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THE GENUS *CALLIRHOE* IN MISSOURI

Maria Morris
Maryville University, Box 196
13550 Conway Rd., St. Louis, MO 63141

George Yatskievych
Flora of Missouri Project, MBG/MDC
P.O. Box 299, St. Louis, MO 63166-0299

The genus *Callirhoe* contains nine species of annual, biennial, and perennial herbs endemic to the United States and adjacent northeastern Mexico. It is one of about eight genera in the Malvaceae tribe Malvae subtribe Malvinae, which is presently thought to contain the New World genera, *Lavateria, Napaea*, and *Sidalcea*, as well as the old World genus, *Malva*, the type of the family.

Species of *Callirhoe* are colloquially referred to as poppy mallows and wine cups for their beautiful, often bright flowers and are of horticultural and ethnobotanical interest. Most have been cultivated sporadically, dating back to when the North American botanist, Thomas Nuttall, first distributed seeds of *C. digitata* in Pennsylvania prior to 1821, but only in recent years have some of the species increased in popularity among gardeners, and the genus continues to be relatively underutilized horticulturally. Native Americans also appreciated the flowers of some species for their aesthetic appeal (Moerman, 1998) and used a decoction of the roots as an analgesic (Dorr, 1990; Moerman, 1998). Two voucher specimens in the Missouri Botanical Garden's herbarium (*Ledman* s.n. on 10 Apr 1946 and 16 May 1946) also attest to the commercial use of *C. alcaeoides* roots in the medicinal or pharmacological trade by the "Luytis Pharmacal. Co. of St. Louis" during the 1940s (data indicate that the vouchers were collected to document the sale of these plants by the company). However, the plants' principal ethnobotanical use was as a food. In his report on the Yellowstone expedition of 1819–1820 (the first federally funded all-scientific expedition to the western U.S.), Edwin James (1823) described the discovery of a species of Malvaceae with

large edible tuberous roots that was presumably *C. alcaeoides* (Dorr, 1990). The roots of all of the perennial species are both edible and palatable, and were eaten by Native Americans and early European travellers in the great Plains and southern states.

The genus was named by Nuttall (1821), and the epithet apparently was derived from the name of several female characters in classical Greek literature. Nuttall's concept of *Callirhoe* included only *C. digitata*, which he collected during his second great westward expedition, in 1819, in open prairies near Ft. Smith in present-day western Arkansas. Subsequent authors expanded and refined the generic limits as additional species were described or transferred from other genera.

We are fortunate to have available a recent comprehensive monograph of the genus (Dorr, 1990), and it is this work that forms the basis for the present study. Dorr's monograph was the first attempt to compile and synthesize data from throughout the range of the genus and the first to integrate information from the various regional accounts available previously for portions of the group. He examined specimens from all of the larger herbaria and provided both a summary of the overall distribution of the taxa and an accurate morphological description of each taxon based on rangewide variation. Dorr's principal taxonomic innovation involved a reevaluation of species limits in the *C. papaver* species complex, which includes *C. bushii* and *C. involucrata* in Missouri. Earlier authors, including Steyermark (1963), had variously treated *C. bushii* as a variety of *C. involucrata* or *C. papaver*. Among other things, Dorr's (1990) monograph was the first to fully explicate the importance of bud characters in untangling these closely related taxa, and his classification is followed here.

The purpose of the present study is to fill in knowledge of the Missouri ranges of *Callirhoe* taxa through examination of a larger suite of specimens than was available to Dorr (1990), especially examination of newer specimens and consultation of the holdings of regional herbaria in the state. Additionally, we hoped to adapt the morphological data presented for each taxon rangewide by Dorr to that portion represented in Missouri materials and to construct a key to species based on specimens collected in the state. We examined a total of ca. 220 collections (ca. 250 total specimens) available for study through the courtesy of the curators

of the following herbaria: Field Museum of Natural History (F), University of Kansas (KANU), Missouri Botanical Garden (MO), Missouri State Parks (MODNR), Truman State University (NEMO), Southeast Missouri State University (SEMO), Southwest Missouri State University (SMS), University of Missouri –Columbia (UMO), University of Missouri–Kansas City (UMKC, now housed at Powell Gardens), and Central Missouri State University (WARM). Specimens were scored for a number of morphological characters and also blooming dates, summarized in the descriptions below. Sporophytic chromosome numbers, most based on counts from outside Missouri, are cited without provenance from Bates et al. (1989).

TAXONOMIC TREATMENT

Callirhoe Nutt. (poppy mallow, wine cup)

Plants perennial herbs (annual or biennial elsewhere), the roots usually thickened and tuberous, branched or unbranched. Stems 1 to several, prostrate to erect, usually unbranched below the inflorescence, glabrous or more commonly pubescent with simple and/or stellate hairs, sometimes glaucous. Leaves alternate (and relatively few on the stems) and usually also basal, petiolate, entire with palmate venation to deeply palmately lobed (usually 3-lobed in *C. triangulata*), the margins entire to irregularly undulate, toothed, or lobed, pubescent with simple and/or stellate hairs. Stipules linear to broadly triangular or rhombic, often asymmetric at the base, shed early in some species. Inflorescences terminal and sometimes also axillary, racemes, less commonly panicles or condensed and appearing as stalked clusters or umbellate. Flowers perfect or uncommonly only pistillate, the pedicel with a small, linear to ovate, bifid bract at the base (this sometimes shed before flowering), in some species the calyx also closely subtended by 3 bracts. Calyces 5-lobed ⅔–¾ of their length, the lobes lanceolate to broadly triangular, the outer surface glabrous or variously hairy, the inner surface usually with a mat of stellate hairs, especially near the margins. Petals 5, distinct except at the very base where fused to the staminal column, wine red to reddish purple or less commonly, pink, pale lavender, or white, the broadly rounded to truncate tips with an irregular to somewhat fringed margin, the

basal portions with white hairs along the margins. Stamens numerous, the filaments fused into a tubular column most of their length, glabrous or variously hairy, the anthers white, red, or purple. Pistils 1 per flower, compound, the ovary superior, with 9–23 locules. Styles equal to the locule number, fused most of their length, each with a single linear stigmatic area along the inner side toward the tip. Fruits schizocarps breaking into 9–23 mericarps arranged in a ring around the central axis. Mericarps indehiscent or dehiscent, wedge-shaped, the dorsal surface usually with a longitudinal groove, oblong to reniform in profile, each differentiated into a beaklike sterile upper cell (this rarely absent) and a lower cell containing a single seed, the upper sterile cell smooth-walled to finely roughened and also usually with a shallow dorsal groove, the lower cell with a prominent honeycomb (reticulate) pattern of thickenings on the sides (except in *C. triangulata*). Seeds 2–3 mm long, reniform, black or less commonly dark brown.

Nine species, endemic to the central and southeastern United States and adjacent northeastern Mexico. Five species in Missouri, all native.

1. Flowers and fruits without subtending bracts; stipules not persistent (shed before flowering) or, if persistent, then 5–8 mm long
    2. Stems densely pubescent with stellate hairs; stipules 5–8 mm long, persistent; inflorescenes racemes, sometimes condensed and appearing as stalked clusters or umbellate; calyx densely hairy; petals nearly white to light pink or pale lavender ..... 1. *C. alcaeoides*
    2. Stems glabrous or nearly so; stipules 6.0–7.5 mm long, shed early; inflorescences panicles; calyx glabrous except for a thin band of hairs along the margins; petals wine red to bright red, rarely light red ..... 3. *C. digitata*
1. Flowers and fruits closely subtended by three bracts; stipules persistent, 4–15 mm in length

3. Cauline leaves triangular to ovate-cordate or ovate-hastate in outline, usually not deeply lobed, margins entire, undulate, crenate, crenate-serrate, or shallowly lobed; inflorescences panicles; bracts spatulate to obovate ..... 5. *C. triangulata*
3. Cauline leaves broadly deltoid to broadly ovate-cordate or obovate in outline, margins deeply lobed and often irregularly lobed again or deeply toothed; inflorescences racemes; bracts linear to ovate
    4. Stems ascending; buds with the sepal tips joined to form a beaklike projection 6–10 mm in length; basal leaves with mostly simple hairs ..... 2. *C. bushii*
    4. Stems decumbent; buds with the sepal tips free and somewhat spreading, not joined into a beak; basal leaves with many 4-rayed stellate hairs in addition to simple hairs ..... 4. *C. involucrata*

1. Callirhoe alcaeoides (Michx.) A. Gray (pink poppy mallow, pale poppy mallow, plains poppy mallow)

Stems 2–5 from the rootstock, 10–45 cm long, erect or ascending, densely pubescent with minute, 3- or 4(–6)-branched stellate, appressed hairs. Basal leaf petioles 7–19 cm long, pubescent with minute, 4-branched stellate, appressed hairs. Basal leaf blades 2.5–10.0 cm long, 2.5–8.0 cm wide, deltoid-cordate to ovate in outline, with 3–5 shallow to deep palmate lobes (rarely unlobed), these often irregularly lobed, the ultimate segments usually relatively broad, the margins entire to crenate, the upper surface pubescent with simple strigose hairs, the undersurface with 4-branched stellate, appressed hairs, and sometimes also with scattered, simple strigose hairs. Cauline leaf blades 4–8 cm long, 3.5–8.0 cm wide, triangular-cordate to broadly obovate in outline, with 3–5 shallow to deep palmate lobes, these often pinnately lobed, the margins entire to crenate, the pubescence as in the basal leaves. Stipules persistent, often partially fused to the petiole, 5–8 mm long, lanceolate-subulate, glabrous except for long-ciliate margins. Inflorescenes racemes with 4–14 flowers, sometimes

condensed and appearing as stalked clusters or umbellate. Pedicels 1–8 cm long. Bracts subtending perianth absent. Buds ovate, the sepal tips valvate, joined to form a short beaklike projection 1.5–4.0 mm long. Calyces 7–10 mm long, the outer surface densely pubescent with simple strigose hairs and often also a few 4-rayed stellate hairs, the lobes 5–8 mm long, lanceolate. Petals 8–20 mm long, nearly white to light pink or pale lavender. Staminal column 8–10 mm long, the portion below the anthers pubescent with 4-branched stellate, appressed hairs. Anthers purplish red, sometimes drying nearly black. Fruits 6–9 mm in diameter, with 10–13 mericarps. Mericarps indehiscent, 4.0–5.5 mm long, the dorsal surface hairy, the sides of the fertile portion with a reticulate pattern of thickenings, separated from the prominent beaklike sterile portion by a well-developed collar. $2n$=28. Flowering early May to early August.

Native from western Iowa to northwestern Louisiana, west to South Dakota, Nebraska, Oklahoma, and eastern Texas, adventive eastward to Indiana and Tennessee. Dorr (1990) considered a historical occurrence in Alabama potentially to be non-native. In Missouri, some populations in the western portion of the Glaciated Plains Natural Division and the Osage Plains appear to represent native occurrences, as well as a few in the Ozarks. At these stations, plants grow in upland prairies, glades (usually on limestone or dolomite), and openings of rocky upland forests. A single site in Carter County (*Davis & Hollums* s.n. [SMS]) originated from an atypical mesic habitat and probably represents an adventive occurrence. Elsewhere in Missouri, plants found along roadsides, railroads, old quarries, and pastures are all adventive.

SPECIMENS EXAMINED.—**Boone County:** M.K.T. Railroad tracks E of Rocheport Cave, 28 June 1930, *Maneval* s.n. (UMO); University Avenue, Columbia, May 1926, *Rickett* s.n. (UMO). **Carter County:** Prichard Hollow, Peck Ranch Wildlife Area, rich soil along creek, 10 May 1964, *Davis & Hollums* s.n. (SMS) **Dent County:** Sligo, on old road, 9 July 1933, *Kellogg 26064* (MO). **Franklin County:** Gray Summit, in field, 4 May 1969, *Christ* s.n. (MO). **Greene County:** Heaton Haines Nature Trail, Hilcrest High School, top of hill in open woods, T29N R22W S2, 3 May 1974, *Key 53* (SMS); Heaton Haines Nature Trail, Hilcrest High School, open meadow near pond, T29N R22W S2, 3 May 1974, *Key 55* (SMS); Wilson's Creek National Battlefield, ca. 100 yd NW of Price's Headquarters parking area, 28

May 1979, *Key 2401* (SMS). **Jackson County:** without locality, along railroad, 22 May 1935, *Bush 14778* (MO, UMO); Courtney, waste ground, 28 May 1934, *Bush 13590* (MO), 22 May 1935, *Bush 14773* (MO); Wayne City, waste places, 22 May 1935, *Bush 14783* (MO); Sheffield, rare along railroad 12 May 1898, *Bush 247* (MO); Sheffield, introduced, 23 May 1906, *Bush 3878* (MO); Sheffield, common along railroad, 27 May 1901, *Bush 610* (MO), 16 May 1897, *Mackenzie* s.n. (MO); Sibley, introduced, 28 June 1907, *Bush 4806* (MO); Grain Valley, along railroad, 24 May 1913, *Bush 6993* (MO); Lake City, prairies, 20 May 1921, *Bush 9361* (MO). **Jasper County:** near Joplin, prairies, 25 May 1922, *Palmer 21487* (UMKC, UMO); along Turkey Creek near Joplin, fertile open ground, 2 May 1922, *Palmer 21078* (UMO); "Sucker Flat," Webb City, waste ground, 29 May 1922, *Palmer 21547* (UMO); upland prairies near Carthage, 4 June 1924, *Palmer 25325* (UMO); 1 mi SE of Webb City, limestone glade and upland prairie, 18 May 1952 *Palmer 53800* (UMO), 12 May 1957, *Palmer 65067* (UMO). **Jefferson County:** Festus, limestone quarry, 9 May 1935, *Duggins 49* (F). **Linn County:** S side of Missouri Highway 5, 0.07 mi W of junction with County Highway F, 2½ mi SE of corner of Brookfield, open grassy ground on S side of highway, T57N R19W S15 N boundary, 26 May 1956, *Steyermark 81656* (MO, UMO). **New Madrid County:** along railroad tracks just E of Morehouse, 24 Apr 1938, *Steyermark 5025* (F). **Newton County:** 1 mi E of Missouri–Kansas state line ½ mi N of Shoal Creek, open upland pasture, 20 May 1953, *Palmer 55597*(UMO). **Platte County:** along U.S. Highway 71, ca. 6 mi N of Platte Woods, roadsides, 7 July 1967, *Henderson 67-685* (SMS, UMKC, UMO). **St. Louis City:** Ranken yard of the Terminal Railroad Association, E of Compton Avenue; upper terrace, N of the roofed ramp, 3 July 1967, *Mühlenbach 2793* (MO); Carrie Avenue freight yard of the Rock Island Railrod on the W roadway along the cleaning track opposite Red Bud Avenue, 13 May 1962, *Mühlenbach 1940* (MO); right-of-way of the Missouri–Pacific Railroad, W of Spring Avenue, 15 May 1971, *Mühlenbach 3527* (MO). **St. Louis County:** Allenton, Missouri Frisco Railroad tracks, 15 May1896, *Letterman* s.n. (MO). **Stone County:** Baxter, barrens, 27 May 1936, *Bush 15562* (MO). **Vernon County:** along disturbed gravel roadside growing with fescue, T35N R32W S8 SW¼, 16 May 1982, *Solecki 958* (SMS); 1.2 mi N of Richards, T36N R33W S3 SW¼ of SE¼, 17 May 1992, *Thom* s.n. (MO). **Webster County:** John Housh farm, 3 mi N of Elkland, open wooded slope bordering Little Greasy Creek, T32N R19W S20 NW¼, 26 May 1981, *Summers 855* (MO).

2. Callirhoe bushii Fernald (Bush's poppy mallow)

C. involucrata (Torr. & A. Gray) A. Gray var. *bushii* (Fernald) R.F. Martin

C. papaver (Cav.) A. Gray var. *bushii* (Fernald) Waterf.

Stems 1–4 from the rootstock, 35–50 cm long, ascending, densely pubescent with simple strigose hairs and sometimes also minute, 4-branched stellate, appressed hairs. Basal leaf petioles 10–23 cm long, pubescent with minute, 4-branched stellate, appressed hairs. Basal leaf blades 4–12 cm long, 7–9 cm wide, deltoid-cordate to broadly ovate in outline, with 3–7 deep palmate lobes, these sometimes irregularly lobed, relatively broad, the margins usually sparsely and coarsely serrate, the upper and lower surfaces pubescent with simple strigose hairs and occasionally also a few 4-branched stellate, appressed hairs. Cauline leaf blades 3–12 cm long, 5–15 cm wide, broadly deltoid to ovate-cordate or obovate in outline, with 3(5) deep palmate lobes, these often pinnately lobed, the margins entire to sparsely and coarsely serrate, the upper and lower surfaces pubescent with simple strigose hairs and usually also 4-branched stellate, appressed hairs. Stipules persistent, free, 9–15 mm long, ovate to auriculate, glabrous except for long-ciliate margins. Inflorescenes racemes with 7–17 flowers. Pedicels 5.5–14.5 cm long. Bracts subtending perianth 8–14 mm long, linear to narrowly elliptic-lanceolate. Buds ovate to broadly ovate, the sepal tips valvate, joined to form a beaklike projection 6–10 mm long. Calyces 15–27 mm long, the outer surface densely pubescent with simple strigose hairs and sometimes also sparse 4-rayed stellate hairs near the tip, the lobes 10–17 mm long, lanceolate to lanceolate-attenuate. Petals 17–32 mm long, pale rose to more commonly wine red or purplish red. Staminal column 9–13 mm long, the portion below the anthers pubescent with sparse simple strigose hairs. Anthers red to purple. Fruits 9–13 mm in diameter, with 16–23 mericarps. Mericarps indehiscent, 4.0–5.5 mm long, the dorsal surface glabrous, the sides of the fertile portion with a reticulate pattern of thickenings, separated from the inconspicuous beaklike sterile portion by a well-developed collar. $2n$=56. Flowering late May to early August.

Native from southwestern Iowa to northeastern Arkansas, west to southeastern Kansas and eastern Oklahoma. In Missouri, it is found mostly in the southwestern portion of the Ozark Natural

Division, but also occurs natively as far north as Carroll County and as far east as Pulaski County. It grows in bottomland and upland prairies, limestone and dolomite glades, and bottomland forests to open rocky upland forests. Within the species' range, adventive plants may also be found on roadsides, road cuts, railroads, pastures, and waste ground.

Callirhoe bushii was originally described by Fernald (in Robinson and Fernald, 1909) based on a type specimen collected at Eagle Rock, in Barry County, Missouri (*Bush 3145* [type: GH; isotype: NY]). The species continues to be tracked as being of conservation concern by the Missouri Natural Heritage Program. In recent years, it has become popular regionally as an ornamental in the native wildflower trade, largely through the efforts of Mervin Wallace of Missouri Wildflowers Nursery, near Jefferson City.

This species is sometimes confused with *C. involucrata*, but the two species differ in a number of subtle characters. In addition to the habit and bud tip characters in the key to species, they also differ in details of the calyx. In *C. involucrata*, the calyx lobes are strongly nerved, the nerves raised and often whitened. The pubescence on the outer surface of the lobes consists of long spreading simple hairs that have the somewhat pustular bases somewhat fused into irregular fascicles, as well as shorter 4-rayed stellate hairs that are mostly loosely appressed. In *C. bushii*, the calyx lobes are less strongly veined and generally not raised into whitened ridges. The pubescence of the outer surface is predominantly of simple spreading hairs, these not fasciculate, with shorter stellate hairs absent or sometimes sparse and near the tips.

Fernald (1950), Gleason (1952), Steyermark (1963), and some other authors ascribed some Missouri specimens to *C. papaver* sensu stricto, apparently based on a misinterpretation of the morphology of that species. The character used by Steyermark (1963) to distinguish *C. papaver* var. *papaver* and var. *bushii* (as he treated them), whether the stems have appressed or spreading pubescence, respectively, fails to take into account the variation in pubescence in both of these taxa, as well as the presence of stellate in addition to simple hairs along at least the basal portions of the stems of both taxa.

SPECIMENS EXAMINED.—**Barry County:** without locality, rocky woods, 3–5 ft high, 16 July 1935, *Bush 14969* (UMO); Eagle Rock, rocky woods, 7 Aug 1905, *Bush 3145* (GH, NY), 17 July1935, *Bush 14989* (UMO); bald knobs near Eagle Rock, rocky open ground, 27 July 1926, *Palmer 31468* (MO, UMO); Shell Knob, barrens, 27 May 1936, *Bush 15560* (MO); Shell Knob, glades, 26 May 1936, *Bush* s.n. (MO); tributary to King's River, 4½ mi SW of Viola, 1 mi S of Prentiss Ford, cherty, limey open ravine slopes, T21N R25W S25, 20 June 1937, *Steyermark 22506* (F). **Benton County**: along S side of gravel road, ca. 40 yards E of Negro Creek Township, T41N R22W S35 NE¼ of NE¼, 7 July 1988, *Gremaud* s.n. (MO). **Carroll County:** 2 mi W of Carrollton along Missouri Highway 10, in dried up mud in bottom prairie thickets, 24 June 1938, *Steyermark 6113* (F, MO); along railroad in alluvial bottoms of Missouri River along Highway 10 between Carrollton and Norborne, 8 Oct 1948, *Steyermark 66638* (F, MO). **Greene County:** 10 mi SE of Springfield, James River and Missouri Highway 125, 25 July 1975, *Stalker & Nelson 476* (SMS). **Jasper County:** Webster City, in waste ground, 25 July 1932, *Kellogg* s.n. (MO). **McDonald County:** Noel, railroad banks, 7 Oct 1931, *Kellogg 25773* (UMO). **Ozark County:** floodplain of Little North Fork of White River 1½ mi S of Theodosia, low rocky woods, T22N R15W S30, 10 June 1939, *Steyermark 27018* (F). **Pettis County:** Houstonia, along roads, in open fields, rare, 1 July 1913, *Emig 182* (MO). **Pulaski County:** Waynesville, 26 June 1938, *Moore* s.n. (F); ½ mi S of Waynesville, rocky open slopes in dense thickets of herbaceous growth above Roubidoux Spring, 28 July 1935 *Steyermark 19316* (UMO); along Roubidoux Creek 3 mi S of Cookville, low alluvial grassy thicket, 8 Aug 1932, *Steyermark 4860* (F). **Stone County:** without locality, rocky woods, 16 July 1935, *Bush 14979* (MO, UMO); Baxter, rocky woods, 2 Oct 1935, *Bush 15257* (MO), Baxter, barrens, 27 May 1936, *Bush 15570* (UMO); 1 mi S of Prentiss Ford in section 19, near Barry County line, rocky wooded slopes and base of ravine tributary to King's River, 21 June 1937, *Steyermark 22546* (F, MO); Highway 86, 6.5 mi W of junction with Highway 13, small population among rocks in highway roadcut, 30 June 1982, *Dorr 2419B* (MO). **Taney County:** without locality, T22N R21W S9 NE¼ of NW¼, 15 June 1979, *Hauser* s.n. (SMS, UMO); Hollister, 14 Aug 1928, *Drouet & Zirkle* s.n.(UMO); vicinity of bluff near Barker Hole, Bull Shoals Lake, ca. 3 mi E of Forsyth, T24N R20W S35/36, 24 June 1962, *Eggers 197* (SMS); Cooper Creek Road, ca. 0.15 road mi E of junction with Fall Creek Road and ca. 2.15 road mi S of junction of Fall Creek Road and Missouri Highway 76, S side of road, land owned by Empire District Electric Company, partially, occasionally mowed roadside, T22N R21WS7 NE¼ of SW¼, elev. ca. 760 ft, 15 June 1990, *Kuhn & Turner 13915* (KANU, MO); bottom field, 20 Sep 1940, *Spencer 125* (UMO);

tributary to White River just S of Blackwell Ferry, 3 mi S of Kissee Mills, low wooded slopes along creek, T23N R19W S34, 28 June 1937, *Steyermark 22725* (F); along W and S side of White River, low woods around Burnett's place, also seen on limestone slopes above, 11½ mi (by road) SE of Mincy, T21N R19W, 20 June 1949, *Steyermark 40085* (F, MO); Hollister, grassy places along roadside, 8 June 1933, *Steyermark 8815* (MO); plants cultivated at Franklin County, Gray Summit, Shaw Arboretum, Whitmire Wildflower Garden, origin from along Hollister railroad, Taney County, Aug 1993, *Woodbury 19* (MO).

3. Callirhoe digitata Nutt. (fringed poppy mallow, finger poppy mallow, finger wine cup)

Stems 1–3 from the rootstock, 30–120 cm long, erect or ascending, glabrous, glaucous, rarely sparsely pubescent with simple pilose hairs near the nodes. Basal leaf petioles 7–30 cm long, glabrous or more commonly pubescent with simple strigose hairs. Basal leaf blades 3–12 cm long, 5–13 cm wide, reniform to nearly circular in outline, with 3–9 deep palmate lobes, these often 1 or 2 times (2)3-lobed, the ultimate segments usually linear, the margins entire or with few shallow lobes or teeth, the upper surface glabrous or pubescent with simple strigose hairs, the undersurface usually pubescent with simple strigose hairs. Cauline leaf blades 3–13 cm long, 5–17 cm wide, reniform to nearly circular or broadly ovate in outline, with 3–9 deep palmate lobes, these often 1 or 2 times (2)3-lobed, the ultimate segments usually linear, the margins entire or with few shallow lobes or teeth, the pubescence as in the basal leaves. Stipules mostly shed before flowering time, free, 6.0–7.5 mm long, subulate, glabrous except for long-ciliate margins. Inflorescenes panicles with 6–20 flowers. Pedicels 1–16 cm long. Bracts subtending perianth absent. Buds ovate, the sepal tips valvate, joined to form a short beaklike projection 1.0–2.5 mm long. Calyces 7–10 mm long, the outer surface glabrous, the lobes 3.5–7.0 mm long, lanceolate to narrowly ovate or triangular. Petals 15–26 mm long, deep rose to wine red or purplish red, usually with a lighter area toward the base. Staminal column 8–12 mm long, the portion below the anthers pubescent with simple strigose hairs. Anthers white or purplish red, sometimes drying nearly black. Fruits 7–9 mm in diameter, with 12–16 mericarps. Mericarps indehiscent, 3.5–4.5

mm long, the surfaces glabrous, the sides of the fertile portion with a reticulate pattern of thickenings, separated from the inconspicuous beaklike sterile portion but without a differentiated collar. $2n$=28. Flowering mid-May to early September.

Native from southwestern Missouri to western Arkansas, west to southeastern Kansas and northeastern Texas, adventive in Illinois and Indiana. The report by Thomas and Allen (1998) of a native occurrence in Caddo Parish, Louisiana, is suspect, and perhaps represents either a non-native occurrence or a misdetermination of the closely related *C. pedata* (Nutt. ex Hook.) A. Gray. In Missouri, native populations apparently are restricted to the western portion of the Ozark Natural Division and the Osage Plains. At these stations, plants grow in upland prairies, limestone and dolomite glades, and openings of rocky upland forests. Single specimens from Boone (*Favor* s.n. [UMO]) and Clay (*Mackenzie 264* [MO]) Counties apparently originated from adventive populations.

SPECIMENS EXAMINED.—**Barry County:** Shell Knob, barrens, 27 May 1936, *Bush 15561* (MO); Purdy, prairies, 17 Aug 1905, *Bush 3258* (MO); Eagle Rock, common along the river, 14 June 1897, *Bush 44* (MO); Eagle Rock, glades, 19 July 1935, *Kellogg* s.n. (MO); "Bald knobs" near Eagle Rock, 1 June 1926, *Palmer 30417* (MO); Seligman, 21 Aug 1892, *Dewart* s.n. (MO); Highway YY, 2.5 mi E of Highway 39, near Turkey Creek Subdivision, glade, 30 June 1982, *Dorr 2417D* (MO); S of Jenkins along Missouri Highway 39, open roadside bank, 11 June 1987, *Holland 5753* (KANU); Roaring River State Park, 17 June 1983, *Rogers 451* (MODNR); Roaring River State Park, roadside ditch, T22N R27W S35 N½, 2 June 1979, *Hornberger 222* (MODNR, SMS, UMO); Roaring River State Park, side of dry rocky trail above spring, T22N R27W S27 SE¼ of NE¼, 27 June 1979, *Hornberger 469* (MO, SMS); Roaring River State Park, rocky glade, T22N R27W S36 NW¼, 3 July 1978, *Timme 224* (SMS); 8 mi N of Golden, openings in rocky open woods, 6 June 1957, *Palmer 65612* (UMO); Piney Creek Wilderness, main trail from Pineview Lookout Tower, growing in an open glade, T23N R25W S23 NE¼, 1 June 1988, *Rebman 107* (SMS); Piney Creek Wilderness, growing along Lake Trail, glade area, T23N R25W S23 NE¼, 8 July 1988, *Rebman 268* (SMS); Piney Creek Wilderness, growing along Piney Creek Trail, glade area, T23N R25W S23 NE¼, 12 June 1988, *Rebman & Klages 209* (SMS); ca. 3 mi W of Seligman, cedar glade, T21N R23W S20, 9 June 1962, *Redfearn 10225* (SMS); along a side road 4 mi N of Monett, May 1927, *Steyermark* s.n. (MO); upper slopes from Prentiss Ford along King's River S, 4½ mi S of Viola, rocky upper lime slope of river, T21N

R25W S25, 20 June 1937, *Steyermark 22522* (F, MO); 1 mi N of County Highway E on State Highway 86 at curve in road (Wolfpen Gap), dolomite glade, 17 June 1990, *Yatskievych & Yatskievych 90-170* (MO). **Barton County:** without locality, 1873, *Broadhead* s.n. (MO); without locality, mesic to dry-mesic sand/shale prairie, rare in typical location, T30N R29W S10 W½, 14 June 1982, *Reese 1565* (SMS). **Boone County:** without locality, July 1902, *Favor* s.n. (UMO). **Christian County:** ca. 4 mi N of Swan Creek, rocky limestone glade above Blue Creek, 12 June 1973, *Marvin 537* (MO); 3 mi W of Nixa, rocky open woods, 24 June 1954, *Palmer 57955* (UMO); Mark Twain National Forest, ½ mi W of Swan look-out tower, forest opening, shallow glade soil, occasional, flower color-purple, 20 Aug 1961, *Richmond 359* (UMO); along slopes of tributary to Swan Creek 4 mi SE of Chadwick, limestone glade, 6 July 1937, *Steyermark 23000* (F). **Clay County:** Randolph, rarely introduced along railroads, 17 July 1898, *Mackenzie 264* (MO). **Dade County:** near S Greenfield, gladey limestone slopes, 10 June 1951, *Palmer 52169* (UMO). **Greene County:** without locality, 17 Sep 1884, *Bush* s.n. (MO); near Bois d'Arc, dry ground on open hillside, 10 June 1901, *Barber 1050* (KANU); Galloway, Idlewild, rocky hillside, 23 June 1924, *Bowler* s.n. (UMO); Springfield, Zoo Park, S slope, woodland, 21 June 1929, *Wakefield* s.n. (UMO); Lake Springfield, S of the pond in Southern Hills, open, rocky, sloping glade, thin soil waterlogged in places by seepage, T28N R21W S12, 31 May 1972, *Brockman 296* (SMS); Springfield, roadsides, 20 July 1926, *Click* s.n. (SMS); Kikapoo Prairie, June 1835, *Engelmann 861* (MO); Wilson's Creek National Battlefield. General Price's Headquarters area, open field and edge of woods, 25 May 1978, *Key 16386* (SMS); Wilson's Creek National Battlefield, W along fence 20 yd from Missouri Pacific Railroad gate, SW of Ray House, 24 June 1979, *Key 2503* (SMS); 50 mi S of Springfield in vicinity of Table Rock Dam, approximately 5 mi above the dam, slopes of cedar glades and power line pathway, 17 July 1958, *Morrison* s.n. (SMS); along Sac River 8 mi E of Walnut Grove, rocky open woods, 8 June 1956, *Palmer 62608* (UMO); along a fence row in vicinity of Brookline, ca. 7 mi SW of Springfield, occurring frequently, 5 July 1958, *Redfearn 3707* (SMS); 3½ mi NE of Republic, common along railroad track, 2 July 1967, *Robertson 284* (MO); prairie relict habitat along railroad tracks, T29N R23W S24 N border with S25, 26 June 1974, *Stalker 209* (SMS); along road T, 5½ mi SW of Ash Grove, prairie upland slopes, 22 June 1941, *Steyermark 40182* (F); Nivoka Lodge, James River, 22 July 1897, *Trelease 133* (MO); Galloway, rocky hillside, 11 June 1929, *Voris* s.n. (SMS). **Jasper County:** without locality, roadside, Aug 1928, *Williams* s.n. (UMO); Highway 71 at Kendricktown, pasture, 28 Aug 1984, *DeLozier 1628* (MO); Joplin, prairies, 11 July 1927, *Kellogg* s.n. (MO); Joplin, prairies, 28 June 1909, *Palmer 2360* (MO); Neck City, frequent in

dry open woods and rocky barrens, 29 July 1919, *Palmer 15717* (UMO); near Neck City, rocky prairies, 1 July 1920, *Palmer 18165* (UMKC, UMO); Oronogo, dry prairies, 17 June 1911, *Palmer 3420* (MO); Prosperity, prairies, 17 June 1909, *Palmer 2251* (MO); Carthage, prairie, 23 June 1909, *Palmer 2329* (MO); Webb City, 12 July 1927, *Kellogg 1037* (MO); near Webb City, rocky upland prairies, 25 June 1927, *Palmer 32378* (UMO); Webb City, frequent on upland prairies, 1 June 1902, *Palmer 348* (MO). **Lawrence County:** NW corner of county, near Turnback Creek, grows on rocky hill slopes-mainly bare, 20 June 1857, *Broadhead* s.n. (MO); Pierce City, 18 July 1880, *Letterman* s.n. (MO); between Stotts City and Mount Vernon, upland prairie, 7 July 1950, *Palmer 50303* (UMO); limestone glade slope along Johnson Creek. 1½–2½ mi SW of Spencer, 6–7 mi W of Halltown, limestone glade slope, 6 May 1939, *Steyermark 22217* (F). **McDonald County:** without locality, 24 July 1892, *Bush* s.n. (MO); Bear Hollow, along Bear Creek 8½–9½ mi SW of Powell, rocky S-facing slopes, T21N R31W S35/36, 24 Sep 1947, *Steyermark 65137* (F). **Newton County:** Burhart Prairie, mine shaft being sunk by owners, W side road, scattered plants, very showy, T26N R33W S33 NE¼ of SE¼, 7 June 1963, *Dunlap* s.n. (UMO); Neosho, prairie, Aug 1882, *Eggert* s.n. (MO); along U.S. Highway 71, ca. 2 mi S of Joplin, roadside embankment, 7 July 1967, *Henderson 67-1125* (SMS, UMKC, UMO); just W of Lawrence County line on Missouri Highway 37, weedy community along railway, rather scarce, 18 Aug 1958, *Marsh 1263* (KANU); along roadside 2½ mi NW of Diamond, 17 June 1957, *Palmer 65636* (UMO). **Stone County:** Baxter, barrens, 27 May 1936, *Bush 15591* (MO); Highway H at Mill Creek, 0.4 mi E of Highway 39, glade margin, 30 June 1982, *Dorr 2418E* (MO); Highway YY opposite turnoff to Turkey Mountain Estates Number 2, rocky roadside, abundant, 23 May 1981, *Dorr & Elisens 1928* (MO); along roadside on way to public campsite and Table Rock Dam from the S, 4 June 1960, *Dunn & Henning 13588* (UMO); W-facing hillside along route 165, ¾ mi S of Table Rock State Park, 21 June 1978, *Green 11* (SEMO); Arrowhead Point Campgrounds, near Kimberling, 2 Aug 1972, *Clinard 249* (SEMO); James River, dry rocky hillsides, 2 June 1914, *Palmer 5834* (MO); adjacent to Table Rock Lake. vicinity of Arrowhead Point Camp, oak-hickory slopes and open cedar glades on open rocky soil, T22N R22W S18, 11 June 1966, *Redfearn 18865* (SMS); ridge above Missouri Highway 86 near crossing of Long Creek, frequent on sandy soil of an oak-hickory forest, 27 July 1958, *Redfearn & Pursell 3808* (SMS); Rice's Camp, bordering Table Rock Lake, limestone glade, T22N R23W S25 NW¼, 10 July 1981, *Summers 881* (MO); central part of county, 10 Sep 1898, *Trelease 961* (MO). **Taney County:** without locality, 23 July 1972, *Brooks 6720* (KANU); ca. 3 mi by air E of Table Rock Dam, limestone barren, T22N R21W S18/19, 16 May

1974, *Christ* s.n. (MO); Highway 160, 3.3 mi E of Kissee Mills, roadside, 30 June 1982, *Dorr 2420D* (MO); Swan, common in barrens, 4 June 1898, *Bush 189* (MO); Swan, rocky hillsides, 19 May 1933, *Kellogg* s.n. (MO); White River Region, Table Rock Dam Reservoir above the junction of Kings River with White River, ca. 23 mi W of Branson between Viola and Shell Knob, E facing, rocky, with hardwoods, elev. 950 ft, 20 June 1935, *Moore & Iltis 117* (F); 5 mi W of Branson on Missouri Highway 76, limestone glade, 20 May 1974, *Nelson 212* (SMS); Limestone glade area off Missouri Highway 76, 5 mi W of Branson, 22 May 1974, *Nelson 212a* (SMS); Limestone ledges and glades, bald knobs near Melva, 12 Sep 1924, *Palmer 26183* (MO); Drury Refuge, rocky glade, 10 June 1941, *Spencer* s.n. (UMO), *Spencer 240* (UMO); limestone glade W of Table Rock, 25 Aug 1935, *Steyermark 19598* (MO); E facing bluffs of White River near Hickey Spring 1½–2 mi N of Mincy, upper cherty limestone slopes in ravine tributary, 29 May 1938, *Steyermark 5549* (F, MO); dry limestone openings in upland near Forsyth, 8 June 1933, *Steyermark 8231* (UMO); 5.2 mi W of Branson, large glade on E- to NE-facing slope, 8 June 1978, *Wagner & Butley 3553* (MO).

4. Callirhoe involucrata (Torr. & A. Gray) A. Gray

var. involucrata (purple poppy mallow)

Stems 2–9 from the rootstock, 7–50 cm long, decumbent, densely pubescent with mostly 4-branched stellate, appressed to somewhat spreading hairs. Basal leaf petioles 5–9(–12) cm long, pubescent with mostly 4-branched stellate, appressed hairs and sparse simple strigose hairs. Basal leaf blades 2–6 cm long, 2–8 cm wide, reniform to nearly circular in outline, with 3 or 5 deep palmate lobes, these sometimes irregularly lobed, broad or narrow, the margins entire or sparsely and coarsely serrate, the upper and lower surfaces pubescent with dense 4-rayed stellate hairs and sparse simple strigose hairs. Cauline leaf blades 3–8 cm long, 3–9 cm wide, broadly ovate-cordate to obovate in outline, with 3 or 5 deep palmate lobes, these usually pinnately lobed, the margins entire to sparsely and coarsely serrate, the upper surface pubescent with simple strigose hairs, lower surface pubescent with 4-branched stellate, appressed hairs and simple strigose hairs. Stipules persistent, free, 7–13 mm long, narrowly to broadly ovate or somewhat auriculate, glabrous except for long-ciliate margins and rarely also 4-rayed stellate hairs on the surfaces. Inflorescenes racemes with 4–10 flowers. Pedicels 3–14 cm long. Bracts

subtending perianth 8–13 mm long, linear to narrowly ovate or oblanceolate. Buds ovate to broadly ovate, the terminal 3-10 mm of the sepals free and loosely ascending to spreading. Calyces 12–19 mm long, the outer surface densely pubescent with simple strigose hairs (these often in irregular fascicles along the strongly raised nerves) and also 4-rayed stellate hairs, the lobes 8–16 mm long, lanceolate to lanceolate-attenuate or less commonly narrowly ovate. Petals 19–33 mm long, pale rose to more commonly wine red or purplish red, sometimes with a lighter area toward the base. Staminal column 8–15 mm long, the portion below the anthers glabrous. Anthers white to red. Fruits 9–12 mm in diameter, with 14–20 mericarps. Mericarps indehiscent, 3.0–4.5 mm long, the dorsal surface glabrous or pubescent with mostly simple strigose hairs, the sides of the fertile portion with a reticulate pattern of thickenings, separated from the inconspicuous beaklike sterile portion but without a well-developed collar. $2n$=30, 60. Flowering late May to mid-August.

This species grows from northwestern Indiana south to central Arkansas, west to eastern South Dakota, Wyoming, and New Mexico; also in adjacent northeastern Mexico. The var. *involucrata* occupies most of the range, but is absent from Mexico and most of Texas, where var. *tenuissima* Baker f. and var. *lineariloba* (Torr. & A. Gray) A. Gray respectively occur. In Missouri, it has been collected at scattered sites nearly throughout the state (although apparently absent from the Mississippi Lowlands Natural Division and the eastern portion of the Glaciated Plains). However, most of the specimens originated from roadsides, railroads, pastures, and other disturbed areas where the plants have escaped from cultivation or are otherwise adventive. The few stations where the species apparently was present as a native component of natural plant communities are from the Glaciated Plains Natural Division, primarily in northwestern Missouri, but east to Putnam County. Here it was collected in upland prairies.

As alluded to above, Dorr (1990) classified *C. involucrata* as consisting of three varieties differing in leaf division and involucral bract characters. Of these, only the var. *involucrata* occurs in Missouri. The range of this variety has become somewhat blurred because it is cultivated as an ornamental and has become

naturalized in a number of states to the east and south of its presumed native distribution. Dorr (1990) considered populations from Pennsylvania to eastern Iowa and the southeastern U.S., as well as southwestern Missouri and eastern Oklahoma, to represent adventive occurrences, and noted that the plant has even become established in Oregon.

See the treatment of *C. bushii* for a discussion of differences between that species and *C. involucrata*.

SPECIMENS EXAMINED.—**Andrew County:** Missouri Highway 71, 3.5 mi S of junction of County Highway B and Misouri Highway 71, SW of Bolokow, open grassy places on the E side of road, 18 Aug 1950, *Steyermark 69962a* (F). **Atchison County:** along roadside, also found growing in lawns and along railroads, 8 June 1988, *Chapple 01806* (UMO). **Benton County:** along Highway 7, ca. 100 yd E of intersection of Highways 7 and 65, S of Warsaw, roadside, 24 June 1986, *Hubbard 01847* (UMO). **Boone County:** lowland in creek bottom near railroad tracks, 10 July 1958 *Buercklm* s.n. (UMO); Rocheport, 20 July 1927, *Rickett* s.n. (UMO); Rock Bridge, 13 July 1929, *Rickett* s.n. (UMO). **Clay County:** William Jewell College campus, lawn near football field, 1 June 1956, *Gier 8472a* (F). **Dent County:** 2 mi E of Sligo, in field bordering East Fork of Crooked Creek, 1 July 1932, *Steyermark* s.n. (MO). **Greene County:** near Seminole and Battlefield in open field, open cut pasture, T28N R21W S4 NW¼, 4 July 1974, *Nelson 341* (SMS), *Nelson 341a* (SMS). **Harrison County:** 7 mi N of Cainsville, 1 mi N of Akron, in bottoms of Grand River, escaped from house in adjoining field ½ mi S and E of swamp, T66N R26W S11, 24 June 1941, *Steyermark 40339* (F, MO). **Holt County:** ca. 2 mi E of Mound City by U.S. 59., 20 May 1968, *Goodnight 316-68* (UMKC); along U.S. Highway 59, ca. 5 mi S of Mound City, roadside, 7 June 1967, *Henderson 67-732* (SMS, UMKC, UMO). **Jackson County:** Kansas City, rare along railroad, 10 July 1898, Bush 270 (MO); Atherton, introduced, 28 June 1907, *Bush 4812* (MO); Sibley, introduced, 21 Aug 1907, *Bush 4821* (MO).; Courtney, uncommon, 21 May 1895, *Bush 67* (MO); Sheffield, uncommon, 23 June 1895, *Bush 69* (MO); Ozark Road near Municipal Farm, roadside, 26 Aug 1982, *DeLozier 164* (UMKC). **Jasper County:** near Webb City, waste places, 25 July 1932, *Kellogg* s.n. (MO). **Johnson County:** roadside embankment along Missouri Highway 13 ca. 8 mi S of Warrensburg, 2 June 1967, *Henderson 67-622* (SMS, UMO). **Linn County:** near Laclede, railroad banks, 28 May 1934, *Kellogg* s.n. (MO). **Nodaway County**: along road, Section 13, 6 mi NE of Clearmont, grassy upland prairie thickets along road, 19 June 1938, *Steyermark 5861* (F, MO). **Pulaski County:** Cookville, 7 Aug 1932, *Christ* s.n. (MO). **Putnam County:** near Unionville, upland prairies,

14 June 1925, *Palmer 27920* (MO). **Ray County:** Orrick Cemetery, abundant throughout cemetery, 28 June 1983, *DeLozier & Raveill 1219* (MO). **Ripley County:** near intersection of State Highway 142 and County Road V, W of Doniphan, glade, July 1989, *Ayers* s.n. (MO); W of Doniphan on Highway 142 and V, 19 June 1986, *Ayers* s.n. (SMS); Highway 142 at Gatewood, roadsides, T22N R1W S8, 9 July 1989, *Summers 3025* (MO). **St. Louis County:** Washington University Campus, 3 June 1926, *Greenman* s.n. (MO); Washington University Campus, NE of main buildings, dry meadow, 15 June 1929, *Steyermark 1378* (MO).

5. Callirhoe triangulata (Leavenw.) A. Gray
(clustered poppy mallow)

Stems 1–3 from the rootstock, 10–45 cm long, procumbent or somewhat ascending, densely pubescent with 4(–6)-branched stellate, appressed hairs. Basal leaf petioles 10–22 cm long, pubescent with 4(–6)-branched stellate, appressed hairs. Basal leaf blades 3.5–10.5 cm long, 2–8 cm wide, triangular to ovate-cordate or ovate-hastate in outline, unlobed or less commonly with 3 shallow to deep palmate lobes, these broad or narrow, the margins entire or more commonly crenate, the upper and lower surfaces pubescent with dense (3–)4(–8)-rayed stellate hairs. Cauline leaf blades 3–12 cm long, 2–8 cm wide, triangular to ovate-cordate or ovate-hastate in outline, with 3 or 5 shallow or less commonly deep palmate lobes, the margins entire or more commonly undulate, crenate, crenate-serrate, or shallowly lobed, the pubescence as in the basal leaves. Stipules persistent, free, 3.5–7.2 mm long, elliptic-lanceolate to less commonly ovate, the surfaces pubescent with simple strigose hairs, the lower surface also with 2–4-rayed stellate hairs, the margins ciliate. Inflorescenes panicles with 2–8 flowers, sometimes condensed and appearing as stalked clusters or umbellate. Pedicels 0.6–2.0 cm long. Bracts subtending perianth 4–7 mm long, narrowly obovate to spatulate. Buds ovate to broadly ovate, the sepal tips valvate, joined to form a short beaklike projection 1–2 mm long. Calyces 5–8 mm long, the outer surface densely pubescent with 4–6-rayed stellate hairs, the lobes 2–6 mm long, triangular-ovate, often with the tip cuspidate. Petals 15–27 mm long, red to purplish red, sometimes with a lighter area toward the base. Staminal column 9–12 mm long, the portion below the anthers sparsely pubescent with simple and/or 4-rayed

stellate hairs. Anthers red to purple. Fruits 6–9 mm in diameter, with 10–13 mericarps. Mericarps dehiscing longitudinally along the dorsal surface, 3.0–3.8 mm long, the dorsal surface pubescent with simple strigose hairs and also irregularly 2-rayed hairs, the sides of the fertile portion thin and smooth to slightly granular, separated from the inconspicuous beaklike sterile portion (this rarely absent) but without a well-developed collar. $2n$=30. Flowering mid-July to late August.

The native distribution of *C. triangulata* includes the southeastern states from North Carolina to Mississippi (except Florida) and a block of midwestern states from Wisconsin and northeastern Iowa south to southwestern Indiana and southeastern Missouri. In Missouri it is known only from Mississippi and Scott Counties. The locations in Franklin and St. Louis Counties indicated by Steyermark (1963) in his dot map for the species could not be corroborated during the present study, nor were they noted by Dorr (1990) during his larger scale survey of herbaria. Throughout its range, the species occupies open sites with sandy soil, including sand prairies and sand hills, but occasionally also sandy roadsides and railroads. The Missouri specimens lack precise habitat data, but presumably originated from sand prairies along the Sikeston Ridge.

Callirhoe triangulata is a morphologically distinctive species that is uncommon and in decline nearly throughout its range. It apparently is no longer extant in Alabama, Indiana, Iowa, and Missouri, and is also presently state-listed as being of conservation concern in Georgia, Mississippi, and Wisconsin (Karetesz and Meacham, 1999). In Missouri, plants have not been seen since the mid-1930s.

SPECIMENS EXAMINED.—**Mississippi County:** Charleston, in cemetery, 20 July 1933, *Kellogg 26073* (MO, UMO); same locality, 20 July 1933, Kellogg s.n. (MO); near Charleston, sandy open ground, 12 July 1933, *Palmer & Steyermark 41519* (MO, UMO). **Scott County:** Commerce, sand, 18 Aug 1927, *Kincaid* s.n. (UMO).

LITERATURE CITED

Bates, D. M., L. J. Dorr, and O.J. Blanchard, Jr. 1989. Chromosome numbers in *Callirhoe* (Malvaceae). Brittonia 41: 143–151.

Dorr, L. J. 1990. A revision of the North American Genus *Callirhoe* (Malvaceae). Mem. New York Bot. Garden 56:1–74.

Fernald, M. L. 1950. Gray's Manual of Botany, edition 8. American Book Company, New York.

Gleason, H. A. 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. Volume 2, the Choripetalous Dicotyledoneae. New York Botanical Garden, Bronx, NY.

James, E. 1823. Account of an Expedition from Pittsburgh to the Rocky Mountains, Performed in the Years 1819 and '20 by Order of the Hon. J. C. Calhoun, Sec'y of War, Under the Command of Major Stephen H. Long. Volume 1. Carey & Lea, Philadelphia, PA.

Kartesz, J. T., and C. A. Meacham. 1999. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC .[CD-ROM]

Moerman, D. E. 1998. Native American Ethnobotany. Timber Press, Portland, OR.

Nuttall, T. 1821. Description of rare plants recently introduced into the gardens of Philadelphia. J. Acad. Nat. Sci. Philadelphia 2:179–182.

Robinson, B. L., and M. L. Fernald. Emendations of the seventh edition of Gray's Manual–1. Rhodora 11:33–61.

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames, IA [errata added at second printing, 1968].

Thomas, R. D., and C. M. Allen. Atlas of the Vascular Flora of Loiusiana. Volume III: Dicotyledons, Fabaceae–Zygophyllaceae. Louisiana Department of Wildlife & Fish-eries, Baton Rouge, LA.

SIGNIFICANT RANGE EXTENSIONS IN MISSOURI FOR *ECHINOCHLOA WALTERI* (POACEAE) AND *CYPERUS FLAVICOMUS* (CYPERACEAE)

Paul M. McKenzie
U.S. Fish and Wildlife Service
608 E. Cherry St., Room 200
Columbia, MO 65201-7712

The range of *Echinochloa walteri* (Pursh) Heller extends from Canada and the eastern United States along the Atlantic coast west to Wisconsin, Missouri, and central Texas; and south to the Gulf Coast, Mexico, Central America and the Caribbean Islands (Mohlenbrock, 1973; Godfrey and Wooten, 1979; Diggs et al., 1999; Yatskievych, 1999). The species has been reported from a variety of habitats, including low, moist ground; lake shores; swamps; shallow water; marshes; drainage and irrigation ditches and canals; banks of rivers and sloughs; and ponds (Mohlenbrock, 1973; Godfrey and Wooten, 1979; Swink and Wilhelm, 1994; Diggs et al., 1999; Yatskievych, 1999). Swink and Wilhelm (1994) listed the common name of this species as "salt-marsh cockspur grass", apparently due to its common occurrence in saline coastal marshes along the Gulf Coast, whereas Allen (1992) recorded the common name as "water millet." This species previously was known in Missouri from only two locations within the Mississippi River floodplain near West Alton and Kampville (Smith, 1997; Yatskievych, 1999).

Cyperus flavicomus Michx. [*C. albomarginatus* (Mart. & Schrad. ex Nees) Steud.] is nearly a cosmopolitan primarily pantropical and warm-temperate species native to the southeastern United States north to Virginia, Kentucky, Alabama and Tennessee; west to Missouri, Texas, and Arizona (Godfrey and Wooten, 1979; Yatskievych, 1999; Gordon Tucker, Eastern Illinois University, pers. comm.). In Missouri, the species previously was known only from two collections in Stoddard County taken on the Mingo National Wildlife Refuge, and from one location on private property in Ripley County (Dunn and

Knauer, 1975; Yatskievych, 1999). Habitats listed for the species include ditches, low fallow fields, washes along streams, alluvial sites (Godfrey and Wooten, 1979), marshy areas, and crop fields (Yatskievych, 1999). Godfrey and Wooten (1979) stated that the species was "local" and "sporadic" throughout its range. Gordon Tucker (pers.comm), who is studying the genus for the Flora of North America Project, concurred with that assessment and noted that he does not know anywhere in the United States where the species is common.

On September 22, 1999, I found *E. walteri* and *Cyperus flavicomus* growing together along the edges of a seasonally flooded pool at Swan Lake National Wildlife Refuge (hereafter Swan Lake) in Chariton County. The populations occurred at the south end of Swan Lake, ca. 0.8 mi east of refuge headquarters directly adjacent to and north of the main east–west entrance road, ca. 1.4 mi W of Silver Lake (T55N R21W Sec. 1, NW¼ of SE¼ of NW¼ of NW¼), and were in association with *C. erythrorhizos, C. esculentus, E. muricata* var. *microstachya, Hibiscus militaris, Leptochloa fascicularis, L. panicoides,* and several *Polygonum* species. The population of *E. walteri* consisted of several thousand plants. Some plants of this grass were 1.0–1.5 m in height and formed nearly a pure stand in certain sections of the pool. Although *C. flavicomus* was much less common than *E. walteri*, I was able to find ca. 70 healthy plants scattered along the edges of the pool. A few plants of *C. flavicomus* approached 1 m in height. Voucher specimens of *E. walteri* (*McKenzie 1877*) and *C. flavicomus* (*McKenzie 1878*) have been deposited at MO and UMO, with other duplicates to be distributed later.

The discovery of these two species at this location extends the range of *E. walteri* westward in the state about 250 km (160 mi) and extends the range of *C. flavicomus* northwest of the previous nearest locations about 400 km (250 mi).

Echinochloa walteri and *C. flavicomus* possess field characters that make them easy to identify and distinguishable from other species in their respective genera. *Cyperus flavicomus* is readily recognizable in the field by the combination of annual habit, red-fragrant roots, purplish red spikelets with white spikelet scale margins (hence the basis for the older name *C. albomarginatus*), 2-parted styles, and 2-sided black achenes.

Echinochloa walteri can be distinguished from other taxa in the genus by the combination of usually hispid to papillose-hirsute leaf sheaths, an awned second glume 2–12 mm long, an awned sterile lemma 10–60 mm long, and a fertile lemma about 3 times as long as wide. Additionally, the long awns of the spikelets of *E. walteri* are often tinged purple at maturity.

The size and density of plants of *E. walteri* at the discovery site suggest that this species has been well established at Swan Lake for several years. Although *E. walteri* occurs primarily in coastal areas and within the floodplains of larger rivers, the species has been documented in inland areas of the Blackland Prairie and Edwards Plateau regions of northcentral Texas (Diggs et al., 1999). The origin of both species at Swan Lake is unknown but appears to have been accidental. Possibilities of introduction are: 1) from migrating waterfowl, as suggested for the introduction of *C. flavicomus* at Mingo National Wildlife Refuge (Dunn and Knauer, 1975), 2) from seed contaminants in seed planted for waterfowl at Swan Lake, or 3) from seeds deposited following past flood events.

An analysis of the three possibilities reveals that two of the potential sources can be eliminated. John Guthrie, Refuge Manager for Swan Lake indicated that the refuge has seeded drawdown areas with Japanese millet [*E. crusgalli* var. *frumentacea* (Link) W. Wright] in the past, and that the seed was purchased from the Siemer/Mangelsdorf Seed Company of East St. Louis, Illinois (pers. comm.). I contacted the company and learned from discussions with its staff that Kansas and Iowa are the seed sources for the Japanese millet shipped to sites in Missouri (Kurt Ostaumann, pers. comm.). Because neither *E. walteri* or *C. flavicomus* have been documented from the Great Plains, including Kansas (Great Plains Flora Association, 1986), it is highly unlikely that Japanese millet seeded for waterfowl in the past at Swan Lake was contaminated with mature fruit of the two species in question.

Near record-level floods occurred along the Missouri River and its major tributaries in 1993 and 1995, including Swan Lake and surrounding areas. This flooding significantly impacted floodplain vegetation throughout the Missouri River floodplain and drainage basin. Numerous surveys following the 1993, and 1995 floods have resulted in the discovery of species new to the

state or at least new to the Missouri River floodplain in Missouri. These new records include *C. fuscus* (McKenzie et al., 1998), *C. difformis* (Johnson, 1998), *Bergia texana, Fuirena simplex* var. *aristulata* (McKenzie and Jacobs, 1999), and *Schoenoplectus saximontanus*. Some of these records could have originated from seeds deposited during the 1993 and/or 1995 floods. McKenzie et al. (1999) postulated how *C. fuscus* could have become established along the Missouri River in this state from achenes carried in flood waters from upstream locations in Nebraska and South Dakota where *Cyperus fuscus* has been documented. It is unlikely, however, that fruits of *E. walteri* and *C. flavicomus* originating from areas north of Missouri were similarly brought in by flood waters, because neither species has been documented for the Great Plains states within the Missouri River flood plain (Great Plains Flora Association, 1986). Consequently, it is likely that fruits of *E. walteri* and *C. flavicomus* were naturally introduced to Swan Lake by migrating waterfowl.

Botanical nomenclature listed herein follows Yatskievych (1999) except for *Bergia texana* and *Hibiscus militaris*, which follow Steyermark (1963).

LITERATURE CITED

Allen, C. M. 1992. Grasses of Louisiana. second edition. Cajun Prairie Habitat Preservation Society, Eunice, LA.

Diggs, G. M., Jr., B. L. Lipscomb, and R. J. O'Kennon. 1999. Shinners & Mahler's illustrated flora of North Central Texas. Sida, Bot. Misc. 16:1–1626.

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

Great Plains Flora Association, eds. 1986. Flora of the Great Plains. University Press of Kansas, Lawrence, KS.

Johnson, R. 1998. *Cyperus difformis*, an introduced species new to Missouri. Missouriensis 19:1–5.

McKenzie, P. M., and B. Jacobs. 1999. New sites for two rare Missouri sedges: *Eleocharis wolfii* and *Fuirena simplex* var. *aristulata*. Missouriensis 21:31–38.

McKenzie, P. M., B. Jacobs, C. T. Bryson, G. C. Tucker, and R. Carter. 1998. *Cyperus fuscus* (Cyperaceae), new to Missouri and Nevada, with comments on its occurrence in North America. Sida 18:325–333.

Mohlenbrock, R. H. 1973. The Illustrated Flora of Illinois—grasses: *Panicum* to *Danthonia*. Southern Illinois Univeristy Press, Carbondale, IL.

Smith, T. 1996. *Echinochloa walteri*, a new grass for Missouri. Missouriensis 17:32–34.

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames, IA [errata added at second printing, 1968].

Swink, F., and G. Wilhelm. 1994. Plants of the Chicago Region, fourth edition. Indiana Academy of Science, Indianapolis, IN.

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised edition, volume 1. Missouri Department of Conservation, Jefferson City, MO.

SPOROBOLUS PYRAMIDATUS (POACEAE) REDISCOVERED IN MISSOURI AFTER 102 YEARS

Brad Jacobs
Missouri Department of Conservation
P.O. Box 180
Jefferson City, MO 65102

Paul M. McKenzie
U.S. Fish and Wildlife Service
608 E. Cherry St.; Room 200
Columbia, MO 65201

Sporobolus pyramidatus (Lam.) Hitchc. is a salt-tolerant grass native to Mexico, Central America, South America, several Caribbean islands, and in the United States from Florida to Arizona north to Kansas, Missouri, and Colorado (Yatskie-vych, 1999), including Oklahoma, New Mexico, and Texas (McGregor et al,. 1986). It has been reported to have been introduced sporadically in the northeastern United States (Yatskievych 1999). The common name for this species is whorled dropseed (Great Plains Flora Association, 1986) or pointed dropseed-grass (Britton and Brown, 1913, as *S. argutus* (Nees) Kunth). In Missouri it was previously known from only one historical collection: Jackson County, Westminister, uncommon, introduced, 27 July 1896, *Bush 510* (MO). On 19 September 1998, the authors discovered a small population of this species along County Highway K in Columbia, Boone County (Smith, 1998).

Based on the 1998 discovery in Boone County, searches were conducted along roadsides in 1999 and new populations were located in Cole, Callaway, Cooper, Johnson, St. Charles, and St. Louis Counties. Voucher specimens were collected at all sites with the exception of the population in St. Charles County, where roadside mowing removed the plants before a specimen could be obtained.

VOUCHER DATA.—**Boone County:** S of Columbia, along County Highway K, 1.6 miles W of Providence Road on S side near gravelly road access points to a new housing development area, ca. 200 plants (T47N R13W Sec. 8, SE¼ of NW¼), 19 Sep 1998, *Jacobs & McKenzie 98-116.3* (MO). **Callaway County:** North Jefferson City, W of Turkey Creek along right-of-way next to old Highway 63 for 100 m W of bridge, ca. 100 plants (T45N, R11W Sec. 9, NE¼ of SW¼), 7 July 1999. *Jacobs 99-55* (MO). **Cole County:** Jeffer-son City, Industrial Boulevard, along bare gravelly roadside between Missouri River Bridge and State Highway 179 (T44N, R12W Sec. 9, N½, Sec. 10, N½), 6 or more locations along a 2 mi stretch, 1,000s of plants, 7 July 1999. *Jacobs 99-54* (MO). **Cooper County**, Boonville, along right-of-way of Interstate 70 Business Loop ca. 0.5 mi E of U.S. Highway 40 intersection (T49N, R7W Sec. 36, SW¼ of SW¼), 100s of plants, 1 Sep 1999. *Jacobs 99-62* (MO). **Johnson County:** Warrensburg, SE corner of intersection of State Highway 13 and Business Loop of US Highway 50 (T46N, R26W Sec. 24 SW¼ of NE¼), ca. 10 plants. 31 Aug 1999. *Jacobs & Jacobs 99-61*(MO). **St. Louis City:** 1 plant in disturbed area between commuter parking lot and Metrolink tracks at Haney Drive Station, just S of Exit #239 on Interstate 70, 19 Sep 1999, *McKenzie 1876* (MO, UMO).

Due to its tufted appearance and mostly erect culms with whorled or verticillate branches, *S. pyramidatus* exhibits a strong resemblance to *Agrostis gigantea* Roth in the field but differs in its shorter inflorescence branches and the spikelets being arranged primarily on the terminal half of the lateral branches. *Agrostis gigantea* was mostly past flowering at the time that *S. pyramidatus* was collected and remained only in scattered dry patches in ditches and more heavily-vegetated roadside areas. For morphological descriptions of both these species, see Yatskievych (1999).

Sporobolus pyramidatus most commonly inhabits dry open disturbed areas (Yatskievych, 1999). In addition to open areas, it also occurs on hammocks and cultivated ground in Florida (Small, 1933, as *S. argutus*); sandy or gravelly soil, especially along streets and along the seashore and in the interior in alkaline soil (Hitchcock, 1935); roadsides and waste places (Fernald, 1950) and clay or well-packed loams, often alkaline or slightly saline soil in open disturbed areas (Correll and Johnston, 1975).

In Missouri, *S. pyramidatus* grows in sparsely vegetated areas of roadsides or disturbed areas adjacent to parking lots with exposed, gravelly soil, usually within 2–3 m of the pavement.

Because frequent mowing of areas along paved roads likely destroys plants before they reach maturity, *S. pyramidatus* probably goes undetected most years. However, due to the late summer drought of 1999, little roadside mowing occurred in July and August, possibly enabling easier detection of this species than in years where normal or above normal growing season rainfall increases the need for roadside mowing.

The salting of Missouri roads in winter has likely created conditions unsuitable for many species, but appears to be compatible with *S. pyramidatus* for seed germination and the growth and establishment of plants. Tóth et al. (1997) studied pasture grass species in eastern Cuba and found that *S. pyramidatus* was in the group that showed the highest tolerance to soil salinity. The authors suggested that the occurrence of halotolerant plant species could be used to evaluate the level of salinity in pastures. The presence of *S. pyramidatus* in the presumed salt-runoff zones of gravelly roadside areas may indicate its ability to spread to extralimital areas via roadways. *Carex praegracilis* W. Boott (Reznicek and Catling, 1987) and *Puccinellia distans* (Jacq.) Parl. are also halotolerant species in Missouri that occur in similar conditions, although apparently to a lesser extent than *S. pyramidatus* (Yatskievych, 1999).

Although the rediscovery of *Sporobolus pyramidatus* in Missouri had been predicted by the authors, we initially concentrated search efforts in mostly sandy soil, based on the reports of others (e.g., Hitchcock, 1936; Gould, 1975; Liogier and Martorell, 1992; and Allen, 1994), and based on past experience by the junior author with the species in sandy habitats in Puerto Rico, Louisiana, Texas, and Florida. Recent discoveries in disturbed habitats, however, especially those associated with saline soils bordering highways, suggest that sandy areas may not be the most suitable areas for this species to become established in Missouri.

Gleason and Cronquist (1991) included Missouri in the range of this species, and apparently considered it native to the state. Given the species' tolerance to saline conditions and its close association with paved highways where salt might accum-ulate in the gravel along highway rights-of-way, *S. pyramidatus* should be considered as an introduced species until additional populations are discovered in more natural habitats that are not under direct

anthropogenic influences. All sites currently known in Missouri are in rights-of-way along roads that are subject to salt runoff. To date, no population has been discovered in the state in natural, sandy habitat as reported elsewhere within the species' range. With further observation along roadsides, this species will likely be discovered in additional Missouri counties.

LITERATURE CITED

Allen, C. M. 1992. Grasses of Louisiana. second edition. Cajun Prairie Habitat Preservation Society. Eunice, LA.

Britton, N. L., and A. Brown. 1943. An Illustrated Flora of the Northern United States and Canada, second edition, volume 1. Charles Scribner's Sons, New York.

Correll, D. S., and M. C. Johnston. 1975. Manual of the Vascular Plants of Texas. Texas Research Foundation, Renner, TX.

Fernald, M. L. 1950. Gray's Manual of Botany, eighth edition. American Book Company, New York.

Gleason, H. A., and A. Cronquist,. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, second edition. New York Botanical Garden, Bronx, NY.

Gould, F. W. 1975. The Grasses of Texas. Texas A&M University Press, College Station, TX.

Hitchcock, A. S. 1935. Manual of the Grasses of the United States. U.S. Government Printing Office, Washington, DC.

———. 1936. Manual of the Grasses of the West Indies. USDA Misc. Publ. 243. U.S. Government Printing Office, Washington, DC.

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

Liogier, H. A., and L. F. Martorell. 1982. Flora of Puerto Rico and Adjacent Islands: A Systematic Synopsis. Editorial de la Universidad de Puerto Rico, Rio Piedras, Puerto Rico.

Reznicek, A. A., and P. M. Catling. 1987. *Carex praegracilis* (Cyperaceae) in eastern North America: a remarkable case of rapid invasion. Rhodora 89:205–216.

Small, J. K. 1933. Manual of the Southeastern Flora. Published by the author, New York.

Smith, T. E. 1998. Highlights of Missouri field botany (1997–1998). Missouriensis 19:54–58.

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames, IA.

Tóth, T., M. Kertész, L. Catasús Fuerra, J. Labrada Labrada, B. P. Machado, P. Castillo Fonseca, and M. Nieto Martínez. 1997. Plant composition of a pasture as a predictor of soil salinity. Rev. Biol. Trop. 45:1385–1292.

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised Edition, volume 1. Missouri Department of Conservation, Jefferson City, MO.

NEW SITES FOR TWO RARE MISSOURI SEDGES: *ELEOCHARIS WOLFII* AND *FUIRENA SIMPLEX* VAR. *ARISTULATA* (CYPERACEAE)

Paul M. McKenzie
U.S. Fish and Wildlife Service
608 E. Cherry St., Room 200
Columbia, MO 65201-7712

Brad Jacobs
Missouri Department of Conservation
P.O. Box 180
Jefferson City, MO 65102–0180

Recent field and herbarium studies have resulted in documented records of two rare species of Cyperaceae in Missouri. These involve the discovery of new extant sites in the state for *Eleocharis wolfii* and *Furiena simplex* var. *aristulata*.

Eleocharis wolfii A. Gray (Wolf's spike rush) is native, but apparently uncommon and local, from Canada south through the eastern United States (North Dakota to Ohio, south to Texas and Mississippi) and Colorado (Great Plains Flora Association, 1977; Godfrey and Wooten, 1979; Phillippe and Robertson, 1992; Yatskievych, 1999). The species has been documented from a wide variety of habitats including: "wet depressions of bottomland and mesic upland prairies", "wet, open sites", "wet river and lake margins", "marshes and seeps", and *Quercus palustris* (pin oak), *Q. bicolor* (swamp white oak), or *Q. stellata* (post oak) flatwoods (Great Plains Flora Association, 1977; Godfrey and Wooten, 1979; Phillippe and Robertson, 1992; Eilers and Roosa, 1994; Yatskievych, 1999). Phillippe and Robertson (1992) conducted an extensive survey for *Eleocharis wolfii* in Illinois and documented 26 populations in 11 counties. Of these, nine populations in four counties occurred in ephemeral pools of remnant native prairie habitat and 17 populations in seven counties were found in ephemeral pools within open oak flatwoods.

Wolf's spike rush was known previously in Missouri only from collections taken in Linn and Callaway counties (Steyermark,

1963; Yatskievych, 1999). Even with repeated searches to document its occurrence in Missouri, the species had not been observed in recent years and was believed to be possibly extirpated from the state (Yatskievych, 1999). On 3 June 1999, while conducting a search for rare plants at the Missouri Department of Conservation's Otter Slough Conservation Area, we discovered *Eleocharis wolfii* scattered in the shaded understory of a forested portion of Otter Slough, and in a wet depression adjacent to the forest (*Jacobs 99-33, with McKenzie, McCarty, & Magai*). Otter Slough is primarily a seasonally-flooded bottomland forest with *Quercus palustris* being a major component of the forest overstory, and is thus similar to the oak flatwoods habitat described in Illinois by Phillippe and Robertson (1992). Culms of *Eleocharis wolfii* observed in the shaded understory of the forest were weak and spindly, and we were able to find only a few fertile achenes within the flowering heads. We were, however, able to find a large population of the spike rush with erect culms and spikes that contained numerous fertile achenes in the open area adjacent to the forest. In the open areas, Wolf's spike rush was growing in association with *Carex scoparia, C. triangularis, C. tribuloides, Eleocharis verrucosa, Isoetes melanopoda, Juncus* spp., *Ludwigia peploides, Panicum hians*, and *Polygonum* sp.

McKenzie and Janeen Laatsch, Regional Natural History Biologist for the Missouri Department of Conservation, returned to Otter Slough on 31 May 2000 and determined that the population was much more extensive than initially observed. The population was scattered in colonies in wet open depressions along the entire southern edge of the forest and contained hundreds of thousands of plants (*McKenzie 1897*). McKenzie and Laatsch searched other areas at Otter Slough and located a second population containing thousands of plants approximately 0.5 mi SSW of the original discovery site (*McKenzie 1898*). The second population was in a wet ditch adjacent to one of the entrance roads into the area. Here the species was in association with *Eleocharis verrucosa, Juncus* spp. and *Polygonum* spp.

Subsequent to these investigations, a third population was discovered during a Missouri Native Plant Society field trip on 3 June 2000 at the Treaty Line Prairie Conservation Area in Barton County (*McKenzie 1905*), where several hundred culms were

discovered scattered throughout a wet prairie swale. Detailed locality data for this and other prairie sites discussed below are listed in Davit (1999). Associates at this locality included *Carex oklahomensis, C. tribuloides, Eleocharis verrucosa, Juncus* spp., and *Platanthera lacera*. A visit to Wha-Sha-She Prairie the same day yielded a fourth population containing a few thousand plants scattered in colonies throughout the area's main prairie swale (*McKenzie 1906*). Associates at this location were similar to those previously reported at other sites, with the addition of *Agrostis hyemalis, Asclepias incarnata, Carex bicknellii* var. *opaca, C. lupulina, Eleocharis acicularis, E. palustris, Helianthus mollis, Hibiscus lasiocarpos, Leersia oryzoides, Panicum scoparium*, and *Tradescantia ohiensis*.

On 4 June 2000, McKenzie searched five additional southwestern Missouri prairies and documented the species at the following four locations: Shelton L. Cook Memorial Meadow, Barton County (*McKenzie 1908*); Osage Prairie Conservation Area, Vernon County (*McKenzie 1911*); Wah'Kon-Tah Prairie (formerly Mo-Ko Prairie tract), Cedar County (*McKenzie 1913*); and Wah'Kon-Tah Prairie, St. Clair County (*McKenzie 1915*). Associates common at all four sites were *Carex oklahomensis, Eleocharis verrucosa, Juncus* spp., and *Scirpus atrovirens*. Other associates at multiple sites include *Carex annectens, C. tribuloides, Glyceria striata, Panicum scoparium, Penstemon tubaeflorus, Physostegia virginiana*, and *Scirpus pendulus*. Population sizes ranged from a few scattered colonies at the Wah'Kon-Tah Prairie sites to hundreds of culms at Cook Meadow and Osage Prairie.

Finally, on 16 June 2000 McKenzie returned to Tucker Prairie in Callaway County, one of the historical sites reported by Steyer-mark (1963) and one in which *Eleocharis wolfii* had been searched for unsuccessfully on several different occasions by the authors and others within the last 10 years. Followng recent field experiences with the species, McKenzie was able to locate a few scattered colonies at Tucker Prairie within a few minutes of searching (*McKenzie 1917*).

Unlike other localities reported above, in Callaway County *Eleocharis wolfii* was noted to occur on a more upland site, where it was in association with *Carex bicknellii* var. *bicknellii, C.*

trichocarpa, Eleocharis verrucosa, Muhlenbergia sp., *Tripsacum dactyloides*, and *Sporobolus heterolepis*. Failure to locate Wolf's spikerush at this locality during other recent investigations suggests that the species simply has been overlooked. The following factors are probably involved in the lack of detection of this species prior to 1999 and 2000: 1) in prairies, the species is often hidden and scattered among taller prairie vegetation; 2) many populations contain culms that are only vegetative or have immature or abortive achenes; 3) it is almost always in association with other species of *Eleocharis*, most frequently *E. verrucosa* but also *E. palustris* in the larger prairie swales and in the Bootheel; 4) the spikes often wither and drop off after flowering, some even prematurely; and 5) the species may be mistaken for *E. acicularis*, with which it shares several characters (see below). Although some have suggested that the rash of recent discoveries has been due to changes in the management of many of our prairies (i.e., hay mowing being replaced more frequently by controlled burning), it is more likely that the species has been overlooked by botanists unfamiliar with its field characters.

Eleocharis wolfii shares several characters with *E. acicularis*: 1) both have hair like rhizomes, 2) both have culms that are red or purplish at the base, 3) both have purplish to reddish-brown bands on either side of the midrib of the pistillate scales similar to the pattern on the scales of *Cyperus bipartitus* or *Cyperus diandrus*, and 4) both have tiny, white achenes with longitudinal ribbing and horizontal cells in between. The main differences, however, are that *E. wolfii* has strongly flattened, twisted (excessively so in some taller specimens) and "hard to roll between the fingers", bluish green culms; usually has longer pistillate scales and fewer longitudinal ribs on the achenes; and occurs primarily in prairie swales, often in the shade of taller prairie vegetation, or open areas adjacent to pin oak flatwoods (in the Bootheel). The culms of *E. acicularis* are 4- or 5-angled, easily rolled between the fingers, and green to dark green. It usually has shorter pistillate scales and more longitudinal ribs on the achenes, and occurs on open exposed mud-flats of lakes, ponds, rivers, etc., where it apparently does compete well with other vegetation.

Given the observations made in 1999 and 2000, it is likely that additional populations of this sedge will be located within

openings adjacent to pin oak flatwoods in other areas in the Missouri Bootheel and in high quality prairies throughout the state. Recent discoveries in the state are similar to the results of Phillippe and Robertson (1992), who documented the occurrence of Wolf's spikerush in two different habitats in Illinois. All vouchers of *Eleocharis wolfii* listed above are accessioned at MO with duplicates to be distributed to selected other selected herbaria.

Fuirena simplex Vahl is a widely distributed sedge extending from "...southern Kansas and Illinois southward through the Interior Highlands and plains of the U.S. into Texas, New Mexico, thence southward through Mexico (incl. Baja California) into Nicaragua; in the Caribbean in Cuba, Jamaica, Puerto Rico." (Kral, 1978; Godfrey and Wooten, 1979). In his treatment of *Fuirena*, Kral (1978) separated the *F. simplex* into two varieties, var. *aristulata* (Torr.) Kral and var. *simplex*. *Fuirena simplex* var. *aristulata* can be distinguished from the nominate variety by its annual (vs. perennial) habit, usually shorter culms, and shorter (0.5–0.6 mm vs. 0.9–1.2 mm) anthers. In Missouri, the two varieties can be further separated due to differences in range and habitat preferences. *Furiena simplex* var. *simplex* is much more common and widely distributed, but is restricted to "fens, seepy ledges of calcareous bluffs and glades, less commonly in calcareous seeps along igneous shut-ins" of the Ozark and Ozark Border Divisions of the state (Yatskievych, 1999). The var. *aristulata* previously was known only from historical collections taken from "mudflats of the Missouri River floodplain" in Holt and Jackson Counties (Yatskievych, 1999), and from collections secured from "sandy soil" at the Little Bean Marsh Conservation Area in Platte County in 1982 and 1986 (George Yatskievych, Flora of Missouri Project, pers. comm.).

On 20 August, 1999, while visiting the only known extant Missouri sites of *Cyperus difformis* L. and *Schoenoplectus saximontanus* (Fernald) J. Raynal, we discovered a large population of *F. simplex* var. *aristulata* in association with the two above-mentioned sedges in a large wet swale on the Missouri River floodplain. Several vouchers were taken by Jacobs from the site. In addition to *Cyperus difformis* and *Schoenoplectus saximontanus*, plants were in association with *Alisma subcordatum, Bergia*

texana, Bolboshoenus fluviatilis, C. acuminatus, C. esculentus, C. odoratus, C. squarrosus, Echinodorus berteroi, Eleocharis ovata, Heteranthera limosa, Lipocarpha micrantha, Juncus torreyi, Polygonum spp., *Rorippa* spp., *S. acutus,* and *S. tabernaemontani.*

Because the site in Carroll County was part of a post-1995-flood vegetation monitoring study conducted by the Missouri Department of Conservation from 1996 through 1998, McKenzie searched the University of Missouri Herbarium (where voucher specimens collected during that study are accessioned) on 16 September 1999 to determine if *F. simplex* var. *aristulata* had been collected at the location prior to the new discovery. These investigations resulted in the discovery of additional vouchers of this taxon taken in 1997 and 1998 (see below).

Examination by McKenzie of of all other voucher specimens taken at study sites within the Missouri River floodplain failed to yield additional examples of this taxon. Field work conducted at other sites along the Missouri River floodplain on 20 August 1999 by McKenzie and Jacobs, as well as on 23 September 1999 by McKenzie, Jacobs, Tim Smith, and Karen Kramer, also failed to yield additional populations of the taxon.

Recent herbarium studies by George Yatskievych have resulted in the discovery of two collections of *F. simplex* var. *aristulata* by David Castaner in 1982 (*Castaner 7246*, MO) and David LaPlante in 1986 (*LaPlante 750*, MO), from Little Bean Marsh Conservation Area, in Platte County. Although both specimens were determined to variety correctly by the collectors, neither LaPlante (1987), nor Castaner and LaPlante (1992) provided any mention of the taxon beyond species level. The status of *Fuirena simplex* var. *aristulata* at this location is unknown.

VOUCHER DATA.—**Carroll County**: thousands of plants in remnant, wet prairie swale, ca. ½ mi E of County Road 509, ca. 2 mi SE of the junction of State Highway 10 and County Highway FF, near Norborne MO and near Missouri River mile 304.0 L; T51N R25W S11 NW¼ SW¼ SE¼, 20 Aug 1999, *Jacobs 99-59, with McKenzie* (BRIT, EIU, KANU, LSU, MO, MICH, UMO, VSC); same location, 30 June 1998, *Johnson T13-98-16* (UMO); same location, 27 July 1997, *Martin T13-97-50* (UMO).

Although searches during 1999 failed to discover any additional locations of *F. simplex* var. *aristulata* than the one in Carroll County, the abundance of widely dispersed habitat within the Missouri River floodplain and recent collections taken from Platte County suggest that further surveys for this taxon are warranted.

Botanical nomenclature listed herein follows Yatskievych (1999), except for *Asclepias incarnata, Bergia texana, Helianthus mollis, Heteranthera limos, Hibiscus lasiocarpos, Ludwigia peploides, Penstemon tubaeflorus, Physostegia virginiana,* and *Quercus* spp., which follow Yatskievych and Turner (1990), and *Cyperus difformis*, which follows Godfrey and Wooten (1979).

LITERATURE CITED

Castaner, D., and D. LaPlante. 1992. Plants of the Little Bean Marsh Wildlife Area, Platte County, Missouri. Missouriensis 13:27–49.

Davit, C., ed. 1999. Public Prairies of Missouri, third edition. Missouri Department of Conservation, Jefferson City.

Eilers, L. J, and D. M. Roosa. 1994. The Vascular Plants of Iowa— an Annotated Checklist and Natural History. University of Iowa Press, Iowa City.

Godfrey, R. K., and J. W. Wooten. 1979. Aquatic and wetland plants of the southeastern United States. Monocotyledons. University of Georgia Press, Athens.

Great Plains Flora Association, eds. 1977. Atlas of the Flora of the Great Plains. Iowa State University Press, Ames.

Kral, R. 1978. A synopsis of *Fuirena* (Cyperaceae) for the Americas north of South America. Sida 7:309–354.

LaPlante, D. W. 1987. Flora and vegetation of Little Bean Marsh. M.S. thesis, Central Missouri State University, Warrensburg.

Phillippe, L. R., and K. R. Robertson. 1992. Report to the Illinois Endangered Species Protection Board on *Eleocharis wolfii* in Illinois. Unpublished report, Illinois Natural History Survey, Champaign.

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames [errata added at second printing, 1968].

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised edition, volume 1. Missouri Department of Conservation, Jefferson City, MO.

Yatskievych, G., and J. Turner. 1990. Catalogue of the flora of Missouri. Monogr. Syst. Bot. Missouri Bot. Gard. 37:i–xii, 1–345.

ANNOUNCEMENTS

Copies of plant lists and other information relating to the flora are requested for inclusion in the Society's flora file. Please send items to the archivist, Jim Bogler (see address on inside front cover).

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STEYERMARK'S FLORA OF MISSOURI, VOLUME 1, ERRATA

Compiled by George Yatskievych
Flora of Missouri Project
Missouri Department of Conservation and
Missouri Botanical Garden
P.O. Box 299, St. Louis, MO 63166-0299

When examined under sufficient magnfication, few things in life are perfect. This is especially true of mammoth long-term undertakings like the preparation of a floristic manual. It has become customary to compile lists of additions, corrections, and deletions for such volumes, to allow readers to annotate their copies. Even in a venerable manual like that of Gleason and Cronquist (1991) for the northeastern United States, errors of detail can be uncovered (Hammond, 1992).

In the case of Volume 1 of the revised Steyermark's Flora of Missouri (Yatskievych, 1999), there was a strong push to get the book into print as quickly as possible, to accomodate the many Missourians who were clamoring (noisily) for it, resulting in some hasty editing (for which the author takes sole responsibility). In the intervening months since publication of the manual, numerous alert users have spotted errors and omissions in the text, maps, plates, and index. The Flora Project has benefitted greatly from having these reported, and the efforts of the lengthy list of individuals who contributed suggestions is acknowledged with thanks.

The following list is by no means complete, but hopefully accounts for the majority of these problems. The only omissions not included in the compilation below are those where distributional records have been reported that would add dots to the county distribution maps. These are better retained for future updates similar to those published previously in the Missouri Botanical Record (Weber and Corcoran, 1992) in this journal. The problems that are corrected in the list below mostly are minor typographical errors, but occasional more substantive mistakes did creep into the final manuscript that were not caught during the

editing process. One glaring omission that cannot be accomodated adequately in the list below is that the introduction to the class Liliopsida (p. 174) should have included mention of *Apteria aphylla* (Nutt.) Barnhart ex Small, a tiny member of the saprophytic family Burmanniaceae that was discussed and excluded from the flora by Yatskievych (1990).

CORRECTIONS TO VOLME 1 OF THE REVISED STEYERMARK"S FLORA OF MISSOURI

Page Number	Correction(s)
Front Endpaper	In the County Finder Map of Missouri, Andrew County should be #11 rather than #2.
1	Sixth line from bottom of "How To Use This Book" section, magnification refers to 10 times. Replace ¥ symbol with multiplication sign (×).
32	Second paragraph, Otto Ohmart retired and Allan Bornstein was hired, both in 1988, not 1993.
56	Fourth paragraph, the generic name *Dodecatheon* is misspelled *Dodecathion.*
65	Second complete paragraph, second line from bottom, "...typical components this vegetation type..." should read "...typical components of this vegetation type...".
65	Third full paragraph, the generic name *Dodecatheon* is again misspelled *Dodecathion.*
69	Second full paragraph, second line, "overwhelmingly" should read "overwhelming".
71	Sixth line from top, "...include several *Arisaema triphyllum, Asplenium* species..." should read "...include *Arisaema triphyllum,* several *Asplenium* species...".
71	Seventh line from top, *tennessensis* should read *tennesseensis.*
73	Fifth full paragraph: *Cephalanathus* should read *Cephalanthus.*
83	Table 7, last row in "introduced" column should read "820," not "20".
89	Lines 4 and 5, "...4.8 million hectares (1.18 million acres)..." should read, "...4.8 million hectares (11.86 million acres)...".
95	First paragraph, second line from bottom, "myccorhizal" should read "mycorrhizal".
102	The map number cited for *Asplenium rhizophyllum* should be Map 6, not Map 5.
114	Plate 5, the labels for parts e and f are reversed.

Page Number	Correction(s)
124	For *Matteuccia struthiopteris*, the cited plate number should be "Pl. 7," not "Pl. 17".
140	In the key to *Ophioglossum* species, couplet 3, second lead, change "fertile portion rounded" to "sterile portion rounded".
156	In the legend for Plate 15, habit for *Polypodium virginianum* should be labeled "f".
182	The names *Yucca filamentosa* and *Y. flaccida* should not have been listed as taxonomic synonyms of *Y. smalliana.* If the these three are combined, the oldest epithet is *Y. filamentosa* L. The usage in Volume 1 was to indicate that all three of these names had been applied to Missouri plants in the past, and that, in the strict sense, Missouri plants are referrable to *Y. smalliana.*
188–191	Species descriptions in *Sagittaria* fail to mention the three white petals.
213	In paragraph 2, line 3, "tripics" should read "tropics".
220	In the key to varieties of *Carex albicans*, a character is reversed. The lead for var. *albicans* should read "perigynia olive green to yellowish green" and the lead for var. *australis* should read "perigynia pale green".
239	In the discussion paragraph under *Carex bromoides*, "Christ (1988)" should read "Christ (1980)".
246	For *Carex microdonta*, delete the unsubstantiated chromosome number of $2n$=38. Naczi (Contr. Univ. Michigan Herb. 22:105–119, 1999) recently published the first verified counts ($2n$=32) for this species.
247	In couplet 3 of the key, the character of whether the body of the pistillate scale is shorter than or longer than the perigynium is misplaced. It should be moved to couplet 5, with species falling under the first lead (*C. oligocarpa, C. planispicata*) having the lowermost pistillate scales with the bodies shorter than than the associated perigynia, and species falling under the second lead (*C. grisea, C. amphibola, C. corrugata*) having the lowermost pistillate scales with the bodies as long as or longer than the associated perigynia. The other two species from the first lead in couplet 3 (*C. flaccosperma, C. glaucodea*) also have scales with short bodies.
264	In the legend for Plate 41, "*Carex (Hymenochlaenae) sartwellii*" and "*Carex (Hymenochlaenae) blanda*" should read "*Carex (Intermediae) sartwellii*" and "*Carex (Laxiflorae) blanda*" respectively.

Page Number	Correction(s)
277	In the discussion under *Carex triangularis*, "*C. annectans*" should read "*C. annectens*".
308	In the first lead of couplet 6 in the key, the second and subsequent lines are not properly indented.
355	The achene of *Carex oklahomensis* is shown with three stigmas. This is a rare condition in the species, which almost always has two stigmas.
324	In the legend for Plate 324, add "**s)** habit".
338	In the discussion paragraph under *Carex typhina*, "*C. squarrosa*" should read "*C. shortiana*".
363	Under *Cyperus echinatus*, the illustration citation should read "Pl. 70 c, d" not "Pl. 70 e, d".
386	In the second lead of couplet 7 in the key, *Eleocharis ovata* should read species #7, not #8.
400	Under *Fimbristylis vahlii*, the illustration citation should read "Pl. 76 e–g" not "Pl. 56 e–g".
470	For *Juncus canadensis*, the Wayne County specimen dates to 1986; the remaining records are historical.
480	The authority for 1c (*Luzula campestris*) should read var. *multiflora* (Retz.) Čelak.
556	In the description of *Isotria*, leaves should be "4–6," not "5 or 6".
574	In the third line from the end of the treatment of *Tipularia discolor*, "rememble" should read "resemble".
588	Add species level synonym for *A. elliottii* Chapm. under entry for *Andropogon gyrans*.
592	In the legend for Plate 121, the names *Bothriochloa laguroides* (should be: **c, d**) and *B. bladhii* (should be: **a, b**) are reversed.
616	In the legend for Plate 128, parts **c)** and **d)** are reversed; part **c)** should read "spikelet" and part **d)** should read "inflorescence and leaf".
678	The last sentence under Bouteloua hirsuta, "...known from a single extant site in Atchison County," actually refers to blue grama, B. gracilis (p. 676).
713	In discussion paragraph under 2b) ssp. *uninervia*, "ssp. *fusca*" should read "ssp. *fascicularis*".
728	In the key, the second lead of couplet 9 and subsequent couplets are indented too far.
766, 777	In Plate 162 and its legend, delete part **h)**, which purports to illustrate an unarmed spikelet of *Echinochloa* but instead is a misplaced spikelet of *E. muricata*; the unawned spikelet illustrated in part **e)** is correct.

Page Number	Correction(s)
768	In the description of *Echinochloa crus-galli*, line 9, "the hairs all or mostly with pustular bases" should read "the hairs all or mostly lacking pustular bases".
794	In the legend for Plate 170, "*Panicum capillaris*" should read "*Panicum capillare*".
835	Under *Festuca arundinacea*, the plate cited should read "Pl. 176", not "Pl. 167".
838	Under *Festuca pratensis*, line nine of the description, the text should read "...pair of auricles at the base..." not "...pair of auricles at the tip...".
842	Delete "X" from in front of "1. Lolium perenne L.".
883	Under *Hordeum vulgare*, in the third line from the end of the discussion, for "*H. distachyon*" substitute "*H. distichon* L."
896	Under *Potamogeton nodosus*, the authority cited should read "Poir.", not "Poiret".
953	Italicize the index entries for *Agropyron caninum 876* and *var. majus 876.*
955	Change page number **635** to boldface for Arrhenatherum elatius var. elatius index entry.
956	In index entry for Bolboschoenus maritimus, change "var. maritimus" to "ssp. maritimus".
958	Add the following index entries: *Camptosorus rhizophyllus, 102* *f. auriculatum, 102.*
958	Add "252" to index entry for: Carex amphibola var. globosa.
958	In index entry for Carex bulbostylis, change page number from "250" to "252".
959	Add the following index entry: *Carex richii 293.*
960	Move the following misalphabetized index entry from column 2 to p. 989: Volumes of descriptions and illustrations 29, 34.
961	Add the following index entry: *Coleogeton pectinatus 896.*
962	Change page number **364** to boldface for Cyperus esculentus index entry.
962	In index entry for Cyperus flavescens var. flavescens and var. piceus, change page number from "367" to "368".
962	In index entry for Cyperus lupulinus ssp. lupulinus, change page number from "**374**" to "**375**".
962	Add "372" to index entry for: Cyperus filiculmis.
964	Change page number **765** to boldface for Echinochloa colonum index entry.

Page Number	Correction(s)
965	Italicize the index entry for *Equisetum praealtum, 129.*
966	In index entry for *Eragrostis lugens*, change page number from "705" to "704".
971	Add the following index entry: Isolepis *planifolia 440.*
972	In index entry for Juncus effusus, change "var. effusus" to "ssp. effusus".
972	Change page number **748** to boldface for Leersia virginica index entry.
973	The page number for *Limosella aquatica* index entry should read "54".
974	Change page number **133** to boldface for Lycopodium dendroideum index entry.
976	Italicize the index entry for *Muhlenbergia expansa 721.*
978	Add page number for the index entry Panicum dichotomum *var. barbulatum 792.*
981	Add the following index entry: Potamogeton pusillus *var. minor 898.*
984	Italicize the index entry for *Scirpus molestus 403.*
987	Add the following index entry: *Stuckenia pectinata 896.*

LITERATURE CITED

Gleason, H. A., and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Adjacent Canada, second edition. New York Botanical Garden, Bronx.

Hammond, H. D. 1992. Corrections and additions for and errors found in *Manual of vascular plants of northeastern United States and adjacent Canada, second edition*, by Henry A. Gleason (late) and Arthur Cronquist. Bull. Torrey Bot. Club 119:88–89.

Weber, W. R., and W. Corcoran. 1992. Missouri botanical record 15. Missouriensis 13:53–70.

Yatskievych, G. 1990. The Missouri wildlfower that wasn't. Missouriensis 11:42–44.

———. 1999. Steyermark's Flora of Missouri, revised edition, volume 1. Missouri Department of Conservation, Jefferson City, MO.

TAXONOMIC AND NOMENCLATURAL DIFFERENCES BETWEEN THE FIRST AND REVISED EDITIONS OF STEYERMARK'S FLORA OF MISSOURI

Kathleen Wood and George Yatskievych
Flora of Missouri Project
Missouri Department of Conservation and
Missouri Botanical Garden
P.O. Box 299, St. Louis, MO 63166-0299

The first volume of the revised edition of Steyermark's Flora of Missouri (Yatskievych, 1999) contains numerous content differences from the original edition of the manual (Steyermark, 1963). Among these, perhaps the most perplexing differences to some users are those involving taxonomic and nomenclatural changes. These have resulted from the study of Missouri specimens in the context of the voluminous body of taxonomic literature applying to these plants published since 1963. Many of these updates and changes were initially reported by Yatskievych and Turner (1990), but because that checklist did not include keys and descriptions, its adoption by the state's botanical community was generally slow. The revised edition of Steyermark's Flora provides explanations, as well as citations of pertinent literature, to justify most of the name changes since the first edition and provides the means to identify all of the taxa in the flora.

Because the first edition of Steyermark's Flora is in such wide circulation, it was deemed of importance to provide a tabulation of the taxonomic and nomenclatural changes between it and the new edition. Table 1, below, should prove of use for those readers who wish to "crosswalk" their copies of the old Steyermark with the new. Because some of the explanations for seemingly simple name changes can be rather complicated, readers are advised to consult the revised edition for more detailed explanations.

The Flora of Missouri database contains a synonymized checklist of the state's flora and is maintained in DBase form on a PC-compatible computer at the Project offices at the Missouri

Botanical Garden. We searched and condensed this nomenclatural database for instances where changes had occurred from the original Steyermark nomenclature for those groups covered in Volume 1 of the revised edition. These entries were transferred to a separate database and scored for various general categories to explain the changes. Table 1 lists 285 entries alphabetically by the original Steyermark name, followed by the nomenclatural equivalent in the revised edition, and one or more numerical codes representing categories of explanations for each change.

Not included in Table 1 are 104 taxa that were reported as new to the state since 1963. Many of these novelties were listed by Turner and Yatskievych (1992), and their repeated listing here would add excessive length to an already lengthy paper. Also not included in Table 1 are 57 cases in which species in the original edition were treated as containing formae (trivial forms), because these are not treated in detail in the new volume. However, 19 taxa accepted by Steyermark and still considered taxonomically valid, but excluded from the Missouri flora, are listed in table 1.

The original edition of Steyermark's (1963) Flora of Missouri contained 715 species, plus an additional 134 subspecies, varieties, and named hybrids (forms excluded), for a total of 849 taxa in the major taxonomic groups included in Volume 1 of the revised edition (pteridophytes, conifers, monocots). Of these, 266 (31.3 percent) taxa have had some sort of name change, and an additional 17 taxa (2.0 percent) have been excluded from the flora. Thus, across all taxonomic levels (excluding forms and new state records), about one third of the flora, as treated by Steyermark, is treated differently in the new edition.

Excluding the 48 instances involving only the lumping and splitting of varieties and subspecies, similar calculations can be performed at the species level. Steyermark's Flora originally included 727 species and named hybrids of pteridophytes, conifers, and monocots. Of these, 223 (30.1 percent) have had some sort of name change, with another 12 (1.7 percent) now excluded from the flora. Thus the overall estimate of about one third change between editions is only slightly depressed when the analysis is made only at the specvies level.

The explanatory categories to account for various nomenclatural and taxonomic changes in Table 1 are as follows (note that

numbers in brackets following each explanation do not add to 285 cases, as two or more categories apply to some changes):

1 Excluded from the Flora (still a taxonomically accepted taxon, but does not grow in Missouri) [17 cases].

2 Replacement name (nomenclatural change to satisfy provisions of the International Code of Botanical Nomenclature, such as the finding of an older name for a taxon than the one accepted in the original Steyermark volume) [39 cases].

3 Change of application (examination of type specimens reveals that the name "Taxon A" actually applies to plants previously called "Taxon B") [16 cases].

4 Taxonomic lumping of genera (two or more genera or parts of two or more genera accepted by Steyermark that are now treated as a single genus) [20 cases].

5 Taxonomic splitting of genera (a genus or part of a genus accepted by Steyermark that is now treated as two or more genera) [43 cases].

6 Taxonomic lumping of species (two or more species accepted by Steyermark that are now treated as a single species or as varieties or subspecies of a single species) [74 cases].

7 Taxonomic splitting of species (a species accepted by Steyermark that is now treated as two or more species) [6 cases].

8 Taxonomic lumping of infraspecific taxa (two or more varieties and/or subspecies accepted by Steyermark that are now treated as a single variety or subspecies, or a species in which formerly accepted varieties and/or subspecies are no longer recognized) [77 cases].

9 Taxonomic splitting of infraspecific taxa (a variety or subspecies accepted by Steyermark that is now treated as two or more subspecies of a species) [3 cases].

10 Change of taxonomic status of infraspecific taxon (a taxon accepted by Steyermark as a variety is now considered a subspecies or species, or a taxon accepted by Steyermark as a subspecies is now considered a variety or species) [45 cases].

We hope that the changes tabulated here serve both to extend the usefulness of copies of the original Flora of Missouri (Steyermark [1963]) and to emphasize the magnitude of the changes in taxonomy and nomenclature that have resulted from three and a half decades of research by the botanical community. It is to be expected that for the dicot families remaining to be published in the revised Steyermark's Flora of Missouri, a similar number of such updates will be necessary.

LITERATURE CITED

Steyermark, J. A. 1963. Flora of Missouri. Iowa State University Press, Ames [errata added at second printing, 1968].

Turner, J., and G. Yatskievych. 1992. County record vouchers for vascular plant species newly recorded for Missouri since 1963. Missouriensis 13: 1–24.

Yatskievych, G. 1999. Steyermark's Flora of Missouri, revised edition, volume 1. Missouri Department of Conservation, Jefferson City, MO.

Yatskievych, G., and J. Turner. 1990. Catalogue of the flora of Missouri. Monogr. Syst. Bot. Missouri Bot. Gard. 37:i–xii, 1–345.

Table 1. Nomenclatural and taxonomic changes between Steyermark's (1963) Flora of Missouri and the first volume of the revised Steyermark's Flora of Missouri (Yatskievych, 1999).

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Agave virginica	Manfreda virginica	179	5
Agropyron repens var. subulatum	Elymus repens	874	4, 8
Agropyron smithii	Elymus smithii	875	4
Agropyron trachycaulum var. glaucum	Elymus trachycaulus	876	4, 8
Agropyron trachycaulum var. trachycaulum	Elymus trachycaulus	876	4, 8
Agrostis alba	Agrostis gigantea, Agrostis stolonifera var. palustris	626	7, 9
Agrostis interrupta	Apera interrupta	635	5
Agrostis perennans var. aestivalis	Agrostis perennans	627	8
Agrostis spica-venti	Apera spica-venti	635	5
Agrostis tenuis	Agrostis capillaris	624	2

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Alisma plantago-aquatica var. americanum	Alisma triviale	184	10
Alisma plantago-aquatica var. parviflorum	Alisma subcordatum	183	10
Alisma plantago-aquatica var. plantago-aquatica	Excluded	183	1
Allium mutabile	Allium canadense var. lavendulare, var. mobilense	496	6
Anacharis canadensis	Elodea canadensis	446	5
Anacharis nuttallii	Elodea nuttallii	447	5
Andropogon elliottii	Andropogon gyrans	588	3
Andropogon saccharoides	Bothriochloa laguroides ssp. torreyana	592	3, 5
Andropogon scoparius	Schizachyrium scoparium	600	5
Arisaema atrorubens	Arisaema triphyllum ssp. triphyllum	194	6
Aristida intermedia	Aristida longespica var. geniculata	614	6
Asplenium ruta-muraria var. cryptolepis	Asplenium ruta-muraria	102	8
Athyrium filix-femina var. asplenioides	Athyrium filix-femina ssp. asplenioides	112	10
Athyrium filix-femina var. michauxii	Athyrium filix-femina ssp. angustum	111	2, 10
Athyrium pycnocarpon	Diplazium pycnocarpon	117	5
Athyrium thelypteroides	Deparia acrostichoides	117	2, 5
Avena sativa	Avena fatua var. sativa	638	6

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Beckmannia syzigachne	Excluded	621	1
Botrychium dissectum var. obliquum	Botrychium dissectum (f. obliquum)	137	8
Botrychium dissectum var. tenuifolium	Botrychium biternatum	137	10
Brachiaria platyphylla	Urochloa platyphylla	828	4
Bromus catharticus	Bromus willdenowii	668	7
Bromus mollis	Bromus hordeaceus	659	2
Bromus purgans	Bromus pubescens	664	2
Bromus racemosus	Bromus commutatus	658	7
Bromus rigidus	Bromus diandrus	658	2
Calamagrostis canadensis var. macouniana	Calamagrostis canadensis	639	8
Calamagrostis inexpansa var. brevior	Calamagrostis stricta ssp. inexpansa	640	6, 8
Calamagrostis insperata	Calamagrostis porteri ssp. insperata	639	6
Calopogon pulchellus	Calopogon tuberosus	545	6
Camptosorus rhizophyllus	Asplenium rhizophyllum	102	4
Carex abdita	Carex umbellata	227	6
Carex amphibola var. globosa	Excluded	252	1
Carex amphibola var. rigida	Carex grisea	253	10
Carex amphibola var. turgida	Carex grisea	250	10
Carex aquatilis var. altior	Carex aquatilis var. substricta	308	8

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Carex artitecta	Carex albicans var. albicans	220	6
Carex cephalophora var. mesochorea	Carex mesochorea	322	10
Carex complanata var. hirsuta	Carex hirsutella	334	2, 10
Carex convoluta	Carex rosea	324	3
Carex crinita var. brevicrinis	Carex crinita	308	8
Carex debilis var. rudgei	Excluded	259	1
Carex digitalis var. macropoda	Carex digitalis	237	8
Carex flaccosperma var. glaucodea	Carex glaucodea	250	10
Carex gravida var. lunelliana	Carex gravida	320	8
Carex grayii var. hispidula	Carex grayi	270	8
Carex lanuginosa	Carex pellita	302	2
Carex lupulina var. pedunculata	Carex lupulina	272	8
Carex muhlenbergii var. australis	Carex austrina	318	3, 10
Carex pensylvanica var. digyna	Carex inops ssp. heliophila	222	3
Carex physorhyncha	Carex albicans var. australis	221	2, 6
Carex projecta	Excluded	298	1
Carex retroflexa var. texensis	Carex texensis	327	10

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Carex rosea	Carex radiata	323	3
Carex stipata var. maxima	Carex stipata	356	8
Carex stricta var. strictior	Carex stricta	312	8
Carex tenera	Carex tenera var. echinodes	296	9
Carex woodii	Excluded	303	1
Cinna arundinacea var. inexpansa	Cinna arundinacea	642	8
Commelina erecta var. deamiana	Commelina erecta	199	8
Corallorhiza trifida	Excluded	549	1
Cyperus aristatus	Cyperus squarrosus	382	6
Cyperus dipsaciformis	Cyperus retrofractus	380	6
Cyperus ferruginescens	Cyperus odoratus	375	6
Cyperus filiculmis var. filiculmis	Cyperus lupulinus ssp. lupulinus	375	3, 10
Cyperus filiculmis var. macilentus	Cyperus lupulinus ssp. macilentus	375	3, 10
Cyperus globulosus	Cyperus croceus	362	6
Cyperus ovularis var. ovularis	Cyperus echinatus	363	6, 8
Cyperus ovularis var. sphaericus	Cyperus echinatus	363	6, 8
Cyperus rivularis	Cyperus bipartus	360	6
Cyperus strigosus var. robustior	Cyperus strigosus	384	8
Cyperus tenuifolius	Kyllinga pumila	405	2, 5

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Cyperus virens	Cyperus pseudovegetus var. pseudovegetus	378	6
Cystopteris fragilis var. fragilis f. fragilis	Excluded	114	1
Cystopteris fragilis var. fragilis f. simulans	Cystopteris tennesseensis	116	10
Cystopteris fragilis var. mackayii	Cystopteris tenuis	116	10
Cystopteris fragilis var. protrusa	Cystopteris protrusa	114	10
Danthonia spicata var. longipila	Danthonia spicata	619	8
Diarrhena americana var. obovata	Diarrhena obovata	685	10
Digitaria ischaemum var. mississippiensis	Digitaria ischaemum	762	8
Digitaria sanguinalis var. ciliaris	Digitaria ciliaris	760	10
Diplachne acuminata	Leptochloa fusca ssp. fascicularis	713	4, 6
Diplachne fascicularis	Leptochloa fusca ssp. fascicularis	713	4, 6
Diplachne halei	Leptochloa panicoides	714	4, 6
Distichlis stricta	Distichlis spicata var. stricta	692	6
Dryopteris austriaca var. intermedia	Dryopteris intermedia	122	10
Dryopteris austriaca var. spinulosa	Dryopteris carthusiana	119	2, 10
Dryopteris clintoniana var. australis	Excluded	119	1

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Echinochloa crusgalli var. frumentacea	Echinochloa crusgalli	766	8
Echinochloa muricata var. ludoviciana	Echinochloa muricata var. muricata	770	10
Echinochloa muricata var. occidentalis	Echinochloa muricata var. microstachya	770	8
Echinodorus berteroi var. lanceolatus	Echinodorus berteroi var. berteroi	186	8
Eleocharis calva	Eleocharis erythropoda	390	2
Eleocharis engelmanni	Eleocharis ovata	392	6
Eleocharis macrostachya	Eleocharis palustris	393	6
Eleocharis obtusa var. jejuna	Eleocharis ovata	392	6, 8
Eleocharis obtusa var. obtusa	Eleocharis ovata	392	6, 8
Eleocharis parvula var. anachaeta	Eleocharis parvula	394	8
Eleocharis quadrangulata var. crassior	Eleocharis quadrangulata	395	8
Eleocharis smallii	Eleocharis palustris	393	6
Eleocharis tenuis var. verrucosa	Eleocharis verrucosa	395	10
Elymus interruptus	Elymus diversiglumis	869	3
Elymus virginicus var. jejunus	Elymus virginicus var. virginicus	879	8
Equisetum hyemale var. elatum	Equisetum hyemale var. affine	129	8
Equisetum hyemale var. pseudohyemale	Equisetum hyemale var. affine	129	8
Equisetum kansanum	Equisetum laevigatum	129	6

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Eragrostis arida	Eragrostis pectinacea var. miserrima	706	6
Eragrostis poaeoides	Eragrostis minor	705	2
Eragrostis spectabilis var. sparsihirsuta	Eragrostis spectabilis	710	8
Eriochloa gracilis	Eriochloa acuminata var. acuminata	772	6
Erythronium albidum var. mesochoreum	Erythronium mesochoreum	508	10
Festuca elatior var. arundinacea	Festuca arundinacea	835	10
Festuca elatior var. elatior	Festuca pratensis	838	2
Festuca myuros	Vulpia myuros	858	5
Festuca obtusa	Festuca subverticillata	840	3
Festuca octoflora var. glauca	Vulpia octoflora var. glauca	860	5
Festuca octoflora var. octoflora	Vulpia octoflora var. octoflora	860	5
Festuca octoflora var. tenella	Vulpia octoflora var. glauca	860	5, 8
Festuca ovina var. duriuscula	Festuca trachyphylla	840	2, 10
Festuca sciurea	Vulpia elliotea	860	2, 5
Fimbristylis caroliniana	Fimbristylis puberula var. puberula	398	2, 6
Fimbristylis dichotoma	Fimbristylis annua	397	7
Glyceria pallida	Torreyochloa pallida var. pallida	856	5

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Glyceria striata var. stricta	Glyceria striata	744	8
Habenaria ciliaris	Plantanthera ciliaris	560	5
Habenaria clavellata	Plantanthera clavellata	562	5
Habenaria flava var. flava	Plantanthera flava var. flava	563	5
Habenaria flava var. herbiola	Plantanthera flava var. herbiola	563	5
Habenaria lacera var. lacera	Plantanthera lacera var. lacera	563	5
Habenaria leucophaea	Plantanthera leucophaea	563	5
Habenaria peramoena	Plantanthera peramoena	564	5
Habenaria psychodes	Plantanthera psycodes	566	5
Heleochloa schoenoides	Crypsis schoenoides	688	4
Hemicarpha drummondii	Lipocarpha aristulata, Lipocarpha drummondii	407	4, 7
Hemicarpha micrantha	Lipocarpha micrantha	407	4
Hordeum jubatum var. caespitosum	Hordeum ×caespitosum	882	10
Hymenocallis occidentalis	Hymenocallis caroliniana	512	2
Hystrix patula	Elymus hystrix	872	2, 4
Juncus alpinus var. fuscescens	Juncus alpinoarticulatus	466	2, 8
Juncus effusus var. solutus	Juncus effusus ssp. solutus	473	10
Juncus kansanus	Juncus brachyphyllus	468	6
Juncus marginatus var. setosus	Juncus marginatus	474	8

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Juniperus virginiana var. crebra	Juniperus virginiana var. virginiana	164	8
Koeleria cristata	Koeleria macrantha	644	2
Lemna minima	Lemna minuta	484	2
Leptochloa filiformis var. attenuata	Leptochloa panicea ssp. mucronata	714	6, 8
Leptochloa filiformis var. filiformis	Leptochloa panicea ssp. brachiata	714	6, 8
Leptoloma cognatum	Digitaria cognata ssp. cognata	760	4
Lilium tigrinum	Lilium lancifolium	515	2
Lolium multiflorum var. diminutum	Lolium perenne var. aristatum	842	6, 8
Lolium multiflorum var. multiflorum	Lolium perenne var. aristatum	842	6, 8
Lolium temulentum var. macrochaeton	Lolium temulentum	844	8
Luzula bulbosa	Luzula campestris var. bulbosa	480	8
Lycopodium lucidulum var. lucidulum	Huperzia lucidula	132	5
Lycopodium obscurum var. dendroideum	Lycopodium dendroideum	133	10
Lycopodium selago var. patens	Huperzia porophila	132	5, 10
Manisuris cylindrica	Coelorachis cylindrica	594	5
Marsilea mucronata	Excluded	135	1
Miscanthus floridulus	Excluded	600	1
Muhlenbergia brachyphylla f. aristata	Muhlenbergia frondosa	721	3, 10

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Muhlenbergia brachyphylla f. brachyphylla	Muhlenbergia bushii	718	2
Muhlenbergia schreberi var. curtisetosa	Muhlenbergia ×curtisetosa	723	10
Muhlenbergia sylvatica var. sylvatica f. attenuata	Muhlenbergia frondosa	721	3, 10
Notholaena dealbata	Argyrochosma dealbata	148	5
Ophioglossum vulgatum var. pseudopodum	Excluded	142	1
Ophioglossum vulgatum var. pycnostichum	Ophioglossum vulgatum	142	8
Orchis spectabilis	Galearis spectabilis	553	5
Panicum agrostoides	Panicum rigidulum	803	2
Panicum annulum	Panicum dichotomum var. mattamuskeetense	797	6
Panicum bicknellii	Panicum boreale	781	6
Panicum boscii var. molle	Panicum boscii	782	8
Panicum calliphyllum	Panicum boreale	781	6
Panicum capillare var. occidentale	Panicum capillare	784	8
Panicum dichotomum var. barbulatum	Panicum dichotomum var. dichotomum	792	8
Panicum gattingeri	Panicum philadelphicum	801	6
Panicum lanuginosum var. lanuginosum	Panicum acuminatum var. acuminatum	778	6, 8
Panicum lanuginosum var. fasciculatum	Panicum acuminatum var. acuminatum	780	6, 8

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Panicum lanuginosum var. implicatum	Panicum acuminatum var. acuminatum	780	6, 8
Panicum lanuginosum var. lindheimeri	Panicum acuminatum var. lindheimeri	781	6
Panicum linearifolium var. werneri	Panicum linearifolium	797	8
Panicum longiligulatum	Excluded	781	1
Panicum microcarpon	Panicum dichotomum var. ramulosum	793	6
Panicum nitidum	Panicum dichotomum var. nitidum	793	6
Panicum oligosanthes var. helleri	Panicum oligosanthes var. scribnerianum	800	8
Panicum perlongum	Panicum linearifolium	797	6
Panicum philadelphicum var. tuckermanii	Panicum philadelphicum	801	8
Panicum polyanthes	Panicum sphaerocarpon var. isophyllum	804	6
Panicum praecocius	Panicum acuminatum var. acuminatum	780	6
Panicum sphaerocarpon var. inflatum	Panicum sphaerocarpon var. sphaerocarpon	804	8
Panicum stipitatum	Panicum rigidulum	803	6
Panicum subvillosum	Panicum acuminatum var. acuminatum	780	6
Panicum texanum	Urochloa texana	828	4
Panicum villosissimum var. pseudopubescens	Panicum acuminatum var. acuminatum	780	6, 8
Panicum villosissimum var. villosissimum	Panicum acuminatum var. acuminatum	780	6

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Paspalum bushii	Paspalum setaceum var. stramineum	818	6
Paspalum ciliatifolium var. ciliatifolium	Paspalum setaceum var. ciliatifolium	817	6
Paspalum ciliatifolium var. muhlenbergii	Paspalum setaceum var. muhlenbergii	818	6
Paspalum ciliatifolium var. stramineum	Paspalum setaceum var. stramineum	818	6
Paspalum fluitans	Paspalum repens	816	6
Pennisetum ciliare	Cenchrus ciliaris	758	4
Phragmites communis var. berlandieri	Phragmites australis	620	2, 8
Pinus nigra var. nigra	Pinus nigra ssp. nigra	169	10
Polygonatum canaliculatum	Polygonatum biflorum var. commutatum	526	6
Polypodium vulgare var. virginianum	Polypodium virginianum	146	10
Potamogeton epihydrus var. nuttallii	Potamogeton epihydrus	895	8
Puccinellia airoides	Excluded	855	1
Sagittaria engelmanniana ssp. brevirostra	Sagittaria brevirostra	188	10
Sagittaria graminea var. platyphylla	Sagittaria platyphylla	191	10
Sagittaria latifolia var. obtusa	Sagittaria latifolia var. latifolia	190	8
Sagittaria montevidensis ssp. calycina	Sagittaria calycina var. calycina	188	10
Salvinia natans	Excluded	104	1
Scirpus acutus	Schoenoplectus acutus	416	5

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Scirpus americanus	Schoenoplectus pungens	417	3, 5
Scirpus atrovirens var. georgianus	Scirpus georgianus	430	10
Scirpus atrovirens var. pallidus	Scirpus pallidus	432	10
Scirpus cyperinus var. pelius	Scirpus cyperinus	429	8
Scirpus etuberculatus	Schoenoplectus etuberculatus	418	5
Scirpus fluviatilis	Bolboschoenus fluviatilis	209	5
Scirpus hallii	Schoenoplectus hallii	420	5
Scirpus heterochaetus	Schoenoplectus heterochaetus	420	5
Scirpus koilolepis	Isolepis carinata	403	2, 5
Scirpus lineatus	Scirpus pendulus	433	3
Scirpus olneyi	Schoenoplectus americanus	417	3, 5
Scirpus paludosus var. paludosus	Bolboschoenus maritimus ssp. paludosus	209	5, 6
Scirpus rubricosus	Scirpus cyperinus	429	6
Scirpus subterminalis	Schoenoplectus subterminalis	424	5
Scirpus torreyi	Schoenoplectus torreyi	427	5
Scirpus validus var. creber	Schoenoplectus tabernaemontani	426	2, 5, 8
Scirpus verecundus	Trichophorum planifolium	440	2, 5
Scleria ciliata var. elliottii	Scleria ciliata	436	8

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Scleria muhlenbergii	Scleria reticularis var. pubescens	438	6
Scleria nitida	Scleria triglomerata	439	6
Scleria pauciflora var. caroliniana	Scleria pauciflora	438	8
Setaria geniculata	Setaria parviflora	824	2
Sisyrinchium bermudiana	Sisyrinchium angustifolium	462	3
Sitanion longifolium	Elymus longifolius	872	4
Smilacina racemosa var. cylindrata	Maianthemum racemosum ssp. racemosum	519	4, 8
Smilacina racemosa var. racemosa	Maianthemum racemosum ssp. racemosum	519	4, 10
Smilax bona-nox var. hederaefolia	Smilax bona-nox	901	8
Smilax glauca var. leurophylla	Smilax glauca	902	8
Smilax herbacea var. herbacea	Excluded	904	1
Smilax herbacea var. lasioneuron	Smilax lasioneuron	904	10
Smilax tamnoides var. hispida	Smilax hispida	902	10
Sorghum caffrorum	Sorghum bicolor ssp. bicolor	604	6
Sorghum caudatum var. caudatum	Sorghum bicolor ssp. bicolor	604	6, 8
Sorghum dochna var. dochna	Sorghum bicolor ssp. bicolor	604	6, 8
Sorghum dochna var. technicum	Sorghum bicolor ssp. bicolor	604	6, 8

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Sorghum drummondii	Sorghum bicolor ssp. drummondii	604	6
Sorghum durra	Sorghum bicolor ssp. bicolor	604	6, 8
Sorghum sudanense	Sorghum bicolor ssp. drummondii	604	6, 8
Sphenopholis intermedia	Sphenopholis obtusata var. major	650	6
Sphenopholis obtusata var. lobata	Sphenopholis obtusata var. obtusata	651	8
Spiranthes cernua var. ochroleuca	Excluded	570	1
Spiranthes gracilis	Spiranthes lacera	568	6
Spiranthes ovalis	Spiranthes ovalis var. erostellata	570	9
Spirodela oligorhiza	Spirodela punctata	487	2
Sporobolus asper var. asper	Sporobolus compositus var. compositus	730	2
Sporobolus asper var. hookeri	Sporobolus compositus var. compositus	732	2, 8
Sporobolus asper var. pilosus	Sporobolus compositus var. compositus	732	2, 8
Sporobolus clandestinus var. canovirens	Sporobolus clandestinus	728	8
Sporobolus neglectus var. ozarkanus	Sporobolus ozarkanus	736	10
Sporobolus poiretii	Sporobolus indicus	733	2
Sporobolus vaginiflorus var. inaequalis	Sporobolus vaginiflorus	737	8
Thelypteris hexagonoptera	Phegopteris hexagonoptera	158	5

Name in Steyermark (1963)	Name in Yatskievych (1999)	Page in Y. (1999)	Reason(s) *see above
Tridens chapmani	Tridens flavus var. chapmanii	738	6
Tridens elongatus	Tridens muticus var. elongatus	739	6
Trisetum pensylvanicum	Sphenopholis pensylvanica	651	4
Uniola latifolia	Chasmanthium latifolium	672	5
Wolffia papulifera	Wolffia brasiliensis	488	2
Wolffia punctata	Wolffia borealis	488	2
Wolffiella floridana	Wolffiella gladiata	490	2
Yucca glauca var. mollis	Yucca arkansana	180	2, 10
Zizania aquatica var. interior	Zizania palustris var. interior	750	7

BOOK REVIEW

Yatskievych, George. 1999. Steyermark's Flora of Missouri, Revised Edition, Volume 1. Missouri Department of Conservation, in cooperation with Missouri Botanical Garden Press. xii, 991 pp., 1 map. $38.00 (ISBN 1-887247-19-X). Hardbound.

As the proverbial saying goes, "Good things come to those who wait." Such is the case with the recent publication of volume one of the updated and thoroughly revised Flora of Missouri by George Yatskievych. For students of the flora, this much anticipated update is a welcome addition that covers the pteridophyte, gymnosperm, and monocot taxa in the state (alas, the cover does not indicate the specific contents). The taxonomic section is organized alphabetically by family (all following the modern "–aceae" ending), genus, and species, which is the current trend in floristic works in order to make them user-friendly. Within some of the larger taxa (grasses and *Carex*) the species are separated first into smaller groups (tribes for the former, sections for *Carex*) and then arranged alphabetically, so one will have to use the initial keys to find species in these few instances.

For those interested in the history of botanical collecting in the state, as well as geographic and natural history units, the introductory chapters provide a wealth of information. As someone relatively new to floristic study in Missouri, I found these summary-like sections to be especially worthwhile and interesting reading without having to wade through volumes to acquire similar information (for those interested in greater depth, the author provides many references for further consultation).

If you're familiar with the earlier 1963 edition by Steyermark, the floristic section has a very similar general format, which should make for a smooth transition to this updated edition. There are, once again, county maps to indicate known distribution for each species. These maps are easier to use than the previous edition because no attempt is made to document distributions below the level of species. This does not mean this information is absent, but instead has been restricted to brief comments assoc-

iated with each infraspecific description. Similarly, the text is accompanied by numerous full-page line drawings that illustrate important features useful in identification. These are entirely new and very well done, thanks to the capable hands of several artists. Their format is much easier to follow with a less crowded organization, more attention to detail, and better captions.

The most significant departure from the 1963 edition is the inclusion of detailed descriptions for each taxon. I find this to be a most welcome addition because like many botanists (amateur or otherwise), I want some confirmation that my keying efforts were successful. Because a key cannot feasibly include all useful information about the taxa in question, having additional details about the families, genera, and species is extremely worthwhile. Each description includes the currently accepted name for that taxon, with pertinent synonymy, common names, references to illustrations and county maps, a paragraph concerning distribution and ecology, and where appropriate remarks about taxonomic issues, natural history, or other interesting tidbits. Although these descriptions are valuable additions, I would have preferred the use of bolding of major characters to make them stand out for easier comparison between taxa (similar to the style used in the recent Flora of North America volumes).

The keys that occur throughout the floristic section are appropriately detailed and, for those unfamiliar with crucial terms a glossary is provided (pp. 915–928). Having made some recent collections of grasses and sedges in southeast Missouri, I had the opportunity to try the keys to these notoriously difficult groups to see first-hand how well they work. I'm happy to report that even someone with a general dislike for these taxa (myself included) will find them to not only work, but to be relatively user-friendly. I still found a few couplets difficult to handle (e.g., couplet #21 of the key to grass tribes that requires some "mystical" understanding of grass inflorescence morphology that escapes me), but these obstacles are no better or worse than any other grass key I've had to endure.

Other useful features include an extensive reference section (pp. 929–951), followed by an equally useful index with boldface numbering to indicate the principal entry location for a given taxon (makes me wonder even more why boldface type was not

included in the taxonomic descriptions). A map of Missouri with county locator is included conveniently on the inside cover, and a family index locator and ruler can be found on the endpaper. A section entitled "Analysis of the Flora" (pp. 77–91) includes a table that summarizes, on a family-by-family basis, the number of native versus introduced species, numbers of infraspecific taxa recognized, and hybrids. A second table in this section provides an interesting comparison of the native, introduced, and total number of species treated in the 1963 edition with the projected number of species to be treated in both volumes of the updated version. Quite clearly, the introduced species have increased tremendously, totaling 820 (not 20 as incorrectly indicated in the table) taxa, or about 25% of the known flora (vs. ca. 20% in the earlier version).

As with any publication of this size and magnitude, errors will occur, both typographic and grammatical. In covering the introductory pages (1–91) in some depth, I found several of these errors (even I could not muster the patience to read through the taxonomic material with an editors mindset!), but they are relatively minor and do not detract significantly from the overall high quality of this volume. In short, the author and his associates are to be commended for providing an extremely useful reference tool for students of the Missouri flora (and neighboring states) at any level. At only $38.00 (plus shipping) it is truly a bargain, but like its predecessor, don't expect to carry it around as a handy field manual. This volume is as large and unwieldy as the entire flora of the first edition, and with almost 2000 dicot taxa still to cover, the second volume promises to be quite an armful! I do hope (and I suspect many others will share my feelings) that a smaller version with just the diagnostic keys will be forthcoming once both volumes are completed. Until then, enjoy this exceptional new edition, and happy keying!

Allan J. Bornstein
Department of Biology
Southeast Missouri State University
One University Plaza
Cape Girardeau, MO 63701