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C. T. Witsell

Arkansas Natural Heritage Commission, theo@arkansasheritage.org

Brent Baker

Arkansas Natural Heritage Commission

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Status of *Tridens* × *oklahomensis* (Poaceae) and Updated Treatment of the Genus *Tridens* in Arkansas

C.T. Witsell* and B.T. Baker

Arkansas Natural Heritage Commission, 323 Center St., Suite 1500, Little Rock, AR 72201

*Correspondence: theo@arkansasheritage.org

Running title: *Tridens* × *oklahomensis* and An Update of the Genus *Tridens* in Arkansas

Abstract

We report the documentation of *Tridens* × *oklahomensis*, the naturally-occurring interspecific hybrid between *Tridens flavus* and *Tridens strictus*, from Arkansas. Collections of this uncommon hybrid were made from open, often disturbed habitat in 12 counties and observations without collections were made in 3 additional counties. All records occurred in areas with populations of both parent species. A summary of occupied site characteristics and a map of the known range within Arkansas are presented along with photographs illustrating *T.* × *oklahomensis* in comparison with both parent species. Keys, notes on habitat, and updated range maps are also presented for all known taxa of *Tridens* occurring in Arkansas.

Introduction

Tridens × *oklahomensis* (Feath.) Feath. ex Chase was first described by Featherly (1938), as *Triodia oklahomensis*, from collections made near Stillwater, Oklahoma. It was later reported for Boone County, Missouri, by Kucera (1957) who suggested it to be the interspecific hybrid between *Tridens flavus* (L.) Hitchc. and *T. strictus* (Nutt.) Nash. It was later reported from Butler County, Missouri, by Schuckman and Kucera (1984), from East Feliciana Parish, Louisiana, by McKenzie et al. (1987), and from Labette and Neosho counties in southeastern Kansas by Freeman et al. (1998). Incidentally, McKenzie et al. (1987) pointed out that the correct author citation for *T.* × *oklahomensis* should be “(Feath.) Chase” or “(Feath.) Feath. ex Chase.”

Kartesz (2013), Tropicos (2013), and The PLANTS Database (USDA, NRCS 2013) all list *T. oklahomensis*, *T.* × *oklahomensis*, or both as synonyms of *T. muticus* var. *elongatus*. However, this seems clearly unfounded, as these taxa are not similar in appearance, habitat, or ecology, nor has any primary

literature been located that supports such synonymy. This apparent error may have originated in the index of Barkworth et al. (2007) where the two taxa are equated with the listing “*T.* × *oklahomensis* = *T. muticus* var. *elongatus*.” Curiously, there is no such synonymy given in the included *Tridens* treatment (Valdés-Reyna 2007) or in the relevant treatment in its sister publication, the Flora of North America (Valdés-Reyna 2003). There is also no record of this synonymy given in Valdés-Reyna and Peterson (2001), which served as the foundation for these subsequent treatments.

Crooks and Kucera (1973) presented detailed analyses that provided evidence that *T. oklahomensis* is indeed of hybrid origin with *T. flavus* and *T. strictus* as the parent species. *Tridens* × *oklahomensis* is intermediate between *T. flavus* and *T. strictus* in a number of characteristics of panicle and spikelet morphology. The most noticeable character is the degree of openness of the panicles (Fig. 1).

Tridens × *oklahomensis* was first collected in Arkansas by Witsell in 2003 and again in 2004 from a site at Railroad Prairie Natural Area in eastern Lonoke County (see below for details) and was originally misidentified as *T. ambiguus* (Elliott) Schult., to which it will key using some references. The report of *T. ambiguus* for Arkansas by the Arkansas Vascular Flora Committee (2006) is based solely on these misidentified specimens and, thus, *T. ambiguus* should be excluded from the Arkansas flora.

Materials and Methods

Once the plants from Railroad Prairie Natural Area were identified as *T.* × *oklahomensis*, we searched for more plants during the fall of 2009 and 2010 in habitats (often roadsides) that supported both *T. flavus* and *T. strictus* in close proximity. Voucher specimens were made where possible and data were gathered on locality, habitat, and number of individuals present.

Figure 1: A) *Tridens strictus*, B) *Tridens × oklahomensis*, C) *Tridens flavus* var. *flavus*, and D) upper stems and inflorescences of *Tridens × oklahomensis* (center) with *Tridens flavus* var. *flavus* (left and right). All images by C.T. Witsell, taken on 9 Nov 2009 at the Washington Co. station.

Results

Voucher specimens for *T. × oklahomensis* were collected from 12 Arkansas counties. These specimens are cited below with associated data provided. Observations of *T. × oklahomensis* were made in 3 other counties, though no voucher specimens were collected due to poor condition of specimens (late season) or inability to safely collect a voucher owing to traffic conditions at the time of observation (along major highways). Data for these occurrences are also provided below.

VOUCHER SPECIMENS: **Benton Co:** Witsell #09-0495 (MO, UARK). 8 Nov 2009. S side of Hwy 16, 6.4 km (4.0 mi.) E of Illinois River. Grassy open highway right-of-way. Several clumps scattered. N36.11619, W94.44545. Rhea 7.5' quad. **Conway Co:** Witsell #10-0422 (ANHC, MO). 18 Oct 2010. N side of I-40 entrance ramp (east bound). Just E of Hwy 9 and S of I-40. Open grassy highway right-of-way. Several clumps. Vicinity of N35.17267, W92.71717. Morrilton East 7.5' quad. **Hempstead Co:** Witsell & Harris #10-0379 (BRIT, MO, UARK). 30 Sep 2010. Grandview Prairie Wildlife Management Area. E of County Road 306, 0.8 km (0.5 mi.) N of area manager's residence. Degraded blackland prairie/old field. Dozens of clumps scattered. N33.79554, W93.76499. Columbus 7.5' quad. **Lonoke Co:** Witsell #03-1040 (ANHC, UARK). 9 Nov 2003. Railroad Prairie Natural Area. Between railroad bed and Hwy 70, just E of first farm road as you head W from the Prairie County line. Unplowed tallgrass prairie. 100+ clumps scattered. Vicinity of N34.78185, W91.70249. Carlisle 7.5' quad.; Witsell #04-1354 (APSU, MO, BRIT). 27 Oct 2004. Same locality. **Pope Co:** Witsell #09-0493 (APCR, MO). 26 Oct 2009. Russellville. N side of I-40 exit ramp (west bound) at Hwy 7 exit. Grassy open highway right-of-way. Several clumps scattered. Vicinity of N35.30598, W93.13629. Russellville West 7.5' quad. **Prairie Co:** Baker & Witsell #09-0035 (AMAL, ANHC, APSC, BRIT, LSU, MO, OKL, UARK). 20 Oct 2009. Railroad Prairie Natural Area. S edge of prairie and natural area, directly N of (behind) house on N side of US Hwy 70, 0.5 km (0.3 mi.) W of Downs Rd. Wet swale in remnant tallgrass prairie. Five clumps observed within about 45 m. (150 ft.) length of prairie. Vicinity of N34.78242, W91.50220. Hazen 7.5' quad. **Pulaski Co:** Witsell, Akin, & Baker #10-0409 (MO, UARK). 11 Oct 2010. W side of I-530, 2.2 km (1.35 mi.) N of Bingham Rd. Open grassy highway right-of-way.

Several clumps scattered along I-530 in this area, especially in median. N34.60513, W92.26873. Spring Lake 7.5' quad. **Saline Co:** Witsell, Akin, & Baker #10-0410 (ANHC, MO). 11 Oct 2010. W side of I-530, 0.8 km (0.5 mi.) S of Woodson Lateral Rd. Open grassy highway right-of-way. Several clumps. Thinly scattered along I-530 in this area, especially in median. N34.54149, W92.24709. Woodson 7.5' quad. **Union Co:** Witsell #10-0408 (MO, UARK). 8 Oct 2010. W side of Pigeon Hill Rd. (Hwy 275), 0.65 km (0.4 mi.) S of jct, with Hwy 15, just N of driveway. Roadside at edge of trees. Uncommon, just a few clumps. N33.26677, W92.36097. Moro Bay 7.5' quad. **Van Buren Co:** Witsell #10-0412 (ANHC, MO). 14 Oct 2010. E side of Hwy 65, 1.13 km (0.7 mi.) S of jct with Hwy 9 & Hwy 330. Open grassy highway right-of-way. Several clumps. N35.51790, W92.43849. Clinton 7.5' quad. **Washington Co:** Witsell #09-0497 (ANHC, MO, UARK). 9 Nov 2009. Fayetteville. Woolsey Prairie (City of Fayetteville Wetland Mitigation Site). W of Broyles Rd. & N of Westside Wastewater Treatment Plant. Degraded prairie/pasture being restored to prairie & marsh. Single large clump in this area. Several smaller clumps elsewhere on site. N36.06757, W94.23376. Fayetteville 7.5' quad. **White Co:** Witsell, Rugar, & Fletcher #10-0437 (BRIT, MO, UARK). 10 Nov 2010. W side of I-64 (Hwy 67/167), 11.3 km (7 mi.) S of Searcy. Open grassy highway right-of-way. Several clumps here, 100+ along this general area of the road, mostly in median. Vicinity of N35.15997, W91.78224. Garner 7.5' quad.

ADDITIONAL OBSERVATIONS WITHOUT VOUCHERS:

Calhoun Co: Witsell. 17 Feb 2010. Moro Big Pine Natural Area. E side of unnamed timber access road along edge of powerline right-of-way, 1.45 km (0.9 mi.) (along road) W of Hwy 167. Single clump. Vicinity of N33.43347, W92.49097. Artesian 7.5' quad. **Faulkner Co:** Witsell. 7 Nov 2009. N side of I-40, approx.. 2.8 km (1.75 mi.) W of Salem Road overpass. Several clumps. Vicinity of N35.12139, W92.49034. Conway 7.5' quad. **Searcy Co:** Witsell & Akin. 1 Nov 2010. E side of Hwy 65, approx. 4.8 km (3 mi.) S of Buffalo River. Several clumps scattered. Vicinity of N35.94824, W92.72551. Marshall 7.5' quad.

Discussion

Given the relative ease with which additional stations were found in Arkansas once a search image for *T. × oklahomensis* was obtained, and the prevalence

of habitats that support both *T. flavus* and *T. strictus*, this hybrid likely occurs as an uncommon element of the flora throughout the state. Similarly, it likely occurs in other states where the two parent taxa are sympatric. It is worth mentioning that *T. × oklahomensis* is usually taller than either of the parent taxa. This display of apparent 'hybrid vigor' can be dramatic with plants of the hybrid reaching 2 m tall, up to twice the typical height of *T. flavus* or *T. strictus*. Its densely flowered panicles are intermediate between those of the parents and are often dark purple; with enough coloration to stand out such that they can be spotted when driving at highway speeds. Many of the collections cited above were made after spotting the plants while driving.

Both parent species, *Tridens flavus* and *T. strictus*, are found at all Arkansas stations of this hybrid. It is worth noting that all known sites in Arkansas occur specifically with *T. flavus* var. *flavus* and none with *T. flavus* (L.) Hitchc. var. *chapmanii* (Small) Shinnery, the latter of which is restricted to open woodlands, glade margins, and sand barrens, primarily in undisturbed sites with high ecological integrity. Most *T. flavus* var. *chapmanii* sites are also uniformly dry and not likely to support *T. strictus*, which has a wetland indicator status code of FACW (Lichvar and Kartesz 2012). *Tridens flavus* var. *flavus*, however, which has a wetland indicator status code of FACU, is a disturbance-tolerant generalist and occurs in a wide variety of habitats across the state. All sites for *T. × oklahomensis* that we observed occur where there is at least some local microhabitat variation providing wetter areas for *T. strictus* and drier areas for *T. flavus* var. *flavus*. The different ecological requirements of these parent species may be why many sites for *T. × oklahomensis* occur along sides of highways, with *T. strictus* inhabiting the moister ditches and *T. flavus* var. *flavus* growing on the higher ditch banks.

The number of plants observed at several of the sites (100+ at some locations) raises the question as to whether or not *T. × oklahomensis* is always sterile. Shuckman and Kucera (1984) mentioned that plants in Boone County, Missouri, with panicle measurements intermediate between *T. flavus* and *T. × oklahomensis* indicate a backcross, with *T. flavus* serving as the staminate parent and the progeny producing viable seed. Further research into this question at these larger Arkansas sites is warranted.

Key to taxa of *Tridens* in Arkansas, modified from Kucera (1998):

1. Panicles broad, 5-20 cm wide, pyramidal, with spreading to ascending branches.....2.
2. Panicles diffuse, with spreading to pendant branches; axillary panicles lacking.....3.
3. Panicle branches lax, somewhat pendant, nodes of inflorescence without dense tufts of axillary hairs.....*T. flavus* var. *flavus*
3. Panicle branches stiff, nodes of inflorescence with dense tufts of axillary hairs *T. flavus* var. *chapmanii*
2. Panicles more contracted, with stiff, ascending branches; axillary panicles present.....*T. × oklahomensis*
1. Panicles compact, 0.3-2.0 cm wide, spikelike, or narrow with short branches4.
4. Panicles spikelike, 1.0-2.0 cm wide, with numerous spikelets; plants of moist or seasonally wet habitats.....*T. strictus*
4. Panicles narrow, 0.3-0.8 cm wide, with relatively few spikelets on short branches; plants of dry, calcareous glades or rock outcrops.....*T. muticus* var. *elongatus*

***Tridens flavus* (L.) Hitchc. var. *flavus*:** purpletop. Common in pastures, hayfields, degraded prairies, roadsides, woodlands, and glades. Tolerant of disturbance and somewhat weedy. Statewide (Fig. 2, A).

***Tridens flavus* (L.) Hitchc. var. *chapmanii* (Small) Shinnery:** Chapman's purpletop. Uncommon in high-quality open oak or pine woodlands, sandhill barrens, and margins of glades. This taxon is much less common than var. *flavus* in Arkansas (Fig. 2, B) and has a strong affinity for dry, open, often acidic woodlands without recent soil disturbance. It is especially common on such sites managed with prescribed fire. Although this plant is not rare enough to be listed by the Arkansas Natural Heritage Commission as an element of conservation concern in the state, it is, nevertheless, uncommon and a reliable indicator of high ecological integrity in woodland habitats. In addition to the characters noted in the key above, we have noticed that var. *chapmanii* often has a dark purple band several centimeters wide just above the nodes of the mid-stem, a feature often lacking in var. *flavus*.

Figure 2: Arkansas county range maps for A) *Tridens flavus* var. *flavus*, B) *Tridens flavus* var. *chapmanii*, C) *Tridens strictus*, D) *Tridens muticus* var. *elongatus*, and E) *Tridens* × *oklahomensis*. Circles represent specimen records (Gentry et al. 2013). For *T.* × *oklahomensis*, squares represent the authors' additional observation records.

***Tridens strictus* (Nutt.) Nash:** narrow purpletop; long-spike tridens. Common nearly statewide but less so in the Ozark region (Fig. 2, C), in seasonally wet, open habitats including prairies, pastures, hayfields, saline barrens, open flatwoods, roadsides, and disturbed woodlands.

***Tridens muticus* (Torr.) Nash var. *elongatus* (Buckley) Shinnars:** slim tridens. Rare in Arkansas. Known only from two historical collections from a region of glades in the northwestern part of the state: an 1881 specimen from “NW Ark., lime rocks” (F.L. Harvey s.n. [UARK]) and a 1934 specimen from Beaver in Carroll County (Fig. 2, D) where it was collected from a “limestone ridge” (D.M. Moore 34-300 [UARK]). This taxon is considered by the Arkansas Natural Heritage Commission to be an element of conservation concern and has a state conservation status rank of SH (historical) in Arkansas. It should be searched for on exposed sites underlain by dolomite or limestone in the White River Hills

Ecoregion of the Ozarks.

***T.* × *oklahomensis* (Feath.) Feath. ex Chase:** hybrid purpletop. Uncommon and scattered in the state (Fig. 2, E) in areas where both parental species occur. Widely scattered but sometimes locally common in some areas along highways, including in medians along I-40 and State Highway 67/167.

Conclusions

Tridens × *oklahomensis*, the hybrid of *T. flavus* var. *flavus* and *T. strictus*, which has been variously reported from scattered occurrences in Louisiana, Missouri, and Oklahoma throughout the mid to late 1900s, has apparently been overlooked in Arkansas until fairly recently. Since 2003, *T.* × *oklahomensis* has been documented from a total of 15 Arkansas counties. It has been most frequently observed in the state growing along roadsides or in other natural or disturbed habitats that provide the juxtaposition of

microhabitats suitable for its two parent taxa. Given the prevalence of such habitats and the statewide distributions of both its parents, *T. × oklahomensis* likely occurs as an uncommon and scattered element of the flora throughout Arkansas. Although reportedly sterile, relatively sizeable populations at several of the *T. × oklahomensis* stations in the state may indicate at least some viability of this hybrid. Further field work in the state would help elucidate the full range and distribution of *T. × oklahomensis* in Arkansas and additional research, especially on larger populations, would help determine if this hybrid is truly sterile or at least occasionally viable.

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