

What in the whorled:

The rediscovery of *Helianthus verticillatus* Small (Heliantheae) over 100 years later

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The whorled sunflower, *Helianthus verticillatus* Small (Heliantheae Cass.), is a federally listed, endangered sunflower species found exclusively in the southeastern United States (Figure 1). It is a diploid ($x = 17$) perennial that reproduces both sexually and asexually by rhizomatous clonal growths in distinct clusters (Edwards & al., 2020; Ellis & al., 2006; Mandel, 2010; Matthews & al., 2002). The species is self-incompatible and insect pollinated which is typical of other members of the genus. *Helianthus verticillatus* is morphologically distinct from other *Helianthus* species in the southeastern United States by having three to four whorled lower leaves, leaves that are nearly sessile to short petiolate, prominent midvein, and yellow disk floret corollas (Matthews & al., 2002). *Helianthus verticillatus* generally grows up to 3 m tall in wet prairie habitats, open floodplains, and wet depressions near the edges of forests in large clonal clumps (Chafin & Owers, 2010).

Helianthus verticillatus was first described by John K. Small in 1898, based on plants collected in Tennessee by Samuel McCutcheon Bain in 1892 (Matthews & al., 2002). The species was not seen again in nature for over 100 years until 1994 when it was rediscovered in Georgia by Richard T. Ware. James R. Allison discovered a second population 3.6 km west of the Georgia population in Alabama in 1997. Then in 1998, Carl Nordman discovered a

third population of *H. verticillatus* in Madison County, Tennessee, only 10 km northwest from where Bain originally collected the type specimen. In 2006, a fourth population was discovered in McNairy County, Tennessee by Andrea Bishop. Most recently, additional populations have been discovered in Mississippi (2017) by Darrell Brandon and Virginia (2019) by Chris Ulrey (Figure 2), totaling six known populations of *H. verticillatus* spanning five states.

During much of the time between its description and re-discovery, *H. verticillatus* was thought to be a hybrid or of hybrid origin (Heiser & al., 1969). However, once new populations were discovered and research using both morphological and genetic evidence was carried out, it became clear that *H. verticillatus* is indeed a distinct species. Even so, *H. verticillatus* is considered an unusual, rare species considering it has relatively high levels of genetic diversity at both the population and species levels (Edwards & al., 2020; Ellis, 2006; Mandel, 2010), suggesting that it may have historically been more common. Researchers and conservation managers believe that the biggest threats to the known populations are modifications of remnant prairie habitats and the loss and degradation of habitat (Chafin & Owers, 2010; USFWS, 2014). A recent study has shown that the primary pollinators of this species are bumblebees, carpenter bees, and sweat bees (Strange & al., 2020); however, some of

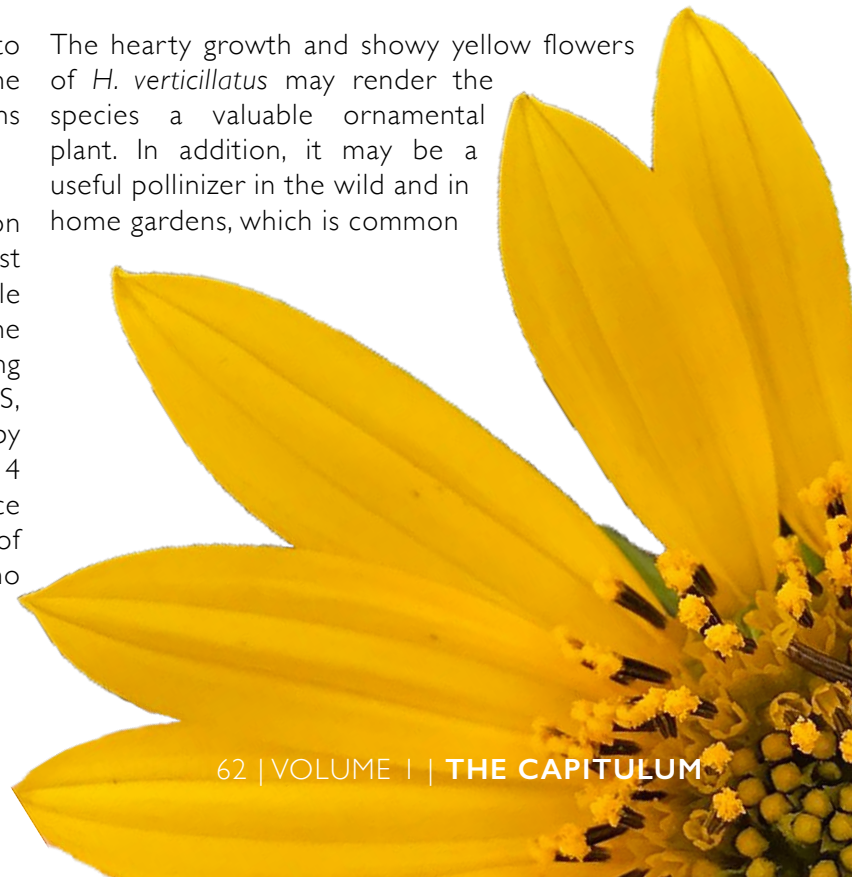


Figure 1. *Helianthus verticillatus* Small. **A.** Close up of heads. **B.** Distinctive whorled leaves. Photos: **A,** C.M. Siniscalchi; **B,** J.R. Mandel.

these bee species only have a flight distance of up to three meters (Schmitt, 1980), greatly reducing the opportunities for gene flow between populations (Loveless & Hamrick, 1984; Edwards & al., 2020).

Having a restricted distribution, small population sizes, and limited sexual reproduction at most known locations make *H. verticillatus* vulnerable to localized extinction. These qualifications led the species to become a candidate for federal listing under the Endangered Species Act in 1999 (USFWS, 1999) and was listed as federally endangered by the United States Fish and Wildlife Service in 2014 (USFWS, 2014). Some actions have been put in place to preserve the populations and limit the effects of habitat degradation, although currently there is no species recovery plan.

The hearty growth and showy yellow flowers of *H. verticillatus* may render the species a valuable ornamental plant. In addition, it may be a useful pollinizer in the wild and in home gardens, which is common



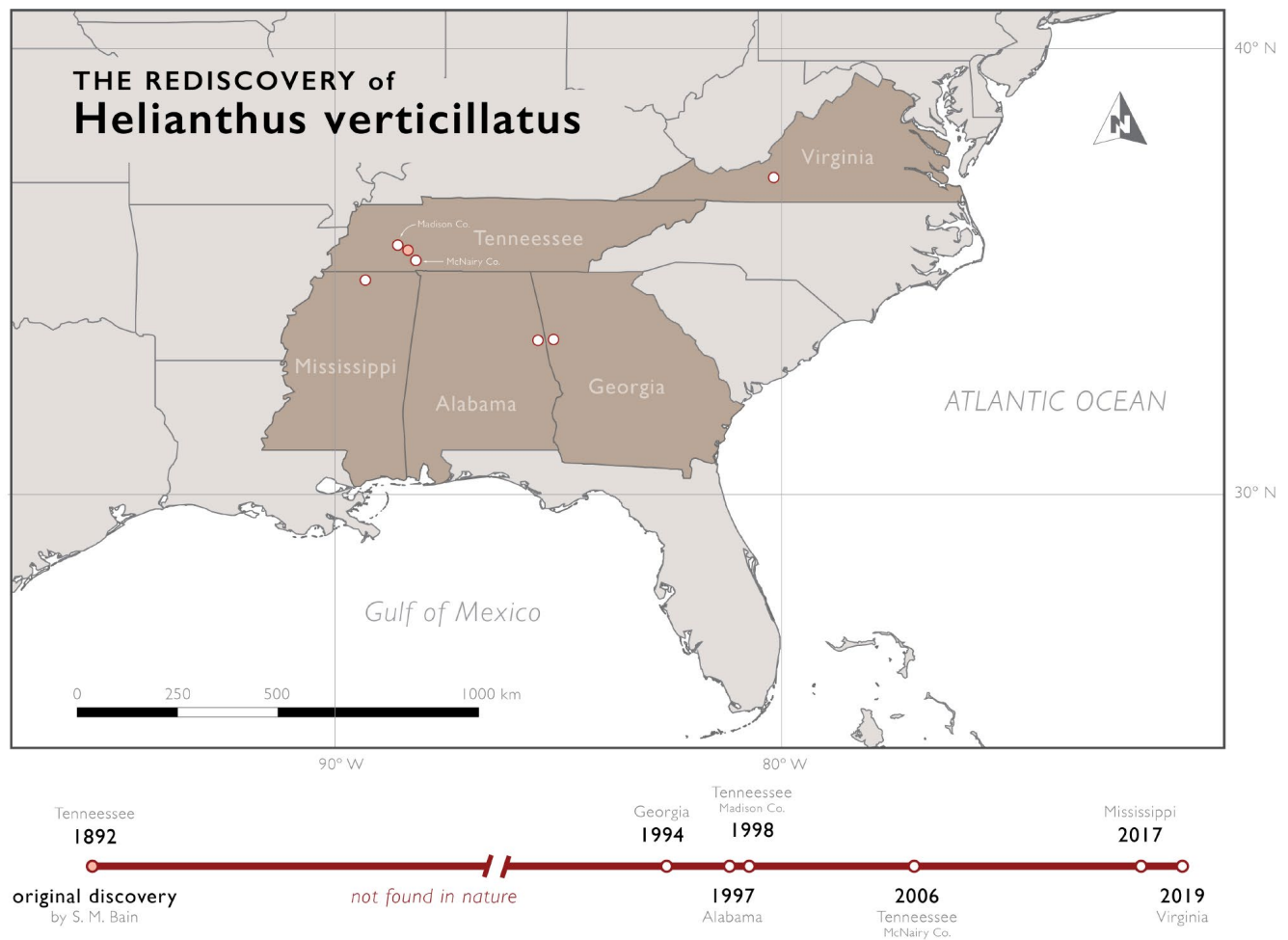


Figure 2. Map showing locations of the six known *Helianthus verticillatus* populations (white circles) and that of the original discovery in 1892 (red circle). The timeline details when populations were discovered.

with other *Helianthus* spp. (Edwards & al., 2020). Its habitat is home to a host of other taxa, some which are considered threatened or vulnerable. Thus, protecting the whorled sunflower is important in preserving biodiversity for both this species and others.

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LITERATURE CITED

Chafin, L., & Owers, K. 2010. *Helianthus verticillatus* Small. https://georgiabiodiversity.org/natels/profile?es_id=21967/

(accessed 6 May 2021).

Edwards, T.P., Trigiano, R.N., Ownley, B.H., Windham, A.S., Wyman, C.R., Wadl, P.A., & Hadziabdic, D. 2020. Genetic Diversity and Conservation Status of *Helianthus verticillatus*, an Endangered Sunflower of the Southern United States. *Frontiers in Genetics* 11: 410.

Ellis, J.R., Pashley, C.H., Burke, J.M., & McCauley, D.E. 2006. High genetic diversity in a rare and endangered sunflower as compared to a common congener. *Mol. Ecol.* 15: 2345–2355.

Heiser, C.B., Smith, D.M., Clevenger, S.B., & Martin, W.C. 1969. The North American sunflowers (*Helianthus*). *Mem. Torrey Bot. Club.* 22: 1–218.

Loveless, M.D. & J.L. Hamrick. 1984. Ecological Determinants of Genetic Structure in Plant Populations. *Annual Rev. Ecol. Syst.* 15: 65–95.

Mandel, J.R. 2010. Clonal diversity, spatial dynamics, and small genetic population size in the rare sunflower, *Helianthus verticillatus*. *Conservation Genet.* 11: 2055–2059.

Matthews, J.F., Allison, J.R., Ware Sr., R.T., & Nordman, C. 2002. *Helianthus verticillatus* Small (Asteraceae) Rediscovered and Redescribed. *Castanea* 67: 13–24.

Strange, N.C., Moulton, J.K., Bernard, E.C., Klingeman, W.E., Sampson, B.J., & Trigiano, R.N. 2020. Floral visitors to *Helianthus verticillatus*, a rare sunflower species in the Southern United States. *HortScience* 55: 1980–1986.

USFWS. 1999. Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates or proposed for listing as endangered or threatened; annual notice of findings on recycled petitions; and annual description of progress on listing actions. (October 25, 1999). Federal Register, 57533–57547.

USFWS. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for *Physaria globosa* (Short's bladderpod), *Helianthus verticillatus* (whorled sunflower), and *Leavenworthia crassa* (fleshy-fruit glaucous); Final Rule. (August 26, 2014). Federal Register, 50990–51039.