ISSN 2576-2338 (online)

Volume 38
2020

Missouriensis

Journal of the
Missouri Native Plant Society

Viburnum dilatatum, reported new to Missouri in article on p. 1. Photo: Michael Saxton

https://monativeplants.org/

effectively published online
28 December 2020

Missouriensis, Volume 38 (2020)

Journal of the Missouri Native Plant Society

FROM THE EDITOR

Reviewing manuscripts is a largely thankless and time-consuming task, yet the ultimate quality of a journal depends in large measure on the insight, expertise, and suggestions of the reviewers. Deep and sincere appreciation is extended to reviewers of manuscript submissions for Volume 38; in addition to one anonymous reviewer, these include:

Michelle Bowe, Missouri State University
Malissa Briggler, Missouri Department of Conservation
Caleb Morse, University of Kansas
Bruce Schuette, Missouri Prairie Foundation
Scott Schuette, Pennsylvania Natural Heritage Program
Justin Thomas, NatureCITE
Gerould Wilhelm, Conservation Research Institute

Thanks to several people who generously assisted with questions or otherwise contributed expertise during the preparation of this volume, including Aaron Floden, Missouri Botanical Garden; Craig Freeman, University of Kansas; Caleb Morse, University of Kansas; Jim Solomon, Missouri Botanical Garden; and George Yatskievych, University of Texas. As usual, Cindy Pessoni of The Nature Conservancy has worked tirelessly on design, editorial and formatting issues, and continues to be in large measure responsible for the final product.

TABLE OF CONTENTS

Missouriensis, **38**: 1-3. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

Viburnum dilatatum Thunb. — a new, potentially invasive species for Missouri

AARON FLODEN[1] AND MICHAEL SAXTON[2]

ABSTRACT. — The Asian shrub *Viburnum dilatatum* is reported new to Missouri from Shaw Nature Reserve in Franklin County, where it is documented as an invasive in woodland understory that has persisted for at least 20 years. Multiple age classes ranging from seedlings to mature fruiting shrubs occur over several acres. Based on its performance at Shaw and data and observations from other states, this species has the potential to be a problem invasive in woodlands due to its abundant fruiting, tolerance of shaded understory conditions, quick maturation, and red fruit which will likely lead to ornithochory.

Viburnum dilatatum Thunb., sometimes known as Linden Arrowwood, is a large shrub native to Japan and eastern China that was first cultivated in the United States before 1845 (Dirr 1998). Despite this species having exhibited invasive behavior in several states in the Mid-Atlantic (Swearingen & Bargeron 2016, UCPD 2020), it remains popular and widely promoted for its adaptability, abundant attractive flowers, and especially for its prolific production of attractive red fruits which remain long-persistent on the branches and attract birds (see cover illustration). The horticultural popularity of the plant is attested to by the availability of at least 13 named cultivars selected for their growth habit, autumn color, and heavy fruit set and color (Dirr 1998).

First reported as invasive in New England and the Mid-Atlantic states (Swearingen and Bargeron 2016), *V. dilatatum* has since been documented as escaped and spreading in Illinois (Basinger 1999), North Carolina (Weakley 2015), and most recently in Kentucky (Brock 2020). The closest naturalized populations to Missouri are in Carbondale in Jackson County, Illinois (Basinger 1999) where the senior author has observed plants of all age classes extensively distributed through woodland understory at the Marberry Arboretum.

In Missouri, *Viburnum dilatatum* has not previously been documented to occur spontaneously outside of cultivation. Here we report a large, long-established, and apparently slowly spreading population from the Missouri Botanical Garden's Shaw Nature Reserve (SNR) in Franklin County, Missouri, where it has presumably spread from plants originally cultivated at the site. Glenn Beffa (pers. comm.) has known of this location for more than 20 years, although Bill Davit, former botanist at SNR, had not observed it at the site prior to this account.

[1] AARON FLODEN — Missouri Botanical Garden, 4344 Shaw Blvd., St. Louis, MO 63110. email: afloden@mobot.org
[2] MICHAEL SAXTON — Shaw Nature Reserve, Missouri Botanical Garden, 307 Pinetum Loop Road, Gray Summit, MO 63039. email: mike.saxton@mobot.org

Missouriensis, **38**: 1-3. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

The well-established population at Shaw Nature Reserve includes plants of all age classes from seedlings to large mature individuals up to 6 m tall. Individual stems on mature multi-stemmed plants range up to 5 cm diameter. Determination of the age of the older plants in the population is difficult due to their multi-stemmed growth form and stem die-back and resprouting, but we have counted 16 growth rings on one large stem. The population occurs near the old plant nursery at SNR, in an area that consisted of extensive open fields and woody fencerows in a 1941 aerial image of the site. These former fields have reverted to a mature successional woodland with a closed canopy of large ash (*Fraxinus* sp.), red cedar (*Juniperus virgianiana*), and shingle oak (*Quercus imbricaria*), shading a nearly continuous shrub layer consisting of *V. dilatatum* mixed with border privet (*Ligustrum obtusifolium*) and bush honeysuckle (*Lonicera maackii*). This population of *V. dilatatum* fruited abundantly in 2019. Current extent of the population, the presence of numerous immature shrubs beneath and around mature plants, and the lack of long-distance dispersal in the region, suggest that distant ornithochorous dispersal has not yet occurred at SNR (Fig. 1).

Figure 1. Aerial image of a portion of Shaw Nature Reserve showing distribution of *Viburnum dilatatum*. Red polygons indicate areas of dense infestation (12 acres), the blue area (7 acres) contains low levels of infestation, the green area (12 acres) contained a few individuals, and the purple area (14 acres) was searched but no plants were found.

Using the key to Missouri *Viburnum* in Yatskievych (2006), *V. dilatatum* would key to *V. molle* or *V. ozarkense* (=*V. bracteatum fide* Estes 2010). Another species occurring in Missouri, *V.*

rafinesquianum, also appears similar. All of these native species have dark, bluish black to black fruits. The petioles of *V. dilatatum* are densely pubescent, whereas the petioles in the other species are glabrate to moderately pubescent. All of these species can have small (to ca. 0.13 mm) stipitate glands on the petioles, but in *V. molle* they are typically abundant, while in the other species they are sparse to rare. Additionally, the leaves of *V. dilatatum* have rounded to shallowly subcordate bases, whereas the leaves of *V. molle* are usually distinctly cordate at their bases. Although there is considerable overlap in the size and number of teeth along the leaf margins, *V. dilatatum* is usually more finely serrate, often averaging 3.5 or more teeth/cm, while the other species are typically more coarsely dentate, often averaging 3 or less teeth/cm.

Given its abundant fruit production even in shaded habitats, continuing availability as a nursery shrub, and its documented ability to become established and self-perpetuating over at least short distances in Missouri habitats, it is likely that this species will become established in other woodlands in the state.

Specimen cited: **U.S.A. MISSOURI:** FRANKLIN CO.: Shaw Nature Reserve, understory shrub in old successional woodland; 3 October 2019, 38.480748ºN 90.816435ºW; *Saxton s.n.* (MO).

Literature Cited

Basinger, M.A. 1999. Notes on some naturalized woody plant species new to Illinois. Transactions of the Illinois State Academy of Science 92: 33–36.
Brock, M. 2020. New vascular plant records for Kentucky. Phytoneuron 2020-6: 1–8.
Dirr, M.A. 1998. Manual of woody landscape plants. Champaign, IL: Stipes Publishing.
Estes, D. 2010. *Viburnum bracteatum* (Adoxaceae) expanded to include *Viburnum ozarkense*. Castanea 75(2): 277-293.
Swearingen, J. and C. Bargeron. 2016. Invasive Plant Atlas of the United States. University of Georgia Center for Invasive Species and Ecosystem Health. https://www.invasiveplantatlas.org/subject.html?sub=10123. Accessed 29 November 2020.
UCPD [University of Connecticut Plant Database]. Storrs, CT: Mark H. Brand, Department of Plant Science and Landscape Architecture. http://hort.uconn.edu. Accessed 1 October 2020.
Weakley, A.S. 2015. Flora of the Southern and Mid-Atlantic States. Chapel Hill: Univ. of North Carolina Herbarium, North Carolina Botanical Garden. Working draft of May 21, 2015. http://www.herbarium.unc.edu/flora.htm. Accessed 1 October 2020.
Yatskievych, G. 2006. Steyermark's Flora of Missouri. Vol. 2. St. Louis: Missouri Botanical Garden Press.

Missouriensis, **38**: 4-7. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

A probable native extant population of *Cyperus flavicomus* in Missouri

PAUL M. MCKENZIE[1]

ABSTRACT. — *Cyperus flavicomus* is reported from a new site, in Henry County, Missouri; this is the first documented report of the species in Missouri in more than 25 years. Identifying characteristics and putative nativity of this population are discussed.

Cyperus flavicomus Mich. (White-edged Flat Sedge) is native from New York and Pennsylvania south along the Atlantic Coast, west to California, and inland to Arkansas, Kentucky, Missouri and Tennessee (Godfrey & Wooten 1979; Yatskievych 1999; Kartesz 2015). In the states where the species is tracked by Natural Heritage programs, it is ranked as S3S4 (vulnerable) in Kentucky, S2 (imperiled) in Mississippi, S1 (critically imperiled) in Missouri, and S4 (apparently secure) in Virginia (NatureServe 2020). In Missouri, the species was historically known solely from Ripley and Stoddard counties (Dunn & Knauer 1975; Yatskievych 1999).

The Stoddard County site was documented by two collections from the same moist soil unit on the Mingo National Wildlife Refuge made 20 years apart, in 1973 and 1993 (Tropicos 2020). The other historical site, in Ripley County, was apparently in a flooded agricultural field in 1994 (Tropicos 2020). The most recent collection was made by the author from a moist soil unit on the Swan Lake National Wildlife Refuge, in Chariton County in 1999 (McKenzie 2000, Tropicos 2020). Due to its occurrence on disturbed sites managed for waterfowl, and its occurrence in an agricultural field, all previous records of *Cyperus flavicomus* in Missouri were considered to be introductions (Yatskievych 1999; Ladd & Thomas 2015).

On 6 October 2020, while conducting a bird survey on the north shore of Truman Reservoir in Henry County, I discovered several culms of *Cyperus flavicomus* (Fig. 1). After exploring a few hundred meters east and west of the initial location, I estimated that there were a few hundred flowering plants along the lake shore. *Cyperus flavicomus* was scattered in a vegetated band that had become established during the receding of the shoreline (Fig. 2). The species was associated with several species typical of receding reservoir and large river shorelines including *Ammania coccinea*, *Cyperus odoratus*, *C. squarrosus*, *Echinochloa muricata* var. *muricata, Eragrostis hypnoides*, *Fimbristylis autumnalis*, *F. vahlii*, *Leptochloa panicea* ssp. *mucronata*, *L. panicoides*, *Persicaria lapathifolia*, *P. pensylvanica*, *Rorippa palustris* var. *fernaldiana,* and *Xanthium strumarium* (nomenclature and authorities follow Yatskievych [1999, 2006, 2013]).

[1] PAUL M. MCKENZIE — 2311 Grandview Circle, Columbia, MO 65203. email: paulbeckymo@mchsi.com

Voucher specimens: **U.S.A. MISSOURI:** HENRY CO.: ca. 5 mi. SSE of Clinton, and ca. 1 mi. SW of the intersection of state highway 13/52 and Henry County Rd. SW450; 38.28880°N, 93.768231°W, 6 Oct 2020, *McKenzie 2660* (ANHC, MICH, MO, VSC).

Figure 1. *Cyperus flavicomus* showing with purplish-red spikelets with white-edged scales. Photo by the author, October 2020.

Figure 2. Vegetation band along shore of Truman Reservoir containing *Cyperus flavicomus.* Photo by the author.

Along with *Cyperus bipartitus*, *C. diandrus*, *C. difformis,* and *C. fuscus*, *C. flavicomus* is striking in appearance due to the purple to reddish-purple or reddish-brown color of the spikelet scales. It is easily distinguished from *C. bipartitus, C. diandrus,* and *C. fuscus,* however, by its much taller culms and its diagnostic white margins to the spikelet scales (Fig. 1). *Cyperus difformis* is also erect and has some white edging on the spikelet scales, but the inflorescence is in compact, dense, globose, umbellate heads, and it has brown to pale brown triangular achenes that are 0.6-0.8mm long and minutely papillose. The achenes of *Cyperus flavicomus* are noticeably larger (1.2-1.6mm long), biconvex, and minutely punctate.

The associated plants listed at the Truman Reservoir site are common species that occur on river banks and receding reservoir shorelines in Missouri. There are no active waterfowl management or disturbance activities occurring at this site. While the location is part of the Missouri Department of Conservation's 15-year Management Plan for Truman Reservoir (Missouri Department of Conservation 2014), there are no listed activities to affect lake shore vegetation. Consequently, the large population of *Cyperus flavicomus* along the lake shore of Truman Reservoir should be judged to be of native occurrence despite the artificial construction of the reservoir that has been in existence since the Osage River was dammed in 1979. With the exception of the exotics like *Leptochloa panicoides,* it is likely that the vast majority of plants that currently occur along the lake shore of Truman Reservoir are the same ones that would have been found along the river historically prior to reservoir construction and alteration of riverine habitats by humans.

Kartesz (2015) listed *Cyperus flavicomus* as native in the United States, including Missouri and adjacent states that have documented records of the species. Public lands associated with Truman Reservoir encompass 58,113 acres (Missouri Department of Conservation 2014) and 958 miles of shoreline that would provide limitless opportunities for botanical surveys. Surveys for *Cyperus flavicomus* and other species of conservation concern should be undertaken in the future, especially during years when lower water levels on the reservoir provide an abundance of shoreline habitat.

LITERATURE CITED

Dunn, D.B. and D.F. Knauer. 1975. Plant introductions by waterfowl to Mingo National Wildlife Refuge, Missouri. Transactions of the Missouri Academy of Science 9:27-28.

Godfrey, R.K. and J.W. Wooten. 1979. Aquatic and Wetland Plants of the Southeastern United States. Volume 1. Monocotyledons. Athens: University of Georgia Press.

Kartesz, J.T. 2015. The Biota of North America Program (BONAP). *North American Plant Atlas.* (http://bonap.net/napa). Chapel Hill, N.C. [maps generated from Kartesz, J.T. 2015. Floristic Synthesis of North America, Version 1.0. Biota of North America Program (BONAP)].

Ladd, D. and J.R. Thomas. 2015. Ecological checklist of the Missouri flora for Floristic Quality Assessment. Phytoneuron 2015-12: 1–274.

McKenzie, P.M. 2000. Significant range extensions in Missouri for *Echinochloa walteri* (Poaceae) and *Cyperus flavicomus* (Cyperaceae). Missouriensis 21:21-25.

Missouri Department of Conservation. 2014. Harry S. Truman Reservoir Management Lands Area Plan, Fifteen Year Area Management Plan, FY 2013-2028. Jefferson City: Missouri Department of Conservation.

NatureServe. 2020. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. https://explorer.natureserve.org/. Accessed 16 October 2020.

Tropicos.org. Missouri Botanical Garden. http://www.tropicos.org/Name/9904860. Accessed 15 October 2020.

Yatskievych, G. 1999. Steyermark's Flora of Missouri. Vol. 1. Jefferson City: Missouri Department of Conservation.

Yatskievych, G. 2006. Steyermark's Flora of Missouri. Vol. 2. St. Louis: Missouri Botanical Garden Press.

Yatskievych, G. 2013. Steyermark's Flora of Missouri. Vol. 3. St. Louis: Missouri Botanical Garden Press.

Missouriensis, **38**: 8-12. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

A second, possibly native, extant population of *Cyperus setiger* in Missouri

PAUL M. MCKENZIE[1] AND CHRIS NEWBOLD[2]

ABSTRACT. — A new population of *Cyperus setiger* is reported from Callaway County. The history and putative nativity of the species in Missouri is discussed.

Cyperus setiger Torrey & Hooker (Lean Flatsedge) is native to Kansas, Oklahoma, Texas, Missouri, and New Mexico (Great Plains Flora Association 1986, Jones & Reznicek 1993, McKenzie & Jacobs 1995, Yatskievych 1999). The binomial *Cyperus setigerus* has commonly been used in the literature for this species (e.g., Great Plains Flora Association 1986, Jones & Reznicek 1993, McKenzie & Jacobs 1995, Yatskievych 1999), but this combination is invalid because of an incorrect termination of the specific epithet (https://www.tropicos.org/name/100177362).

The species has been reported from a variety of habitats, including prairie swales, clay meadows, ditches, and the shorelines of ponds and lakes (Correll & Correll 1972, Great Plains Flora Association 1986, McKenzie & Jacobs 1995, Yatskievych 1999). The only previous Missouri reports are a 1915 record from Jackson County and a 1995 record from Boone County along Interstate 70 which remains extant (McKenzie & Jacobs 1995; Yatskievych 1999).

Subsequent to the discovery of the I-70 population in Columbia, near the West Boulevard exit (McKenzie & Jacobs 1995), repeated attempts were made to transplant rhizomes of *C. setiger* from the Boone County site to multiple locations in Boone and Callaway Counties, due to concerns related to right-of-way maintenance activities by the Missouri Department of Transportation. To become established before translocating, rhizomes were initially grown in pots at Rock Post Wildflowers, a private nursery in Fulton, Missouri. Transplants of potted plants were attempted at Eagle Bluffs Conservation Area, Rockbridge State Park, Tucker Prairie, and Prairie Fork Conservation Area between 1996 and 2018 (McKenzie & Jacobs 1995; Malissa Briggler, Missouri Department of Conservation, pers. comm.). The only translocation site where *C. setiger* survived was at Prairie Fork Conservation Area (Briggler & Newbold, personal observations 2015-2020). Translocation of plants to Tucker Prairie occurred on 10 May 2002, but subsequent observations by the authors and others (Malissa Briggler, Ann Wakeman) from 2003 to date failed to document any survival or reproduction at the planting site.

[1] PAUL M. MCKENZIE — 2311 Grandview Circle, Columbia, MO 65203. email: paulbeckymo@mchsi.com
[2] CHRIS NEWBOLD — Missouri Department of Conservation, 3500 E. Gans Rd., Columbia, MO 65201. email: chris.newbold@mdc.mo.gov

On 30 July 2019, Newbold observed a large population *C. setiger* along a prairie swale near the western boundary of Tucker Prairie (Figs. 1 & 2); McKenzie vouchered the new location on 23 June 2020. The authors assumed incorrectly that this location was one of the original 2002 translocation sites. Those plantings, however, occurred near the eastern boundary of the prairie, approximately 300 m W and WNW from the 2019 discovery site (Wakeman, pers. comm.).

Figure 1. Culm of *Cyperus setiger* from near the western boundary of Tucker Prairie, 30 July 2019. Photo: Chris Newbold.

Figure 2. Large population of *Cyperus setiger* at the 2019 discovery site. Photo: Paul McKenzie.

Due to the fact that all known translocations along the eastern boundary of Tucker Prairie did not survive after repeated searches, and the 300+ meters distance between the eastern and western boundaries, we believe the 2019 discovery is possibly a native occurrence. It is unlikely that plants translocated to the eastern edge of Tucker Prairie were the source of the large population growing near the western boundary because as noted, the translocated plants did not flower or persist. Since no seeds were produced by the transplanted population, the only potential movement of *C. setiger* 300 meters to the current extant location would be from rhizomes dug up by some unknown mammal species while the translocated plants were still alive. We find this possibility unlikely. Additionally, Tucker Prairie is located ca. 17 mi. WNW of Prairie Fork CA and it is extremely unlikely this was a source population for plants discovered on Tucker Prairie.

The current extant site at Tucker Prairie is robust, with an estimated 500+ flowering culms (Fig. 2). Main associates of *Cyperus setiger* at the location are *Agrimonia parviflora, Andropogon gerardii, Baptisia alba* var. *macrophylla, Carex scoparia, Carex tribuloides, Cornus drummondii*

Eryngium yuccifolium, Eupatorium perfoliatum, Euthamia graminifolia, Glyceria striata, Helianthus grosseseratus, Helianthus mollis, Penstemon digitalis, Scirpus georgianus, Sorghastrum nutans, Vernonia baldwinii, and *Veronicastrum virginicum*. Nomenclature and authorities follow Yatskievych (1999, 2006, 2013).

The West Boulevard exit on I-70 in Columbia is directly adjacent to Cosmo-Bethel Park in the northwest corner of the city. An examination of the USGS 7.5' topographic map for the location reveals that the park was part of what was historically Cosmos Prairie. It is likely that the I-70 site was constructed through this prairie and that *C. setiger* was a native component of swales or wet depressions in the area. The discovery of a naturally occurring population of *Cyperus setiger* in a prairie swale at Tucker Prairie provides further support that such habitats were important for this sedge, as they are in some other areas of the species' extant range.

In Boone and Callaway counties, *C. setiger* is one of the earliest flowering perennial species of the genus, with inflorescences present as early as late May and continuing through mid-June. Due to its combination of stout culms, long floral bracts, reddish-purple spikelets (Figs. 1 & 3), and long rhizomes that have a noticeable sweet smell, this species is not likely to be confused with any other perennial *Cyperus* in Missouri. Although the prairies in southwest Missouri have been intensively surveyed, *Cyperus setiger* has not been discovered in this region of the state. The species should be looked for in prairie swales as well as ditches, pond edges, and low depressions.

Figure 3. Close-up of *Cyperus setiger* (*McKenzie 2659*) inflorescences showing reddish-purple spikelets and long floral bracts. Photo: Paul McKenzie.

Specimen cited: **U.S.A. MISSOURI:** CALLAWAY CO.: Tucker Prairie, south of I-70, ca. 2.5 miles west of highway 54 exit; in prairie swale near western boundary of site; 38.9519°N, 91.9984°W, McKenzie 2659 (MO).

LITERATURE CITED

Correll, D.S. and H.B. Correll. 1972. Aquatic and wetland plants of the southwestern United States. Washington, DC: U.S. Government Printing Office.

Great Plains Flora Association. 1986. Flora of the Great Plains. Lawrence: University Press of Kansas.

Jones, S.D. and A.A. Reznicek. 1993. *Cyperus setigerus* (Cyperaceae) new for New Mexico. Sida 15: 655-656.

McKenzie, P.M. and B. Jacobs. 1995. *Cyperus setigerus* and *Kyllinga gracillima* (Cyperaceae) in Missouri. Missouriensis 16(2): 24-30.

Yatskievych, G. 1999. Steyermark's Flora of Missouri. Vol. 1. Jefferson City: Missouri Department of Conservation.

Yatskievych, G. 2006. Steyermark's Flora of Missouri. Vol. 2. St. Louis: Missouri Botanical Garden Press.

Yatskievych, G. 2013. Steyermark's Flora of Missouri. Vol. 3. St. Louis: Missouri Botanical Garden Press.

Missouriensis, **38**: 13-18. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

Rhaphidostegium planifolium is a synonym of *Calliergonella lindbergii* var. *lindbergii*, and a note on the variety *americana*

JOHN J. ATWOOD[1] AND JOHN C. BRINDA[2]

ABSTRACT. — *Rhaphidostegium planifolium* Kindb. is a scarcely known species based solely on the type specimen collected in 1905 near Ironton, Missouri. Examination of a syntype revealed it to be conspecific with *Calliergonella lindbergii* var. *lindbergii* (Mitt.) Hedenäs, a widespread and common species in North America. In addition, the new combination *C. lindbergii* var. *americana* (Renauld & Cardot) J.J. Atwood & Brinda is proposed for a variety that currently has no available name in *Calliergonella* Loeske.

Rhaphidostegium planifolium Kindb. was described from a specimen collected by Nels L. T. Nelson (1862–1932) labelled as 'Trenton,' Missouri in 1905 (but see locality discussion below). Kindberg (1907) characterized this species as dioicous and having pale-red to green, subpinnate stems, and somewhat flattened branches; loosely arranged leaves in nearly two rows; curved, ovate-oblong leaves with short-acuminate to acute apices; plane, entire leaf margins; linear upper and median leaf cells; and inflated, hyaline or reddish alar cells. The genus *Rhaphidostegium* (Schimp.) De Not. is no longer available for use following lectotypification of the earlier name *Sematophyllum* Mitt. with the same type (*Hypnum demissum* Wilson).

Regardless, the described morphology of *R. planifolium*, such as the dioicous sexuality, pale-red to green stems, and loosely arranged leaves, is more indicative of species of Hypnaceae Schimp. *s.lat.* rather than any *Sematophyllum* known from North America. Brotherus (1908) mentioned *R. planifolium* alongside *H. pseudodrepanium* Müll. Hal. & Kindb. [= *Calliergonella lindbergii* var. *lindbergii* (Mitt.) Hedenäs] in his treatment of *Stereodon* (Brid.) Brid., but did not make a new combination in the genus to accommodate it. Grout's (1932) treatment of Hypnaceae *sensu stricto* did not include *R. planifolium*, and Gier (1955) cited the species in his checklist of Missouri bryophytes with a question mark after it. No mention of *R. planifolium* was made by Redfearn (1972) in *Mosses of the Interior Highlands* and Crum and Anderson (1981, p. 1208) excluded *R. planifolium* from their Hypnaceae treatment without speculating on its correct placement. More recently, *R. planifolium* did not appear in the *List of mosses of North America north of Mexico* (Anderson et al. 1990) or in the second part of the moss treatments in the *Flora of North America* (Flora of North America Editorial Committee 2014).

[1] JOHN J. ATWOOD — Missouri Botanical Garden, 4344 Shaw Boulevard, St. Louis, MO 63110. email: john.atwood@mobot.org
[2] JOHN C. BRINDA — Missouri Botanical Garden, 4344 Shaw Boulevard, St. Louis, MO 63110. email: john.brinda@mobot.org

Nils C. Kindberg's (1832–1910) personal herbarium is deposited at the Swedish Museum of Natural History (S). A search for the species in the museum's online specimen catalog (http://herbarium.nrm.se/) revealed a specimen of *R. planifolium* marked 'holotype.' However, that specimen (B178168) is currently inaccessible for study due to museum renovations. Another type specimen was located in Viktor F. Brotherus's (1849–1929) herbarium, now deposited at the Finnish Museum of Natural History at the University of Helsinki (H). Since Kindberg (1907) did not formally designate a holotype for *R. planifolium*, both the S and H specimens are syntypes. A lectotype is not selected here because these two types could not be compared and the specimen in S is likely to be much larger.

An image of the H syntype specimen and label is available at the Global Plants database (http://plants.jstor.org/stable/10.5555/al.ap.specimen.h3301454). The specimen label (Fig. 1G) has 'Missouri Mosses. 1905.' printed across the top, and 'N.L.T. Nelson' printed at the bottom. Beneath the heading is handwritten '*Rhaphidostegium planifolium* Kindb. n.sp. ined.' Attached on a separate piece of paper is a brief species description. The description matches the protologue of *R. planifolium* almost verbatim, and along with the determination, appears to be in Kindberg's handwriting, based on comparison with a sample of his handwriting in the archives of the Missouri Botanical Garden (MO). The remaining information on the label, 'Ironton, on root of sycamore tree, Dec. 27, [No.] 1056' is in Nelson's handwriting, as confirmed by similar specimen labels at MO. Kindberg's use of the locality 'Trenton' in the type citation is a misreading of Nelson's handwriting for the city of 'Ironton.' Although Trenton is a city in northern Missouri more than 300 road miles northwest of Ironton, two similarly numbered bryophyte specimens at MO, also collected by Nelson near Ironton on the same date (27 December 1905), corroborate Ironton as the correct locality.

Examination of the type material from H found the glossy, yellowish plants to be about 1.5–2.0 cm long with somewhat complanate-foliate shoots and a few irregularly spaced, short branches. The loosely arranged leaves are mostly erect-spreading, but become falcate-secund near the stem and branch tips. The stems have short, broadly triangular scale leaves that are approximately 100 × 85–100 µm and axillary hairs composed of a single quadrate cell terminated by 2–3 elongated cells. The dissected shoots show a distinct stem hyalodermis, with some of the enlarged stem cells attached to the leaf insertion after removal of the leaves. The concave, mostly oblong-lanceolate stem leaves (Fig. 1A–B) are 1.2–1.6 × 0.4–0.7 mm, and have falcate-secund, broadly acuminate apices, as well as plane and entire margins, slightly decurrent bases and short, double costae that extend about 1/5 the leaf length. The apical and median cells are linear-flexuose, 40–65 × 2.5–4 µm, with firm walls, while the basal cells are linear-rectangular, 22–34 × 4–6 µm, and sometime porous-pitted. The alar region (Fig. 1C–F) consists of 1–3 rows of quadrate cells, 10–16 × 8–10 µm, with thick walls positioned above 2–3 rows of differentiated, hyaline, oblong to rectangular cells, 20–36 × 10–16 µm, with thin walls. These morphological characters are diagnostic for *C. lindbergii* var. *lindbergii* (Mitt.) Hedenäs, a widespread and common species in Missouri and throughout North America (Schofield 2014, as *H. lindbergii* Mitt.).

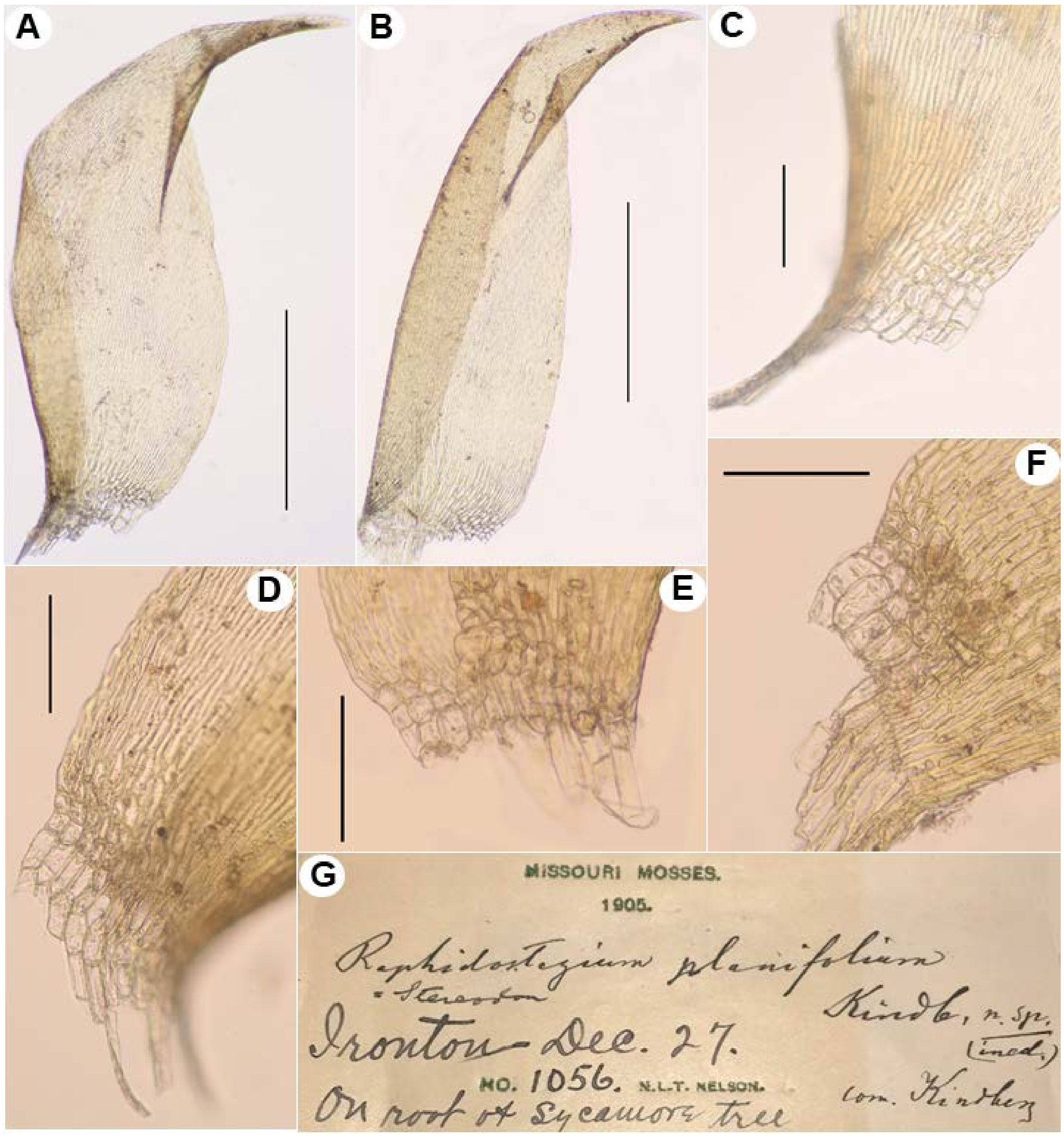


Figure 1. *Rhaphidostegium planifolium* Kindb. **A–B**. Stem leaves. **C–F**. Alar cells. **G**. Specimen label. Scale bars: 0.5 mm for A–B; 50 µm for C–F. All from syntype (*Nelson 1056*, H-0465005).

Although a direct comparison was not made between the type material of both *R. planifolium* and *C. lindbergii*, the specimen of *R. planifolium* compares well with numerous non-type specimens of *C. lindbergii* var. *lindbergii* deposited at MO. Additionally, the *R. planifolium* specimen matches several illustrations of *C. lindbergii* var. *lindbergii* from North American manuals (Allen 2014: Fig. 183, Breen 1963: Pl. 84, Crum 1976: Figs. 923–924, Crum and Anderson 1981: Fig. 579A–H, Grout 1965: Fig. 188 as *H. patientiae*, Jennings 1951: Pl. 50 as *S.*

patientiae, Welch 1957: Fig. 194 as *H. arcuatum*). Therefore, the formal synonymy of *R. planifolium* with *C. lindbergii* var. *lindbergii* is given below.

Calliergonella lindbergii var. *lindbergii* (Mitt.) Hedenäs, Lindbergia 16:167. 1990 [1992]; ≡*Hypnum lindbergii* Mitt., J. Bot. 2: 123. 1864, new name for *H.* (*Drepanium*) *arcuatum* Lindb. Öfvers. Förh. Kongl. Svenska Vetensk.-Akad. 18: 371. 1861 (1862), illegitimate homonym, not *H. arcuatum* Hedw., Sp. Musc. Frond. 245. 1801. ≡*H. curvifolium* subsp. *lindbergii* (Mitt.) Kindb., Canad. Rec. Sci. 6: 74. 1894; ≡*Stereodon lindbergii* (Mitt.) Braithw., Brit. Moss Fl. 3: 157. 1902; ≡*Drepanium lindbergii* (Mitt.) G. Roth, Eur. Laubm. 2: 628. 1904; ≡*Breidleria lindbergii* (Mitt.) W. Schultze-Motel, Nova Hedwigia 5: 88. 1963. **Type Citation:** Bryac. Scand. exsicc. fasc. IX, N:o 270. **Type Specimens:** 270. *Hypnum arcuatum* Lindb. In terra argillaceae circa Holmiam. leg. S. O. Lindberg, in R. Hartman: Bryac. Scand. exsicc. (lectotype, S (ac:B213052, not seen), selected by Hedenäs (1992, p. 167); isolectotype: BM (bc:BM000851575, not seen).

= *Rhaphidostegium planifolium* Kindb., Rev. Bryol. 34: 25. 1907. **Type Citation:** [U.S.A.] Missouri on root of sycamore tree near Trenton, 1905, *N. L. T. Nelson s.n.* **Type Specimens:** U.S.A., Missouri, Ironton, on root of sycamore tree, 27-Dec-1905, *N. L. T. Nelson 1056*. (syntypes: H-BR! (ac:0465005/bc:H3301454); S (ac:B178168, not seen), *syn. nov.*

In Missouri, *C. lindbergii* var. *lindbergii* is morphologically similar to *C. lindbergii* var. *americana* (Renauld & Cardot) J.J. Atwood & Brinda **comb. nov.** (basionym: *Hypnum arcuatum* var. *americanum* Renauld & Cardot, in Delamare et al., Ann. Soc. Bot. Lyon 15: 120. 1887 [1888]). As compared to the typical variety, the var. *americana* has straight to weakly falcate leaves; shorter, blunt to broadly acute apices with denticulate margins; interior alar cells and cells across the leaf insertion that tend to have a reddish-orange coloration; and slightly narrower and more acuminate scale leaves (Fig. 2; also Crum and Anderson 1981: Fig. 580 as *H. lindbergii* var. *americanum*).

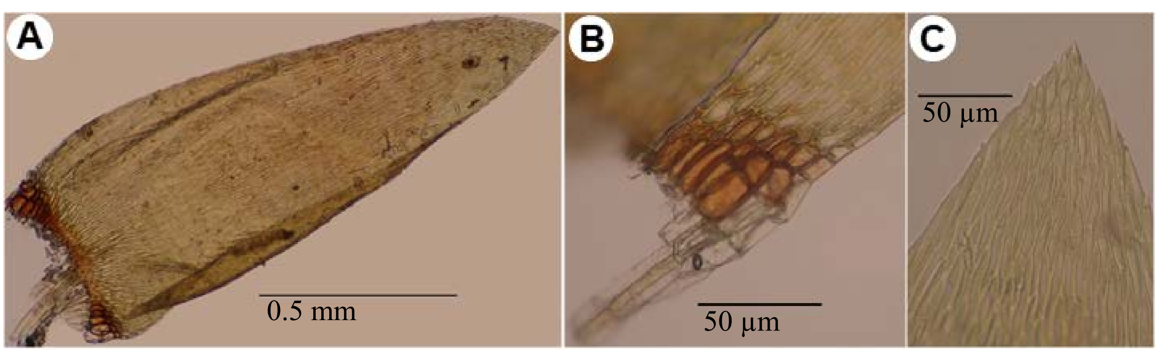


Figure 2. *Calliergonella lindbergii* var. *americana* (Renauld & Cardot) J.J. Atwood & Brinda. **A**. Stem leaf. **B**. Alar cells. **C**. Leaf apex. All from *Holmberg 2988* (MO-6166351).

Schofield (2006) provisionally noted that the var. *americana* (as *H. lindbergii* var. *americanum*) might be elevated to species rank after a more thorough study of its morphology is undertaken. Presently, the variety ranges from North Carolina, south to Florida, and west to Missouri and Texas. We note in passing that Whitehouse's (1954) earlier combination for var. *americana* under *Hypnum lindbergii* is invalid. She cites "Bot. Gaz. 14: 99. 1889" which cannot be corrected because in that work Renauld & Cardot give a clear reference to the original place of publication as "Florule de l'ile Miquelon, 56" (Art. 41.8, Ex. 25; Turland et al. 2018).

The numerous new North American taxa described by Kindberg have been the subject of much criticism by North American bryologists, due to his lack of experience with the flora (Steere 1977, Steere and Crum 1977). In addition to *R. planifolium*, Kindberg described 21 other North American taxa from specimens either collected or communicated by Nelson (Steere and Crum 1977). Of these, *Ditrichum rhynchostegium* Kindb. is the only currently accepted species that is reasonably well-known (Flora of North America Editorial Committee 2007). Two Colorado species (*Bryum coloradense* Kindb. and *Pohlia excelsa* Kindb.) remain insufficiently known because of the lack of new information about them since their original publication (Crosby et al. 1999). The remaining eighteen taxa have since been combined at a subspecific rank (Tropicos.org), or are now synonyms of other taxa. Now added to that list is *R. planifolium*, a new synonym of *C. lindbergii* var. *lindbergii*.

ACKNOWLEDGMENTS

The curators and staff at the Finnish Museum of Natural History at the University of Helsinki are thanked for locating and loaning the type specimen of *Rhaphidostegium planifolium*.

LITERATURE CITED

Allen, B.H. 2014. Maine mosses: Drummondiaceae – Polytrichaceae. Memoirs of the New York Botanical Garden 111: 1–607.

Anderson, L.E., H.A. Crum, and W.R. Buck. 1990. List of the mosses of North America north of Mexico. The Bryologist 93: 448–499.

Breen, R.S. 1963. Mosses of Florida. Gainsville: University Presses of Florida.

Brotherus, V.F. 1908. *Stereodon*. In: A. Engler and K. Prantl, eds. Die Natürlichen Pflanzenfamilien. 1(3): 1067–1074. Leipzig: Wilhelm Engelmann.

Crosby, M.R., R.E. Magill, B.H. Allen, and S. He. 1999. A checklist of the mosses. St. Louis: Missouri Botanical Garden, published by the authors.

Crum, H.A. 1976. Mosses of the Great Lakes Forest, second edition. Contributions from the University of Michigan Herbarium.

Crum, H.A. and L.E. Anderson. 1981. Mosses of Eastern North America. 2. New York: Columbia University Press.

Delamare, E., F. Renauld, and J. Cardot. 1887 [1888]. Florule de l'ile Miquelon (Amérique du Nord). Énumération systématique avec notes descriptive des phanérogames, cryptogames vasculaires, mousses, sphaignes, hépatiques et lichens. Annales de la Société Botanique de Lyon 15: 65–143.

Flora of North America Editorial Committee. 2007. Flora of North America North of Mexico 27: Bryophytes: Mosses. New York: Oxford University Press.

Flora of North America Editorial Committee. 2014. Flora of North America North of Mexico 28: Bryophyta, part 2. New York: Oxford University Press.

Gier, L.J. 1955. Missouri Bryophytes. Transactions of the Kansas Academy of Science 58: 24–49.

Grout, A.J. 1932. Moss Flora of North America North of Mexico. III, Part 3. Newfane, VT: published by the author.

Grout, A.J. 1965. Mosses with a Hand-Lens and Microscope. Ashton, MD: Eric Lundberg.

Hedenäs, L. 1990 (1992). Taxonomic and nomenclatural notes on the genera *Calliergonella* and *Breidleria*. Lindbergia 16: 161–168.

Jennings, O.E. 1951. A manual of the mosses of western Pennsylvania and adjacent regions. Second edition. American Midland Naturalist Monograph 6.

Kindberg, N. 1907. New or less known Bryineæ from N. America. Revue Bryologique 34: 25–29.

Redfearn Jr., P.L. 1972. Mosses of the Interior Highlands of North America. Annals of the Missouri Botanical Garden 59: 1–103.

Schofield, W.B. 2006. *Hypnum*. In: Flora of North America Editorial Committee (eds.). Flora of North America North of Mexico, 28 (Bryophyta, part 2). St. Louis: Missouri botanical Garden provisional publication, 6 April 2006. [http://www.mobot.org/plantscience/bfna/V2/HypnHypnum.htm]

Schofield, W.B. 2014. *Hypnum*. Pages 532–549. In: Flora of North America Editorial Committee (eds.). Flora of North America North of Mexico 28, Bryophyta, part 2. New York: Oxford University Press.

Steere, W.C. 1977 [1978]. North American muscology and muscologists — a brief history. The Botanical Review (Lancaster) 43: 285–343.

Steere, W.C., and H.A. Crum. 1977. New combinations and new taxa of mosses proposed by Nils Conrad Kindberg. Memoirs of the New York Botanical Garden 28: 1–220.

Tropicos.org. Missouri Botanical Garden. http://www.tropicos.org. Accessed 5 February 2020.

Turland, N.J., J.H. Wiersema, F.R. Barrie, W. Greuter, D.L. Hawksworth, P.S. Herendeen, S. Knapp, W.-H. Kusber, D.-Z. Li, K. Marhold, T.W. May, J. McNeill, A.M. Monro, J. Prado, M.J. Price, and G.F. Smith. 2018. International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Vegetabile 159: 1–254.

Welch, W.H. 1957. Mosses of Indiana. 478 pp. Bookwalter Co., Indianapolis.

Whitehouse, E. 1954. *Hypnum lindbergii* Mitt. var. *americanum* (Ren. & Card.) Whitehouse, comb. nov. Field & Laboratory 22: 30.

Missouriensis, **38**: 19-22. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

A third record of *Puccinellia distans* for Missouri with notes on its identification and distribution

PAUL M. MCKENZIE[1]

ABSTRACT. — Information is provided for a third Missouri collection of *Puccinellia distans* from St. Louis County, representing the first report from the state since 1997. Distinguishing features separating this species from similar taxa are provided.

The genus *Puccinellia* (alkali grass) consists of ca. 120 species that are most prevalent in the middle and high latitudes of the Northern Hemisphere (Davis 2007). There are 21 species in North America north of Mexico, including three introduced species (Davis 2007). Most species are halophytic and adapted to soils with high salinity and/or pH. Species native to Europe and Asia occur in North America mostly as waifs in areas where salt is added for snow and ice during the winter months (Yatskievych 1999).

Puccinellia distans (Jacq.) Parl. (weeping alkali grass or European alkali grass) occurs throughout North America, from Alaska to Newfoundland and south to Virginia and west to California (see http://bonap.net/MapGallery/County/Puccinellia_distans.png). Previous to this report, there were only two records of this species for Missouri, both also from St. Louis County – a Muehlenbach collection from along a railroad right-of-way in St. Louis City County collected on 23 May 1954 (*Muehlenbach 70*) (http://legacy.tropicos.org/Specimen/3528760), and a collection made by the author and Brad Jacobs along a roadside on the University of Missouri, St. Louis campus, St. Louis County, on 4 June 1997 (*McKenzie and Jacobs 1770*) (http://legacy.tropicos.org/Specimen/2598922). Both specimens are archived at MO.

On 29 May 2020, while conducting a bird survey at Little Creve Coeur Marsh in St. Louis County, Missouri, I noticed a large population of *Puccinellia distans* on bare soil in the southernmost River Valley Drive parking lot and along a roadside ditch just west of the entrance (Fig. 1). I collected multiple specimens for distribution in various herbaria. The only associate noted at the site was *Anthemis cotula*.

Specimen cited: **U.S.A. MISSOURI:** ST. LOUIS CO.: Parking lot of Little Creve Coeur Marsh and adjacent roadside of River Valley Dr., ca. 0.74 mi. WNW of the intersection of Waterworks Rd. and Maryland Heights Expressway, 38.694949 N, 90.512045 W, 29 May 2020, *McKenzie 2658* (MO).

[1] PAUL M. MCKENZIE — 2311 Grandview Circle, Columbia, MO 65203. email: paulbeckymo@mchsi.com

Puccinellia distans is a member of Tribe Poeae, which includes eight genera in Missouri (Yatskievych 1999). The genus *Puccinellia* Parl. most closely resembles members of the genus *Poa* with its open leaf sheaths, membraneous ligule, paniculate inflorescences with ascending or reflexed branches, and multiple-floreted spikelets with glumes much shorter than the rest of the spikelet. *Puccinellia distans* differs from all *Poa* species other than *Poa annua* in lacking cobwebby hairs at the base of the lemmas. The related and *Torreyochloa pallida* (Torr.) G.L. Church var. *pallida* also lack hairs on the lemmas, but is a conservative native aquatic species that roots at the lower nodes, with lemmas that are only faintly 5-nerved.

Figure 1. Population of *Puccinellia distans* at Little Creve Coeur Marsh parking lot, St. Louis County, 29 May 2020. Photo by the author.

The strongly spreading and reflexed downward appearance of some panicle branches of *Puccinellia distans* (Fig. 2) most closely resembles *Poa sylvestris* A. Gray, but that species usually occurs in shaded, rich, mesic upland forests with soils having a much lower pH. *Poa sylvestris* also differs from *Puccinellia distans* in having lemmas that are hairy on the keel and lateral nerves, and with cobwebby hairs at the base. With *Puccinellia distans*, the lemmas lack cobwebby hairs at the base and are usually glabrous or with only a few short hairs at the base.

Figure 2. Specimen of *Puccinellia distans* (*McKenzie 2658*) showing reflexed, downward-pointing panicle branches. Little Creve Coeur Marsh parking lot, St. Louis County, 29 May 2020. Photo by the author.

Due to its adaptation to disturbed, saline or alkaline soils, *Puccinellia distans* is not likely to have a significant impact on Missouri's native flora. It has been shown to be useful in establishing vegetation on bare soils with a high pH and may have potential as a turf grass or on the fairways of golf courses (Mohlenbrock 1992, Cao & Sturtevant 2020).

Because of its similarity to *Poa sylvestris*, it is likely that this species is easily overlooked. As predicted by Yatskievych (1999), it is probable that additional records of this species will be found in urban or industrial areas where winter deicing salt is applied to roads. In Missouri, searches for the species should occur around the last week of May through the third week of June, especially in urban areas where salt was applied to highway rights-of-way or bare soil the previous winter.

LITERATURE CITED

Cao, L., and R. Sturtevant. 2020. *Puccinellia distans* (Jacq.) Parl. U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, FL, and NOAA Great Lakes Aquatic Nonindigenous Species Information System, Ann Arbor, MI, https://nas.er.usgs.gov/queries/GreatLakes/FactSheet.aspx?SpeciesID=2689. Accessed 6 September 2020.

Davis, J.I. 2007. *Puccinellia*. Pages 459-464 *In:* Flora of North America Editorial Committee, eds. Flora of North America North of Mexico. Volume 24: Magnoliophyta: Commelinidae (in part): Poaceae, part 1. NY: Oxford University Press.

Mohlenbrock, R.H. 1992. Western Wetland Flora Field Office Guide to Plant Species. Portland, OR: USDA Soil Conservation Service West National Technical Center.

Yatskievych, G. 1999. Steyermark's Flora of Missouri. Vol. 1. Jefferson City: Missouri Department of Conservation.

Missouriensis, **38**: 23-28. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

Caloplaca cinnabarina – a new candidate for Missouri's most colorful lichen

CLAIRE M. CIAFRÉ[1], DOUGLAS LADD[2], AND ANDREW BRAUN[3]

ABSTRACT. — The colorful crustose lichen *Caloplaca cinnabarina* is reported new to Missouri and Kentucky, with a discussion of its Midwestern distribution, historical problems surrounding the application of the name in North America, and several new reports for the Great Plains and Midwest. The species typically occurs on massive siliceous rock exposures and is characterized by striking orange-red areolate thalli with immersed apothecia.

Although most lichens typically range from black and brown to various shades of grays, blue-grays, and greens, some lichens are far more spectacularly hued in yellows, oranges, and reds. One of the larger groups of brightly colored lichens occurs within the genus *Caloplaca* s.l. (Teloschistaceae) — a famously difficult and poorly understood genus with more than 500 known species (Kirk et al. 2008).

Many *Caloplaca* species have prominent yellow, orange, or reddish coloration. In Missouri, where at least 24 species have been documented (Ladd, unpublished data), 17 have some features with prominent yellow or orange coloration. These colors are largely due to the presence of various polycyclic aromatic hydrocarbons called anthraquinones, notably parietin ($C_{16}H_{12}O_5$), which occurs in lichens, non-lichenized fungi, and some vascular plants including species of *Rhamnus, Rheum,* and *Rumex* (Fernández-Marín et al. 2018). In laboratory studies, the pigment protects against damaging effects of UV-B radiation (Solhaug & Gauslaa 1996) and blue light (Gauslaa & Ustvedt 2003); it also has antibacterial and antifungal properties (Basile et al. 2015).

A visually spectacular species of *Caloplaca* in North America is *Caloplaca cinnabarina* (Ach.) Zahlbr. This striking crustose lichen occurs on massive siliceous rock exposures, usually in well-drained microhabitats, such as on vertical faces of bluffs, outcrops, and large boulders. The thallus is a vivid reddish orange and the immersed, disk-like apothecia are similarly colored but slightly redder. This species often occurs in populations with multiple adjacent thalli merging to create patches of bright orange-red several centimeters across which are visible from

[1] CLAIRE M. CIAFRÉ — NatureCITE, 1530 E. Farm Road 96, Springfield, MO 65803. email: claire.ciafre@gmail.com
[2] DOUGLAS LADD — Missouri Botanical Garden, 4344 Shaw Blvd., St. Louis, MO 63144. email: dladd@tnc.org
[3] ANDREW BRAUN — NatureCITE, 1530 E. Farm Road 96, Springfield, MO 65803. email: apbraun1s@gmail.com

considerable distances (Fig. 1). *Caloplaca* is in the process of being divided into numerous smaller genera based on recent molecular data (Arup et al. 2013), but the status of *C. cinnabarina* remains uncertain. *Caloplaca subsoluta* and related taxa have been segregated into the newly described genus *Squamulea* Arup, while some other species closely resembling *C. cinnabarina* have been placed in the genus *Polycaulonia*.

Caloplaca cinnabarina has been erroneously attributed to Missouri by several sources (including reports summarized in Ladd [1996], most of which are referable to *C. subsoluta* [=*Squamulea subsoluta*]). This is part of a long historical pattern throughout North America of misidentifying saxicolous species of *Caloplaca* with orange thalli (particularly those now segregated into the genus *Squamulea*) as *C. cinnabarina*, as discussed by Wetmore and Kärnefelt (1999). They restrict the North American range of *C. cinnabarina* to the southern United States, Mexico, and the Caribbean; within the United States they report it from 14 states including four counties in the Ouachita region of Arkansas and three poorly documented 19th century collections from Illinois, Pennsylvania, and Tennessee without further locality data (Wetmore & Kärnefelt 1999). Subsequent field work in the Ozark region has resulted in three new Arkansas localities (cited below) but despite intensive lichen field work in suitable Missouri habitats, particularly in the St. Francois mountains region of the Ozarks, the species was not known from Missouri.

In July 2015, the senior author discovered a small population of *C. cinnabarina* (Fig. 1 A & 1 B) in an extensive and remote igneous glade system on Proffit Mountain in Reynolds County, Missouri. Here, despite abundant available substrate, it was restricted to several small patches (10-15 total) in one area of the glade at an approximate elevation of 1310 feet on a steep west-facing slope. Individuals grew primarily on the south and west sides of large, rhyolitic boulders and outcrops. Associates growing in the same habitat included *Acarospora fuscata, Dimelaena oreina, Lecanora oreinoides, Rhizoplaca subdiscrepans,* and *Xanthoparmelia viriduloumbrina* (nomenclature and authorities for lichen names follow Esslinger 2019). Interestingly, Paul McKenzie later independently found and photographed this population in 2016.

Subsequent field work by Braun in September 2018 revealed another Missouri population (Fig. 1 C) about 7.8 air miles northwest of the Reynolds County location, on Bell Mountain in neighboring Iron County. This population appears to be limited to a few rhyolitic boulders on a west-southwest facing igneous glade at an approximate elevation of 1200 feet. Both Missouri populations occur on boulders and outcrops in igneous glades in the St. Francois Knobs and Basins region of Missouri. While many igneous glades exhibit impacts of past grazing activities (Nelson 2010), both of these glades seem less affected and retain deep, intact soils and rich vascular vegetation exhibiting strong floristic affinities with tallgrass prairies.

Caloplaca cinnabarina is readily distinguished in the field by its thin, continuous, bright orange-red areolate thallus that is closely adnate to the underlying rock substrate. The marginal areoles are often elongate and appear sub-effigurate, with sharply defined margins and no marginal thinning or evident prothallus (Fig. 1B & 1C). Older portions of the thalli in the Missouri populations have abundant, mostly immersed, apothecia to 0.5 mm broad; these are darker orange-red than the thallus, with an evident thalline margin.

Locally, *C. cinnabarina* is most likely to be confused with *C. subsoluta,* which is common throughout Missouri, occurring on all types of rocks. The thallus of *C. subsoluta* is more yellowish orange and dispersed-areolate, and the margins of the areoles are often not tightly attached to the underlying rock and are often undulate or irregularly indented (Fig. 2). The apothecia of *C. subsoluta* are sessile but not immersed in the thallus as in *C. cinnabarina*. Another lichen of uncertain identity with which *C. cinnabarina* can be confused occurs on siliceous and calcareous rocks in Ozark glades and has been reported erroneously as *C. squamosa* (e.g. Ladd 1996). This taxon has well-developed, deep orange, thicker, squamulose thallus that can be pried from the substrate[4].

When the University of Missouri divested its herbarium in 2016, we identified a Kentucky specimen of *C. cinnabarina* while reviewing undetermined specimens during transfer of the university's lichens to the University of Kansas (KANU). This specimen, collected from Natural Bridge State Resort Park in Powell County, Kentucky, presumably occurred on Rockcastle Sandstone, a Pennsylvanian age conglomerate sandstone which forms the cliffs in the area (McFarlan 1954). It is unknown whether other populations occur in the state, although sandstone cliffs are abundant in southeastern Kentucky, particularly on the Cumberland Plateau and its escarpments.

It is possible that further exploration in Missouri will find more locations for *C. cinnabarina*, but given its charismatic appearance and the intensity of lichen survey in the Missouri Ozarks, this showy lichen is likely rare in Missouri. Despite abundant occurrences of apparently suitable habitat, the limited extent of known populations suggests some type of ecological constraint. This may result from climate factors near the northern edge of the known range for the species, or the extreme environmental conditions that characterize igneous glades. This species appears to be more common at southern latitudes in North America as well as in Africa, Asia, and Australia (Wetmore & Kärnefelt 1999). There may be few suitable habitats available locally for *C. cinnabarina,* minimizing the probability of successful colonization even at sites with apparently abundant available substrate. This species shows a strong preference for being elevated above the ground on well-drained, often vertical surfaces, such as boulders or faces of bluffs and outcrops rather than on bedrock flats. This preference is likely to limit the potential for many of Missouri's abundant sandstone glades to harbor this species, although it occurs on massive sandstone bluffs in the southern Ozarks.

[4] McCune (2017) mentions Missouri material of this taxon was "tentatively" identified as *C. inconnexa* by W.A. Weber.

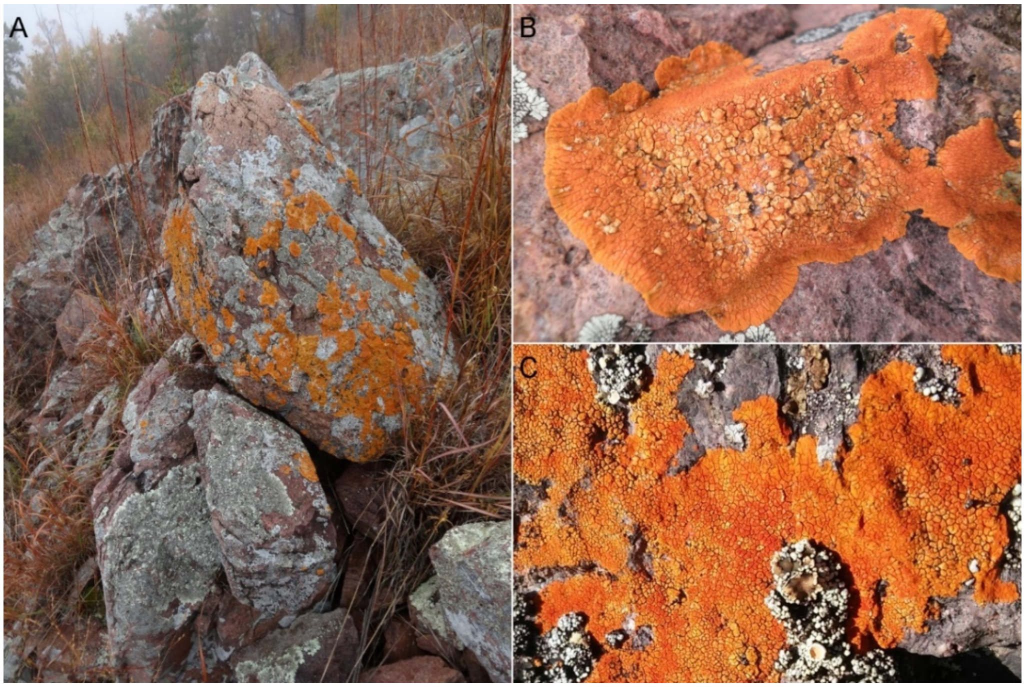


Figure 1. *Caloplaca cinnabarina* **A**: original discovery on rhyolitic boulders in a glade on Proffit Mountain, Reynolds Co.; **B**: close-up of thallus showing contiguous areoles and elongated, sub-effigurate marginal aeroles; **C**: thalli from Bell Mountain population, Iron Co. Photos A & B: Claire Ciafré; photo C: Andrew Braun.

Figure 2. *Caloplaca* (=*Squamulea*) *subsoluta* from exposed sandstone; scale intervals are 1 mm. (*Ladd 18506*). Photo: Douglas Ladd.

Many potential habitats are relatively inaccessible due to difficult terrain, limited roads, and lack of access to private land. Igneous glades are locally abundant within an approximately 5,000 square mile region of the southeastern Missouri Ozarks (Nelson 2010). In conjunction with extensive sandstone exposures, and more limited but similar chert systems present in the state, there are opportunities for more populations to occur. Given the remote location of existing populations on protected public lands, additional information is required before assessments of rarity and need for state level protected status can be completed.

Missouri specimens examined: **U.S.A. MISSOURI:** IRON CO.: Bell Mountain Wilderness Area, on southern face of large rhyolitic boulder in open, degraded glade, 2018, *Braun 20180909.01* (hb. Ladd; photo voucher). REYNOLDS CO.: Proffit Mountain, Ketcherside Conservation Area, on exposed well-drained rhyolitic edges and face in extensive igneous glade on south-facing slope, 2017, 37.563689, -90.787471, *Ladd 34025 with C. Ciafré & A. Braun* (hb. Ladd);

Other previously unreported specimens examined: **U.S.A. ARKANSAS**: CONWAY CO.: on sandstone; 1954, *Hale 3364* (US); NEWTON CO.: exposed summit of sandstone bluff; 2005, *Ladd 27119* (hb. Ladd). POPE CO.: Ozark National Forest, exposed summit of sandstone bluff; 2002, *Ladd 24306* (hb. Ladd). STONE CO.: Ozark National Forest, on exposed edge of massive sandstone bluff; 2005, *Ladd 27206* (hb. Ladd). **KENTUCKY**: POWELL CO.: Natural Bridge State Park; 1967, *Cameron s.n.* (KANU). **OKLAHOMA**: LE FLORE CO.: Heavener Runestone State Park, on vertical sandstone face; 1996, *Ladd 19827 with M. Ladd* (hb. Ladd). Wister State Park, on exposed face of south-facing sandstone bluff; 1996, *Ladd 19861 with M. Ladd* (hb. Ladd).

LITERATURE CITED

Arup, U., U. Søchting, and P. Frödén. 2013. A new taxonomy of the family Teloschistaceae. Nordic Journal of Botany 31: 16-83.

Basile, A., D. Rigano, S. Loppi, A. Di Santi, A. Nebbioso, S. Sorbo, B. Conte, L. Paoli, F. De Ruberto, A.M. Molinari, L. Altucci, and P. Bontempo. 2015. Antiproliferative, antibacterial and antifungal activity of the lichen *Xanthoria parietina* and its secondary metabolite parietin. International Journal of Molecular Science 16(4): 7861-7865.

Esslinger, T.L. 2019. A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada, version 23. Opuscula Philolichenum 18: 102-378.

Fernández-Marín, B., U. Artetxe, J. Becerril, J. Martínez-Abaigar, E. Núñez-Olivera, and J. García-Plazaola. 2018. Can parietin transfer energy radiatively to photosynthetic pigments? Molecules 23(7): 1741 (8 pp.).

Gauslaa, Y. and E.M. Ustvedt. 2003. Is parietin a UV-B or a blue-light screening pigment in the lichen *Xanthoria parietina*? Photochemical & Photobiological Sciences 4: 424-432.

Kirk, P.M., P.F. Cannon, D.W. Minter and J.A. Stalpers. 2008. Dictionary of the fungi, 10th ed. Wallingford, UK: CAB International. 784 pp.

Ladd, D. 1996. Checklist and bibliography of Missouri lichens. Jefferson City: Missouri Department of Conservation Natural History Series No. 4: 92 pp.

McCune, B. 2017. Microlichens of the Pacific Northwest. Vol. 2: keys to the species. Corvallis, OR: Wild Blueberry Media.

McFarlan, A.C. 1954. Geology of the Natural Bridge State Park Area. Kentucky Geological Survey Special Publication no. 4. https://kgs.uky.edu/kgsweb/olops/pub/kgs/KGS11SP4.pdf

Nelson, P.W. 2010. The terrestrial natural communities of Missouri. Missouri Natural Areas Committee, Jefferson City, Missouri, USA.

Solhaug, K.A. and Y. Gauslaa. 1996. Parietin, a photoprotective secondary product of the lichen *Xanthoria parietina*. Oecologia 108 (3): 412–418.

Wetmore, C.M. and E.I. Kärnefelt. 1999. What is *Caloplaca cinnabarina*? Bryologist 102(4): 683-691.

Missouriensis, **38**: 29-50. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

Desmodium glabellum and *D. perplexum* (Fabaceae): a morphological reevaluation

JUSTIN R. THOMAS[1]

ABSTRACT. — Traditional morphological distinctions between *Desmodium glabellum* and *D. perplexum* are investigated. The ambiguity of traditional concepts is verified. Alternative distinctions based on less variable character states are proposed and tested as a new prescription for taxonomic concepts and as a model for accommodating ambiguities in organismal biology.

INTRODUCTION

Conceptualizing morphological, genetic, and ecological distinctions among species within diverse genera of organisms is notoriously difficult. The process lends itself to error largely from overlapping or cryptic character states, biased weighting of characters states, and the degree to which the interpreter has experienced the organisms in situ as expressions of the natural world. In short, cryptic taxa are not only difficult to physically discern, they are also conceptually difficult to grasp. It is challenging to mentally untangle the technical complexity of such entities, where doing so requires an intuitive familiarity beyond simple observation. This familiarity, dedication to practice, and openness to detail endows one with an optimistic intuition regarding the myriad ways nature can express itself that otherwise cannot be fully explained to the uninitiated. Polanyi's Paradox states that it is possible to understand real truths and phenomena that can only be explained through heuristics. Such is nearly the case here.

Desmodium Desv. are trifoliate herbaceous perennials that produce articulated loments (specialized legumes that separate between their single-seeded segments). The segments of loments are called articles. The articles are a notorious nuisance to late summer explorers who fall victim to their ingenious dispersal mechanism (via their uncinate puberulence) and who then spend hours picking and scraping them off their clothes.

While contemporary interpretations of the taxa within North America's *Desmodium* are mostly stable, there are problematic complexes. To field-focused practitioners, the "*Desmodium paniculatum* complex" has remained one of the more persistently confounding. This complex includes such familiar names as *D. paniculatum*, *D. glabellum*, *D. perplexum*, *D. dillenii*, and *D. fernaldii*. All of these names except *D. dillenii* are currently in use. Contemporary practitioners consider *D. paniculatum* and its closely allied *D. fernaldii* to be distinct from *D. glabellum* and *D. perplexum*, if not from each other. The real confusion in the complex has largely emanated from

[1] JUSTIN R. THOMAS — NatureCITE, 1530 E. Farm Road 96, Springfield, MO 65803. email: justin.thomas@naturecite.org

the relationship of *D. glabellum* and *D. perplexum*, even when they were collectively called *D. dillenii*. Schubert (1950) invalidated the name *D. dillenii* as a *nomen confusum* and split its interpretation into *D. glabellum* and *D. perplexum*. There is a history of gradual resolution from only *D. paniculatum*, to the recognition of both *D. paniculatum* and *D. dillenii*, to the revelation of *D. paniculatum* and *D. fernaldii* differing from *D. glabellum* and *D. perplexum* (the latter two comprising the former *D. dillenii*). This process involved intermediate designation of varietal statuses along the way, just as there are currently accepted varieties within our continually evolving concepts of *D. paniculatum*.

Isely (1983) thoroughly and concisely summarized the history of concepts around this complex. His account is well worth reading, not only for the content but also as an example of a structure and philosophy that is scarcely seen in contemporary published material. Since Isely's work, little has changed at the species scale. As outlined by Isely, the works of Schubert (1950) and Wilbur (1963) hypothesized that *D. glabellum* has densely uncinate-puberulent internodes which can also be sparsely pilose, and *D. perplexum* has moderately to densely pilose internodes that either lack uncinate-puberulent vestiture (Wilbur 1963) or also have uncinate-puberulent hairs (Schubert 1950). Isely tested these hypotheses by reviewing each author's annotated material and applying their concepts to 650 specimens.

Finding little satisfaction in the complex, especially between *D. glabellum* and *D. perplexum*, Isely remarked:

> "I think it is fairly clear that all of us who have studied this complex are somewhat groping in the dark."

Based on a graph provided in his analysis, roughly half of the non-*D. paniculatum* specimens he examined were categorized as "ambiguous." He provided a synoptic key that included a code to what he interpreted as "groups" of morphologies within the complex, and suggested that in lieu of satisfaction, of which he found little, all three taxa could be defaulted to *D. paniculatum sensu lato*. Finding no differences in other morphological characters or habitat preferences, his key, like those of Schubert and Wilbur, is largely based on stem pubescence type and density, with the expressed caveat that it does not work well except in segregating most specimens of *D. paniculatum sensu stricto*.

Isely hypothesized about the sources of confusion and reiterated that, despite not finding consistent distinguishing characters for *D. glabellum* and *D. perplexum*, he, Schubert, and Wilbur agreed that they seem to be real entities. Isely provided what he called "the conventional apologia" that more detailed work is needed, including greater field familiarity with the taxa. One could summarize Isely's findings as: while *D. glabellum* and *D. perplexum* seem to be valid species distinct from *D. paniculatum*, investigations have failed to elucidate a consistent set of characters to effectively differentiate them. Variations of Isely's key and, if only by association, the keys of Schubert and Wilbur, are still used in contemporary regional floras.

Missouriensis, **38**: 29-50. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

UNTANGLING THE PROBLEM

For years, botanists in the field have struggled with Isely's stem pubescence characters, and its derivations in subsequent floristic treatments. It has been frustrating for me working primarily throughout the Midwest and midsouth where there appear to be two morphological entities that differ in leaf shape, leaf abundance, leaf distribution, and stem branching. These frustrations peak when attempting to rigidly apply Isely's stem pubescence characters, which ultimately leads to an ungratifying hodge-podge of unconsolidated character states. In order to better test and perhaps elucidate meaning from the combinations of these characters, I compiled the entire collection of 179 Missouri specimens at the Missouri Botanical Garden herbarium (MO), and sorted them by Isely's stem pubescence characters. Serendipitously, Isely's stem pubescence characters had already been applied to the Missouri material and annotated by Dr. Jay Raveill in preparation for the treatment of *Desmodium* in Yatskievych (2013). My interpretation of Isely's stem pubescence characters in the Missouri material were congruent with those of Raveill, with the only exceptions being specimens that I felt were too ambiguous to make a clear determination.

During this sorting, I noted that much of the *D. glabellum* material indeed lacked long hairs except at the nodes, and much of the *D. perplexum* material had long hairs. But, as I'd observed previously in the field, specimens with similar characters (leaf shape, leaf distribution, and leaf texture) were conceptually divided by the stem hair characters. Hoping to dispel some confusion, I independently sorted the traditional *D. glabellum* and *D. perplexum* stacks into two piles each: one with narrower terminal leaflets and a gradual reduction in leaf size along the stems (phyllopody), and one with wide leaflets that are not gradually reduced in size along the stem.

While this was moderately satisfying, I worried that the narrowness and gradually reduced leaflet character could be induced by the sunniness of the habitat. So, I re-sorted based on label data and found that these characters did not correlate with openness of the habitats from which they were collected, although a few more narrow-leaved specimens were associated with more open habitats. In examining the loments, I noticed in looking directly down on the broad faces of the triangular articles, that the ventral margins that meet at the bottom of each article were of two forms: concave in some specimens, and straight to slightly convex in others (Fig. 1). I then re-sorted the specimens with mature fruit and found that the leaf differences by which I had sorted earlier matched exceedingly well. However, this meant that many of the specimens that were referable to *D. glabellum* by Isely's stem pubescence characters better fit with *D. perplexum* and vice versa.

Next, I consulted images of the type specimens. Luckily, each is a fruiting specimen. The type specimen of *D. perplexum* (Fig. 2) has mostly concave article margins (Fig. 1 A) and stem leaves of approximately the same size, except for a few in the inflorescence. The type specimen of *D. glabellum* (Fig. 3) has straight to convex article margins (Fig. 1 B) and although it lacks many leaves and is likely a branch of a plant rather than a whole plant, it exhibits some degree of a gradual reduction below the inflorescence or at least a suggestion of that tendency. I then did a final sort of the Missouri specimens, compiling a hierarchical list of characters that seemed to well differentiate them. I then tested these characters using all the available material from across the geographical range of the species and found that the characters held. From this emerged a key bridging the disparities between field and herbarium observations, but one that differs markedly from conventional concepts

While this treatment varies from conventional concepts of this species pair, the conventional view, according to experts in the group (Isely 1983, Schubert 1950, and Wilbur 1963), was not particularly defendable. When the new interpretation provided here was applied to the 179 Missouri specimens housed at MO, it changed the identification of 59% of them (65% of "new" *D. glabellum* had previously been annotated as *D. perplexum* and 53% of "new" *D. perplexum* had been annotated as *D. glabellum*). Similar ratios occurred in evaluation of the non-Missouri material. All specimens were annotated according to these new concepts (Tropicos 2020).

These characters were subsequently tested in the field for several seasons across a large geographical range, since characters that apply in the herbarium don't always work in the field and vice versa. These new concepts were also tested by other experienced field botanists (Andrew Braun, Brett Budach, Jacob Hadle, and Scott Namestnik) over three field seasons (2018-2020). We all found that the new characters held, often contradicted the old characters, and ultimately provided more consistent and predictable results than previous interpretations.

Figure 1. The subtle differences in general outline of the articles. The articles of the type specimen of *Desmodium perplexum* (**A**) are slightly concave on the lower (ventral) margin. The articles of the type specimen of *Desmodium glabellum* (**B**) are straight. Another way to see this is in the negative space the articles create, in that of *D. perplexum* (**A**) is more rounded and *D. glabellum* (**B**) is more angular.

Figure 2. Type specimen of *D. perplexum* showing overall habit.

Figure 3. Type specimen of *D. glabellum* showing overall habit.

Key to the Species

Ventral margins of most articles straight to slightly convex (Fig. 1 B); leaves gradually but noticeably reduced in size and petiole length distally along the stem, often with small leaves extending well onto the flowering branches; terminal leaflets lanceolate to broadly ovate (most specimens, especially of full sun habitats, are on the narrow end of this range; see field notes below), broadest nearer the base than the middle………… 1. *Desmodium glabellum*

Ventral margins of most articles concave (Fig. 1 A); leaves mostly all the same size and not or little extending onto the flowering branches (the few leaves that do extend into the inflorescence branches will also be reduced in size but more abruptly so); terminal leaflets narrowly ovate to broadly elliptic-ovate (most specimens are on the wider end of this range), broadest nearer the middle than the base………………………….. 2. *Desmodium perplexum*

Discussion

1. *Desmodium glabellum* (Michx.) DC.

<u>Vegetative characters</u>: The most straightforward specimens of *D. glabellum* have lanceolate to narrowly ovate terminal leaflets, leafy stems with the leaflets and petioles becoming notably reduced distally, and leaves progressing well onto the stems beyond the bases of the lowermost flowering branches. The more expressive plants in this regard tend to be found in more open habitats. Fig. 4 demonstrates this condition. The average condition for *D. glabellum* has wider terminal leaflets that taper to a more defined point than is expressed in *D. perplexum*. Fig. 5 demonstrates this average condition. A smaller percentage of plants produce more ovate terminal leaflets with blunt tips. These plants also tend to be less leafy and have less reduction in the size of leaflets and length of petioles along the stem. These plants tend to be found in deeper shade and have thinner leaves than plants in sunnier habitats. Fig. 6 demonstrates this more broad-leaved condition. While these plants do cross into the vegetative expressions of *D. perplexum*, the similarities are superficial, as is most evident when fruiting characters are available.

<u>Fruiting characters</u>: As the key describes, the fruits of *D. glabellum* have straight to convex margins on the lower (ventral) side of articles. Fig. 7 shows an example of the most convex expression of *D. glabellum*. The fruits of some specimens are not this dramatically convex. Fig. 8 shows example of the average condition, which has more of a straight edge. A minority of specimens have slightly concave article margins, especially if the loments are immature and dry with a curve, in which case experience with the degree of concavity/convexity both taxa can express must be weighed against the characters of the vegetative condition. Fig. 9 is an example of nearly *D. perplexum*-like articles found in occasional specimens of *D. glabellum*.

<u>Field notes</u>: As shown in Figure 10, based on specimens at MO, *Desmodium glabellum* appears to be distributed throughout most of Missouri, while *D. perplexum* appears to be mostly absent in the

prairie regions north and west of the Ozarks. This pattern has been corroborated by extensive field work throughout Missouri and west into the Flint Hills of Kansas. Jacob Hadle (pers. comm.) has tested these characters throughout eastern Kansas and agrees that everything in the region is *D. glabellum*, with the exception of the Cross Timbers region of southern Kansas where some *D. perplexum*-like specimens have been found in woodland communities. In the Ozarks *D. glabellum* and *D. perplexum* occur in the same habitats, which are varied, though *D. glabellum* tends to be more common in acidic upland woodlands and *D. perplexum* tends to be more common in mesic woodlands and forests.

Although no specimens in this study closely resembled *D. paniculatum*, the morphological characters of *D. glabellum* do seem somewhat intermediate between *D. paniculatum* and *D. perplexum*, potentially supporting Isely's (1983) notion that *D. glabellum* could have derived from introgression of these two. That said, given the findings of this study, *D. glabellum* has sufficiently consistent morphological, ecological, and biogeographic cohesiveness across a large geographical area to warrant continued recognition as a species. Stipules aside, narrow-bladed specimens of *D. glabellum* also resemble *D. canadense*.

2. *Desmodium perplexum* B.G. Schub.

<u>Vegetative characters</u>: *Desmodium perplexum* expresses much less morphological variability than *D. glabellum*. Most specimens of *D. perplexum* have fewer leaves, ovate to broadly ovate terminal leaflets, leaves below the inflorescence branches of nearly equal size, and few to no leaves along the stems of the flowering branches. Figs. 11-13 demonstrate the typical morphological range of the vegetative condition.

<u>Fruiting characters</u>: As the key describes, the fruits of *D. perplexum* have concave to essentially straight margins on the lower (ventral) side of articles. Fig. 14 shows an example of the most concave expressions and Fig. 15 shows an example of straighter margins. Most fruits of *D. perplexum* are this easily interpreted, but occasionally one must rely on a combination of fruiting and vegetative characters, at least until the combination of signatures is experienced and understood. Additionally, the articles of *D. perplexum* tend to be longer, more angular, and thinner-walled than those of *D. glabellum*. In order to understand the range of variation in *Desmodium* article shapes, I also examined, in the field and herbarium, the range of expressions of numerous other species. All were very uniform, though many closely related species had similarly shaped articles. While this is certainly not proof of anything, it does suggest that the subtle but consistent morphology observed between *D. glabellum* and *D. perplexum* articles is typical of many members of the genus.

<u>Field Notes</u> (also see notes under *D. glabellum*): *Desmodium perplexum* appears to attain its northwesternmost extent along the Ozarks/Plains border region of Missouri (Fig. 10). Despite over a century of botanical collecting, including from such prolific collectors as B.F. Bush, there are no specimens of *D. perplexum* from the Kansas City area. Although I have looked for it at several

potentially suitable locations, I have never seen it north or west of the Ozarks. As discussed previously (Jacob Hadle, pers. com.) all of the material in this complex from the Flint Hills of Kansas is referable to *D. glabellum*. This geographical relationship emerged independently during testing of morphological characters, providing additional support for this conceptual approach. This is a common geographical range limit for many species more associated with eastern woodlands and/or Coastal Plain where they meet the Great Plains. This also corresponds to the tendency for *D. perplexum* to be more common in mesic and dry mesic woodland and forest communities than *D. glabellum*, which, though the two often co-occur, is more common in upland woodland and even grassland habitats. These community affinities break down in old-field, clear-cut, and slash-burn habitats where either species can be equally common. While they are not extreme generalists, neither species is particularly sensitive to ecosystem disturbance (in the sense that disturbance is anything that reduces the ecological integrity/complexity of a site).

Figure 4. *Desmodium glabellum*, showing narrow leaf dimensions, distribution of leaves well beyond and within the flowering branches, and general phyllopody seen in many specimens.

Missouriensis, **38**: 29-50. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

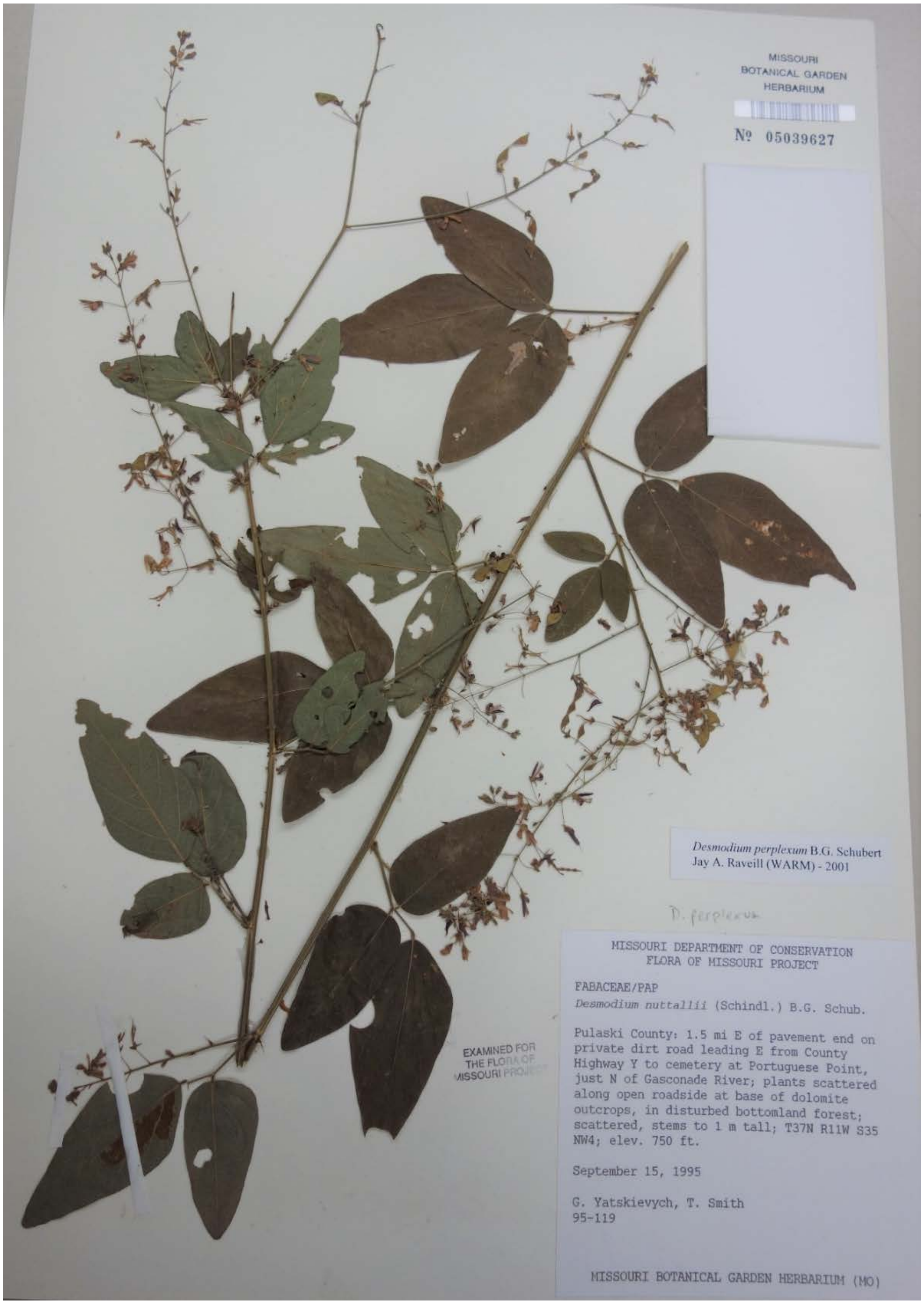


Figure 5. *Desmodium glabellum*, showing average leaf dimensions, distribution of leaves beyond the flowering branches, and general phyllopody seen in many specimens.

Missouriensis, **38**: 29-50. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

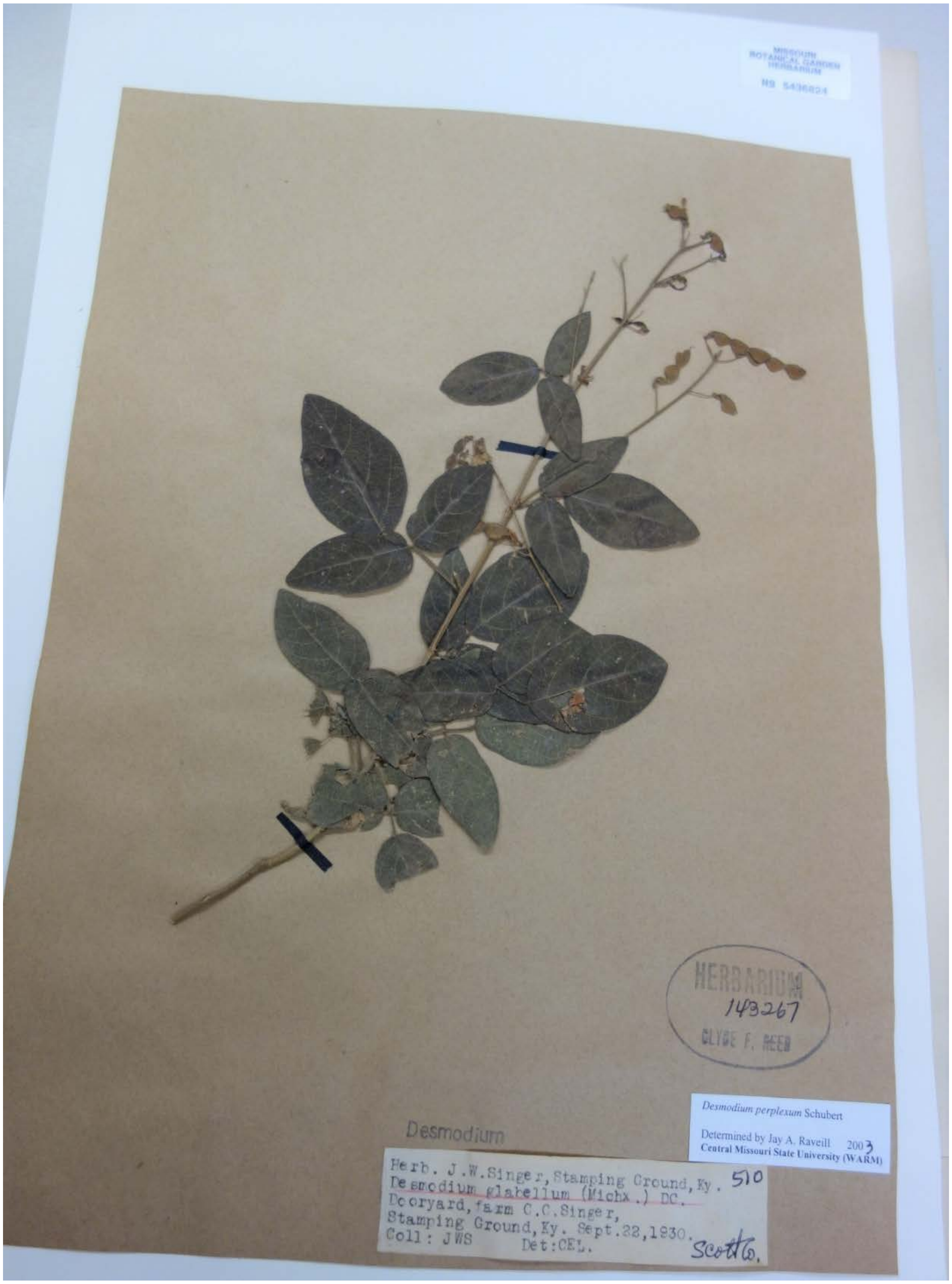


Figure 6. *Desmodium glabellum*, showing wider leaf dimensions, more restricted distribution of leaves towards the flowering branches, and reduced phyllopody seen in rare specimens.

Missouriensis, **38**: 29-50. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

Figure 7. *Desmodium glabellum*, showing more pronounced expression of convexity to the lower margins of the articles seen in many specimens; scale in centimeters.

Figure 8. *Desmodium glabellum*, showing the straight lower margins of the articles seen in most specimens.

Figure 9. *Desmodium glabellum*, showing some concavity to the lower margins of the articles seen in rare specimens; scale in centimeters.

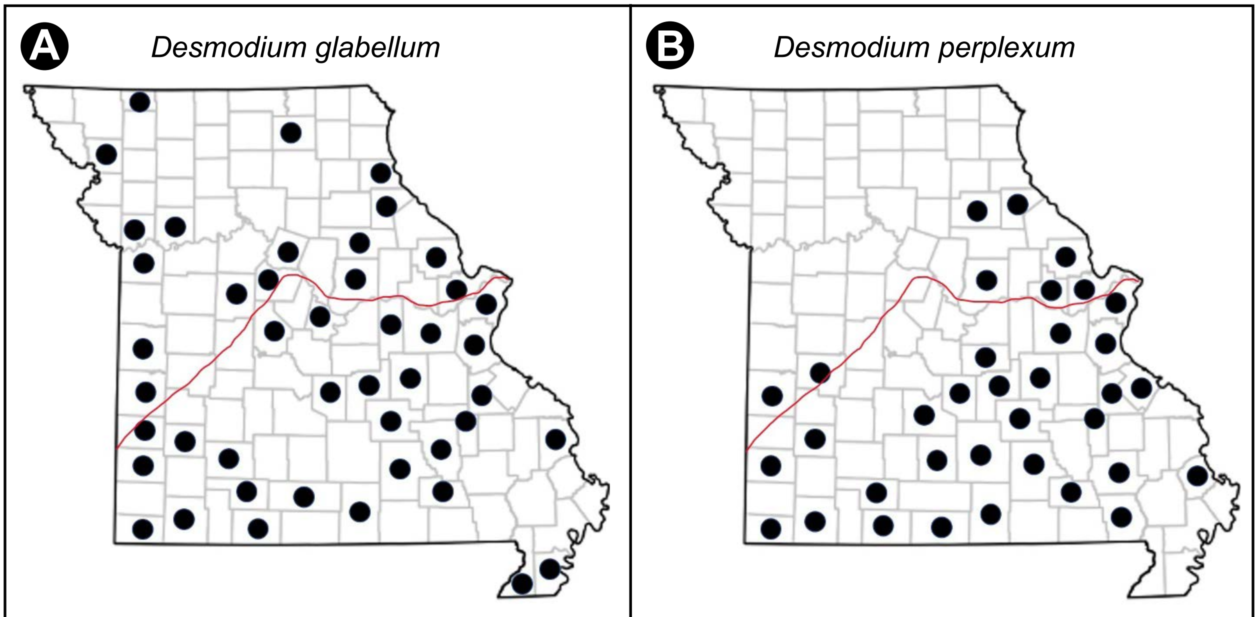
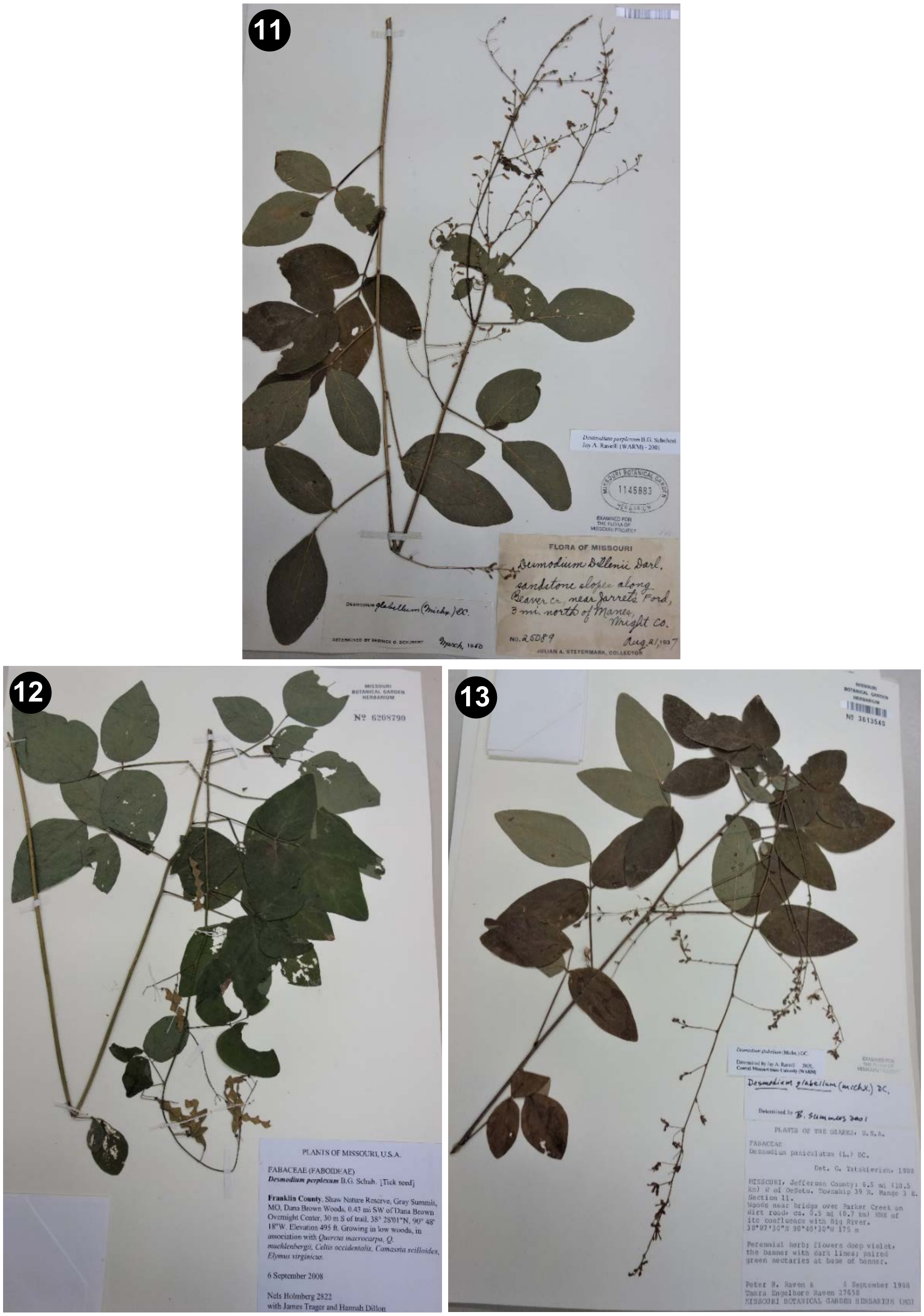


Figure 10. Distribution of *Desmodium glabellum and D. perplexum* in Missouri based on MO material. **A:** *D. glabellum*, showing statewide pattern; **B:** *D. perplexum*, suggesting a distribution within the Ozarks and Ozark border regions. The red line approximates the border between the Ozarks and the Great Plains.



Figures 11-13. *Desmodium perplexum*, showing typicl examples of the wider leaf dimensions, fewer stem leaves, infrequency of leaves beyond or within the inflorescence branches, and lack of phyllopody.

Figure 14. *Desmodium perplexum*, showing typical example of the concave margins of the articles.

Figure 15. *Desmodium perplexum*, showing an example of more straight-edged article margins that can occur; scale in centimeters.

CONCLUSIONS

As is often the case with morphologically similar taxa, when presented with an individual specimen, it can be difficult to derive an accurate identification. Even when placed side by side, the differences can be obscure. Such is the case here (Fig. 17) where archetypical examples of *D. perplexum* and *D. glabellum* are juxtaposed. There are similarities for sure, but there are also differences. Those differences cannot be expressed in simple character states, which are too subtle. Strict adherence to the key should lead to a conclusion, but the consistency and accuracy of that conclusion depends on experience with the ranges of variation in the character states. While users of taxonomic treatments abhor the frustration that comes from such antinomy, the nature of living systems demands that one experience phenomena before one understands them. After all, understanding is an emergent property of experience. The entities embroiled in species complexes, such as presented here, require more patience and experience than more approachable and easily interpreted taxa. The goal here is to set the stage for that experience rather than provide an absolute shortcut to an absolute solution.

Figure 16. Side-by-side comparison of archetypical average specimens of *D. perplexum* (left) and *D. glabellum* (right).

This situation illustrates the inherent difficulty of field biology in general. Even with character states clearly enumerated, one must often experience deeply and intimately the nature of things to understand them. Interpretation is always performative and a function of the interpreter. Many taxa that require experience and intuition for accurate identification are sunk into synonymy and buried under phrases like “needs more study” and “further research is needed.” Yet, that which cannot be expressed clearly in a key, that which ultimately is experiential, is often discouraged from publication. Not because they are not accurate, but because they are not easily explainable – they are tacit and proto-hypothetical. In a society that cares less and less about the interdependence of real organisms and the real systems they create, it has become too easy to lose the pieces in the puzzle and therein lose the puzzle. The true test of our intention – the ability to devise a functional philosophy – is hidden by our inability to accept complexity for the sake of complexity and to look not only harder, but deeper, and with more than our eyes. In short, studying and discerning taxa is as much about the phenomena of experience and interpretation as it is about the biota itself. Understanding the biota means understanding living processes, including the variations in the motives and awarenesses of we the living interpreters.

Acknowledgments

Scott Namestnik’s keen eyes and skeptical mind were present and extremely helpful during the herbarium portion of this work. He also field tested the concepts. As mentioned previously, Andrew Braun, Brett Budach, and Jacob Hadle – three of the best field botanists I know – applied the concepts presented here in the field and kindly shared their observations. To them, a heartfelt thank you.

Literature Cited

Isely, D. 1983. The *Desmodium paniculatum* (L.) DC. (Fabaceae) complex revisited. Sida 10: 142–158.

Schubert, B.G. 1950. *Desmodium*: preliminary studies—III. Rhodora 52:135–155.

Tropicos.org. Missouri Botanical Garden. 20 Dec 2020 <http://www.tropicos.org>

Wilbur, R.L. 1963. The leguminous plants of North Carolina. N. C. Agricultural Experiment Station Tech. Bull. No. 151, Raleigh, N.C. 294 pp.

Yatskievych, G. 2013. Steyermark’s Flora of Missouri. Vol. 3. St. Louis: Missouri Botanical Garden Press.

Missouriensis, **38**: 51-53. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

Adapting to City Life

BOOK REVIEW

Darwin Comes to Town: How the Urban Jungle Drives Evolution,
by Menno Schilthuizen. 2018. Picador division of Macmillan Publishing Group, New York. 293 pp.
[ISBN 978-1-250-12782-2 (hardcover); 978-1-250-12783-9 (ebook)]

Reviewed by:
SARAH SLAYTON[1]

In *Darwin Comes to Town,* Dutch evolutionary biologist and urban ecologist Menno Schilthuizen takes readers on an exciting, unexpected journey through the cities of our rapidly urbanizing world. By embracing the growth of human cities as a "fully natural phenomenon" and accepting continued urbanization as inevitable, Schilthuizen rebrands global metropolises as biodiverse "urban ecosystems" where the dynamic and inexorable forces of evolution are hard at work in our own backyards.

Through engaging storytelling and many well-researched examples, Schilthuizen reveals a hidden side of cities and evolutionary theory that is surprising and captivating to scientists and non-scientists alike. However, his evolution-focused rhetoric misses the point when it comes to thinking about conservation of species that will never be able to call places such as New York, London, or Singapore home.

The author develops his natural framework for modern cities in just under 250 pages (plus ample references and notes) divided into four primary sections, each building on the concepts and evolutionary examples introduced in the last. He starts by defining the characteristics of both urban ecosystems and the organisms that manage to survive, and even thrive, under some of the least "natural" conditions conceivable. He then spends the bulk of the next two sections introducing a cast of surprisingly well-adapted characters and some of their unexpected ecological interactions, most of which could have never occurred without human influence.

Japanese crows that drop nuts in front of moving cars for a little cracking assistance, genetically distinct mosquitos living in separate subway lines, and sparrows that sing at higher frequencies to be heard over the ubiquitous urban cacophony are just a few of the examples invoked to show how organisms are adapting to human-dominated landscapes. Although the

[1] SARAH SLAYTON — Environmental Studies Program, Washington University, 1 Brookings Drive, St. Louis, MO 63130. email: sarahslayton@wustl.edu

multitude of examples and evolutionary concepts they illustrate can start to feel repetitive at times, the author's persistent enthusiasm for the natural world keeps the reader engaged and eager to see what unusual adaptation he'll introduce next. Finally, Schilthuizen concludes his celebration of urban evolution by reflecting on the future of these urban ecosystems, and the increasing similarities among species able to take advantage of the new ecological niches created by human activity.

All of this information is incredibly accessible to the reader, regardless of their scientific background. The author doesn't avoid complex scientific concepts such as phylogenetic analyses, phenotypic plasticity, or epigenetics; instead, he strips away the jargon and integrates narrative examples that bring them to life. His clear excitement and curiosity about evolutionary processes is palpable and infectious, and his playful tone and moments of self-reflection make the text inviting and engaging to a popular audience. Furthermore, his ability to showcase the diversity and determination of life on earth encourages city-dwellers to appreciate the natural world, and their place in it, in a brand-new way.

Although this book provides us with a window into the rapidly evolving field of urban ecology while inspiring an appreciation for nature in unlikely settings, some aspects of Schilthuizen's overall argument are somewhat misleading or oversimplified. For example, he describes cities as "ecological oases" that provide habitat for species from around the globe, without really acknowledging that the habitat surrounding these developed areas are often rendered uninhabitable for a wide variety of native species. He also spends an enormous amount of time idealizing novel interactions between organisms naturally found on different continents, but barely touches on how introduced species can become dangerously invasive. Additionally, his measurement of biodiversity assumes that high species richness is inherently a good thing and relies on a simple count of species present regardless of their origin or effects on their environment. When he briefly mentions the need for conservation of "unspoiled wilderness areas," he writes about them as if there are many intact, pristine ecosystems on earth that are not in danger from intense human impacts. These messages are not only unrepresentative of the true environmental and ecological crises facing our planet, but could also give readers the false impression that a perfectly biodiverse and sustainable urbanized future is attainable without other conservation efforts.

This brings me to my final critique of this book's overall optimistic view of the fate of species occupying cities. Although Schilthuizen spends most of this book discussing cases of urban/wildlife relationships, he chooses to omit an incredibly important part of the story. Aside from tacking on a few sentences about the importance of conservation near the end of his book, he largely ignores how city organisms, including humans, *heavily* depend on natural ecosystems for survival. He also omits the myriad ways in which urban development and growth endanger sensitive biodiversity at both the organismal and system level. He frames "the wild" as "a source of pre-adapted species and genes that urban ecosystems may put to good use," but fails to mention city-dwellers' reliance on agriculture, clean water, and energy sources that come from beyond cities and require intact ecosystems to persist. He discusses habitat fragmentation within cities, but spends no time discussing the effects of continued urbanization on habitat destruction and fragmentation around the world. Urban and natural ecosystems cannot be disentangled, and not taking even a page to reflect on the other side of the story is misguided.

Overall, this book is a fun set of stories about the flexibility and tenacity of life on earth, and a beautifully written exposé on the extraordinarily powerful forces of evolution acting on short time scales. If you're looking for an introduction to the fascinating world of fast-paced urban evolution, I would happily recommend this book. However, I would be wary of its somewhat glibly optimistic conservation message, and omission of key aspects of the effects of continued urbanization of our planet.

Missouriensis, **38**: 54-55. 2020.
**pdf effectively published online 28 December 2020 via https://monativeplants.org/missouriensis*

Instructions for authors

Missouriensis is the Missouri Native Plant Society's electronically published, open-access scientific journal containing technical articles relevant to Missouri plants and natural systems. It is distributed to all members of the Society, multiple libraries, and is also indexed and available through the Biodiversity Heritage Library, the world's largest open-access digital library for biodiversity literature and archives. A single volume is published annually and available through the Society's website <https://monativeplants.org/publications/missouriensis> as downloadable pdf files either for the entire volume or individual articles.

The journal welcomes manuscripts presenting original research and insights into ecology, conservation, floristics, taxonomy, biology, and ecological restoration related to plants and natural communities in Missouri and the surrounding region, including vascular plants, bryophytes, hepatics, lichens, and fungi. Suitable topics include original floristic, ecological (including ecological restoration and species reintroductions), native horticulture and propagation, invasive species and taxonomic research, reports of new records, floristic analyses, conservation research, review articles, and reviews of book relevant to these topics. Historical accounts of Missouri botany and conservation, including biographies, are also appropriate. Authors are encouraged, but not required, to be members of the Missouri Native Plant Society. There are no charges to publish pages and images.

Manuscripts should be original and not previously published or currently under consideration for publication elsewhere. All submissions to *Missouriensis* must be clearly and concisely written in English and submitted electronically to the editor as a Word or WordPerfect document, double spaced, preferably using Times New Roman 12-point font. Except for short notes, please include an abstract containing a short summary of the key points and findings of the work.

Scientific names should be italicized; authorities for names should be used only as needed for clarity and should be abbreviated following the International Plant Name Index (IPNI) or Yatskievych (1999, 2006, 2013). Unless they deviate from the names included in Yatskievych, authorities should not be used in lists of species, such as associates or natural community inhabitants. Except for italicization of scientific names and certain unusual and unavoidable situations, do not use different fonts, font sizes, bold, small caps, margin changes, or other formatting in the manuscript. Please refer to a recent issue of the journal for examples, including specimen citations and literature cited. Images and graphics should be submitted separately, and not embedded in the manuscript; captions should be submitted as separate text and not embedded in the figures; this text can be included at the end of the manuscript.

All submissions are reviewed by independent reviewers with expertise in the subject matter of the manuscript. These reviewers provide recommendations to the editor, who then communicates with the corresponding author of the manuscript. Authors of submitted manuscripts are welcome to recommend (for or against) specific reviewers, but the editor is under no obligation to abide by these suggestions.

IPNI (2020). International Plant Names Index. Published on the Internet http://www.ipni.org, The Royal Botanic Gardens, Kew, Harvard University Herbaria & Libraries and Australian National Botanic Gardens.

Yatskievych, G. 1999. Steyermark's Flora of Missouri. Vol. 1. Jefferson City: Missouri Department of Conservation.

Yatskievych, G. 2006. Steyermark's Flora of Missouri. Vol. 2. St. Louis: Missouri Botanical Garden Press.

Yatskievych, G. 2013. Steyermark's Flora of Missouri. Vol. 3. St. Louis: Missouri Botanical Garden Press.