

Noteworthy plant records in Missouri after a major pipeline construction project

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ABSTRACT. — *Myosotis arvensis* and *Centaureum pulchellum* are reported new to Missouri from the Litzsinger Road Ecology Center in St. Louis County. Three additional species are reported new to St. Louis County: *Sesamum indicum*, *Cyclosporum leptophyllum*, and *Krigia cespitosa*. These records were documented after the completion of a sewer pipeline project. Comparisons between closely resembling species, known distributions, and potential propagule origins are discussed.

INTRODUCTION

Two plants new to Missouri were discovered following construction of a major sewer pipeline at the Litzsinger Road Ecology Center (LREC) in St. Louis County: *Myosotis arvensis* (L.) Hill (Boraginaceae) and *Centaureum pulchellum* (Sw.) Hayek ex Hand.-Mazz., Stadlm., Janch. & Faltis (Gentianaceae). Three additional species at the site are new to St. Louis County: *Sesamum indicum* L. (Pedaliaceae), *Cyclosporum leptophyllum* (Pers.) Sprague ex Britton & Wilson (Apiaceae), and *Krigia cespitosa* (Raf.) K.L. Chambers (Asteraceae).

The newly discovered occurrences come after the initiation of Project Clear, a sewer pipeline project led by the Metropolitan St. Louis Sewer District (MSD). Project construction started at the LREC in September 2019 and ended in August 2022. Prior to Project Clear, the area was predominantly restored bottomland woodland and prairie (Kathriner & Faupel 2022). During construction, the pipeline path was heavily disturbed by large machinery and trenching for pipeline insertion. Further, adjacent Deer Creek holds the potential for flash flooding at high creek levels that temporarily inundate the pipeline path. With a multitude of disturbances during three years of construction, early successional and adventive species covered the pipeline path during its first full year of unmanaged post-construction growth.

METHODS

All records were discovered during surveys of the LREC property and pipeline path from 2020 to 2023. An iNaturalist observation (iNaturalist 2023) was made for all specimens at the time of collection. Herbarium specimens were prepared following the protocol of Bridson and Forman (1998). Specimens were accessioned into the Missouri Botanical Garden herbarium (MO) and are stored offsite at the LREC. Digitized information for specimens discussed in this report are available on Tropicos, the herbarium collections database of the Missouri Botanical Garden

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(Tropicos 2023). Specimens were determined as Missouri or St. Louis County records based on the existence of herbarium specimens in the Southeastern Regional Network of Expertise and Collections (SERNEC), Tropicos, and Research Grade quality iNaturalist observations.

SPECIES ACCOUNTS

Myosotis arvensis

A single individual of *Myosotis arvensis* (field forget-me-not) was discovered on the pipeline path along Deer Creek in June 2023. *Myosotis* L., commonly named forget-me-not or scorpion grass, is a genus of 100 species found in temperate and tropical regions (Winkworth et al. 2002). The genus is characterized by its blue, white, or yellow corolla, unbranched style, single stigma, and laterally compressed mericarps (Al-Shehbaz 1991). Only four *Myosotis* species were previously known to occur in Missouri (Weakley et al. 2023; Yatskievych 2006).

Myosotis arvensis is native to Eurasia but occurs across subarctic Canada and the northern United States and the eastern portion of the Southeastern United States (NatureServe 2023; Weakley et al. 2023). Based on digitized herbarium specimens, the nearest populations to Missouri are from the northeast in Grant County, Wisconsin and a 19th century record from Cook County, Illinois, from the east in Posey County, Indiana, from the south in Shelby County, Tennessee, and from the west in Decatur County, Kansas.

In Missouri, *M. arvensis* is most morphologically similar to *M. stricta* Link ex Roem. & Schult.; both species have blue corollas (occasionally with yellow and white) and a calyx with five equal lobes. However, *M. arvensis* has fruiting pedicels that equal or exceed the calyx, whereas *M. stricta* has fruiting pedicels shorter than the calyx (**Figure 1**; Weakley et al. 2023). Both species occur in disturbed areas, so care should be taken when identifying these two species in the field, paying attention to the pedicel length relative to the calyx length.

Voucher specimen: **U.S.A. MISSOURI**: ST. LOUIS CO.: Litzsinger Road Ecology Center, southern section of fallow pipeline path near woodland edge and creek bank, 38.623762°N, 90.37577°W, 12 June 2023, C.M. Sims CMS1106 (MO).

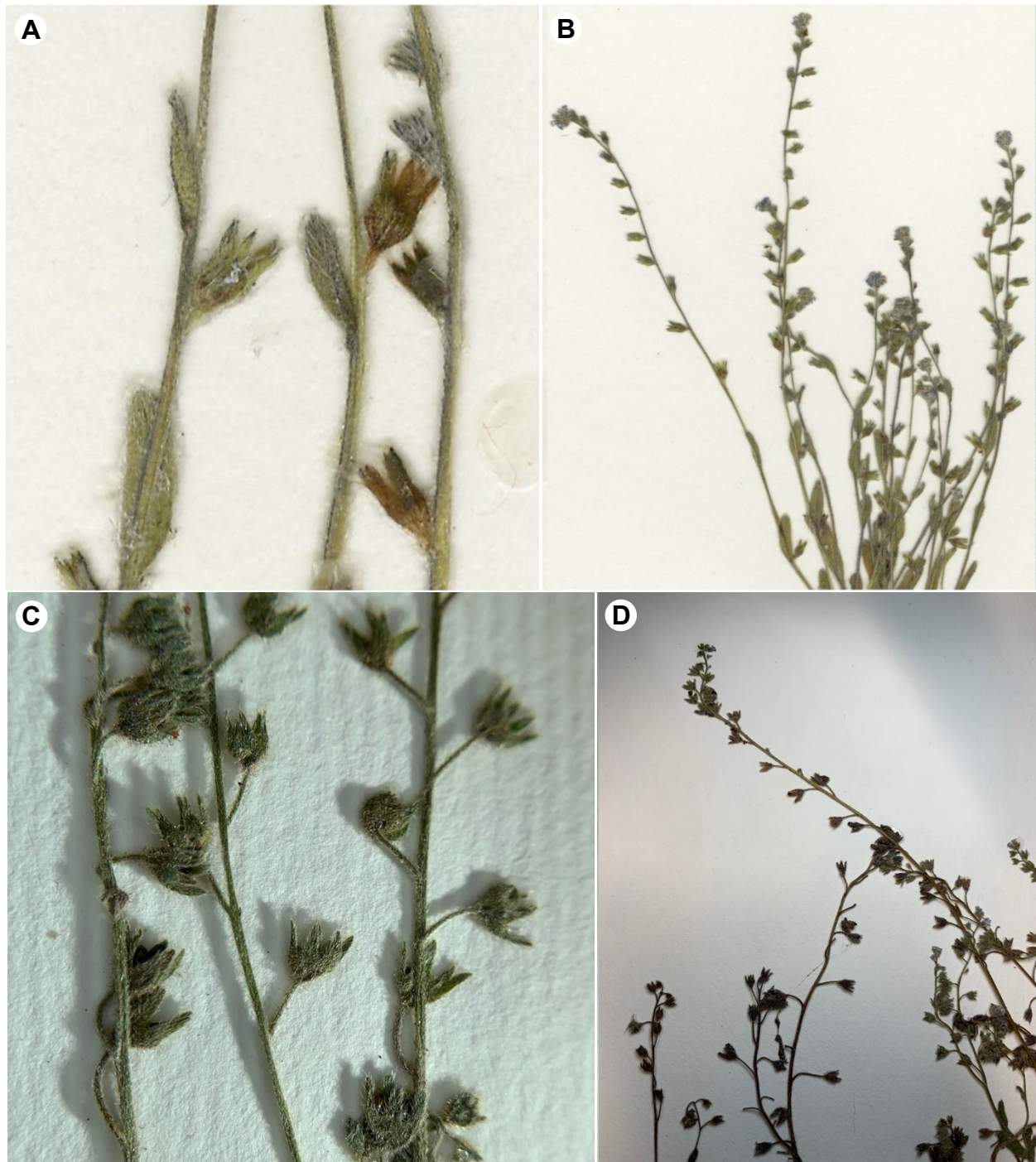


Figure 1. A. and B. *Myosotis stricta* fruiting pedicel and calyx (Davidse 40480, MO). C. and D. *Myosotis arvensis* fruiting pedicel and calyx (Sims CMS1106, MO). Photos: Caitlyn Sims.

Centaurium pulchellum

Three plants of *Centaurium pulchellum* (lesser centaury) occurred on the pipeline path, scattered through a 1.27 ha (3.14 ac) area, on fallow ground and on the edge between the fallow path and woodland. Three species of *Centaurium* occur in the southeastern United States; none have been previously recorded in Missouri (Weakley et al. 2023), although there is a 2020 iNaturalist observation of *C. erythraea* Rafn from Jefferson County (iNaturalist 2023). *Centaurium erythraea* has sessile to subsessile flowers, as opposed to the pedicellate flowers of *C. pulchellum*. A native of Eurasia, *C. pulchellum* occurs across North America, from Washington and California to New York, Massachusetts, and Maine, and from Texas and Louisiana to Canada, Wisconsin, and Michigan (Kartesz 2015; Mansion 2014).

The nearest records to Missouri are in the north from the six northeasternmost counties in Illinois (Wilhelm & Rericha 2017) and digital herbarium records from Rock County, Wisconsin, the east in Shelby County, Indiana, the south in Prairie County, Arkansas, the west in Arapahoe County, Colorado, and the northwest in Antelope County, Nebraska. Kaul et al. (2006) report a specimen from Douglas County, Nebraska.

In Missouri, *C. pulchellum* is morphologically similar to *Zeltnera texensis* (Griseb.) G. Mans. ex J.S. Pringle [= *Centaurium texense* (Griseb.) Fernald]. These two species cannot be confidently differentiated without magnified inspection of the stigma and style (Mansion 2004). The style of *C. pulchellum* is divided just below the stigma surface and the stigma lobes are reniform, while the style of *Z. texensis* is undivided and the stigma lobes are flabelliform (Mansion 2004; McDaniel 2022; Pringle 2023). *Zeltnera* is not yet included in the keys of the *Flora of the Southeastern United States* (Weakley et al. 2023), complicating identification between the two species. However, both genera are treated by Pringle (2023).

Centaurium pulchellum has pedicels shorter than the calyces, 1–5(11) mm long, calyces (3)5–9(11) mm, and broader, elliptic-oblong to lanceolate cauline leaves, 1–5(12) mm broad, (**Figure 2**), whereas *Z. texensis* has pedicels 4–20 mm long, calyces 6–12 mm, and narrowly elliptic to linear leaves, 0.5–4.5(8) mm broad (**Figure 3**; McDaniel 2022; Pringle 2023). Additionally, *C. pulchellum* has occasionally persistent obovate basal leaves, and branching above the middle in small individuals, but at lower nodes in large individuals, whereas *Z. texensis* does not usually have persistent basal leaves and branching begins below the middle (Pringle 2023).

Habitat may further support species identification, because *C. pulchellum* occurs in moist, disturbed habitats, and *Z. texensis* is found in rocky sites or in calcareous soils (Pringle 2023; Yatskievych 2013). *Zeltnera texensis* also has an assigned coefficient of conservatism rank of 9, suggesting that it is not likely to be found in post-construction sites (Ladd & Thomas 2015). Due to the minor differences between *C. pulchellum* and *Z. texensis*, it is likely that *C. pulchellum* has been overlooked in the state. A 2021 iNaturalist observation from Cottleville, Missouri has been suggested as *C. pulchellum*, but identification cannot be confirmed without images of the stigma and style.



Figure 2. *Centaurium pulchellum*. A. Flower pedicels (Fleetwood 10346, MO). B. Lateral view of style and stigma lobes (Sims, CMS1108, MO). C. Stigma lobes (Bailey, s.n., MO1007061). D. Style and stigma lobes (Sims, CMS1108, MO). E. Habit (Sims, CMS1108, MO, from Tropicos). Photos: Caitlyn Sims.



Figure 3. *Zeltnera texensis*. **A.** Habit (Riggins 308, APSC, from SERNEC). **B.** Pedicels (Steiermark 22666, MO). **C.** Stigma lobe and style (MO1809050). Photos: Caitlyn Sims.

Voucher specimens: **U.S.A. MISSOURI:** ST. LOUIS CO.: Litzsinger Road Ecology Center, fallow pipeline path east of Deer Creek, 38.624236°N, 90.376134°W, 9 June 2023, C.M. Sims CMS 1107 with D.M. Deterding, C.A. Krutzsch, & K.C. Schmiedeler (MO); Litzsinger Road Ecology Center, fallow pipeline path near woodland edge, east of Deer Creek, 38.625263°N, 90.37655°W, 27 July 2023, C.M. Sims CMS1108 (MO).

Observations: **U.S.A. MISSOURI:** JEFFERSON CO.: High Ridge, 38.385663°N, 90.604209°W, 2020, *nyxchaos* (<https://www.inaturalist.org/observations/53599853>); ST. CHARLES CO.: Cottleville, 38.760938°N, 90.649577°W, 2021, *paulabetz* (<https://www.inaturalist.org/observations/88719242>).

Sesamum indicum

The first spontaneous population of *Sesamum indicum* in St. Louis County was discovered growing along Deer Creek at the LREC. There have been three other Missouri collections (as *S. orientale* L.), from Kansas City, Jefferson City, and St. Louis, with at least one from a wild population (St. Louis City: *Mühlenbach*, 3181, MO2432426; *Mühlenbach* 1979; *Tropicos* 2023). Two cultivated specimens were also collected from St. Louis City (Merello, 1781, 1998; Zarucchi, 2013; SERNEC 2023; *Tropicos* 2023), but they are not considered here. *Sesamum indicum*, or sesame, is an internationally used crop thought to be native to the Old-World tropics (Ashri 2007). None of the ca. 20 species in *Sesamum* L. are native to North America. However, *S. indicum* is a waif escaping cultivation (Weakley et al. 2023; Yatskievych 2013). Its distribution is sporadic throughout the eastern United States, Wisconsin, Texas, Louisiana, and California (Kartesz 2015).

Staff observed 20-30 plants growing on gravel bars along Deer Creek at the LREC in 2020 and 2021, with the first observation in July 2020 (Faupel & Rembert, pers. obs.). In September and October 2021, *Sesamum* was observed growing along the same gravel bars. This species occurred approximately 265 m (869 ft) downstream of the Metropolitan St. Louis Sewer District's pipeline construction site. An herbarium voucher was not created for this species at the LREC, but detailed picture evidence was uploaded to iNaturalist by James Faupel.

Observations: **U.S.A. MISSOURI:** ST. LOUIS CO.: Ladue, 38.625173°N, 90.377107°W, 2020, *arembert* (<https://www.inaturalist.org/observations/54647347>); Ladue, 38.625764°N, 90.377475°W, 2021, *aazmy* (<https://www.inaturalist.org/observations/96679206>); Ladue, 38.625713°N, 90.37758°W, 2021, *jfaupel* (<https://www.inaturalist.org/observations/95402852>); Ladue, 38.62587°N, 90.377752°W, 2021, *arembert* (<https://www.inaturalist.org/observations/97447381>).

Cyclosporum leptophyllum

One individual of *Cyclosporum leptophyllum* (marsh parsley) was discovered along Deer Creek in an overgrown lawn area undergoing reconstruction into native habitat. This is the second time that *C. leptophyllum* has been reported in Missouri. The first observation was in 2021 by Paul Winn, in Jefferson City. This species occurs in freshwater marshes, roadside ditches, and other

disturbed areas (Kartesz 2015; Weakley et al. 2023). Interestingly, *C. leptophyllum* has a primarily southern distribution including the Lower Mississippi River region, with the Kansas City area at the northernmost part of its midwestern range (Freeman & Morse 2019). *Cyclospermum* Lag. includes three species, with only one known from Missouri (Plunkett et al. 2018; Weakley et al. 2023). In Missouri, *Spermolepis* Raf. looks most similar to *C. leptophyllum*, but *Spermolepis* has tubercles or hairs on the mericarps while *C. leptophyllum* has smooth mericarps (**Figure 4**; Weakley et al. 2023; Yatskievych 2006). Successful identification requires examining the mericarps at 10× or higher magnification.



Figure 4. A. *Spermolepis inermis* fruits (Reverchon 367, MO). B. *Cyclospermum leptophyllum* fruits (Stimson 157, MO). Photos: James Faupel.

Voucher specimen: **U.S.A. MISSOURI:** ST. LOUIS CO.: Litzsinger Road Ecology Center, weedy, former lawn area near Deer Creek, adjacent to pipeline path, 38.622834°N, 90.375446°W, 11 May 2023, C. M. Sims CMS1109 (MO).

Observation: **U.S.A. MISSOURI:** COLE CO.: Jefferson City, 38.588741°N, 92.231215°W, 2021, pwinn47 (<https://www.inaturalist.org/observations/85698128>).

Krigia cespitosa

Krigia cespitosa (opposite-leaved dwarf dandelion) is native to the Southeastern United States and occurs in disturbed habitats (Weakley et al. 2023). In Missouri, *K. cespitosa* predominantly occurs south of the Missouri River, but was recorded in St. Louis City by Viktor Mühlenbach in 1976 (3939, MO3526935, Tropicos 2023) and in Franklin County by Nels Holmberg in 2012 (4287, MO6469567, Tropicos 2023), so it is possible its existence in St. Louis County has been previously overlooked. At the LREC, one individual was found in an overgrown lawn area next to Deer Creek. *Krigia cespitosa* is identified by unkeeled, erect phyllaries in fruit, achenes lacking a pappus, and branching stem leaves (Weakley et al. 2023; Yatskievych 2006). Of the five species of *Krigia* in Missouri, *K. cespitosa* is most morphologically similar to *K. occidentalis* Nutt. However, *K. occidentalis* has basal leaves only and a more western distribution (Kim & Turner 1992).

Voucher specimen: **U.S.A. MISSOURI:** ST. LOUIS CO.: Litzsinger Road Ecology Center, southern section of the pipeline path, parallel to gravel driveway, former lawn area near Deer Creek. 38.62283°N, 90.375687°W, 8 June 2023, C.M. Sims CMS1105 with S.B. Killmer (MO).

DISCUSSION

Although it is impossible to know with certainty how these species arrived in St. Louis County, I suspect they have been recently introduced at the LREC in one of three ways: (1) propagules in the soil added to the pipeline path, (2) fluvially via Deer Creek and its proximity to two major rivers, or (3) introduction via construction machinery.

In 2022, significant rainfall caused flash floods on Deer Creek, stripping away the first soil layer shortly after construction ended. Imported soil was then deposited by contractors in the eastern and southern sections of the pipeline path where the *C. pulchellum* specimen was later discovered. This soil had been harvested from the Missouri River floodplain bottomlands in Chesterfield, Missouri. The known western distribution of *C. pulchellum* includes Nebraska, South Dakota, Wyoming, and Colorado, which encompass the Upper Missouri River watershed (Kartesz 2015). Considering the western distribution of *C. pulchellum*, the imported soil from Chesterfield potentially introduced propagules to the LREC. *Centaureum pulchellum* also occurred in northern sections of the pipeline path where the Missouri River bottomland soil was not deposited, but Project Clear construction continued upstream of the LREC along Deer Creek, and presumably imported soil from the same supplier at those sites as well.

It is possible that Deer Creek has deposited these species at the LREC. With a large area of disturbed ground exposed after pipeline construction, these weedy species can now occupy areas where they could not before. For example, *M. arvensis* has a facultative wetland status (FAC) and a distribution that is western and northeastern in the Missouri, Mississippi, and Illinois River watersheds (Kartesz 2015; U.S. Army Corps of Engineers 2020). These rivers are passages for migratory shorebirds which serve as vectors for plant propagule dispersion (Green et al. 2002; Smith 1996). Deer Creek at the LREC is approximately 15 km (10 mi) south of the nearest bend of the Missouri River and west of the Mississippi River (Google Earth Pro 7.3.6.9345 2023). Although the two bodies are not physically connected, it is possible traveling water birds dispersed the seeds of *M. arvensis* between streams (Farmer et al. 2017; Kleyheeg & van Leeuwen 2015). The LREC is a part of the Mississippi Flyway, and many species of shorebirds and waterfowl visit annually during spring and fall migration.

The Metropolitan St. Louis Sewer District works throughout the St. Louis metropolitan area, so it is possible that propagules were retained on vehicles and machinery from different Project Clear sites. The pipeline construction project required use of large machinery and vehicles such as trucks, trenchers, backhoes, dump trucks, front loaders, and bulldozers. The pipeline path was occupied for three years with machines that are capable of dispersing seeds as far as 250 km between sites (Taylor et al. 2012). Gravel was also imported to the LREC at the Deer Creek crossings for machinery to traverse the entire pipeline pathway. It is unknown where the imported gravel came from, and it was washed downstream by flooding several times during the construction period (Faupel, pers. obs.). Presumably, gravel was imported by contractors at upstream Project Clear construction creek crossings as well. It is possible that *S. indicum* came from the upstream construction or residential areas. Regardless, this annual plant appears to be transient at the LREC and has not been recorded on site since construction ceased.

Although four out of the five species records are introduced to Missouri, they do not appear to pose a threat to Missouri's natural communities since they favor disturbed habitats and were found in small numbers. Several of these species are diminutive, easily overlooked, and are easily misidentified. Additional populations of these species may occur in Missouri and St. Louis County, so surveying construction zones, floodplains, and roadsides may yield new discoveries.

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