

Calystegia spithamea ssp. *spithamea*

Erect Bindweed

Convolvulaceae



Calystegia spithamea ssp. *spithamea* by Andrew Lane Gibson, 2019

***Calystegia spithamea* ssp. *spithamea* Rare Plant Profile**

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

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Life History

Calystegia spithamea ssp. *spithamea* (Erect Bindweed) is a perennial rhizomatous herb in the morning-glory family. Most of the other local species in the Convolvulaceae have lengthy trailing or twining stems but those of *C. spithamea* are more or less erect and less than 5 dm in height. The leaves of *C. spithamea* ssp. *spithamea* are alternate, elliptic, and short-stalked; they may be either rounded or notched at the base. The foliage is usually smooth or slightly pubescent but not densely hairy. The flowers, which are typically solitary and have a large pair of smooth-edged bracts at the base, are produced in the axils of the lower leaves. *C. spithamea* flowers are large (4.1–6.3 cm wide) and white with funnel-shaped bases and flaring lobes. The fruits are round, few-seeded capsules. (See Britton and Brown 1913, Fernald 1950, Gleason and Cronquist 1991, Brummit 2024).



Left: Britton and Brown 1913, courtesy USDA NRCS 2024a. Center: G. Glynn, 2023. Right: Bianca Peterman, 2022.

In addition to *Calystegia spithamea* ssp. *spithamea*, two other subspecies (ssp. *purshiana*, ssp. *stans*) are presently recognized. Although the status of the subspecies is somewhat controversial (see Synonyms and Taxonomy section) there appear to be some differences in their habitat preferences (Baskin and Baskin 1988, Spaulding 2013). Only ssp. *spithamea* is known to occur in New Jersey, but the other two have been documented in adjacent states (Brummit 2024). Their velvety-wooly foliage and more clasping leaf-bases distinguish them from ssp. *spithamea* (Spaulding 2013).

Throughout its range *Calystegia spithamea* flowers and fruits from May to August (Corrigan 2004, Rhoads and Block 2007, Brummit 2024, Weakley et al. 2024). In New Jersey, blooming has been noted from late May to late June and fruits may be present through August (Stone 1911, Hough 1983). *C. spithamea* also reproduces clonally via its rhizomes (Corrigan 2004, Farnsworth and Ogurcak 2008), and Holm (1925) cited it as an example of a species that makes a greater investment in vegetative expansion than in sexual reproduction. Holm observed that Erect Bindweed could develop multiple shoots along the length of a rhizome, and that the

rhizomes appeared able to remain dormant for several years when conditions were not favorable for vegetative growth. He further noted that *C. spithamea* ramets rarely produced more than one flower, and that most of the flowers failed to develop mature fruit.

Pollinator Dynamics

The fertilization mechanisms of *Calystegia spithamea* do not appear to be documented but studies of related species point to insect pollination (Corrigan 2004, Farnsworth and Ogurcak 2008). Individual *Calystegia* flowers bloom only for a single day, but they offer both pollen and nectar rewards to potential pollinators so they attract a broad array of insects. Bees are the most important pollinators. There are two northeastern bees (*Melitoma taurea* and *Cemolobus ipomoeae*) that specialize on the blooms of *Calystegia* and *Ipomoea* species (Fowler and Droege 2020). However a wide variety of both long-tongued and short-tongued bees have been reported as pollinators of *Calystegia* flowers (Robertson 1929, Ushimaru and Kikuzawa 1999, Wolf and Harrison 2001, Hilty 2020). Some syrphid flies, butterflies, or beetles may also play a role in pollination.

The separation of pistils and stamens in *Calystegia* flowers limits the likelihood of self-fertilization so insects are needed to transport the pollen. Some *Calystegia* species are self-compatible but many are not. In the latter group, seed yield can be limited by vegetative reproduction because plants growing in close proximity are likely to be clones (Ushimaru and Kikuzawa 1999, Wolf and Harrison 2001). The lack of fruit development in the *C. spithamea* populations observed by Holm (1925) suggests that the species is self-incompatible.

Seed Dispersal and Establishment

The seeds of *Calystegia spithamea* do not have any special structures to facilitate long-distance distribution. Gravity appears to be the primary means of dispersal in other *Calystegia* species (Ushimaru and Kikuzawa 1999), and *C. spithamea* was characterized as a locally-dispersed species by Farnsworth and Ogurcak (2008). The long distance dispersal of viable propagules following their consumption by birds has been documented in *Convolvulus* (Proctor 1968), so that might occasionally occur with *Calystegia spithamea* seeds.

Calystegia seeds have impermeable coats that impose dormancy at the time of their dispersal. Once the seed coats have broken down, germination can be triggered by suitable weather conditions (Corrigan 2004, Harrington et al. 2019, Jēkabsons and Ievinsh 2021). *Calystegia* species do not appear to persist for long in the seed bank. Only one *C. spithamea* seed germinated during a seed bank study in Wisconsin (Sturtevant et al. 2020), although that might be expected since the species rarely produces viable seeds. However, similar findings have been reported for *Calystegia sepium*, which—according to Ushimaru and Kikuzawa (1999)—is a self-compatible species that produces numerous seeds. *C. sepium* was only documented in the seed bank once during a ten year study in New Jersey (Leck and Leck 1998) and it was consistently absent from the seed bank at another location despite being present in the vegetation (e.g. Leck and Leck 2005, Elsey-Quirk and Leck 2015).

Calystegia spithamea was one of the first species to establish following a fire in Ontario and it was noted that sprouting from roots and rhizomes, as well as from buried seeds, had facilitated the rapid revegetation of the site (Catling et al. 2001). After a woodland had been cleared in the District of Columbia, Holm (1925) examined the *C. spithamea* plants that colonized the clearing and found that they had all emerged from old rhizomes. The ability to establish new plants from fragments of dormant rhizomes has also been recorded in other *Calystegia* species (Jēkabsons and Ievinsh 2021). Mycorrhizae have been documented in *Calystegia sepium* (Wang and Qiu 2006), and it seems likely that fungal partners could help *C. spithamea* plants to survive extended periods of dormancy but further study is needed. On the whole, sexual reproduction appears to play a limited role in the maintenance of established *Calystegia spithamea* populations. It should be noted, though, that seedlings of the species may be difficult to detect because they closely resemble young plants that are produced vegetatively (Corrigan 2004).

Habitat

Although *Calystegia spithamea* ssp. *spithamea* can tolerate some shading it fares much better in open places (Weakley et al. 2024). The species is often associated with early successional habitats, and it has been characterized as disturbance-dependent (Farnsworth and Ogurcak 2008). *C. spithamea* ssp. *spithamea* usually grows in dry rocky or sandy ground (Taylor 1915, Hough 1982, Peters et al. 2005, Kelloff and Kass 2018, Corbin and Flatland 2022, Brummit 2024, Weakley et al. 2024). Natural habitats include grasslands, prairies, savannas, pine barrens, or open woods (Ebinger 1981, Peters et al. 2005, Catling 2008, Varga 2008, Taft et al. 2009, Ruch et al. 2010, McClain et al. 2012, Spaulding 2013, Baranski and Faupel 2021, Brummit 2024). Some of the sandplain habitats where Erect Bindweed occurs in the Northeast are populated with mosses like *Ceratodon purpureus* and *Polytrichum commune* and lichens such as *Cladonia rangiferina* and *C. cristatella* (Corbin and Thiet 2020). Interior prairie communities are usually dominated by graminoids but they also include a mixture of non-graminoid herbs (Ruch et al. 2010). Narrower habitat preferences have been described for the other two subspecies—*C. spithamea* ssp. *purshiana* is restricted to Appalachian shale barrens and ssp. *stans* is most likely to be found in conifer or birch woodlands over deposits of gravel or glacial till (Spaulding 2013, Brummit 2024).

During a survey of barrens habitats in northwestern Wisconsin *C. spithamea* was found in seven out of eight study sites, and two of the sites where it was most abundant had been subject to frequent disturbances from fire or equestrian activity (Anderson et al. 2023). In the northeastern states *C. spithamea* often establishes in waste places, including roadsides or old fields (Hough 1982, Rhoads and Block 2007, Kelloff and Kass 2018). The two extant populations in New Jersey are located on a dry embankment alongside an abandoned road and in a utility right-of-way (NJNHP 2024). Several historic collection sites around the state were within railroad corridors and a number of others were in old fields, one of which was situated in a floodplain. Other New Jersey habitats were described as a sandy beach, a dry open sandy pine and oak scrubland, and the edge of a marsh (Mid-Atlantic Herbaria 2024, NJNHP 2024).

Wetland Indicator Status

Calystegia spithamea is not included on the National Wetlands Plant List (NWPL). Any species not on the NWPL is considered to be Upland (UPL) in all regions where it occurs. The UPL designation means that it almost never occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2024b)

CASPS2

Coefficient of Conservancy (Walz et al. 2020)

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 *Calystegia spithamea* ssp. *spithamea* is restricted to the eastern half of the United States and Canada (POWO 2024). The map in Figure 1 depicts the extent of the species in North America.

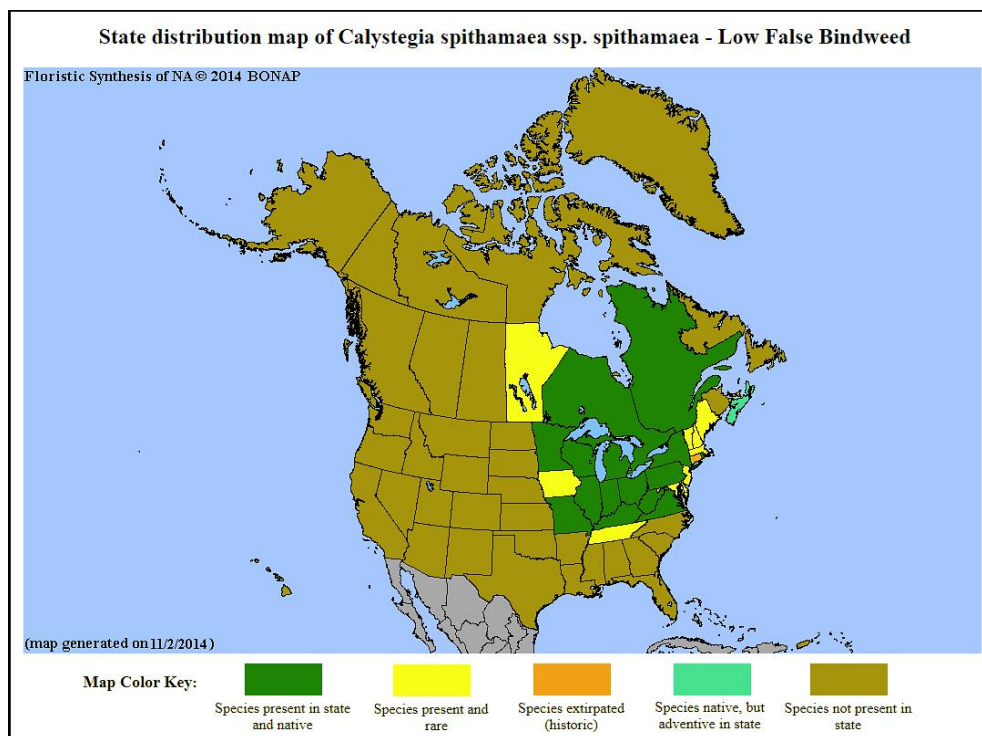


Figure 1. Distribution of *C. spithamea* ssp. *spithamea* in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2024b) shows records of *Calystegia spithamea* ssp. *spithamea* in 13 New Jersey counties: Burlington, Camden, Cumberland, Essex, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Salem, Somerset, Sussex, and Warren (Figure 2). The data include historic observations and do not reflect the current distribution of the species.

Figure 2. County records of *C. spithamaea* ssp. *spithamaea* in New Jersey and vicinity (USDA NRCS 2024b).

Conservation Status

Calystegia spithamea ssp. *spithamea* is apparently secure at a global scale. The G5T4 rank means the species is secure and the subspecies is at fairly low risk of extinction or collapse due to an extensive range and/or many populations or occurrences, although there is some cause for concern as a result of recent local declines, threats, or other factors (NatureServe 2024). The map below (Figure 3) illustrates the conservation status of *C. spithamea* ssp. *spithamea* throughout its range. The subspecies is imperiled (high risk of extinction) in two states and critically imperiled (very high risk of extinction) in three states. It is thought to be extirpated in Canada (Ventrella 2024). In the majority of states where it occurs, Erect Bindweed is secure, apparently secure, or unranked.

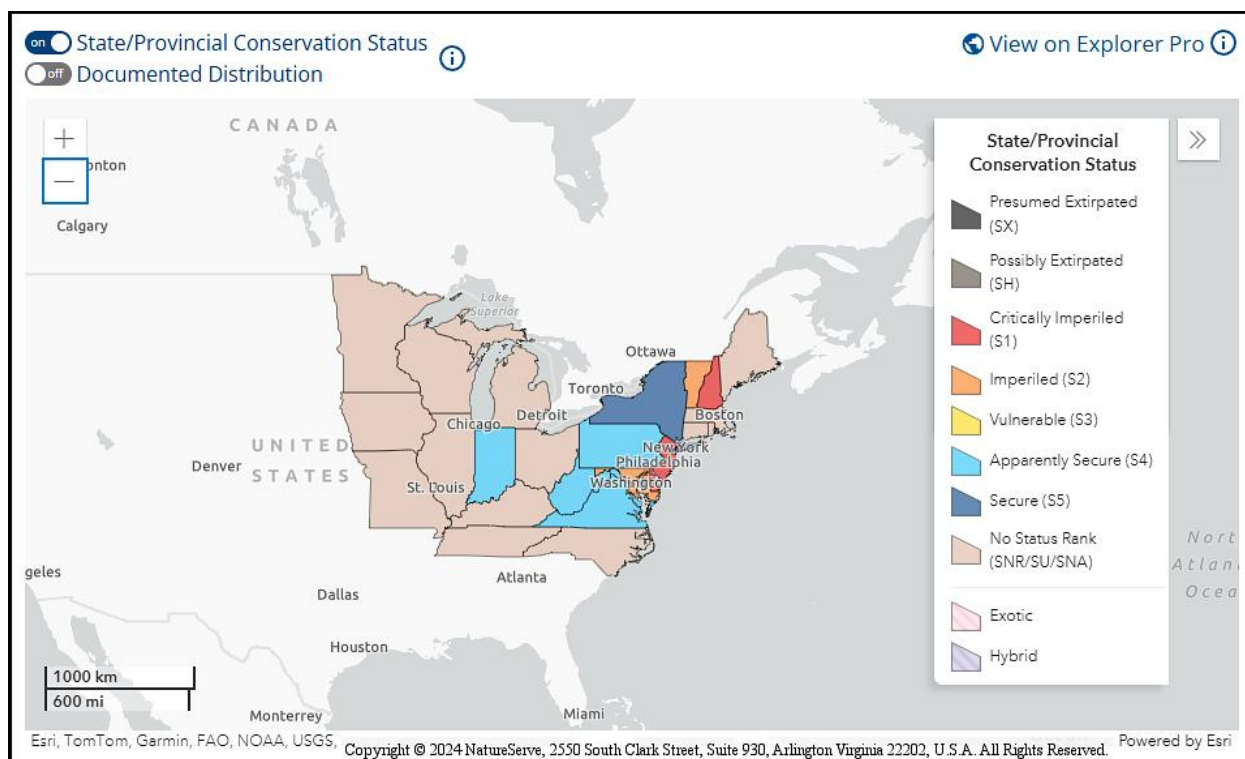


Figure 3. Conservation status of *C. spithamea* ssp. *spithamea* in the United States (NatureServe 2024).

Calystegia spithamea ssp. *spithamea* is critically imperiled (S1) in New Jersey (NJNHP 2024). The 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. *C. spithamea* ssp. *spithamea* 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, being listed does not currently provide broad statewide protection for plants. Additional regional status codes assigned to Erect Bindweed signify that the subspecies is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

Calystegia spithamea ssp. *spithamea* was collected from numerous locations around New Jersey during the late 1800s and early 1900s (Mid-Atlantic Herbaria 2024). The records of Erect Bindweed extended from Sussex County south to Cumberland and Salem counties, although it was absent from the Pine Barrens (Britton 1889, Keller and Brown 1905, Taylor 1915). Willis (1877) noted that the species was common in Monmouth County, and sources cited by Britton (1889) indicated that it was quite plentiful at a site in Somerset County and frequent around another location in Cumberland County. Stone (1911) said it was "at some stations certainly a weed." However, *C. spithamea* was rarely recorded in New Jersey after 1950, and it was included on the state's first official list of endangered species (NJONLM 1990). The bindweed is now considered historical or extirpated at nearly all of the places where it formerly occurred. Two small populations remain in Sussex County (NJNHP 2024).

Threats

As in New Jersey, small population sizes have been noted as a concern for *Calystegia spithamea* ssp. *spithamea* in New England (Brumback and Gerke 2013). Throughout its range, the alteration of habitat for development, agriculture, or recreation has been noted as a cause of previous declines as well as an ongoing threat to the species. Because *C. spithamea* ssp. *spithamea* favors early successional communities, occurrences are also threatened by natural succession and competition with invasive flora (Corrigan 2004, Catling 2008, Ventrella 2024).

Catling (2008) indicated that fire suppression imperils *Calystegia spithamea* ssp. *spithamea* and other rare species that utilize the same habitats. Although the effects of succession on Erect Bindweed have not been formally studied they can be ascertained by the species' response in settings where the process was reversed. *C. spithamea* has been known to colonize sites following canopy removal (Catling and King 2007, Catling and Kostiuk 2010) and fires (Catling et al. 2001, McClain and Ebinger 2007, Mandryk 2018). It is generally most abundant shortly after disturbances but disappears as woody species become established (Catling et al. 2002). *C. spithamea* exhibits a similar response to competitive herbaceous species: For example, a slow deterioration of one of New Jersey's extant populations resulted from the spread of Crown Vetch (*Securigera varia*) at the site and the long-term viability of that occurrence is now rated as poor (NJNHP 2024). Invasive plants that were noted as threats to New England populations included *Berberis thunbergii* and *Rhamnus cathartica* (Corrigan 2004).

Bruchid beetles in the genus *Megacerus* are seed predators on plants in the Convolvulaceae, including many species of *Calystegia*, *Convolvulus*, and *Ipomoea*. The female beetles lay eggs on sepals, mature fruits, or dispersed seeds and the larvae complete their development inside of the seeds, consuming them in the process. *Megacerus* beetles that preferentially oviposit on a certain kind of plant can sometimes switch to another species in the morning-glory family (Schlising 1980, Kingsolver 2004, Stotz et al. 2013). *Calystegia spithamea* plants were not utilized by the beetles during a host specificity study by Wang (1985), but their avoidance of Erect Bindweed may have been attributable to its low seed production.

Climate Change Vulnerability

Information from the references cited in this profile was used to evaluate the vulnerability of New Jersey's *Calystegia spithamea* ssp. *spithamea* populations to climate change. The species was assigned a rank from NatureServe's Climate Change Vulnerability Index using the associated tool (Version 3.02) to estimate its exposure, sensitivity, and adaptive capacity to changing climatic conditions in accordance with the guidelines described by Young et al. (2016) and the state climatic computations by Ring et al. (2013). Based on available data Erect Bindweed was assessed as Moderately Vulnerable, meaning that it is likely to show some decrease in abundance or range extent in New Jersey by 2050. However, the conclusion was reached with relatively low confidence due to gaps in information regarding the species' ecological requirements.

Shifting climactic conditions in New Jersey are resulting in higher temperatures, more frequent and intense precipitation events, and increasing periods of drought (Hill et al. 2020). Since *Calystegia spithamea* ssp. *spithamea* appears to be relatively secure in states that are situated at lower latitudes it will likely be able to withstand warmer temperatures and a longer growing season. However, no information was found regarding the extent of its tolerance for drought or flooding. Erect Bindweed's reliance on clonal reproduction has probably resulted in low genetic variability, which is likely to make the species less adaptable in the face of rapid change (Jump and Peñuelas 2005). Low rates of seed development and poor dispersal will limit opportunities for the bindweed to colonize new sites if existing locations become unsuitable. Sensitivity to competition with invasive plants further increases its vulnerability, as they are likely to become an even greater problem in the northeast as the climate continues to change (Bellard et al. 2013, Salva and Bradley 2023).

Management Summary and Recommendations

Monitoring of New Jersey's two *Calystegia spithamea* populations during recent decades has indicated that they are primarily vegetative (NJNHP 2024), and even if they do occasionally flower the species rarely produces viable seeds. Consequently, management of those occurrences should focus on sustaining the established plants. Removal of woody and invasive species in the immediate vicinity may allow the rare bindweed to persist and reproduce clonally. For the occurrence that is situated in a utility corridor, it would be advisable to determine how the right-of-way is maintained so that steps could be taken to avoid inadvertent damage to the *Calystegia* plants. During monitoring visits to extant *Calystegia spithamea* populations the leaves and stems should be checked for signs of herbivory damage. Warren and Hurst (1981) indicated that a related species (*C. sepium*) was moderately browsed by White-tailed Deer (*Odocoileus virginianus*) during the summer months, and their data was collected at sites where the deer population sizes were considerably lower than they are in New Jersey.

Calystegia spithamea was once much more abundant in New Jersey than it is today. There are currently seven counties where one or more occurrences of the species have been labeled as historical due to the presence of unsearched suitable habitat, and it is possible that some of those could be relocated with focused efforts.

Long term planning for the management of *Calystegia spithamea* populations could benefit from some additional research. A better understanding of the ways in which *Calystegia spithamea* propagules can be dispersed to new locations is needed. Self-incompatibility and low genetic diversity have been inferred from observational studies but concrete information appears to be lacking. It would be useful to know whether *C. spithamea* is reliant on fungal associations to establish and persist, particularly during extended periods of dormancy. Studies that evaluate the species' ability to tolerate environmental extremes could make it easier to evaluate its capacity for resilience in response to climate change. Additionally, as discussed in the following section, there are unresolved taxonomic issues regarding *Calystegia spithamea* at both genus and subspecies level.

Synonyms and Taxonomy

The accepted botanical name of the species is *Calystegia spithamea* (L.) Pursh ssp. *spithamea*. Orthographic variants, synonyms, and common names are listed below (ITIS 2024, POWO 2024, USDA NRCS 2024b). *Calystegia* is closely related to *Convolvulus*, and sometimes included therein. Although the two genera can be distinguished by the structure of their pollen grains, stigmas, and fruits, molecular studies have indicated that *Calystegia* is nested within *Convolvulus*. Some taxonomists continue to recognize *Calystegia* and accept *Convolvulus* as paraphyletic but those who prioritize phylogenetic relationships identify this species as *Convolvulus spithameus* (Lewis and Oliver 1963, Stefanović et al. 2003, Wood et al. 2015, Mitchell et al. 2016, Weakley et al. 2024).

There is also disagreement about *Calystegia spithamea* at the subspecific level. Some sources recognize three subtaxa—ssp. *purshiana*, ssp. *spithamea*, and ssp. *stans* (e.g. Brummit 1965 & 2024, POWO 2024). Both ssp. *purshiana* and ssp. *stans* were initially published as distinct species of *Convolvulus* (Michaux 1803, Wherry 1933), although Tryon (1939) considered them to be minor variations of *C. spithamea* and found no reasonable basis for their separation. Kartesz (2015) and Weakley et al. (2024) merged ssp. *purshiana* and ssp. *stans* but they took different approaches: The former viewed ssp. *purshiana* as a synonym of ssp. *stans* while the latter recognized *C. purshiana* and listed *C. spithamea* ssp. *stans* as a synonym of that species.

Botanical Synonyms

Convolvulus spithameus L.
Convolvulus camporum Greene
Convolvulus pensylvanicus Schrank

Common Names

Erect Bindweed
Low False Bindweed
Low Bindweed

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