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Chelone (Plantaginaceae)

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X. CHELONE Linnaeus, Sp. Pl. 2: 611. 1753; Gen. Pl. ed. 5, 267. 1754 *

Turtlehead [Greek for tortoise or turtle, alluding to appearance of enlarged corolla tube] E

Allan D. Nelson

Herbs, perennial; rhizomes producing 1--12 aerial stems. **Stems** erect, glabrous or glabrate. **Leaves** cauline, opposite, not leathery; petiole present or absent; blade margins serrate to dentate. **Inflorescences** axillary and terminal, spikelike cymes; bracts (ovate to broadly lanceolate, margins glabrous to ciliate). **Pedicels** absent or present; bracteoles present. **Flowers** bisexual; sepals 5, connate, calyx radially symmetric, campanulate, lobes obtuse to ovate; petals 5, corolla white, light pink-red, or dark purple throughout or white and pink to purple distally, bilaterally symmetric, bilabiate, spurs absent, abaxial lobes 3, (lobes ovate to rounded with middle abaxial lobe elevated into villous to lanate bearded palate nearly closing throat), adaxial lobes 2; stamens 4(5), adnate to corolla proximally, didynamous, filaments pubescent to villous, staminode 1, rarely 0, spatulate; ovary 2-locular, placentation axile; stigma capitate. **Capsules** symmetric, dehiscence septical. **Seeds** +/- 50, tan to light brown, becoming darker towards center, spheric to ovoid, winged circumferentially. $x = 14$.

Species 4 (4 in the flora): c, e North America.

Chelone is a member of tribe Cheloneae, which in North America includes *Chionophila*, *Collinsia*, *Keckiella*, *Nothochelone*, *Penstemon*, and *Tonella*. These genera share a cymose inflorescence, the presence of a staminode, simple trichomes, and stems that contain pith (A. D. Wolfe et al. 2002). In phylogenetic analyses using molecular (Wolfe et al.) and morphological (A. D. Nelson 1995) data, species of *Chelone* occur in a clade with *N. nemorosa*. *Chelone* has a reduced cyme with relatively large bracteoles, dorsally ridged corolla, triangular pollen amb (grain shape from polar view) shape, rugulate-reticulate pollen exine sculpting pattern, and a circumalate (surrounded by a wing) seed, whereas *Nothochelone* has a more-branched cyme with relatively small bracteoles, a ventrally ridged corolla, circular pollen amb shape, reticulate pollen exine sculpting pattern, and asymmetrical seed wing (Nelson). Both genera have hypogynous disc nectaries (Wolfe et al.).

Species of *Chelone* occur in wetland habitats. Their seeds float readily and are likely dispersed by water. Flowers are pollinated by bumblebees (*Bombus* spp.) (F. W. Pennell 1935). A number of leaf and seed herbivores use species of *Chelone* as a host (N. E. Stamp 1984, 1987). Common examples of leaf herbivores include the Baltimore checkerspot (*Euphydryas phaeton*) on *C. glabra* as well as sawfly larvae (*Macrophya nigra* and *Tenthredo grandis*), which are known from *C. glabra* and *C. obliqua*. One common larval seed predator known from *C. glabra* and *C. obliqua* is an agromyzid dipteran (*Phytomyza cheloniae*).

Species and cultivars of *Chelone* are available from nurseries and florists because of their showy flowers. Plants can escape from cultivation (T. S. Cooperrider 1969) and

may have become naturalized outside their native range, especially in New England. *Chelone* was used medicinally in a number of ways by Native Americans and pioneers (C. S. Rafinesque 1828[–1830]; D. E. Moerman 1998).

Three species of *Chelone* are diploid whereas *C. obliqua* is an allopolyploid with tetraploid and hexaploid chromosome races (T. S. Cooperrider 1970; A. D. Nelson et al. 1998) that also intergrade morphologically with diploid species (Nelson 1995; Nelson and W. J. Elisens 1999).

There are several purported examples of inter- and intraspecific hybridization in *Chelone* (A. D. Nelson and W. J. Elisens 1999). Rare individuals of *C. cuthbertii* or *C. lyonii* with narrow leaf bases might be the result of hybridization with *C. glabra* or *C. obliqua* (Nelson 1995). Rare individuals of *C. lyonii* with pink-tipped staminodes might result from hybridization with *C. cuthbertii* (Nelson). Individuals of *C. glabra* with completely pink, red, or purple corollas might be the result of hybridization with sympatric species of *Chelone* that have similar corollas (Nelson), but this seems to occur rarely based on morphologic and isozyme variation (Nelson and Elisens).

Chelone glabra and *C. obliqua* may be difficult to distinguish because all qualitative characters exhibit some overlap. Staminode colors usually are preserved in herbarium specimens, but corolla and beard colors are often difficult to determine from dried material.

SELECTED REFERENCES Nelson, A. D. 1995. Polyploid Evolution in *Chelone* (Scrophulariaceae). Ph.D. dissertation. University of Oklahoma. Nelson, A. D. and W. J. Elisens. 1999. Polyploid evolution and biogeography in *Chelone* (Scrophulariaceae): Morphological and isozyme evidence. *Amer. J. Bot.* 86: 1487–1501.

1. Petioles 0–3 mm; staminodes purple-tipped; corollas pink-red to purple..... 1. *Chelone cuthbertii*
1. Petioles (0–)2–40 mm; staminodes white- to light pink- or green-tipped, rarely purple-tipped; corollas completely dark pink, red, or purple with ventral surface sometimes lighter colored to white or completely white to white in tube but distally green-white, pink, red, or purple.
 2. Petioles (2–)10–40 mm; leaf bases rounded to truncate; inflorescence bracts 2–7 mm; staminodes white- to light pink-tipped 2. *Chelone lyonii*
 2. Petioles (0–)2–20 mm; leaf bases narrowed; inflorescence bracts 4–23 mm; staminodes usually white- or green-tipped, rarely purple-tipped.
 3. Corollas completely white to white in tube but distally green-white, pink, red, or purple; palate white-bearded, rarely green-yellow bearded; staminodes green-tipped..... 3. *Chelone glabra*
 3. Corollas completely dark pink to red to purple, sometimes lighter color to white ventrally; palate yellow-bearded, rarely white-bearded; staminodes white-tipped, rarely green- or purple-tipped..... 4. *Chelone obliqua*

1. *Chelone cuthbertii* Small, Fl. S.E. U.S., 1058, 1337. 1903 * Cuthbert's turtlehead E

Stems 0.23–1 m. **Leaves:** petiole 0–3 mm; blade broadly lanceolate to ovate, 4.9–11.5 x 1–3.6 cm, glabrous or pilose abaxially, usually glabrous adaxially, base rounded, margins once-serrate, teeth 2–7 per cm. **Cymes** 25–70 mm; bracts 3–8 x 3–8 mm, apex obtuse to acute. **Flowers:** calyx lobes 5–9 x 3–6 mm, margins entire to sparsely ciliate; corolla pink-red to purple, tube 11–19 mm, abaxial lobes 8–17 x 3–11 mm, adaxial lobes slightly keeled; palate yellow-bearded; adaxial filaments 11–23 mm; staminode purple-tipped, 6–15 mm; style 16–24 mm. **2n** = 28.

Flowering Jul–Oct. Bogs, streamsides, wet streamheads, and swamps; 0–1200 m; Ga., N.C., S.C., Va.

Chelone cuthbertii occurs in the coastal plain and Appalachian regions. The species can be distinguished from other species of the genus by its short petioles and purple-tipped staminodes.

Chelone cuthbertii is rare throughout its range, making it especially vulnerable to extinction. Drainage of wetlands and bog succession threaten the habitat where the species is found (NatureServe, www.natureserve.org/explorer).

2. *Chelone lyonii* Pursh, Fl. Amer. Sept. 2: 737. 1813 (as *lyoni*) * Lyon's or pink turtlehead E

Stems 0.35--1 m. **Leaves:** petiole (2--10--40 mm; blade broadly lanceolate to ovate, 3.7--13.7 x (2--3--5.5(--8) cm, glabrous or pilose to slightly villous abaxially, glabrate to glabrous, mostly glabrous adaxially, base rounded to truncate, margins at middle of lamina once-serrate, teeth 3--8 per cm. **Cymes** 27--71 mm; bracts 2--7 x 2--8 mm, apex obtuse to acute, sometimes acuminate. **Flowers:** calyx lobes 5--11 x 3--7 mm, margins sparsely to densely ciliate; corolla pink-red to purple, tube 15--21 mm, abaxial lobes 10--12(--14) x 5--12 mm, adaxial lobes strongly keeled; palate yellow-bearded; adaxial filaments 16--23 mm; staminode white- to light pink-tipped, (8--10--15 mm; style 20--30 mm. $2n = 28$.

Flowering Jun--Oct. Mountain stream banks, cove and spruce-fir forests, balds; 60--2000 m; Ala., Conn., Ga., Miss., N.C., S.C., Tenn.

Garden escapes of the species are reported from Connecticut, Maine, Massachusetts, and New York. *Chelone lyonii* can be distinguished from other species of the genus by its longer petioles, rounded to truncate leaf bases, and white to light pink staminodes. The species is sometimes confused with *C. obliqua*, especially in the rare situation where *C. lyonii* is found with leaves narrowed to the base. When this occurs, *C. lyonii* can be distinguished from *C. obliqua* by the presence of wider leaves, longer petioles, more strongly keeled corollas, shorter abaxial corolla lips, and longer staminodes. *Chelone lyonii* has been proposed as a diploid progenitor for the allopolyploid *C. obliqua* (A. D. Nelson 1995; Nelson and W. J. Elisens 1999).

3. *Chelone glabra* Linnaeus, Sp. Pl. 2: 611. 1753 * White turtlehead, galane glabre E F

Chelone chlorantha Pennell & Wherry; *C. glabra* var. *dilatata* Fernald & Wiegand; *C. glabra* var. *elatior* Rafinesque; *C. glabra* var. *linifolia* N. Coleman

Stems 0.2--2.3 m. **Leaves:** petiole (0--2--10(--20) mm; blade broadly elliptic to narrowly elliptic, 1.7--2.3 x 0.6--5.4 cm, glabrous or pilose, rarely tomentose, abaxially, glabrate to glabrous, mostly glabrous adaxially, base cuneate, margins at middle of lamina once-serrate, teeth 1--6 per cm. **Cymes** 30--115 mm; bracts 4--23 x 3--10 mm, apex acute to acuminate or rarely obtuse. **Flowers:** calyx lobes 5--11 x 3--8 mm, margins entire to sparsely, rarely densely, ciliate; corolla completely white to white in tube but distally green-white, pink, red, or purple, tube 13--20 mm, abaxial lobes 6--16 x 5--15 mm, adaxial lobes slightly keeled; palate white-bearded, rarely green-yellow-bearded; adaxial filaments (10--15--24 mm; staminode green-tipped, 4--12(--16) mm; style 15--30 mm. $2n = 28$.

Flowering Jul--Nov. Bogs, fens, marshes, swamps, seeps, stream banks, wet meadows and woods, margins of ponds and lakes; 0--2000 m; St. Pierre and Miquelon; Man., N.B., Nfld. and Labr. (Nfld.), N.S., Ont., P.E.I., Que.; Ala., Ark., Conn., Del., D.C., Ga., Ill., Ind., Iowa, Ky., Maine, Md., Mass., Mich., Minn., Miss., Mo., N.H., N.J., N.Y., N.C., Ohio, Pa., R.I., S.C., Tenn., Vt., Va., W.Va., Wis.

One tetraploid population reported (T. S. Cooperrider 1970) for *Chelone glabra* likely is based on a misidentified specimen of *C. obliqua* var. *erwiniae*.

Chelone glabra has been proposed as a diploid progenitor for the allopolyploid *C. obliqua* (A. D. Nelson 1995; Nelson and W. J. Elisens 1999).

Intraspecific variants of *Chelone glabra* as proposed by F. W. Pennell (1935) are not recognized in this treatment because morphological variation within and among populations appears to be independent of geography. Qualitative and quantitative characters used to distinguish varieties have been shown to be highly variable; recognition of varieties is unwarranted (A. D. Nelson 1995; Nelson and W. J. Elisens 1999).

Chelone glabra in central Maine has been observed to be visited exclusively by two species of bumblebees (*Bombus fervidus* and *B. vagans*) (B. Heinrich 1975). American Indians and pioneers used *C. glabra* as a

tonic, laxative, treatment for jaundice and internal parasites, and as an ointment to relieve itching and inflammation (C. S. Rafinesque 1828[–1830]); it is also used as an ornamental in bog gardens.

4. *Chelone obliqua* Linnaeus, Syst. Nat. ed. 12, 2: 408. 1767 E

Stems 0.25–1.8 m. **Leaves:** petiole 3–20 mm; blade broadly elliptic to narrowly elliptic, 4.5–19.7 x 0.8–3.5(–5) cm, glabrous or pilose, rarely villous abaxially, usually glabrous adaxially, base cuneate, margins at middle of blade once- or twice-serrate, teeth 1–7 per cm. **Cymes** 38–86 mm; bracts 4–10(–17) x 3–8 mm, apex obtuse to acute or acuminate. **Flowers:** calyx lobes 7–10 x 3–7 mm, margins glabrous or sparsely to densely ciliate; corolla dark pink to red to purple, sometimes lighter color to white ventrally, tube 14–22 mm, abaxial lobes (10–)12–19 x 5–15 mm, adaxial lobes slightly keeled; palate yellow-bearded, rarely white-bearded; adaxial filaments (13–)16–27 mm; staminode white-tipped, rarely green- or purple-tipped, 4–12(–14) mm; style 16–34 mm.

Varieties 3 (3 in the flora): c, e United States.

Chelone obliqua can be identified by its completely dark pink, red, or purple corollas with abaxial surfaces sometimes lighter colored to white, yellow beards, and white staminodes. The species may be difficult to distinguish from other species of *Chelone* when rarely its beards are white or staminodes green- or purple-tipped. This may be due to rare intra- and interspecific hybridization (A. D. Nelson and W. J. Elisens 1999).

Chelone obliqua is allopolyploid in origin (A. D. Nelson 1995; Nelson and W. J. Elisens 1999) and has a recombinant phenotype representing all three extant diploid species. Variation within *C. obliqua* reflects multiple independent origins (Nelson; Nelson and Elisens); some of the rare color variants could be due to this rather than hybridization (Nelson).

Chelone obliqua comprises two known chromosome races, $2n = 4x = 56$ and $2n = 6x = 84$. Tetraploids are found in the Blue Ridge Province, whereas hexaploids are found in the Interior Low and Ozark plateaus as well as Central Lowland provinces and the Coastal Plain Province. Within each of these three physiographic provinces, a number of distinct genotypes occur (A. D. Nelson 1995; Nelson and W. J. Elisens 1999; NatureServe, www.natureserve.org/explorer). Because of rarity of *C. obliqua*, only seven populations were examined for this treatment, and it appears from this limited sample that the cytotypes might have regional ranges and minor morphological variation that support the varieties of *C. obliqua* as proposed initially by Pennell and Wherry and later treated as subspecies by Pennell. However, with the exception of calyx lobe margin pubescence, new characters are used to distinguish varieties because those used by Pennell had wide quantitative ranges or highly variable qualitative characters.

1. Staminodes 0.4–0.8(–1.2) cm; calyx lobe margins densely ciliate; Interior Low and Ozark plateaus, Central Lowland provinces 4b. *Chelone obliqua* var. *speciosa*
1. Staminodes (0.6–)0.8–1.2(–1.4) cm; calyx lobe margins glabrous or sparsely ciliate; Coastal Plain and Blue Ridge provinces.
 2. Abaxial corolla lobes (1.2–)1.5–1.9 cm; mid-cauline leaves 5.3–8(–11.7) cm; Coastal Plain Province 4a. *Chelone obliqua* var. *obliqua*
 2. Abaxial corolla lobes 1.2–1.5(–1.6) cm; mid-cauline leaves (6–)8–19.7 cm; Blue Ridge Province 4c. *Chelone obliqua* var. *erwiniae*

4a. *Chelone obliqua* Linnaeus var. *obliqua* * Red turtlehead E

Leaves: mid-cauline leaf 5.3–8(–11.7) cm. **Flowers:** calyx lobe margins glabrous or sparsely ciliate; abaxial corolla lobes (1.2–)1.5–1.9 cm; staminode (0.6–)0.8–1.2(–1.4) cm. $2n = 84$.

Flowering Jul–Oct. Along streams and rivers, marshes, swamps, seeps or springs, wet meadows and woods, pond and lake margins; 0–100 m; Ala., Ga., Ky., Md., Miss., N.C., S.C., Tenn., Va.

Variety *obliqua* is considered to be vulnerable to extinction throughout the Coastal Plain Province, although specific threats to populations have not been assessed (NatureServe, www.natureserve.org/explorer).

4b. *Chelone obliqua* Linnaeus var. *speciosa* Pennell & Wherry, *Bartonia* 10: 19, plate 2, fig. 1. 1929 *
Rose or purple turtlehead E

Chelone obliqua subsp. *speciosa* (Pennell & Wherry) Pennell

Leaves: mid-cauline leaf (6.9--8.8--17 cm. **Flowers:** calyx lobe margins densely ciliate; abaxial corolla lobes 1--1.6 cm; staminode 0.4--0.8(--1.2) cm. $2n = 84$.

Flowering Jul--Oct. Along streams and rivers, marshes, swamps, seeps or springs, wet meadows and woods, pond and lake margins; 90--200 m; Ark., Ill., Ind., Iowa, Ky., Mich., Minn., Mo.

Variety *speciosa* occurs in the Interior Low and Ozark plateaus as well as Central Lowland provinces, where it is vulnerable to extinction. NatureServe (www.natureserve.org/explorer) estimates 21--80 populations of var. *speciosa* throughout its range and lists forest clearing, agriculture, and construction activities that change wetland hydrology, long-term flooding and excessive siltation of flood plains, habitat succession, livestock grazing, insect herbivores, and seed predators as threats to these populations.

4c. *Chelone obliqua* Linnaeus var. *erwiniae* Pennell & Wherry, *Bartonia* 10: 19. 1929 * Erwin's or red turtlehead E

Chelone obliqua subsp. *erwiniae* (Pennell & Wherry) Pennell

Leaves: mid-cauline leaf (6--8--19.7 cm. **Flowers:** calyx lobe margins glabrous or sparsely ciliate; abaxial corolla lobes 1.2--1.5(--1.6) cm; staminode (0.6--0.8--1.2(--1.4). $2n = 56$.

Flowering Jul--Oct. Along streams and rivers, marshes, swamps, seeps or springs, wet meadows and woods, pond and lake margins; 1000--1700 m; N.C., S.C.

Variety *erwiniae* is considered to be vulnerable to extinction in the Blue Ridge Province, but threats to populations have not been assessed (NatureServe, www.natureserve.org/explorer). N. E. Stamp (1987) identified two common larval seed predators, *Endothenia herbesana* and *Phytomyza cheloniae*, which were observed to attack 25% of the capsules from a population and destroy 21% of its seeds. Insect defoliation prior to development of inflorescences reduces floral and seed output significantly in *Chelone glabra* and *C. obliqua* var. *erwiniae* (Stamp 1984). Severe herbivory after flower buds appeared caused decreased seed output, and plants that were defoliated twice in one year often produce no flowers (Stamp 1984). Because of severe levels of herbivory and seed predation observed in var. *erwiniae*, it may reproduce via seed infrequently, relying on clonal reproduction by rhizomes (Stamp 1987).