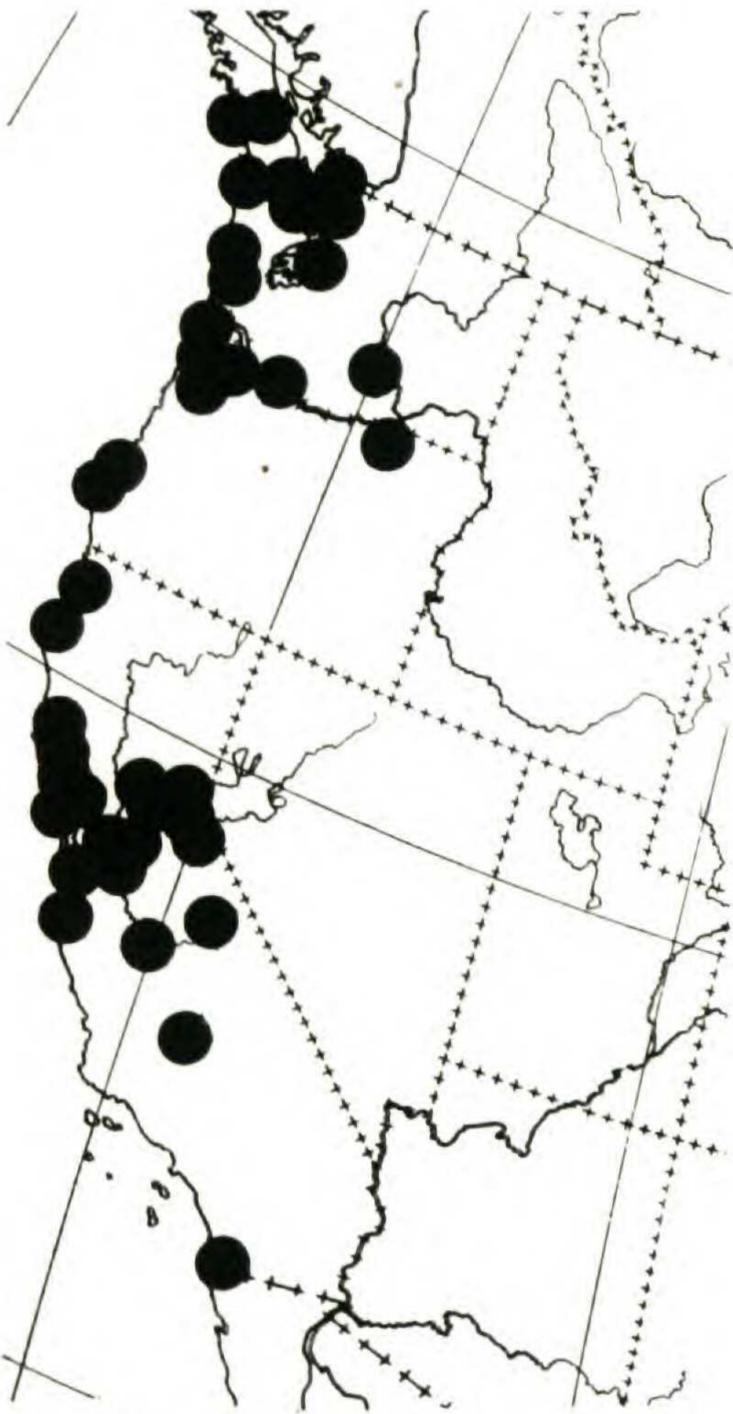


13. *C. heterophylla* var. *heterophylla*.

Oct. 7, 1898, *Henderson 4604* (GH). **Washington:** Bingen, Klickitat Co., July 13, 1920, *Suksdorf 10553* (MO, GH, NY, UC, US). **Oregon:** Lakeview, Lake Co., May 29, 1940, *Hitchcock 6735* (MO); W. Salem, Polk Co., April 13, 1918, *Nelson 2040* (GH); Steens Mts., Harney Co., July 31, 1946, *Maguire & Holmgren 26753* (NY). **California:** Searsville, *Bolander* (GH—mixed with *C. marginata*, *C. verna*, and an aquatic *Ranunculus*—probably COTYPE of *C. stenocarpa* Heglem.); Glen Alpine Lake, Eldorado Co., Sept. 4, 1935, *Abrams 13701* (GH); Mather, Tuolumne Co., June 1, 1931, *Keck 1171* (GH); Ione, Amador Co., March 19, 1921, *Eastwood 10083* (GH); Knight's Ferry, Stanislaus Co., April, 1930, *Mason 5549* (UC); San Bernardino Mountains, June 28, 1894, *Parish 3395* (MO, US). **Arizona:** 37 miles from Young on road to Payson, Gila Co., May 24, 1937, *Peebles & Smith 13296* (US). **Mexico:** Majalca, Chihuahua, June 24, 1936, *LeSueur 768* (CM, GH); Sierra Madre, Chihuahua, Oct. 6, 1887, *Pringle 1523* (NY); Morales, San Luis Potosí, 1879, *Schaffner 123* (NY); San Luis Potosí, March, 1878, *Parry* (MO); Zimatlán, Oaxaca Mts., Dec. 8 & 9, 1905, *Conzatti 1311* (US); Sierra de Pachuca, Hidalgo, July 20 & 24, 1905, *Rose & Painter 8865* (US). **Guatemala:** Dept. Huehuetenango, between Tojquiá and Caxín bluff, Sierra de los Cuchumatanes, alt. 3700 m., Aug. 6, 1942, *Steyermark 50222* (US, CM). **Hispaniola:** Santo Domingo, Cordillera Central, prov. de la Vega, Valle Nuevo, Aug. 17, 1929, *Ekman 13821* (US); prov. de la Vega, Constanza, Los Montazos, Oct. 21, 1929, *Ekman 13885* (US).

**Uruguay:** Blanquillo, Dept. Duranzo, Sept., 1947, *Herter 1966* (MO). **Argentina:** Partido de Tornquist, Sierra de la Ventana, Parque Provincial, Provincia de Buenos Aires, Oct. 6, 1939, *Cabrera 5305* (LP).

**C. heterophylla** var. **Bolanderi** (Hegelm.) n. comb. *C. Bolanderi* Hegelm. Verhandl. Bot. Ver. Brandenburg 10: 116. 1869; Howell, Fl. N. W. Am. 219. 1898; Peck, Man. Higher Pl. Ore. 466. 1941.—Southern Vancouver Island, Washington, Oregon and California, in many places grading into var. *heterophylla*.—**British Columbia:** Cowichan Lake, Vancouver Island, June 14, 1907, *Rosendahl 1761* (US, NY, MO, GH); District of Renfrew, Aug. 7, 1902, *Rosendahl 885* (NY, MO); Koskilah, July 20, 1908, *Macoun 88228* (NY, US, GH); Somenos, June 11, 1887, *Macoun* (NY, US, UC); Ucleulet, July 1, 1909, *Macoun 88557* (NY); Alberni, July, 1916, *Carter 300* (US); Shawnigan Lake, Aug. 5, 1919, *Carter* (GH); Vancouver Island, June 11, 1887, *Macoun 43* (GH). **Washington:** Olympic Mts., Clallam Co., Aug., 1900, *Elmer 2779* (NY, US, MO); Hoquiam, Chehalis Co., May 10 or 11, 1897, *Lamb 1012* (NY, MO, CM); Aloha, Grays Harbor Co., July 9, 1933, *Thompson 9369* (NY); Montesano, May 20, 1917, *Grant* (NY, US); East Sound, July 20, 1905, *Euberg* (NY); Granville, July 17, 1902, *Conard 340* (US); Mt. Adams, August, October, 1881, *Suksdorf* (US, UC, CM, MO); Hoh River bottoms, Jefferson Co., April 25, 1924, *Otis 1408* (US); Seattle, April 28, 1889, *Piper 696* (US); Northwood Swamp, Whatcom Co., June 26, 1937, *Muenscher 8222* (UC) and Lummi Slough, *Muenscher 8221* (GH); Mount Baker National Forest, Whatcom Co., June 14, 1939, *Muenscher 9949* (WIS); Belfast, Friday Creek, Skagit Co., June 12, 1932, *Mason* (UC, GH); Cascade Mts., Sept., 1882, *Tweedy* (MO); Seattle, April 15, 1910, *Zeller* (MO); Seattle, April 23, 1889, *Smith* (MO); Yakima Terr., 1882, *Brandeggee 15176* (MO). **Oregon:** Salem, 1871, *Hall 461* (MO, CM, GH, US); Salem, May 3, 1918, *Nelson 2093* (GH); Cape Blanco, June 25, 1919, *Peck 8537* (NY, MO, GH); Gale's Peak, Washington Co., Nov. 16, 1893, *Lloyd* (NY); Tillamook Co., June 25, 1894, *Lloyd* (NY); Sparta, Union Co., Oct. 15, 1897, *Sheldon 9121* (US); Arch Cape, Clatsop Co., July 11–12, 1922, *Abrams 8845* (MO); Bastendorf's Beach, Coos Co., June 26, 1926, *Scullen* (UC). **California:** Ione, Amador Co., 1889, *Greene* (US, CM, GH); Amador Co., July, 1892, *Hansen 486* (MO); Chico, Butte Co., May 4, 1929, *Kennedy* (UC); Wright's Lake, El Dorado Co., July 22, 1934, *Copeland* (UC); Layne's Ranch, El Dorado Co., April 30, 1909, *Brandeggee* (UC); Eureka, Humboldt Co., May 23, 1909, *Tracy 2974* (UC); Mad River Valley opposite Blue Lake, June 13, 1909, *Tracy 2994* (UC); Ryan's Slough, Humboldt Bay, April 13, 1913, *Tracy 4038* (UC, NY, US); between High Prairie and Redwood Creek, Humboldt Co., May 28, 1918, *Tracy 4950* (UC); Lone Pine, Inyo Co., Aug. 31, 1942, *Alexander & Kellogg 3421* (UC); Kernville, Kern Co., June 23, 1891, *Coville & Funston 1043* (US); Bogg's Lake, Mt. Hannah, Lake Co., May 22, 1929, *Blankinship* (MO); Madera, Madera Co., March 24, 1929, *Mason 5111* (UC, GH); Olema, Marin Co., April 26, 1929, *Mason 5224* (UC); Ukiah, Mendocino Co., *Bolander* (MO); Carmel Hill, Monterey Co., April 4, 1916, *Abrams 5599* (NY); Mount Saint Helena, Napa Co., June 21, 1932, *Fenley* (UC); St. Helena, Napa Co., April 19, 1903, *Baker 1998* (US, MO, GH) and *2772* (NY, US, MO, GH); Auburn, Placer Co., April 11, 1865, *Bolander 4528* (US, MO—ISOTYPES of *C. Bolanderi*); near San Francisco, *Wilkes 1380* (US); Julian, San Diego Co., June, 1882, *Parish 1404* (NY, GH, CM); Clements, San Joaquin Co., April 7, 1929, *Mason 5202* (UC); Mount Day Ridge, Mount Hamilton Range, Santa Clara Co., May 21, 1936, *Sharsmith 3677* (UC); Kenwood, Sonoma Co., April, 1893, *Bioletti* (UC); Oakdale, Stanislaus Co., April 5, 1929, *Mason 5170* (UC); Tuolumne R., 1866, *Bolander 5090* (US, UC, MO);



13a (left). *C. heterophylla* var. *Bolanderi*. 15 (right). *C. hamulata* in the New World.

Searsville, *Bolander* (MO—mixed with *C. verna*, *C. marginata*, and an aquatic *Ranunculus*—probably COTYPE of *C. stenocarpa*); Glacier Point, Yosemite National Park, Sept. 3, 1932, *Wiggins 5903* (UC).

Pursh described 3 species, with no mention of fruit. His *C. heterophylla*, with spatulate-obovate floating leaves and linear submersed leaves could have been the species here under consideration or it could have been *C. verna*. *C. linearis*, with leaves all linear but the upper ones somewhat spatulate could also have been either the *C. heterophylla* or the *C. verna* of the present treatment, but scarcely *C. autumnalis* as Pursh suggested. *C. brevifolia* could have been a terrestrial form of *C. heterophylla*, or possibly the *C. terrestris* of the present treatment. I am indebted to Dr. F. W. Pennell of the Academy of Sciences of Philadelphia and to Sir Edward Salisbury of the Royal Botanic

Gardens at Kew for the information that Pursh's material representing these three names is not to be found at either institution.

The first definite application of the name *C. heterophylla* appears to have been made by Darby in 1841.<sup>1</sup> While he did not describe the fruit, his description of foliage applies, in his region, only to this species. He described, also, the floral bracts ("Perianth persistent, lanceolate, white") found only in *C. heterophylla* in the southern states. Hegelmaier, in 1864, clearly described *C. Asagraei*, with only a rather ambiguous reference to *C. heterophylla* and *C. linearis* as related species. Three years later Hegelmaier definitely adopted the name *C. heterophylla* in the sense used by Darby as well as by most authors since that time, reducing *C. Asagraei* to its synonymy. In the same year, Engelman, with whom Hegelmaier had been exchanging both material and comments, also took up *C. heterophylla* in its modern application, with the citation of *C. Asagraei* as a synonym and *C. brevifolia* and *C. linearis* as phases of it.

*C. heterophylla* var. *Bolanderi* seems indistinguishable from the broad-ranging phase of the species, except in size of fruits (compare Figs. 13a to 13x with Figs. 13Aa to 13Aq on the same page). These two phases definitely intergrade, as is shown in Graph I. Here are plotted the width and height of fruits of 50 individuals picked at random from eastern collections (var. *heterophylla*) and 50 individuals of var. *Bolanderi*. Fruits of var. *heterophylla* range from 0.6–1.0 mm. in height, with a great majority having a height of 0.7 mm. In var. *Bolanderi* they range from 0.7–1.2 mm. in height, a majority having a height of 1.0 mm. While the recognition of varieties on measurements involving tenths of millimeters may seem like hair-splitting, it must be remembered that we are dealing with very small objects: the mean length of the fruit of *Bolanderi* is half again as great as that of *heterophylla*, and the volume of the fruit is more than three times as great.

The original description of *C. Bolanderi* really has very little of diagnostic value, but the two isotypes cited above are clearly the large-fruited plant of California.

The original description of *C. Tuerckheimii* is long and detailed, but most of the details refer to the Section *Callitriche* as distinguished from Section *Microcallitriche*. There is nothing in

<sup>1</sup> I am indebted to Dr. Wilbur H. Duncan for a copy of the description from this rare volume.

## GRAPH 1.

Size classes of fruits of *C. heterophylla* var. *heterophylla* (erect numerals) and var. *Bolanderi* (slanted numerals).

1.3							
1.2						3	
1.1				7	4	1	
1.0			6	15			
0.9		/	6	/			
		2	3				
0.8			5				
		19	2				
0.7		10	9				
0.6		4					
	0.6	0.7	0.8	0.9	1.0	1.1	1.2
	width in millimeters						

the description that does not apply perfectly to *C. heterophylla*; the type material has not been seen but the two collections cited, from the same region, seem to be *C. heterophylla*.

The width and height of the fruit are often equal, and do not differ from one another by more than 0.1 mm. A pair of fruits like those illustrated as 13Aa and 13Ag may look quite different but their relationship to the ranges of variability may be seen by study of Graph I. Wide-fruited individuals like Fig. 13w have been confused with *C. terrestris*, even by Hegelmaier, who cited such an individual with his description of *C. deflexa*  $\beta$  *Austini*. Conversely, narrow fruits like Fig. 13a and 13Aa are often identified as *C. verna*.

Persistence of the styles, often used to distinguish *C. verna* from *C. heterophylla*, appears to be of no significance.

While the carpels are usually quite wingless, there is sometimes a minute wing at the summit of the fruit, 5–10 micra wide (Figs. 13i, 13o, 13v, 13z). This can ordinarily be demonstrated only after a mericarp has been boiled in KOH, the pericarp stripped from the seed and examined with a compound microscope. The figures were drawn from such preparations.

The true wing is clearly differentiated from the reticulate face of the mericarp. What may be called a false wing is of more frequent occurrence. This seems to be formed when the seed fails to fill the mericarp completely, and the unexpanded marginal portion of the pericarp appears thin and wing-like, but more or less reticulate like the rest of the pericarp. Such a fruit is shown in Figs. 4 & 5 of Plate 1167. Dr. Engelmann observed this condition and was confused by it (as was the present writer), noting on a sheet from South Carolina, "These southern specimens are to me doubtful, and apparently intermediate or transitionform—but I refer them now (doubtfully) to *verna*. G. E. 1864."

From Newfoundland to Cape Cod, there are occasional individuals intermediate between *C. heterophylla* and *C. anceps*, and between *C. heterophylla* and *C. verna*. These seem to be most common in the White Mountain region of New Hampshire.

The two sheets of *C. heterophylla* var. *heterophylla* cited from South America are both from the region about the mouth of Rio de la Plata, and both appear to be quite characteristic of this species. Perhaps there has been a mixing of labels, never-