

Distribution and Habitat Characteristics of *Silene ovata* Pursh (Caryophyllaceae) Populations in Illinois

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ABSTRACT

Silene ovata is a perennial species in the pink family characterized by cauline leaves that are ovate and clasping and flowers with deeply notched petals, each petal often with 8 segments. This species is state endangered and only occurs in Hardin County in extreme southeast Illinois. Five populations were surveyed twice in 1998 and a sixth population was surveyed once in 2000. A total of 3612 plants were sampled, with 93% of the plants in two populations. Plants tended to be multi-stemmed. Over one-half of the plants that were surveyed in June 1998 flowered the following September, but capsules were only produced at the Sturgeon Hill population. The most consistent features of the habitat were upland forest of varying moisture regimes, moderate to steep slopes, often very rocky with cliffs and slide blocks common, shallow loess-derived soils above sandstone rock, and a soil pH between 5.8 and 6.2.

INTRODUCTION

Silene ovata Pursh, ovate catchfly, is a rare member of the Caryophyllaceae or pink family. Friedrich Pursh, a German botanist, named this species in his 1814 *Flora Americae Septentrionalis*, which was one of the earliest floras of North America (Isley 1994). The specific epithet *ovata* refers to the leaf shape that is characteristic of the species.

Silene ovata is restricted to the eastern United States and is currently known from 11 states and 49 counties. It is distributed from southwest Virginia south to Georgia, west to Arkansas and north to Illinois and Indiana (Radford et al. 1968, Gleason and Cronquist 1991). *S. ovata* is most abundant in the southern Appalachian Mountains of North Carolina, Tennessee, and Georgia. *Silene ovata* has been reported in the literature from such vague habitats as "rich woods, local" (Fernald 1950), "woodlands" (Gleason 1952), "rare plant of rich woods" (Justice and Bell 1968), "rich woods" (Radford et al. 1968), and "woods" (Gleason and Cronquist 1991). It is considered a species of special concern with a G3 global rank, very rare or local throughout its range (Federal Register 1997). It is listed as endangered in Illinois, Indiana, and South Carolina, threatened in Kentucky and Tennessee, special concern in Alabama, a candidate species in North Carolina, and is

on state rare plant lists in Mississippi and Virginia but not given a specific status. *S. ovata* is not currently listed in either Arkansas or Georgia.

Silene ovata was first discovered in Illinois in 1994 by Jody Shimp while working on his master's thesis in Hardin County (Shimp 1996). Subsequent fieldwork led to the discovery of five additional populations. The objectives of this survey were to determine if additional populations exist, to determine demographic characteristics of each population, to determine specific environmental characteristics at each population, and to determine associated plant species at each population.

GENUS AND SPECIES DESCRIPTION

Silene is a genus of approximately 400 to 500 species native primarily to the Northern Hemisphere (Fernald 1950; Gleason 1952; Gleason and Cronquist 1991; Hickman 1993). Mohlenbrock (1986) listed 10 species of *Silene* in Illinois, which included five of European origin. Gleason (1952) stated that 54 species of *Silene* were recognized in North America. Kartesz (1994) listed 76 species for the United States, Canada, and Greenland. Gleason (1952) stated that species of *Silene* are most numerous in Eurasia. The most recent revision of *Silene* in North America was by Hitchcock and Maguire (1947).

There has been and currently is much confusion over generic and family classification of *Silene*. *Silene* was classified into its own family, Silenaceae, by the German botanist Friedrich Bartling (Watson and Dallwitz 1992). Weber (1990) treated *Silene* in a strict sense and uses the segregate genera *Anotites*, *Gastrolychnis*, and *Melandrium* in his flora of the eastern slope of Colorado, using characteristics of the capsules and number of styles. Gleason and Cronquist (1991) separated *Silene* from the closely related *Lychnis*, with *Silene* having only 3 styles or having 5 styles and a glandular or inflated calyx and included three taxa that had previously been classified in either *Lychnis* or *Melandrium*. Kartesz (1994) treated *Silene* in the broad sense and includes *Anotites*, *Gastrolychnis*, *Melandrium*, *Oberna*, *Pleconax*, *Wahlbergella*, and several members of *Lychnis* in his checklist. It is likely that Kartesz (1994) used the same criteria as Gleason and Cronquist (1991) since he also included *Lychnis* as a valid genus. However, Radford et al. (1968) stated that *Lychnis* is similar to *Silene* and perhaps better included in that genus.

Fernald (1950) stated that Carolus Linnaeus applied the genus name *Silene* in 1753 in his Species Plantarum from earlier authors who used the name in reference to the mythological character Silenus. Silenus was the intoxicated foster-father of Bacchus and was described as being covered with foam. *Silene* was used because many species tend to have viscid, sticky excretions along their stem internodes, especially in the inflorescence. Gleason (1952), in contrast, stated that *Silene* came from the Greek word *sialon* that means saliva, again referring to sticky secretions on the stems of several species.

Silene is a genus of significant conservation importance in North America because 16 of the approximate 45 native perennial species were listed as candidate threatened or endangered taxa until recently redefined as taxa of special concern (Federal Register 1993, 1997).

Silene ovata is a coarse, multi-stemmed perennial from creeping underground rhizomes. The stems are pubescent, from 0.3 to 1.5 m tall, with opposite, sessile leaves that are

broadly lanceolate to oblanceolate along the lower portion of the stem and ovate along the middle and upper portions of the stem. The leaves have acute or acuminate apices, are rounded to slightly clasping at the base, and are usually densely pubescent on both lower and upper surfaces. The inflorescence is an open, pubescent panicle or cyme that is 0.1 to 0.5 m long. Flowers have five white, deeply dichotomously divided petals usually with 8 segments, five sepals, 10 stamens, and three carpels. The fruit is a dehiscent capsule with six apical teeth. The petals are from 1.0-1.5 cm long with blades 5-10 mm of this length. The petal blades have very inconspicuous appendages at their base. Sepals are pubescent and are fused into a tube from 8-10 mm long. Capsules are ellipsoid and from 7-8 mm long. The capsule is elevated from the receptacle by a 1.5-2.5 mm long carpophore. Characteristics of mature seeds were not described. The base chromosome number is $n = 24$ (Fernald 1950; Gleason 1952, Radford et al. 1968; Gleason and Cronquist 1991).

The following is a key adapted from Mohlenbrock (1986) and Gleason and Cronquist (1991) to distinguish *Silene ovata* from other species, primarily *S. stellata*, in Illinois. Species with an asterisk (*) are introduced from Europe.

Key to distinguish *Silene ovata* from other species in Illinois

- A. Petals red, crimson, or scarlet B
- B. Stems with 10-20 pairs of leaves; petals entire to slightly emarginated. *Silene regia*
- B. Stems with 2-8 pairs of leaves; petals 2-cleft *Silene virginica*
- A. Petals white, pink, or purplish C
- C. Plants perennial D
- D. Petals deeply dichotomously cleft several times or fimbriate E
- E. Midstem leaves opposite; petals usually 8-cleft *Silene ovata*
- E. Midstem leaves whorled in 4's; petals fimbriate *Silene stellata*
- D. Petals entire or bilobed, the lobes often with a small lateral tooth F
- F. Plant green; flowers solitary in upper leaf axils *Silene nivea*
- F. Plant glaucous; flowers in cymose panicles ... **Silene cucubalus* (= **S. vulgaris*)
- C. Plants annual or biennial G
- G. Flowers up to 4 mm across *Silene antirrhina*
- G. Flowers up to 1 cm or more across H
- H. Stems glutinous below each node; flowers pink or purple **Silene armeria*
- H. Stems not glutinous below each node; flowers white or whitish-pink I
- I. Stems and calyx glabrous; biennial **Silene cserei*
- I. Stems viscid-pubescent or hirsute; calyx pubescent J
- J. Flowers nodding, opening at dusk; viscid pubescent annual **Silene noctiflora*
- J. Flowers ascending, opening during the day; hirsute biennial ... **Silene dichotoma*

METHODS

Five populations of *Silene ovata* were visited twice during the 1998-growing season. Additional populations were searched for during 1998 but the searches were unsuccessful. However, Beth Shimp discovered a sixth population in 1999, and this population was surveyed once in May 2000. Demographic data that were collected include number of plants, number of stems, stem height, number of flowering plants, number of flowering stems, number of flowers, and flowering stem height, and number of capsules. Height was measured using a Lufkin 3m tape measure. Environmental data that were collected include soil depth (using a graduated, circular metal rod), soil pH (using a soil tester pH meter), percent canopy cover (using a spherical densiometer), percent slope (using a clinometer), slope aspect (using a compass), and slope position (xeric, dry, dry-mesic, mesic). Associated plant species were recorded within 5m of the boundary of each population. Nomenclature follows Mohlenbrock (1986). The natural community where *S. ovata* was found was recorded using criteria in White and Madany (1978).

RESULTS AND DISCUSSION

Demographic Characteristics

A total of 3612 plants of *Silene ovata* were sampled in six populations during the May-June survey (Table 1). Approximately 93% of all plants were located within two populations at Haney Creek and Sturgeon Hill. The number of plants at each population ranged from three at Panther Hollow to 1797 at Haney Creek. The average number of stems per plant ranged from 2.0 at Sturgeon Hill to 16.0 at Panther Hollow. Approximately 90% of all stems were at the Haney Creek and Sturgeon Hill populations. Stem height ranged from 24.6 cm Panther Hollow to 48.7 cm at Cane Creek. Of the 1815 plants that were surveyed in June 1998, 54% were flowering in September. There was only one flowering plant at Panther Hollow, whereas 847 plants flowered at Sturgeon Hill. The average number of flowering stems per plant ranged from 1.7 at Sturgeon Hill to 4.3 at Barker Bluff. Average flowering stem height ranged from 50.0 cm at Finneyville to 72.6 cm at Barker Bluff. The number of flowers per stem varied from 13.9 at Cane Creek to 26.4 at Sturgeon Hill. The only population that produced capsules was at Sturgeon Hill. Of 847 plants that flowered at Sturgeon Hill, 51% produced fruit. The number of fruits per plant was 13.7.

Environmental Characteristics

Silene ovata is restricted in Illinois to the Shawnee Hills Physiographic Division, with four populations in the Greater Shawnee Hills Section and two populations in the Lesser Shawnee Hills Section. This division is an unglaciated region with some of the largest forested tracts that remain in Illinois. The Greater Shawnee Hills Section is a region characterized by an east-west escarpment of Pennsylvanian-aged sandstone. This section has gentle to rugged hills with such features as sandstone bluffs, cliffs, and overhangs (Schwegman et al. 1973, Harris et al. 1977). *Silene ovata* is restricted to soils that overlay Battery Rock sandstone of the Caseyville Formation within the Greater Shawnee Hills Section. Bands of iron oxide cement in the sandstone rock characterize Battery Rock sandstone. The Lesser Shawnee Hills Section is a region of lower hills underlain by Mississippian-aged limestone and sandstone. This section is characterized by gently rolling hills and features such as limestone bluffs and glades, caves, and sinkholes (Schwegman

et al. 1973, Harris et al. 1977). *Silene ovata* is restricted to soils that overlay Bethel and Cypress sandstone of the West Baden Group within the Lesser Shawnee Hills Section. All six populations were located on soils of the Alford-Wellston association. These soils are found on gently sloping to steep uplands and are well drained and moderately permeable. Alford and Wellston soils are classified as typic hapludalfs and ultic hapludalfs, respectively. These soils belong to the alfisol soil order, which includes soils derived under forest vegetation. This soil order has a distinct eluvial layer (E horizon), often light-colored or whitish, which results from the leaching of dissolved ions, especially aluminum and iron (Parks 1975). The soil types where *Silene ovata* was found were loess-derived and found on moderate to steep uplands with 18 to 60 percent slopes. *Silene ovata* was also found in areas classified as sandstone rock land, which includes areas with very stony or rocky soils with an abundance of rock outcrops and 20 to 60 percent slopes (Parks 1975). Soil depth ranged from 1.3 cm at Panther Hollow to 17.5 cm at Haney Creek. Soil pH was consistent for all populations and ranged from 5.8 at Finneyville to 6.2 at Barker Bluff and Haney Creek. Percent slope varied from 13.0% at Cane Creek to 59.0% at Barker Bluff. All populations occurred in forested habitats that had canopy cover from 61.5% at Barker Bluff to 77.8% at Cane Creek. Slope position and natural community type were variable and ranged from dry upland forest to mesic upland forest. Plants were often found growing on sandstone slide blocks, sandstone cliffs, or rocky, talus slopes when growing in dry-mesic and mesic upland forest (Table 2). The number of associated plant species at each site was related to population extent and size, as the smallest population (extent and size) at Panther Hollow had only 19 associates while the largest population (extent only) at Sturgeon Hill had 140 associates. The most frequent associated plant species that occurred at five or all populations include *Acer saccharum*, *Arabis laevigata*, *Celtis occidentalis*, *Hydrangea arborescens*, *Parthenocissus quinquefolia*, *Pilea pumila*, *Sanicula canadensis*, *Sassafras albidum*, *Toxicodendron radicans*, and *Woodsia obtusa* (Table 3).

CONCLUSIONS

Silene ovata is listed in Illinois as state endangered because it only occurs in Hardin County and is restricted to six populations. All but one population occurs on the Shawnee National Forest. The five populations on the Shawnee National Forest are located in remote areas within large forested tracts, so these populations appear to be secure. However, the largest population in Illinois at Haney Creek occurs on private property adjacent to a gravel road. This population should be protected through a conservation easement with the landowner or land purchase to ensure that this important habitat is not destroyed in the future.

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Table 1. Characteristics of *Silene ovata* Pursh populations in Illinois (mean \pm standard deviation; range in parentheses).

Attribute	Barker Bluff	Cane Creek	Finneyville	Haney Creek	Panther Hollow	Sturgeon Hill
A. Population Characteristics: May-June Survey						
Number of plants	18	28	207	1797	3	1559
Number of stems	68	114	757	5382	48	3064
Stems per plant	3.8 \pm 8.1 (1 - 35)	4.1 \pm 2.6 (1 - 10)	3.7 \pm 3.4 (1 - 19)	3.0 \pm 2.3 (1 - 18)	16.0 \pm 26.0 (1 - 46)	2.0 \pm 2.0 (1 - 34)
Stem height, cm	42.4 \pm 23.0 (2.5 - 92.2)	48.7 \pm 19.3 (12.5 - 88.1)	28.2 \pm 13.8 (3.0 - 79.6)	39.2 \pm 14.6 (3.0 - 83.5)	24.6 \pm 10.7 (5.6 - 51.6)	38.9 \pm 21.7 (1.0 - 119.0)
B. Flowering Characteristics: September Survey						
Flowering plants	7	20	109	N/A	1	847
Flowering stems	30	55	274	N/A	4	1448
Flowering stems per plant	4.3 \pm 6.7 (1 - 19)	2.8 \pm 1.5 (1 - 6)	2.5 \pm 2.2 (1 - 11)	N/A	4.0	1.7 \pm 1.9 (1 - 30)
Number of flowers	533	766	4549	N/A	58	38,299
Flowers per stem	17.8 \pm 9.5 (6 - 52)	13.9 \pm 9.9 (1 - 53)	16.6 \pm 12.6 (1 - 85)	N/A	14.5 \pm 4.4 (12 - 21)	26.4 \pm 18.3 (1 - 114)
Flowering stem height, cm	72.6 \pm 16.0 (40.5 - 105.0)	71.2 \pm 14.5 (40.5 - 99.0)	50.9 \pm 10.4 (37.6 - 82.4)	N/A	57.5 \pm 6.2 (49.0 - 63.0)	68.8 \pm 19.5 (25.5 - 139.0)
Fruiting plants	N/A	N/A	N/A	N/A	N/A	430
Number of capsules	N/A	N/A	N/A	N/A	N/A	5884
Capsules per plant	N/A	N/A	N/A	N/A	N/A	13.7 \pm 15.9 (1 - 157)

Table 2. Environmental characteristics of *Silene ovata* Pursh populations in Illinois (mean \pm standard deviation; range in parentheses).

Attribute	Barker Bluff	Cane Creek	Finneyville	Haney Creek	Panther Hollow	Sturgeon Hill
Soil depth	8.2 \pm 3.4 (3.9 - 14.6)	2.8 \pm 4.1 (0.8 - 2.1)	4.6 \pm 5.2 (0.5 - 20.0)	17.5 \pm 7.3 (5.3 - 20.0)	1.3 \pm 0.5 (0.8 - 2.1)	10.2 \pm 7.0 (0.4 - 20.0)
Soil pH	6.2 \pm 0.2 (6.0 - 6.4)	5.9 \pm 0.2 (5.4 - 6.4)	5.8 \pm 0.2 (5.4 - 6.2)	6.2 \pm 0.3 (5.8 - 6.4)	6.0 \pm 0.2 (5.6 - 6.3)	6.0 \pm 0.2 (5.6 - 6.4)
% Canopy Cover	61.5	77.8 \pm 3.2 (75.0 - 81.3)	70.7 \pm 5.2 (64.6 - 77.1)	77.2 \pm 5.7 (64.3 - 81.2)	73.0	67.4 \pm 4.3 (61.5 - 73.0)
% Slope	59.0	13.0 \pm 9.5 (7.0 - 24.0)	28.0 \pm 9.8 (17.0 - 43.0)	47.8 \pm 9.3 (41.0 - 63.0)	31.0	38.5 \pm 12.5 (28.0 - 67.0)
Slope position	Dry	Dry-mesic	Dry-mesic	Mesic	Mesic	Dry to dry-mesic
Community type	Dry upland forest	Dry-mesic upland forest (slide block)	Dry-mesic upland forest (slide block and cliff)	Mesic upland forest (talus slope)	Mesic upland forest (slide block)	Dry and dry-mesic upland forest (slide block and cliff)

Table 3. Frequent plant species associated with *Silene ovata* Pursh in Illinois.

Species	Barker Bluff	Cane Creek	Finneyville	Haney Creek	Panther Hollow	Sturgeon Hill
<i>Acer saccharum</i> Marsh.		X	X	X	X	X
<i>Arabis laevigata</i> (Muhl.) Poir.		X	X	X	X	X
<i>Arisaema triphyllum</i> (L.) Schott		X	X	X	X	
<i>Asimina triloba</i> (L.) Dunal		X	X	X		X
<i>Asplenium platyneuron</i> (L.) Oakes	X	X		X		X
<i>Carex blanda</i> Dewey		X	X	X		X
<i>Celtis occidentalis</i> L.	X	X	X	X		X
<i>Fraxinus americana</i> L.		X	X	X		X
<i>Galium aparine</i> L.		X	X	X		X
<i>Galium circaezans</i> Michx.		X	X	X		X
<i>Geum canadense</i> Jacq.		X	X	X		X
<i>Hydrangea arborescens</i> L.		X	X	X	X	X
<i>Juglans nigra</i> L.		X	X	X		X
<i>Morus rubra</i> L.		X	X	X		X
<i>Parthenocissus quinquefolia</i> (L.) Planch.	X	X	X	X	X	X
<i>Phryma leptostachya</i> L.		X	X	X		X
<i>Pilea pumila</i> (L.) Gray		X	X	X	X	X
<i>Polygonum virginianum</i> L.		X	X	X		X
<i>Prenanthes altissima</i> L.		X	X	X	X	
<i>Sanicula canadensis</i> L.	X	X	X	X		X
<i>Sassafras albidum</i> (Nutt.) Nees	X	X	X	X	X	X
<i>Solidago caesia</i> L.		X	X	X		X
<i>Toxicodendron radicans</i> (L.) Kuntze	X	X	X	X	X	X
<i>Tradescantia subaspera</i> Ker.		X	X	X	X	
<i>Ulmus rubra</i> Muhl.		X	X	X		X
<i>Woodsia obtusa</i> (Spreng.) Torr.	X		X	X	X	X
Total Number of Associated Species	39	59	89	106	19	140

