Persicaria densiflora

Dense-flower Knotweed

Polygonaceae

Persicaria densiflora by Brian Keener, 2022

***Persicaria densiflora* Rare Plant Profile**

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

501 E. State St.
PO Box 420
Trenton, NJ 08625-0420

Prepared by:
Jill S. Dodds
jsdodds@biostarassociates.com

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For:
New Jersey Department of Environmental Protection
Office of Natural Lands Management
New Jersey Natural Heritage Program
natlands@dep.nj.gov

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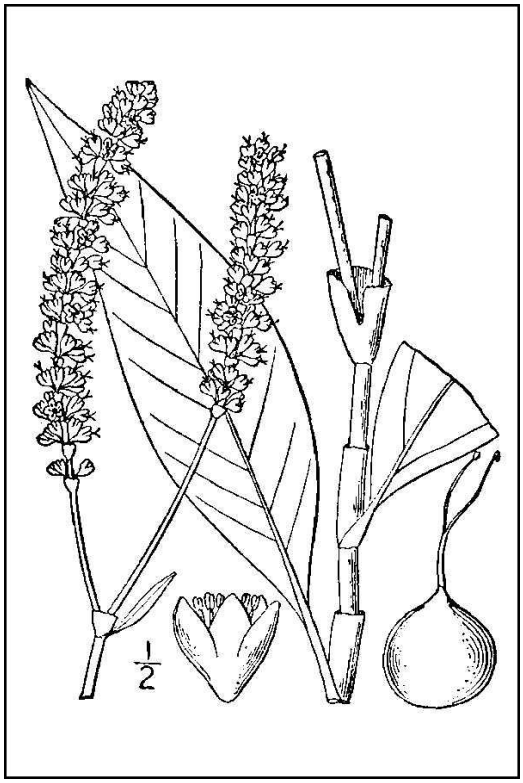
Life History

Persicaria densiflora (Dense-flower Knotweed) is a semi-aquatic, rhizomatous, perennial herb in the Polygonaceae. The family is distinguished by swollen stem nodes and membranous sheaths (ocreae) at the base of the leaf petioles, the characteristics of which are often useful in species identification (Fassett 1957, Zomlefer 1994).

The stems of *Persicaria densiflora* are typically bent, with their lower parts resting on the substrate and rooting at the nodes while the upper portions are erect. In aquatic settings some roots may be connected to the soil while others are free-floating in the water (Achá et al. 2011). *P. densiflora* plants can reach 1.5 meters in height and usually have forking branches near the top. The lanceolate leaves are alternate, entire, and pointed at both ends, ranging from 15–30 cm long and 2–5.4 cm wide. The 12–23 mm long ocreae are light brown, papery, and do not have a fringe of hairs at the top. The inflorescence is a dense, uninterrupted spike of small greenish-white, white, or pink flowers with five petals. The spikes—which are usually terminal but sometimes also axillary—are erect or somewhat nodding, 3–10 cm long, and 5–9 mm wide. Along the floral spike the flowers are clustered in groups of 3–8 with a sheath (ocreola) at the base of each bunch that usually overlaps with the one above. Minute glandular dots are present on the ocreolae, pedicels, and tepals (See Britton and Brown 1913, Fernald 1950, Fassett 1957, Gleason and Cronquist 1991, Tiner 2009, Hinds and Freeman 2021). *Persicaria densiflora* may bloom from June through November (Weakley 2015, Hinds and Freeman 2021); August through October has been reported for New Jersey (Hough 1983).



Left: Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: Larry Allain, USGS.


Images by Larry Allain, USGS.

The root zones of *Persicaria densiflora* plants may harbor various kinds of sulfate-reducing bacteria that produce high levels of methylated mercury (Achá et al. 2005, 2011). Inorganic mercury (Hg) in water or sediments can be converted by the bacteria into methylmercury (CH_3Hg or $MeHg^+$), a toxic form of the element that accumulates in food chains (Batten and Scow 2003). In some plants high concentrations of mercury compounds can affect growth, photosynthetic activity, or nutrient metabolism but often the toxins can be locked away in vacuoles or cell walls (Beauvais-Flück et al. 2018). No reports of adverse effects to *P. densiflora* were found. If the species proves able to sequester significant amounts of mercury it could be a valuable resource for biomonitoring or phytoremediation of contaminated sites (Henry 2000, Cosio et al. 2014, Wang et al. 2020).

Pollinator Dynamics

Although many aquatic plants are pollinated by wind, insect pollination prevails in the Smartweed family (Zomlefer 1994) and the pollinators of *Persicaria* species include an assortment of bees, wasps, flies, and butterflies (Robertson 1929, Perveen 1999, Hilty 2020). The insects are likely attracted by the nectaries which are located between the bases of the stamens (Stanford 1925).

The flowers on a single *Persicaria* plant do not open simultaneously. Flowers within each individual cluster mature in a sequence that may take days or weeks to reach its conclusion (Stanford 1925). Stanford observed that many *Persicaria* species limit the frequency of self-pollination by having two types of flowers with differing style lengths in which the development of either male or female organs is favored, but the flowers of *P. densiflora* have styles that are all the same length (Hinds and Freeman 2021). Nevertheless, the staggered opening of the flowers may help to promote outcrossing by regulating the number of blooms available to insects on the same plant. No studies of self-fertility in *P. densiflora* were found but research on *Persicaria*

japonica determined that self-pollination did not reduce seed set in that species (Nishihiro and Washitani 1998).

Seed Dispersal

Mitchell (1971) observed that relatively few seeds are produced by *Persicaria densiflora* plants, particularly in comparison to more prolific species in the genus. The fruits of *P. densiflora* are one-seeded achenes which are dark brown or blackish, shiny and smooth, and do not project beyond the tepals (Hinds and Freeman 2021). The achenes are released soon after maturity and, because they are relatively heavy, often fall close to the parent plants (Stanford 1925). In aquatic settings some local transport by water may also occur, while longer-distance dispersal can be carried out by animals. The seeds of *Persicaria*, including *P. densiflora*, are often cited as an important food for waterfowl (Fassett 1957, Landers et al. 1977, Ringelman 1991). The dispersal of viable seeds following ingestion by waterfowl is well-documented, although the efficacy varies depending on both plant species and seed retention time (Soons et al. 2008, Wongsriphuek et al. 2008, Farmer et al. 2017). *Persicaria* seeds may also be consumed and subsequently dispersed by game birds, songbirds, and rodents (Martin 1954).

Seeds that have been dispersed may remain in the soil for some time. *Persicaria densiflora* seeds germinated from soil samples taken at and above the waterline of a constructed reservoir in South Carolina (Collins and Wein 1995). However, it was not clear how long the propagules might have persisted at the site. No information regarding the germination requirements of *P. densiflora* was found, although Mitchell (1976) identified the species as "a potential invader of shallow lakes and ponds" which suggests that its prerequisites for establishment are not too narrow.

Some vegetative dispersal may occasionally occur, at least for plants that are growing in water. Stanford (1925) reported that the stems of aquatic *Persicaria* species can be broken by water movement or storms, eventually taking root where they are deposited.

Habitat

Persicaria densiflora can utilize a variety of wet habitats throughout its range, where it has been known to occur at elevations from 0–300 meters above sea level (Hinds and Freeman 2021). It can grow in the shallow waters of both tidal freshwater wetlands and inland marshes and swamps (Hotchkiss 1972, Smith et al. 2002, Rhoads and Block 2007, Tiner 2009, Weakley 2015). In slightly deeper water *P. densiflora* has been found on large, floating mats of vegetation (Hunt 1943, Frye 1996 and 2008). A number of historical populations in New Jersey were associated with ditches (NJNHP 2022). Other reported habitats include pool edges and marshy shorelines (Hough 1983, Hinds and Freeman 2021), beaver ponds (Ringelman 1991), and intermittent ponds (Landers et al. 1977). Dense-flower Knotweed plants are able to withstand periods of both inundation (Mitchell 1976) and desiccation (Hudak 2014).

Persicaria densiflora is not especially sensitive to water quality, as it appears to be tolerant of phosphorous enrichment (Vaithiyanathan and Richardson 1999) and mercury contamination (Acha et al. 2005, 2011). It was also found to be fairly resistant to some herbicides that are used to reduce invasive plant species in aquatic settings, including triclopyr amine and imazapyr (Allen et al. 2007).

Wetland Indicator Status

Persicaria densiflora is an obligate wetland species, meaning that it almost always occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2022b)

POGL10 USDA Plants Code (*Polygonum glabrum*), see Synonyms and Taxonomy section
PEDE15 NJ accepted (NJNHP listed as *Persicaria densiflora*)

Coefficient of Conservatism (Walz et al. 2018)

CoC = 9. Criteria for a value of 9 to 10: Native with a narrow range of ecological tolerances, high fidelity to particular habitat conditions, and sensitive to anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

Persicaria densiflora ranges from South America to North America, reaching the northern edge of its range in the United States (Weakley 2015). The map in Figure 1 depicts the extent of *P. densiflora* in the United States and Canada.

The USDA PLANTS Database (2022b) shows records of *Persicaria densiflora* in two New Jersey counties: Cape May and Cumberland (Figure 2). There are also current records in the state from Atlantic and Sussex counties (NJNHP 2022).

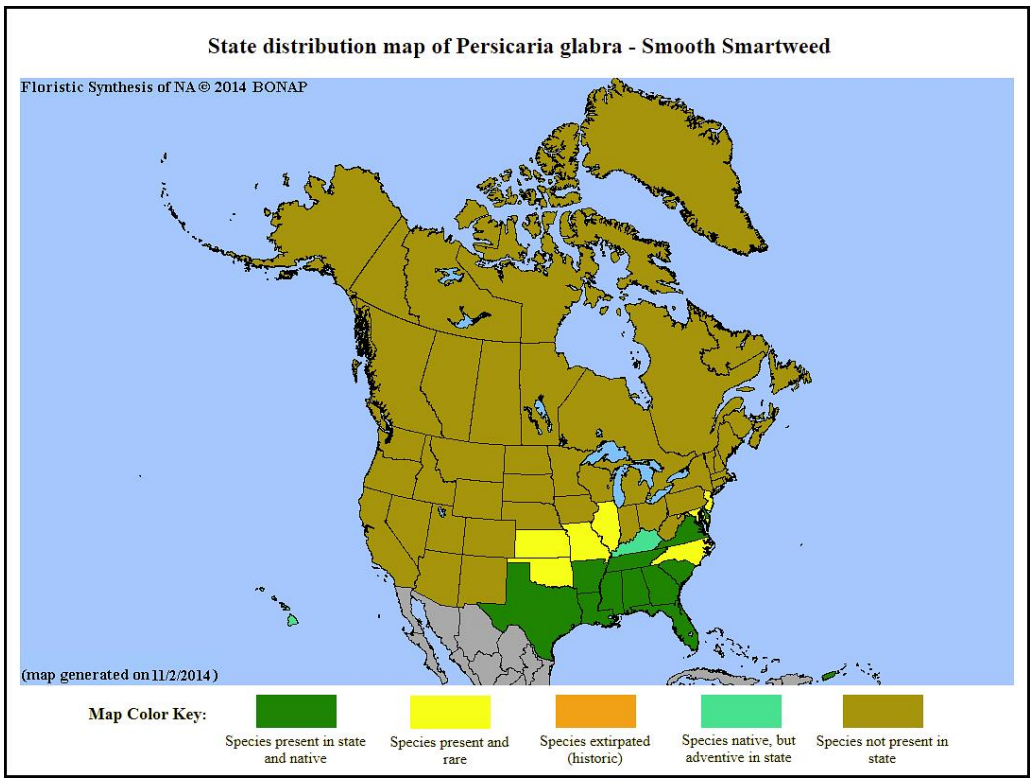


Figure 1. Distribution of P. densiflora in the United States, adapted from BONAP (Kartesz 2015).

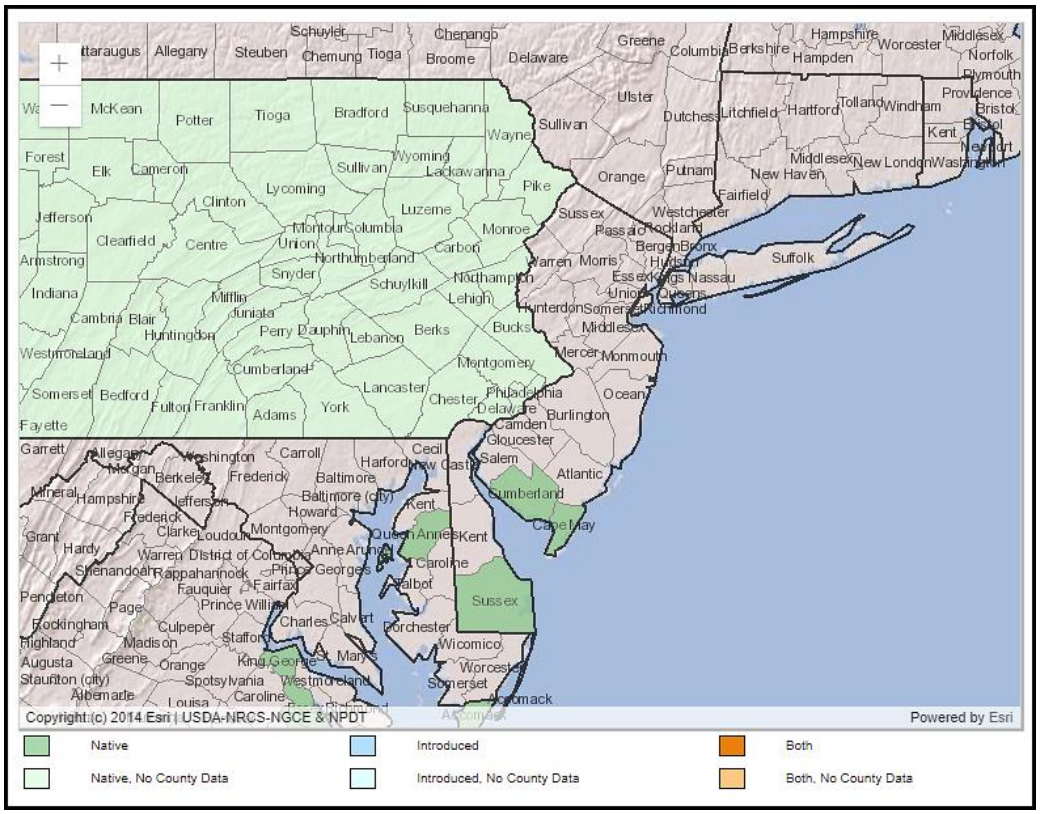


Figure 2. County records of P. densiflora in New Jersey and vicinity (USDA NRCS 2022b).

Conservation Status

Persicaria densiflora is considered globally secure. The G5 rank means the species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2022). The map below (Figure 3) illustrates the conservation status of *P. densiflora* throughout the United States and Canada. Dense-flower Knotweed is currently listed as critically imperiled (very high risk of extinction) in three states and vulnerable (moderate risk of extinction) in two. It is unranked, secure, or apparently secure in most other states where it has been found although its native status is in doubt in two states on the northern edge of its range. In areas where *P. densiflora* is seldom seen it can still be locally abundant. In North Carolina—where the species is uncommon to rare—it is the dominant herb at one of the sites where it occurs (LeGrand et al. 2022).

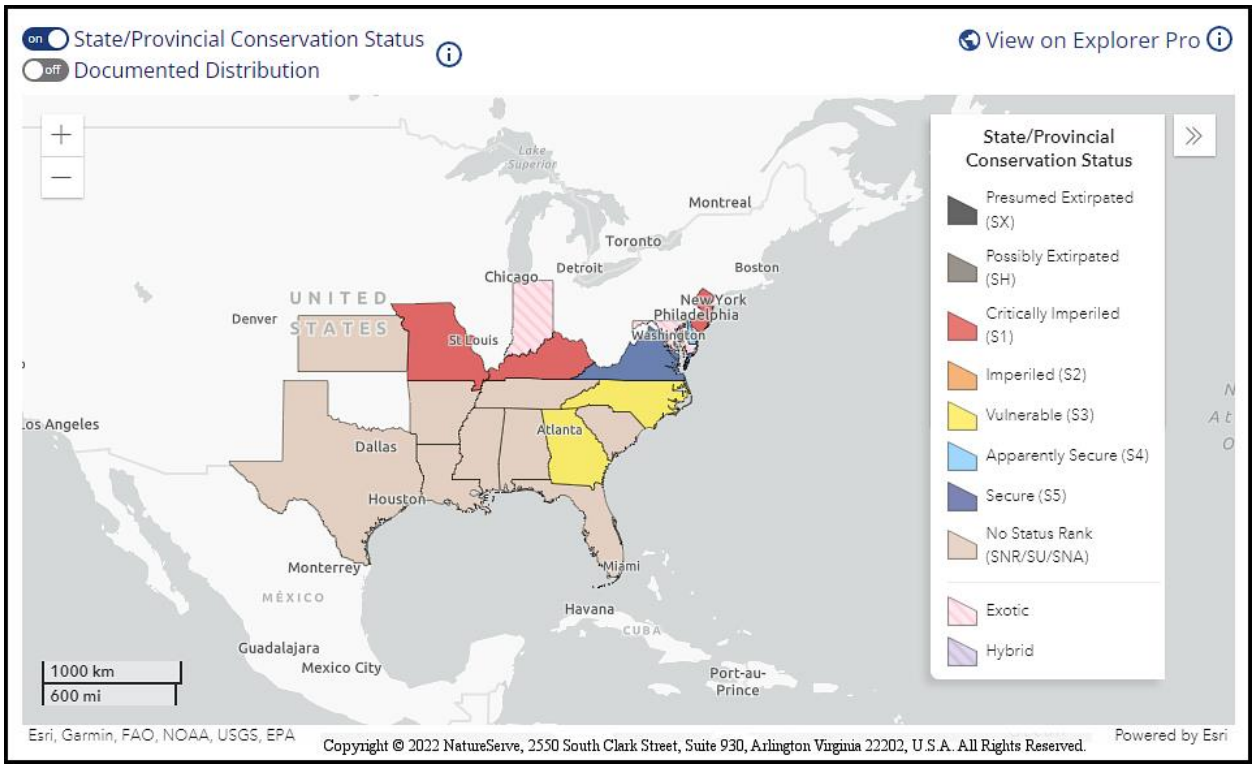


Figure 3. Conservation status of P. densiflora in North America (NatureServe 2022).

Although it is shown as critically imperiled on the map above, *Persicaria densiflora* is presently ranked as imperiled (S2) in New Jersey (NJNHP 2022). The rank indicates that the species is very rare in the state, typically with 6 to 20 occurrences. Species with an S2 rank may have once been more abundant in the state but now persist in only a few of their former locations. *P. densiflora* is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities such as wetlands or coastal habitats, being listed does not currently provide broad statewide protection for the plants. Additional regional status codes assigned to the plant signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Persicaria densiflora was collected from two locations in Cape May County during the late 1800s but the species was not included in the early state flora compiled by Britton (1889). Specimens obtained from New Jersey sites during the early 1900s mostly originated in Cape May County, although one population was documented in Cumberland County (NJNHP 2022). According to Moldenke (1934), the Cape May plants identified by Stone (1911) as *Polygonum eciliatum* (Bristleless Smartweed) were in fact *P. densiflora*. Hough (1983) noted that the last known collection was made in 1940. David Snyder reestablished the species' presence in the state when he found a few plants in 1989 but the small colony subsequently disappeared. Since 2000, the relocation of one historic site and the discovery of four new populations has brought the state's count of extant *P. densiflora* occurrences up to five and resulted in reclassification of the species from S1 to S2 because it appears to be expanding its range northward (NJNHP 2022).

Threats

There is no site-specific data to explain the loss of the ten New Jersey populations of *Persicaria densiflora* that are now considered historic (NJNHP 2022), but other rare plant extirpations in the region were mainly caused by development, road maintenance, and canal construction (Breden et al. 2006). *Lythrum salicaria* (Purple Loosestrife) was noted as a potential threat at one extant site, along with trampling by work crews that were accessing the lake in order to control some invasive aquatic plants (NJNHP 2022).

Persicaria densiflora plants may be consumed by beavers but the species is not one of their preferred foods (Parker et al. 2007). Insect herbivory of *Persicaria densiflora* has been widely documented, although most of the time damage is minimal. Dense-flower Knotweed is the host plant for two flea beetles, *Disonycha conjuncta* and *D. pennsylvanica*. Both the larvae and adults feed on the leaves, leaving them dotted with small holes, but no harmful impacts to the plants have been observed (Heppner and Habeck 1977, Center et al. 1999, Harms and Grodowicz 2009). Larvae of the Smartweed Node Weevil (*Rhinoncus longulus*) burrow into the thickened joints of *Persicaria* stems and excavate a chamber where they pupate, leaving a small hole after they emerge. The larval damage disrupts the vascular tissue, causing the tips of the plants to wilt, and feeding adults create small punctures on the leaf surfaces. Both larval and adult Smartweed Stem Weevils (*Lixus merula*) also perforate the leaves of *P. densiflora* as they feed (Center et al. 1999). Heppner and Habeck (1977) reported the rearing of soldier fly larvae (*Nothonymia calopus*) on *P. densiflora*. An assortment of moths also utilize Dense-flower Knotweed: Larvae of the Ivana Leafroller (*Argyrotaenia ivana*) eat the leaves, Eyeringed Chionodes (*Chionodes discoocellella*) larvae are leaf skeletonizers, Hidden Aristotelia (*Aristotelia absconditella*) larvae are stem borers, and the larvae of the Herbivorous Pleuroptya (*Patania silicalis*) feed on submerged leaves (Heppner and Habeck 1976). The insect most likely to do notable damage to *P. densiflora* plants is also a moth—the American Lotus Borer (*Ostrinia penitalis*). American Lotus (*Nelumbo lutea*) is the preferred host plant of the insect but it also feeds on various smartweeds. The moth's larvae eat the leaves and tunnel into the petioles to pupate. The species has been known to do extensive damage to American Lotus plants, consuming both leaves and developing seeds, and leaf senescence resulting from the larval activity has sometimes been mistaken for herbicide damage (Center et al. 1999).

No detrimental impacts from climate change have been reported for *Persicaria densiflora*. Established plants might be able to endure some consequences of shifting weather patterns that are impacting regional wetlands such as fluctuating water levels and changes in water quality caused by more frequent droughts and increasingly intense storm events. In fact, it appears that *P. persicaria* may be expanding the northern boundary of its range as the climate warms. However, some habitats could become unfavorable as sea levels rise and wetlands in coastal areas are exposed to higher levels of salinity (Hill et al. 2020).

Management Summary and Recommendations

No pressing management needs have been identified for New Jersey populations of *Persicaria densiflora*. However, current viability assessments are needed for all of the state's extant occurrences. A clearer picture of the species' status in New Jersey may develop as a result of regular monitoring to determine whether the recently discovered populations are stable or expanding, along with de novo searches of suitable habitats in the vicinity of known colonies.

Although many plants in the genus *Persicaria* appear to have similar life history characteristics, specific studies of *P. densiflora* might explain the relatively low seed set in the species. Additional research on topics such as seed longevity, germination, and establishment requirements could also shed light on how climactic conditions and other factors influence the distribution and survival of Dense-flower Knotweed.

Synonyms and Taxonomy

The accepted botanical name of the species is *Persicaria densiflora* (Meisn.) Moldenke. *Persicaria* is sometimes viewed as a subgenus of *Polygonum*. Many current taxonomic treatments include *Persicaria* (or *Polygonum*) *densiflora/densiflorum* as a synonym of *P. glabra/glabrum* (e.g. Kartesz 2015, ITIS 2022, POWO 2022, USDA NRCS 2022b). Over a century ago, Small (1892) argued that *P. glabrum* did not occur in North America and plants labeled as such had been misidentified, and Weatherby (1923) later explained that *P. glabrum* could be distinguished from *P. densiflora* by its smaller perianth and paucity of glandular dots. Kim and Donoghue (2008) supported differentiation based on molecular evidence and Weakley (2015) agreed that a distinction between *P. densiflora* and *P. glabra* was justifiable. However, Hinds and Freeman (2021) have asserted that the minor differences between American plants recognized as *P. densiflora* and the Asian and Pacific *P. glabra* do not warrant their separation into distinct species. The orthographic variants, synonyms, and common names listed below are all-encompassing but those with asterisks (*) were referenced in Moldenke's (1934) description of *Persicaria densiflora*.

Botanical Synonyms	**Common Names**
**Polygonum densiflorum* Meisn.	Dense-flower Knotweed
Persicaria glabra (Willd.) M. Gómez	Smooth Smartweed
Polygonum glabrum Willd.	Southern Smartweed

Amblygonum glabrum (Willd.) P. D. Sell
Persicaria glabra var. *scabrinervis* (Hook.f.) H. Hara
**Persicaria portoricensis* (Bertero ex Small) Small
**Polygonum acuminatum* Meisn.
Polygonum caucanum Fassett
Polygonum densiflorum var. *ciliolatum* Meisn.
Polygonum densiflorum f. *ciliolatum* (Meisn.) Fassett
**Polygonum densiflorum* var. *imberbe* Meisn.
**Polygonum densiflorum* f. *imberbe* (Meisn.) Fassett
Polygonum glabrum sensu Cham. & Schltdl.
Polygonum glabrum var. *caribaeum* Griseb.
Polygonum hippopotami Ehrenb. ex Meisn.
Polygonum imberbe Sol. ex G. Forst.
**Polygonum portoricense* Bertero ex Small
Polygonum scabrinervium Royle ex Bab.
Polygonum schimperi Vatke ex Engl.
Polygonum serrulatum Spreng.
Polygonum truncatum A. Rich.

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