Ammannia latifolia

Koehn's Toothcup

Lythraceae

Ammannia latifolia by Jason Sharp, 2012

***Ammannia latifolia* 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

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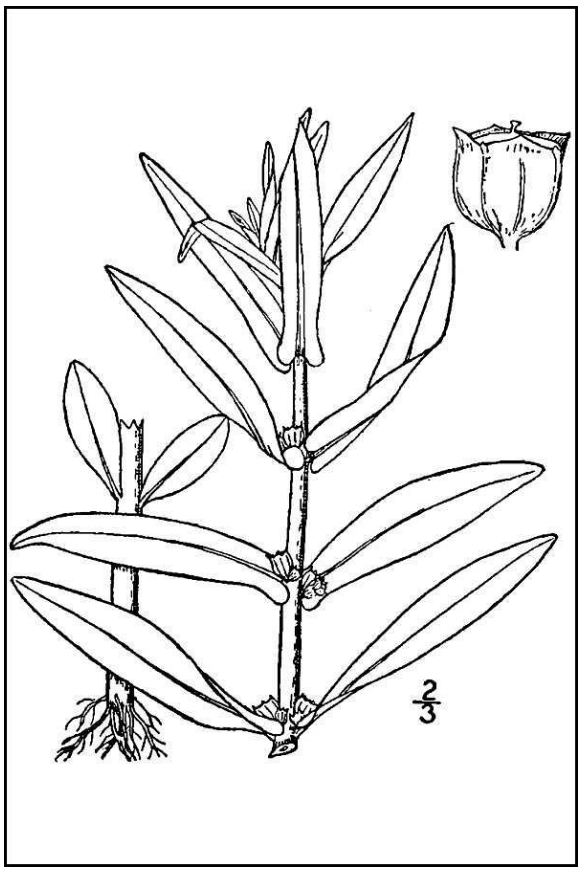
Life History

Ammannia latifolia (Koehn's Toothcup or Pink Redstem) is a smooth, erect annual herb with green or reddish stems. The leaves are paired, and those along the upper portion of the stem have a clasping base although the lower leaves are often simply tapering and sessile or short-stalked. The inconspicuous flowers are tucked in the leaf axils in small clusters of 2–10 (usually 3) and may have 0–4 petals. When petals are present, they are small (1 mm) and white or pinkish and their presence is fleeting: Snyder (1994) noted that they can be dislodged with just a touch. The flowers and fruits bear short (0.5 mm), thick styles that are notably shorter than the ovaries. Koehn's Toothcup may flower from July through September. (See Britton 1891, Britton and Brown 1913, Fernald 1950, Fassett 1957, Graham 1985, Gleason and Cronquist 1991, Tiner 2009).

Several plant species with a similar appearance may be encountered in New Jersey wetlands. *Rotala ramosior* (Lowland Toothcup) is a rare native species that has only one flower per axil. *Ammannia coccinea* (Valley Redstem) and *A. robusta* (Grand Redstem) are both adventive in the state and have long (1.5–3 mm), slender styles that equal or exceed the ovary in length and larger (2 mm) petals (Weakley 2015). Graham (1985) warns that in *A. coccinea* the upper portion of the style may wither and fall off after fertilization, leaving a short style base that can result in the misidentification of that species as *A. latifolia*. Additional tips for distinguishing the two species are provided by LeGrande et al. (2022).



Left: Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: Jason Sharp, 2012.

Pollinator Dynamics

Although many species in the Lythraceae are insect-pollinated, the small-flowered members of the family with inconspicuous or absent petals are mainly self-fertilized (Zomlefer 1994). Self-pollination in *Ammannia latifolia* may occur either before (cleistogamy) or after (chasmogamy) the flowers open (Graham 1985). Darwin (1884) wrote "*From a note received from Dr. Koehne it is clear that Ammannia latifolia bears cleistogamic flowers*." Graham (1985) reported that *A. latifolia* flowers are cleistogamous in some parts of the species' range, but chasmogamy may occur in both petalous and apetalous flowers. The morphology of *A. latifolia* flowers facilitates self-fertilization— the anthers bend inward, closely surrounding the pistil, and as they split open to release their pollen they frequently detach from the filaments and adhere to the stigma (Graham 1985). No reports of cross-fertilization were found for the species.

Seed Dispersal

The capsules of *Ammannia latifolia* contain numerous of small seeds (Les 2017), and *Ammannia* species in the western hemisphere typically produce an average of 250 seeds per capsule (Graham 1985). *A. latifolia* seeds are shiny, yellow, and boat-shaped with an average size of 660 x 460 µm (Tiner 2009, Graham and Graham 2014, Panigrahi 1986).

Image by Jose Hernandez, ARS Systematic Botany and Mycology Laboratory, courtesy USDA NRCS 2022b.

Ammannia seeds are well-adapted for water dispersal. A thin layer of spongy, air-filled tissue on the inner (concave) surface promotes buoyancy, as does the small size, light weight, and disc-like shape (Graham 1985, Graham and Graham 2014). The reduced size and high surface to volume ratio indicate that some dispersal may also be accomplished by wind (Howe and Smallwood 1982). Les (2017) reported long-distance dispersal by birds for the genus. At one New Jersey site Snyder (1994) noted that *A. latifolia* was particularly abundant on and around muskrat middens and runs, which suggests that the seeds might be carried to new locations by adherence to fur and feathers.

Ammannia latifolia seeds can either germinate rapidly or remain in the soil until conditions are favorable, but the factors that determine the trajectory of an individual seed are unclear. When *A. latifolia* seeds become wet they exude hairlike projections from their outer surface that may help them to adhere to substrate and also to absorb additional water in preparation for germination (Graham 1985, Panigrahi 1986). Graham (1985) indicated that a staggered period of germination between 10 days and 10 weeks is typical for plants in the genus. Les (2017) noted that some *Ammannia* seeds can remain viable for many (up to 27) years, although they generally experience a rapid loss of viability. Studies in Louisiana coastal marsh communities dominated by *Spartina patens* (Salt-meadow Cordgrass) have reported seed banking in *Ammannia latifolia*. At one site, *A. latifolia* seeds comprised 21% of the seed bank although the species was not recorded in the vegetation (Baldwin et al. 1996). However the authors noted that vegetation sampling was conducted late in the season (mid-November) and may have overlooked some annual species. At another location, *A. latifolia* was present but rare in the community while seedling emergence following experimental plot treatments averaged a density of 6,587 seeds per square meter (Baldwin and Mendelssohn 1998). The habitat manipulations that encouraged *A. latifolia* germination are discussed in the next section.

Habitat

Ammannia latifolia occurs in both freshwater and saltwater sites and can adapt to a wide range of salinity levels (Graham et al. 2021); a salinity tolerance of up to 10.0 parts per trillion has been reported (Les 2017). The species may occur in tidal and nontidal marshes, ditches, shorelines, wet forest edges, and other open, wet places at elevations up to 28 meters (Tiner 2009, Weakley 2015, Les 2017). Substrates may include marl, peat, sand, or sandy muck (Les 2017). In New Jersey, Snyder (1994) found *A. latifolia* growing in a brackish tidal marsh on bare mud covered with 1–2 inches of water and noted that the plants were most likely to be encountered in areas with open, low vegetation.

In Louisiana, *Ammannia latifolia* was present in the seed bank of communities dominated by *Paspalum vaginatum* and *Spartina patens*, particularly the latter, but absent from those dominated by *Sagittaria lancifolia* (Baldwin et al. 1996). The authors noted that both the *Paspalum* and the *Spartina* form dense clumps that persist throughout the year, which may be more effective at trapping floating seeds but could also inhibit germination. *Ammannia* typically requires sites with ample light and a lack of competition in order to establish (Les 2017). In a salt marsh community where *Ammannia latifolia* was abundant in the seed bank but rare in the vegetation, experimental removal of the extant *Spartina*-dominated cover promoted the

establishment of *A. latifolia* (Baldwin and Mendelssohn 1998). The result was obtained only when the existing vegetation was completely eradicated via herbicide— simply cutting back the aboveground portion of extant *Spartina* cover did not increase A. *latifolia* germination.

Wetland Indicator Status

Ammannia latifolia 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 2022c)

AMLA3

Coefficient of Conservatism (Walz et al. 2018)

CoC = 8. Criteria for a value of 6 to 8: Native with a narrow range of ecological tolerances and typically associated with a stable community (Faber-Langendoen 2018).

Distribution and Range

The native range of *Ammannia latifolia* extends from the southeastern United States through much of Central and South America, and the species was introduced and has become established in Morocco (POWO 2022). The map in Figure 1 depicts the extent of Koehn's Toothcup in the United States and Canada.

The USDA PLANTS Database (2022c) shows records of *Ammannia latifolia* in two New Jersey counties: Bergen and Cape May (Figure 2). The data include historic observations and do not reflect the current distribution of the species. Two specimens labeled as *Ammannia latifolia* from Camden County, both collected by the same individual, reside in the collections of the Carnegie Museum of Natural History and the Putnam Museum and Science Center (Mid-Atlantic Herbaria 2022). However, some of the older specimens may have been mislabeled due to a long history of confusion between morphologically similar plants: *Ammannia* and *Rotala* were often mixed up until the genera were clarified by Koehne in 1880, *Ammannia latifolia* and *A. coccinea* sometimes grow together and specimens of both have been mounted on the same herbarium sheet, and *A. robusta* was overlooked in North America for a long time due to its close resemblance to *A. coccinea* (Graham 1985).

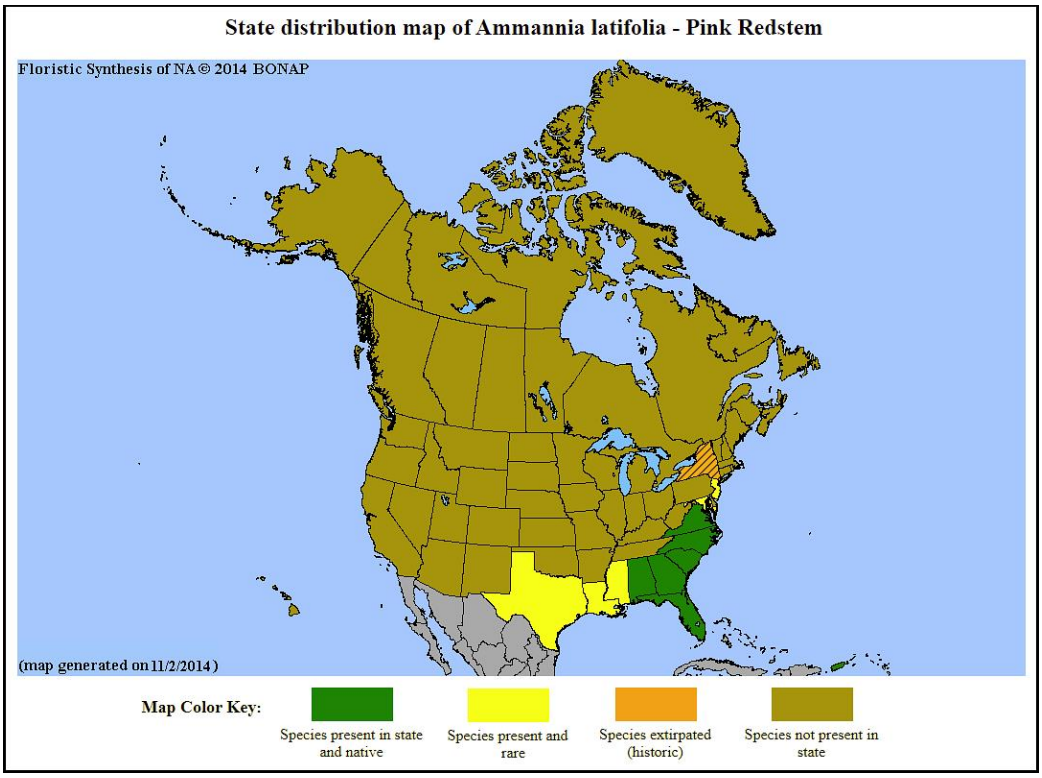


Figure 1. Distribution of A. latifolia in North America, adapted from BONAP (Kartesz 2015). Cross hatching /// indicates a questionable presence.

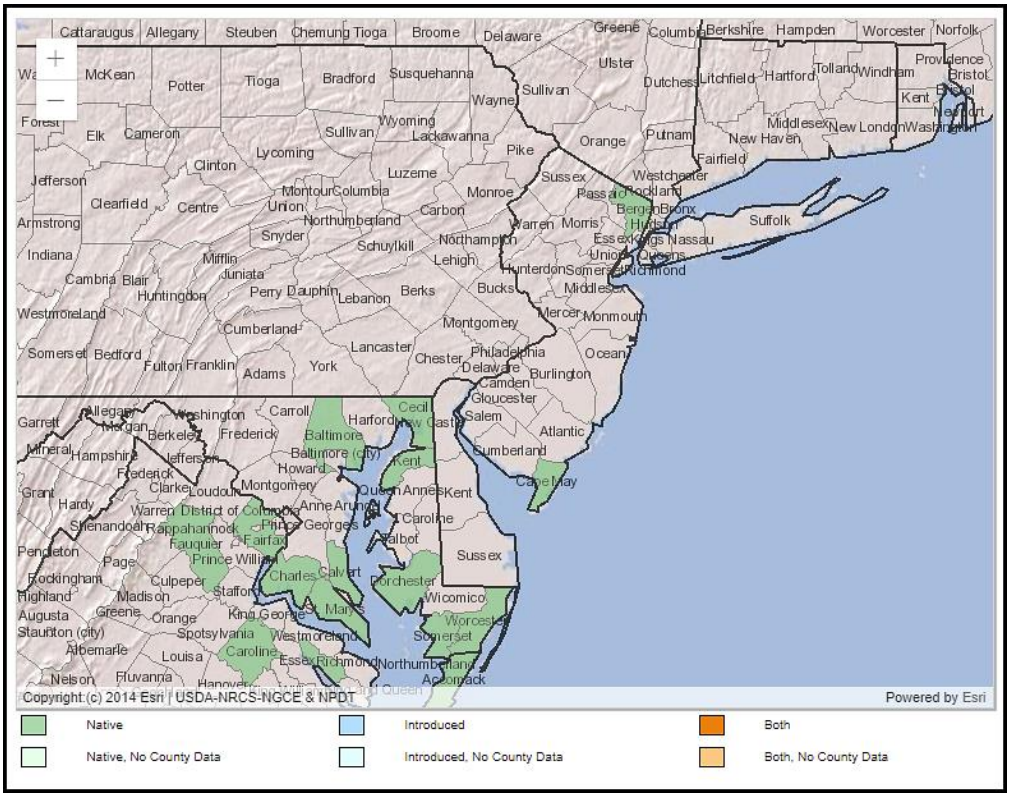


Figure 2. County records of A. latifolia in New Jersey and vicinity (USDA NRCS 2022c).

Conservation Status

Ammannia latifolia 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 in Figure 3 illustrates the conservation status of *A. latifolia* in the United States. Koehn's Toothcup is critically imperiled (very high risk of extinction) in two states, imperiled (high risk of extinction) in one state, vulnerable (moderate risk of extinction) in one state, apparently secure in one state, and unranked in five states. LeGrande et al. (2022) indicated that the North Carolina state rank was a mismatch with its actual abundance, suggesting instead that a rank of vulnerable would be more appropriate.

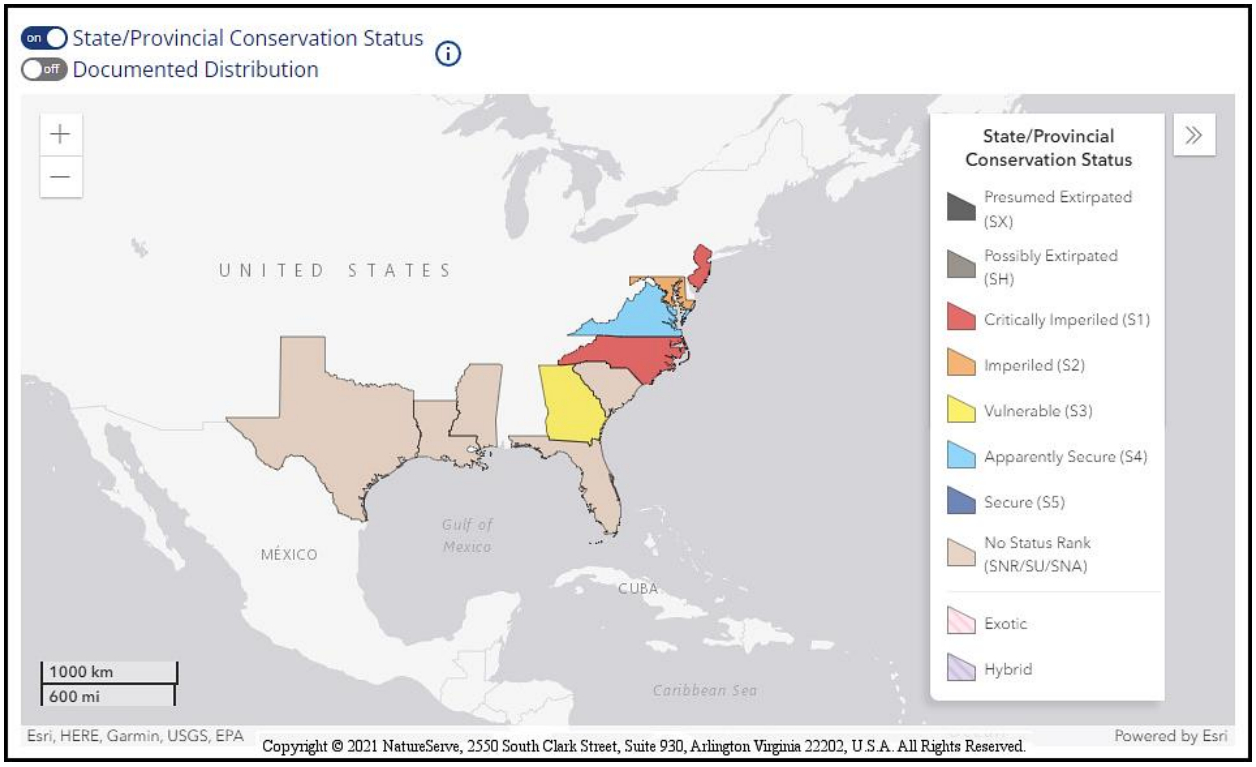


Figure 3. Conservation status of A. latifolia in North America (NatureServe 2022).

New Jersey is one of the states where *Ammannia latifolia* is critically imperiled (NJNHP 2022). The S1 rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. Koehn's Toothcup 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 *A. latifolia* 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).

Taylor (1915) reported that the only regional records of *Ammannia latifolia* were specimens collected in the Hackensack marshes, where the plant had not been seen since 1868. Subsequently the species was thought to be absent from New Jersey for more than 120 years until a population was found in Cape May County in 1990 (Snyder 2000). In the decade that followed Snyder's discovery two additional occurrences were documented in the same vicinity, and *A. latifolia* is presently considered extant at three locations in the state (NJNHP 2022).

Threats

A number of threats have been identified for rare plant species in the watershed where New Jersey's *Ammannia latifolia* populations are located including habitat disturbance, land clearing, development, right of ways, mining, and roadways (Breden et al. 2006). The intensive development of the area surrounding the Hackensack Meadowlands probably caused the extirpation of the state's original population of Koehn's Toothcup (NJNHP 2022). While direct development of habitat that is routinely flooded by tidal action is less likely today, offsite activities that alter the natural hydrologic regime of *Ammannia* habitat can still have a detrimental impact (Les 2017).

Ammannia species generally require sunny, unvegetated sites in order to establish (Les 2017). *A. latifolia* has many characteristics of a ruderal species (Grime 1977), and such plants typically persist by rapidly colonizing patches of favorable habitat created by local conditions or disturbances. The proliferation of non-native invasive plants that form monocultures can disrupt natural community dynamics and reduce the number of potential sites for the establishment of native species. The introduced genotype of Common Reed (*Phragmites australis* ssp. *australis*) has been noted as a concern for one New Jersey occurrence of *A. latifolia* (NJNHP 2022), and Purple Loosestrife (*Lythrum salicaria*) has been reported as a threat to *Ammannia* populations at other locations (Les 2017).

New Jersey's coastal regions are expected to face increasing impacts from climate change including loss of habitat to rising seas, increasing temperatures, and greater storm intensity (USEPA 2016). A limited understanding of many aspects of *Ammannia latifolia*'s life history makes it difficult to predict whether the species will be able to adapt to rapidly shifting circumstances. The outcome is likely to depend on whether Koehn's Toothcup is able to keep pace with sea level rise by establishing at new habitats as saline waters extend further inland.

Management Summary and Recommendations

Aside from the protection of *Ammannia latifolia*'s habitat at extant sites, little can be suggested for management of the species without additional information about its biology and ecological requirements. As with many annual species, the seeds of *A. latifolia* appear to be primarily adapted for rapid germination yet seed banking has also been reported. In order to plan for conservation of the species in areas where it is imperiled, it is important to understand the factors that promote or postpone germination as well as the extent of seed viability.

Knowledge concerning the competitive ability of *A. latifolia* is also lacking. While the annual plants reportedly need sunny, open habitat in order to establish, some individuals have been found growing in the dense cover of *Phragmites* stands (Snyder 1994). Some developmental plasticity has been reported for *A. coccinea*, which can adapt to shadier conditions by allocating more resources to its leaves (Gibson et al. 2001), but the subject has not been studied in *A. latifolia*.

Ammannia latifolia seems to be mainly reliant on self-pollination for reproduction. It would be useful to know whether the species has any mechanisms for cross-fertilization. No studies of genetic variation in *A. latifolia* were found, but greater comprehension of the species' range of variability would help to predict how well Koehn's Toothcup may be able to adapt to changing environmental conditions.

Synonyms

The accepted botanical name of the species is *Ammannia latifolia* L. Orthographic variants, synonyms, and common names are listed below (ITIS 2021, USDA NRCS 2022c, POWO 2022, NatureServe 2022, Fernald 1950, Gann et al. 2018). Several of the synonyms have been widely applied in the northeastern U. S., including in some of the references cited for use in species identification. Britton (1891) first described *A. koehnei* as separate from *A. latifolia*, and the distinction was accepted by Engler (1903) in his monograph of the Lythraceae. During the mid-1900s the epithet *A. teres* came into use (e.g. Fernald 1944, 1950; Graham 1964) until Graham (1975) formally included it under *A. latifolia*.

Botanical Synonyms	**Common Names**
Ammannia koehnei Britton	Koehn's Toothcup
Ammannia koehnei var. *exauriculata* Fernald	Pink Redstem
Ammannia teres Raf.	Koehne Ammannia
Ammannia teres var. *exauriculata* Fernald	Crab Weed
Ammannia catholica Cham. & Schltdl.	
Ammannia catholica var. *brasiliensis* Cham. & Schltdl.	
Ammannia friesii Koehne	
Ammannia hastata (Spreng.) DC.	
Ammannia lingulata Griseb.	
Ammannia lythrifolia Salisb.	
Ammannia pallida Lehm.	
Ammannia sagittata (Poir.) DC.	
Rotala catholica (Cham. & Schltdl.) Leeuwen	
Isnardia subhastata Ruiz & Pav.	
Jussiaea sagittata Poir.	
Ludwigia hastata Spreng.	
Ludwigia scabriuscula Kellogg	

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