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ALOCASIA MACRORRHIZOS (ARACEAE), *BUXUS SEMPERVIRENS* (BUXACEAE), AND *NOTHOSCORDUM GRACILE* (ALLIACEAE) NEW IN THE ARKANSAS FLORA, WITH ADDITIONAL NOTEWORTHY RECORDS OF ANGIOSPERMS FOR THE STATE

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ABSTRACT

Nothoscordum gracile (Dryander) Stearn is here documented for a first occurrence in the Arkansas flora, outside of cultivation. In 2019, eight escaped plants of *N. gracile* were discovered growing as weeds in a disturbed lawn area along a street edge in the city of Arkadelphia in Clark County, Arkansas. *Alocasia macrorrhizos* (L.) G. Don and *Buxus sempervirens* L. also are documented for first occurrences in Arkansas as adventive waifs. Two spontaneous plants of *A. macrorrhizos* were discovered growing in a large dumpsite for horticultural waste in Clark County in 2018. The *A. macrorrhizos* plants have persisted through 2019. Several plants of *B. sempervirens* were discovered along Mill Creek, adjacent to the Ouachita River, establishing from horticultural discards. The *A. macrorrhizos* and *B. sempervirens* records represent the first documented occurrences of the genera *Alocasia* and *Buxus*, along with the Buxaceae family, in Arkansas, not in cultivation. Additionally, eight species of angiosperms, *Euonymus japonicus* Thunb., *Koelreuteria bipinnata*, *Liriope graminifolia*, *Liriope muscari*, *Ophiopogon japonicus*, *Physalis philadelphica*, *Trachelospermum jasminoides*, and *Vitex negundo*, are reported for second or third occurrences in the Arkansas flora or as significant county records.

NOTHOSCORDUM GRACILE

In 2019, eight escaped plants of *Nothoscordum gracile* (Dryander) Stearn (fragrant false garlic) were discovered growing at the edge of a street in a highly disturbed lawn area of a residence in the city of Arkadelphia in Clark County (Fig. 1). Propagules, presumably seeds and/or bulblets, apparently were transported via runoff water to the site from cultivated plants of *N. gracile* that occurred upslope from the site, allowing for establishment of the escaped plants. This record represents the first documented occurrence of this species in Arkansas, outside of cultivation.

Nothoscordum gracile is a bulbaceous perennial that is native to the Americas, possibly Argentina (Ravenna 1991; Jacobsen & McNeal 2002). This species has a somewhat convoluted nomenclatural history, with a number of epithets and misapplications, including *N. borbonicum* Kunth, *N. fragrans* (Vent.) Kunth, and *N. inodorum* (Ait.) Nichols. (Ravenna 1991; Jacobsen & McNeal 2002). Ravenna (1991) proposed that its correct name was *N. borbonicum*, a naturally occurring, interspecific hybrid between *N. gracile* Ait. and *N. entrerianum* Ravenna; however, according to Jacobsen and McNeal (2002), rather than *N. borbonicum*, *N. gracile* is the correct name for this species. *Nothoscordum gracile* sometimes is cultivated in the southern USA, including Arkansas, and has become naturalized in a number of other states (Jacobsen & McNeal 2002; Weakley 2015). Because of its prolific ability to establish escaped populations from a combination of seeds and bulblets, *N. gracile* should be expected elsewhere in the state's flora.

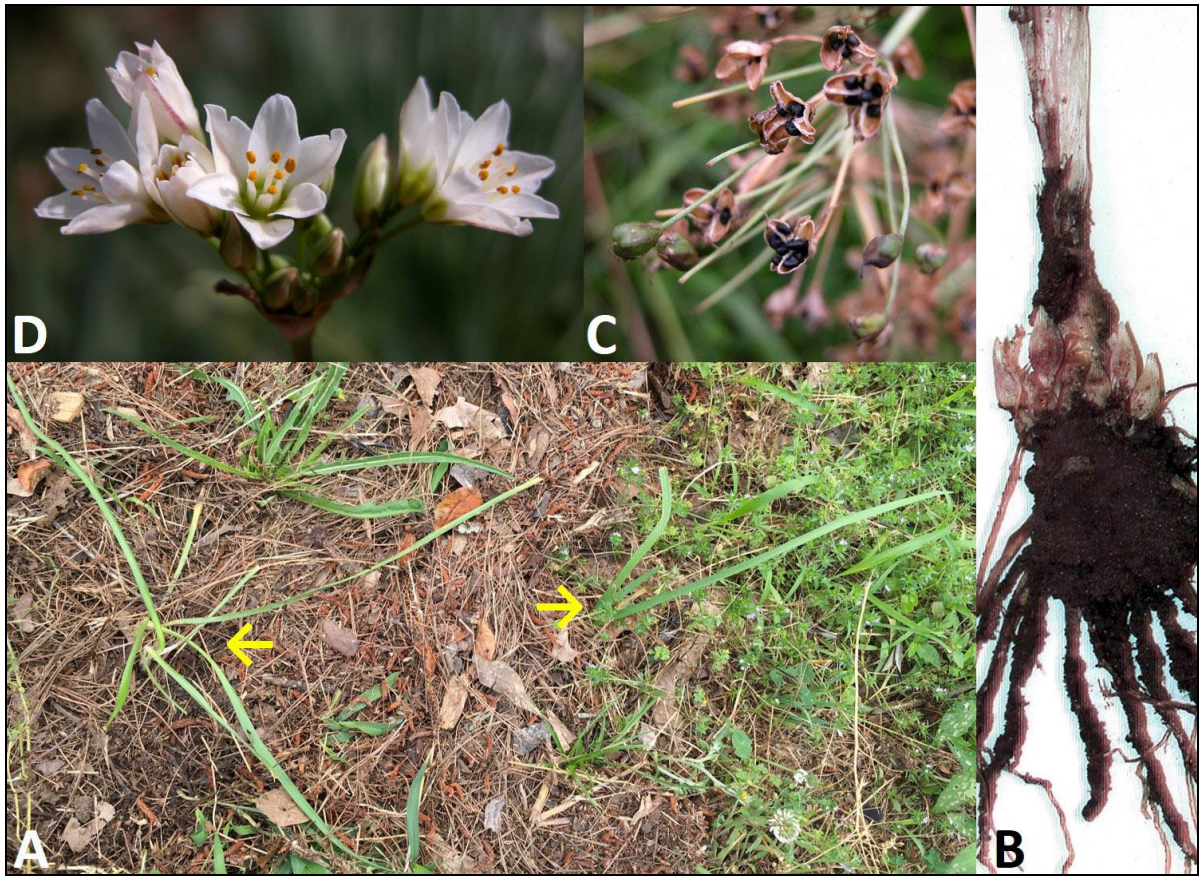

Figure 1. (A–D) *Nothoscordum gracile* escaped in Clark County, Arkansas. (A) Escaped plants at street edge in highly disturbed lawn area; notice plants are small and spaced apart as to indicate probable recent establishment via seeds; two of the plants are designated by yellow-colored arrows. (B) Bulb of escaped plant with numerous bulblets. (C) Mature fruits and seeds. (D) Flowers.

Nothoscordum gracile morphologically is similar to the native *N. bivalve* (L.) Britt. (false garlic, grace garlic) but may be distinguished from it reliably using the following key.

1. Perianth segments united up to one-third of their length; leaves 4–12 mm wide ...**Nothoscordum gracile**
1. Perianth segments separate or only united basally; leaves 1–5 mm wide.....**Nothoscordum bivalve**

Voucher specimen. **Arkansas**. Clark Co.: Small colony of plants growing in highly disturbed lawn area along edge of street — escaped, at intersection of O'Connell St. and 19th St., Arkadelphia, 21 May 2019, *Serviss 8695* (HEND).

ALOCASIA MACRORRHIZOS

In 2018, two spontaneous plants of *Alocasia macrorrhizos* (L.) G. Don (giant taro) were discovered growing at the edge of a dumpsite for horticultural waste in the city of Arkadelphia in Clark County (Fig. 2). The spontaneous plants presumably were established from horticultural discards. *Alocasia macrorrhizos* easily is propagated asexually from tubers and plantlets; hence, discards of these propagules or even whole plants as horticultural waste could have led to their presence at the site. The plants at the dumpsite overwintered from 2018 and were present in 2019. *Alocasia macrorrhizos* sometimes is cultivated in Arkansas and will overwinter (as buried tubers) in at least some years if grown in a protected location. At present, *A. macrorrhizos* should be considered a waif in Arkansas and is not likely to become an established component of the flora. Its presence in Arkansas as spontaneous plants should be expected, however, under conditions similar to those previously described. This record represents the first occurrence of the genus *Alocasia* in the Arkansas flora, not in cultivation.

Figure 2. *Alocasia macrorrhizos* adventive in Clark County, Arkansas — one of two spontaneous plants present at a large dumpsite for horticultural waste in the city of Arkadelphia. Both plants have been present at the site since at least 2018. Several plants of *Rubus* sp. may be seen in the foreground. A number of other non-native species are present at this site, including several escaped plants of *Lagerstroemia indica* L. (crepe myrtle), which appear to have established also from horticultural discards via rooting of stem cuttings.

The only other large-leaved aroid in the Arkansas flora that potentially could be confused with *A. macrorrhizos* is *Colocasia esculenta* (L.) Schott (elephant ear, taro). In addition to much of the *C. esculenta* material naturalized in Arkansas being the aggressively stoloniferous form (see Serviss et al. 2017a — *A. macrorrhizos* is not stoloniferous), the two species also may be distinguished reliably using the following key (some forms of *C. esculenta* are not stoloniferous but are large-bodied and similar to *A. macrorrhizos* in overall form).

1. Veins of adaxial (upper) leaf surface conspicuously raised above the lamina ..... **Alocasia macrorrhizos**
1. Veins of adaxial leaf surface flush with or slightly sunken below the lamina ..... **Colocasia esculenta**

Alocasia macrorrhizos is a tuberous, often caulescent perennial that is native to tropical Asia (Bailey & Bailey 1976). In the USA, it currently has been documented from the naturalized floras of Alabama and Florida (Wunderlin & Hansen 2011; Kartesz 2015; Keener et al. 2019).

Voucher specimens. **Arkansas**. Clark Co.: Two spontaneous plants present at edge of dumpsite for horticultural waste, presumably established from discards, plants have overwintered since at least 2018, W of intersection of Huddleston St. and 12th St., Arkadelphia, 29 Oct 2019, *Serviss 8712* (HEND); Two spontaneous plants present at dumpsite for horticultural waste, presumably established from discards, W of intersection of Huddleston St. and 12th St., Arkadelphia, 26 Oct 2018, *Serviss 8638* (HEND).

BUXUS SEMPERVIRENS

In 2019, two small groups of adventive plants of *Buxus sempervirens* L. (common boxwood) were discovered establishing along the edge of Mill Creek in proximity to where the creek empties into the Ouachita River in Clark County (Fig. 3). The *B. sempervirens* plants appeared to have initially been deposited at the site as horticultural waste consisting of whole plants. Subsequent to deposition, plants survived and establishment continued via adventitious rooting of stems (Fig. 3A). In Arkansas, *B. sempervirens* is planted as a hedge and border plant and as a shade tolerant evergreen. In general, it easily is grown and tolerates regular pruning and shaping, and thus regularly is used in landscaping. At present, it should not be considered an established component of the state's flora; however, it previously has been documented persistent from cultivation in the state (Garland Co., *Serviss 8642*, HEND), and is escaped/naturalized in the floras of a number of other eastern states (Diamond 2013; Kartesz 2015; Keener et al. 2019; USDA, NRCS 2020) — *B. sempervirens* should be expected as escaped elsewhere in Arkansas.

Figure 3. (A–B) *Buxus sempervirens* adventive in Clark County, Arkansas. (A) Stem segment from one of the adventive *B. sempervirens* plants with numerous adventitious roots present. (B) Whole plant established from horticultural discards.

In the Arkansas flora, the small, opposite, leathery leaves, sharply quadrangular stems, and dense growth form of *B. sempervirens* distinguish it from most other shrubs. It potentially could be confused with some of the smaller-leaved, evergreen hollies, such as *Ilex vomitoria* Ait. (yaupon holly) and *I. crenata* Thunb. (Japanese holly) — *I. crenata* is a recent addition to the state's flora; see Serviss et al. 2016c). However, *B. sempervirens* has oppositely arranged leaves, whereas both *Ilex* species have alternate phyllotaxy.

This record represents the first occurrence of the genus *Buxus* and the Buxaceae family in the Arkansas flora, not in cultivation. *Buxus sempervirens* is an evergreen shrub or small tree to eight or more meters tall that is native to Europe, North Africa, and Asia Minor (Bailey & Bailey 1976; Krüssmann 1976). Much natural variation occurs within the species. It has been cultivated for centuries and numerous forms and cultivars currently exist (Krüssmann 1976).

Voucher specimen. **Arkansas**. Clark Co.: Two distinct groups of plants establishing from discarded horticultural waste (whole plants deposited and adventitiously rooting in along stems), edge of Mill Creek at Ouachita River, OBU campus pavilion area, Arkadelphia, 29 Oct 2019, *Serviss 8714* (HEND).

Noteworthy records for Arkansas

EUONYMUS JAPONICUS Thunb. (Japanese spindle tree) is a large, evergreen shrub or small tree to five meters or more that is native to Japan (Bailey & Bailey 1976; Krüssmann 1977; Ma & Funston 2008). It has been reported previously as a component of the naturalized floras of a few eastern states (Diamond 2013; Hannick et al. 2013; Kartesz 2015; Weakley 2015; USDA, NRCS 2020). It first was documented outside of cultivation in Arkansas from Clark County by Serviss et al. (2017b). In 2019, a second naturalized occurrence of *E. japonicus* in Arkansas was documented from Union County (Fig. 4). Two escaped plants of *E. japonicus* occurred along a steep bank of a small stream in an urban greenbelt and riparian zone, with residential areas surrounding the site.

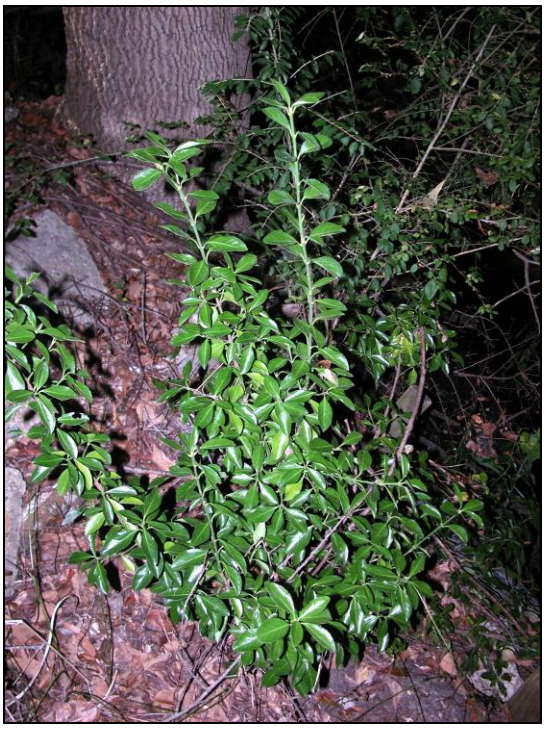

Figure 4. Escaped plants of *Euonymus japonicus* growing on steep streambank in an urban greenbelt in Union County, Arkansas.

Voucher specimen. **Arkansas**. Union Co.: Two escaped plants growing on steep streambank, highly disturbed greenbelt and riparian zone, N/NW of intersection of Briarwood Dr. and Crestwood Dr., El Dorado, 31 Aug 2019, *Serviss 8705* (HEND).

KOELREUTERIA BIPINNATA Franch. (Chinese flame tree) is a small to medium-sized tree to 20 meters that is native to southwestern China (Kriissmann 1977; Xia & Gadek 2007). It occasionally is cultivated in the southern USA for ornamental purposes because of its showy flowers and fruits and its tolerance of a wide variety of soil types (Bailey & Bailey 1976; Krussmann 1977; Griffiths 1992). In addition to Arkansas, *K. bipinnata* has been documented in the naturalized floras of Alabama, Florida, and Georgia (Kartesz 2015). It initially was documented in Arkansas from Clark County in 2005 (Serviss et al. 2006). The site with the original naturalized *K. bipinnata* population was cleared soon following discovery, and the population was believed to be extirpated. However, in 2019, a single, reproductively mature plant was discovered at the site, presumably generated from seeds of previously naturalized plants (Fig. 5). A second, small, naturalized population of *K. bipinnata* in Clark County also is present in close proximity to the site where initially discovered. These three occurrences represent the only known records of this species outside of cultivation in the state. *Koelreuteria bipinnata* prolifically self-seeds, giving rise to large numbers of plants in a short period of time. The species has the potential to be invasive under the correct conditions. It should be expected elsewhere in Arkansas.

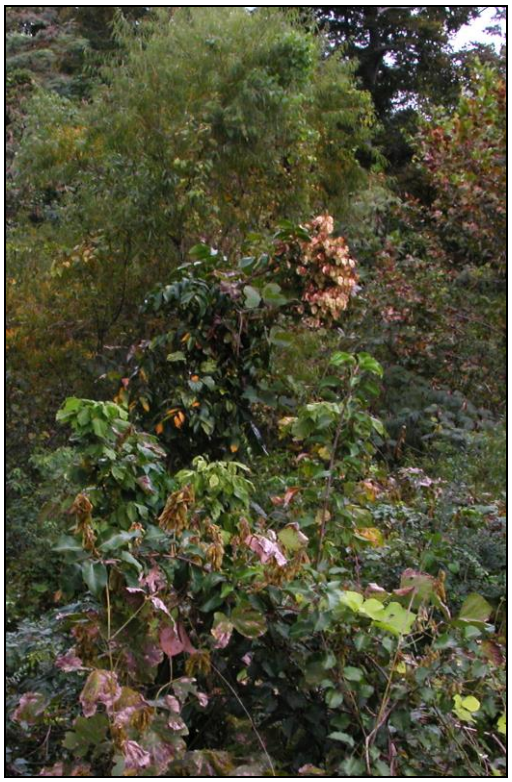

Figure 5. Naturalized plant of *Koelreuteria bipinnata* in Clark County, Arkansas. This plant occurred in a rocky ravine above a small stream in a highly disturbed, urban greenbelt in the city of Arkadelphia. Notice the large infructescence of yellowish-pink, nearly mature fruits (top one-third of photograph).

Voucher specimen. **Arkansas**. Clark Co.: One reproductively mature tree (with nearly mature fruits), ca. four to five meters tall, growing on rocky slope above streambank in ravine and greenbelt, immediately E of University Ave. and N 8th St. intersection, Arkadelphia, 29 Oct 2019, *Serviss 8713* (HEND).

LIRIOPE GRAMINIFOLIA (L.) Baker (grass lilyturf, creeping lilyturf) is a stoloniferous perennial that is native to China, Pakistan, Taiwan, and Vietnam (Chen & Tamura 2000a; Nesom 2010). In the USA, it previously only has been documented outside of cultivation in Arkansas and Texas (Nesom 2010; Serviss et al. 2016b — from Clark and Pulaski counties in Arkansas). In 2019, an additional occurrence of naturalized plants of *L. graminifolia* was documented from Clark County (Fig. 6). Although already known from this county, the record is important because of the few recorded occurrences of this species outside of cultivation in the USA. The *L. graminifolia* plants from 2019 occurred as a small colony of ramets/clones spreading via stoloniferous offsets. Bird-mediated dispersal of seeds from nearby cultivated plants of *L. graminifolia* is the presumed source of the escaped plants.

Figure 6. (A–B) *Liriope graminifolia* escaped in Clark County, Arkansas. (A) Voucher specimen: notice the elongate, slender stolons at the lower left (designated by yellow-colored arrows), wide leaves, and tall inflorescences. (B) Escaped plants in habitat; several ramets/clones may be seen. The colony is slightly larger than what is shown in the photograph.

Voucher specimen. **Arkansas**. Clark Co.: Small colony of escaped plants growing in moist soil in disturbed, overgrown area, plants with flowers, off 10th St. immediately W of University Ave., Arkadelphia, 19 Sep 2019, *Serviss 8710* (HEND).

LIRIOPE MUSCARI (Dcne.) L.H. Bailey (monkey grass) is a caespitose, sometimes weakly stoloniferous perennial that is native to China, Japan, and Taiwan (Chen & Tamura 2000a; Nesom 2010). In addition to Arkansas, it previously has been documented from Alabama, Georgia, Kansas, Louisiana, Maryland, Mississippi, Missouri, North Carolina, South Carolina, and Tennessee (Thomas & Allen 1993; Nesom 2010; Kartesz 2015; Weakley 2015). *Liriope muscari* initially was documented outside of cultivation in Arkansas by Serviss et al. (2016a) from Clark, Garland, and Pulaski counties. In 2019, two additional occurrences of *L. muscari* were recorded from Hot Spring and Union counties. The Hot Spring County plants consisted of a small population of a few closely spaced clumps growing at the edge of a disturbed woods near Prairie Bayou. In Union County, two escaped plants were observed (one growing in the streambed near the water line and a second toward the top of a steep bank) along a small stream in a highly disturbed greenbelt and riparian zone within the city of El Dorado.

Voucher specimens. **Arkansas**. Hot Spring Co.: A few clumps of escaped plants just inside edge of disturbed woods, plants in flower, off Hwy 84, Prairie Bayou, 1–2 miles NE of Junction 128 and Hwy

84 intersection, 3 Aug 2019, *Serviss 8698* (HEND). Union Co.: Two escaped plants: one plant at top of steep streambank and the second plant at edge of streambed near waterline, plants with spent flowers, highly disturbed, urban greenbelt and riparian zone, N/NW of intersection of Briarwood Dr. and Crestwood Dr., El Dorado, 31 Aug 2019, *Serviss 8704* (HEND).

OPHIOPOGON JAPONICUS (L.f.) Ker-Gawl. (Japanese mondo grass) is a stoloniferous perennial that is native to China, Japan, Korea, and Taiwan (Chen & Tamura 2000b; Nesom 2010). In addition to Arkansas, it only has been documented outside of cultivation in four states: Alabama, Mississippi, North Carolina, and Texas (Diggs et al. 1999; Nesom 2010; Spaulding et al. 2010; Roling et al. 2011; Weakley 2015). It first was documented in the Arkansas flora by Serviss et al. (2016a) from Clark and Pulaski counties. In 2016 and 2019, naturalized populations of *O. japonicus* were recorded from Garland and Union counties, respectively. The Garland County plants were spreading in an unkempt lawn area of an old homesite, presumably naturalizing mostly or exclusively via stoloniferous offsets. The Union County plants occurred as a single, large population along the top of a steep streambank in a highly disturbed, urban greenbelt and riparian zone.

Voucher specimens. **Arkansas**. Garland Co.: Several plants/ramets naturalized at old homesite in disturbed woods, plants reproductive with young fruits/seeds, Conway Terr., 3431.895N, -9302.53W, Hot Springs, 7 Sep 2016, *Olsen 7* (HEND); Colony of hundreds of plants/ramets, escaped from cultivation, wooded area of residence, Conway Terr., Hollywood Estate, Hot Springs, 30 Aug 2016, *Olsen 6* (HEND). Union Co.: Colony of hundreds of clones/ramets growing on top and side of steep streambank of highly disturbed, urban greenbelt and riparian zone, N/NW of intersection of Briarwood Dr. and Crestwood Dr., El Dorado, 31 Aug 2019, *Serviss 8702* (HEND).

PHYSALIS PHILADELPHICA Lam. (tomatillo, Mexican ground cherry) is an annual herb to 1.3 meters tall that is native to Mexico (Bailey & Bailey 1976). It is naturalized in a number of states (Kartesz 2015; USDA, NRCS 2020). This species is the tomatillo of commerce, the fruits of which are used in Latin American cuisine. In 2018, one to two large plants of *P. philadelphica* were discovered growing on the rocky bank of Hot Springs Creek in Garland County, in immediate proximity to a sewer access point (Fig. 7). Plants had flowers and mature fruits. The fruits resembled typical tomatillos in color and size, with some having a diameter of over seven centimeters (Fig. 7A). Seeds distributed to the site by stream or waste water presumably gave rise to the plants. *Physalis philadelphica* previously only has been documented in Arkansas from Craighead County (Gentry et al. 2013).

Voucher specimen. **Arkansas**. Garland Co.: One to two spontaneous plants growing on rocky streambank of Hot Springs Creek, adjacent to sewer manhole access area, plants with flowers and mature fruits, probably established via seeds from sewer overflow, adjacent to intersection of Fontana Rd. and Tatum St., 50 meters N of Fontana Rd., 34.0465691, -93.042161, Hot Springs, 13 Jul 2018, *Serviss 8616* (HEND).

TRACHELOSPERMUM JASMINOIDES (Lindl.) Lem. (Confederate jasmine) is an aggressive, twining, evergreen liana to 10 meters that is native to China (Bailey & Bailey 1976; Li et al. 1995). In addition to Arkansas, it has been documented outside of cultivation in a number of southern states, including Alabama, Arizona, Florida, Georgia, Louisiana, and Texas (Kartesz 2015; USDA, NRCS 2020). *Trachelospermum jasminoides* previously has been documented in Arkansas from Clark and Drew counties (Gentry et al. 2013; Serviss et al. 2015). In 2019, it was recorded from Union County growing along a steep streambank in a highly disturbed greenbelt and riparian zone (Fig. 8). Plants also were observed climbing trees. Naturalized plants of *T. jasminoides* also were recorded from Clark County in 2017 (subsequent to the 2015 record), with plants exhibiting similar patterns of growth and establishment to that observed with those in 2015. *Trachelospermum jasminoides* likely is more widespread in Arkansas than current records indicate, and it appears to have a high potential for invasiveness.

Figure 7. (A–B) *Physalis philadelphica* escaped in Garland County, Arkansas. (A) Voucher specimen of escaped plant of *P. philadelphica*; it occurred along a highly disturbed, open, rocky area of the streambank. One to two reproductively mature plants of *P. philadelphica* were present at the site, along with numerous plants of *Lycopersicum esculentum* Mill. (tomato) and *Cucurbita pepo* L. (squash). (B) Habitat showing escaped *Physalis* and *Lycopersicum* plants. A large, sewer access manhole is present just to the right of the area shown in the photograph.

Figure 8. Naturalized plants of *Trachelospermum jasminoides* in Union County, Arkansas. Plants cover the nearly vertical bank, extending considerably beyond what is shown in the photograph. Plants occurred from the waterline to the top of the bank and also were climbing nearby trees.

In Arkansas, *Trachelospermum jasminoides* closely resembles the native *Thyrsanthella difforme* (Walt.) Pichon (climbing dogbane) and *Gelsemium sempervirens* (L.) St. Hill (yellow jasmine); however, *T. jasminoides* may be distinguished from these species reliably using the following key.

1. Plant exudes milky-white sap when damaged or cut; stems pubescent, at least when young; flowers white to cream or pale yellow in color; fruit an elongate, linear follicle, many times longer than wide.

2. Leaves coriaceous and often with conspicuous pale-green to whitish-green venation on the upper surface; corolla lobes ca. 8 mm long or longer ..... **Trachelospermum jasminoides**
2. Leaves membranous to subcoriaceous and without conspicuously pale-green or whitish-green venation on the upper surface; corolla lobes 5 mm or less long ..... **Thyrsanthella difforme**

1. Plant without milky-white sap; stems glabrous; flowers bright yellow; fruit a rounded to ellipsoid capsule, about as long as wide ..... **Gelsemium sempervirens**

Voucher specimens. **Arkansas**. Clark Co.: Plants spreading along the ground at edge of roadside, escaped, disturbed roadside adjacent to homesite, on Deceiper Hill Rd., immediately SW of intersection of Hwy 26 and Deceiper Hill Rd., 28 Sep 2017, *Serviss 8601A1* (HEND); Many plants covering the ground and climbing into trees, semi-wooded waste area of residential zone, Elaine Circle, W/SW of intersection of Elaine Circle and 21st St., Arkadelphia, 1 Sep 2017, *Serviss 8582* (HEND). Union Co.: Large expanse of plants covering the streambank and climbing into trees, naturalized, highly disturbed, urban greenbelt and riparian zone, N/NW of intersection of Briarwood Dr. and Crestwood Dr., El Dorado, 31 Aug 2019, *Serviss 8706* (HEND).

Figure 9. Escaped plants of *Vitex negundo* in Clark County, Arkansas. Plants occurred in a highly disturbed, mostly open area at the edge of the road. A second, smaller plant of *V. negundo* may be seen a short distance behind the one in flower. No other plants of *V. negundo* were apparent in the vicinity.

VITEX NEGUNDO L. (negundo chaste tree) is a large, deciduous shrub or small tree to a height of eight or nine meters that is native to Europe, Asia, and possibly portions of North Africa (Bailey & Bailey 1976; Kriissmann 1978). In addition to Arkansas, *V. negundo* has been documented from the naturalized floras of Alabama, Florida, Louisiana, Maryland, Missouri, Ohio, Oklahoma, and Texas (Kartesz 2015; USDA. NRCS 2020). It previously was documented in Arkansas from Baxter, Drew, Garland, Lincoln, Miller, Pulaski, and Yell counties (Serviss et al. 2007; Gentry et al. 2013). In 2019, two escaped plants of *V. negundo* were discovered growing along a roadside in Clark County (Fig. 9); no other plants of *V. negundo* were observed in the vicinity. Documentation of *V. negundo* from new counties is important because of its tendency to establish naturalized populations via prolific self-seeding.

Voucher specimen. **Arkansas**. Clark Co.: Two escaped plants, larger one ca. 1.3 meters tall and in flower, growing along roadside next to shoulder; no other plants of *V. negundo* observed in the vicinity, at 99 Serenity Ln., Arkadelphia area just W of the main city, 28 Sep 2019, *Serviss 8711* (HEND).

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